The Economic Theory of Tax Compliance with special Reference to Tax Compliance Costs

Arindam Das-Gupta

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Overview and Motivation

A clear understanding of the impact of different types of taxes on individual behaviour is necessary if taxes are to be designed to minimise their negative impact on economic efficiency and equity. This is a major motivation of optimal tax theory in economics. Furthermore, the intended and actual impact of taxes will differ if the tax administration is not able to counteract attempts by taxpayers to minimise the taxes they pay given administratively complex taxes. One important dimension of individual responses to taxes is the extent to which they willingly comply with tax laws. Tax evasion and avoidance are major causes of deviation between the actual and intended impact of taxes. Identifying administratively simple taxes which provide limited opportunity for tax evasion and avoidance is therefore also an important part of the agenda for tax research in economics.

Before attempting to tackle normative tax design, it is important to understand tax compliance behaviour. Towards this end, the economic theory of taxpayer compliance behaviour with tax laws is reviewed here. Given the likely importance of compliance costs on compliance and given that this link has not been sufficiently explored,

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*This paper is partly based on Chapter 2 of Chattopadhyay and Das-Gupta (2002a); available at the Planning Commission website http://www.planingcommission.nic.in/reports. The usual disclaimers apply.

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particular attention is paid to the impact of compliance costs on compliance. In fact, to illustrate how existing economic analysis of compliance behaviour can be extended to additional determinants, the extension to compliance costs is considered in detail.

The discussion proceeds as follows. First determinants of tax compliance identified in the literature are reviewed. Next, basic economic models of tax compliance and the impact of tax compliance costs on individual behaviour are presented. This is followed by an exposition of models which examine the link between the two. The analysis up to this point assumes a given income subject to an income tax. An extension to endogenously determined income from sales and simultaneous sales and income taxes is then discussed to understand how compliance costs of each tax have an impact on compliance with the other tax. In the concluding section, brief comments are made on the implications of the analysis for empirical analysis of the compliance, compliance cost link and normative analysis of optimal taxes in the presence of non-compliance.

II.Determinants of Tax Compliance: A Brief Review

There is an extensive literature on the determinants of tax compliance by individuals.[1] The major impetus for tax compliance research in economic theory is a seminal paper by Allingham and Sandmo (1972), with some important earlier exceptions. Before formally presenting the Allingham and Sandmo (AS) model, determinants of tax compliance are briefly reviewed.

As in all individual choice situations, there are two essential elements which determine the final outcome of tax compliance choices by individuals: What choices are feasible and what choices are considered desirable by individuals.[2] As in much of neo-classical analysis, amoral individuals are assumed to desire more income but to be risk averse. From this assumption it follows that individuals will not comply with taxes unless non-compliance either lowers their real income (by, say, decreasing the quantity of publicly provided goods) or increases its riskiness. The feasibility of different levels of non-compliance or, more accurately, an individual's ability to get away with a given level of non-compliance, is determined by the prevailing environment, particularly tax administration effectiveness. This is captured, in the AS model and many of its subsequent extensions, by the probability of punishment and the penalty structure which together constitute a summary description of the effectiveness of tax enforcement.[3] Both the probability and the effective penalty are affected by corruption in tax administration. However, in empirical research of tax compliance behaviour, besides enforcement, several other important factors have been found to affect tax compliance.

- A key determinant of tax evasion, is the tax burden, particularly tax rates or, more precisely, effective tax rates taking into account tax concessions and exemptions. Though its impact is indeterminate in the AS model, all empirical studies to date have found a negative impact of the tax burden on tax compliance.[4]
- Financial development, particularly the extent of use of banking channels for making payments, leads to income generating transactions being easy to observe, reducing the scope for transactions "off the books". However, sophisticated financial systems coupled with openness can make it easy for funds to cross international borders to escape taxes. [5]
- As the attractiveness of the formal sector *vis-a-vis* the cash or informal economy grows, voluntary compliance should also increase due to the lower relative attractiveness of the cash economy.[6] A successful program of structural adjustment, therefore, is likely to result in increased compliance.
- The ease with which evasion can be detected is linked with the number of separate transactions that have to be detected to verify a taxpayers taxable income. If development is associated with scale economies in the size of transactions, this will tend to reduce non-compliance.[7]
- Similarly, high industrial concentration implies fewer large taxpayers in the economy allowing for better monitoring by the tax authorities.[8]

- The timing of tax liabilities relative to income earning is the basis of the negative *Tanzi-Olivera* effect of inflation on effective tax rates and so tax revenue. As discussed, high effective tax rates have an impact on tax compliance.[9]

- This difference between the timing of income accrual and tax due on income as also inexact provisions in the tax code, exemptions and deductions, are the main determinants of tax avoidance which, in turn, affects tax compliance. The existence of a well-developed accounting profession and of tax preparers will also help tax avoidance.[10]

- Research, primarily in the United States, suggests that what may be termed "cultural" factors may significantly influence taxpayer attitudes.[11] Included in this are such things as fiscal knowledge, income and social class, risk aversion, race, age, sex, occupation, peer attitudes to tax evasion and bribe payment, deference to authority, and acquaintance with tax offenders.

- Tax complexity also influences non-compliance by causing misinterpretation of rules, omissions and unintentional errors besides deliberate under-reporting.[12]

- The extent to which a taxpayer perceives that the government uses taxes efficiently to provide a desirable mix of public goods has also been found to affect taxpayer compliance.[13]

- The effect of higher compliance costs in promoting non-compliance and improved taxpayer services in promoting compliance has also been confirmed.[14]

Most of the factors outlined above have implications for the design of appropriate compliance policy. For example, the evidence suggests that a polite and helpful tax administration and simplification of tax forms could lower compliance costs and improve compliance at the margin. To take another example, a high proportion of wasteful government expenditure, which lowers the marginal benefit from additional taxation is likely to promote non-compliance.

These factors can also be accommodated in extensions of the basic AS model and their impact on compliance analysed. However, the exposition of such a "complete" model would be of limited use. Instead, the basic economic model of tax evasion is now described followed, by way of illustration, by an exposition of extensions to incorporate the impact of tax compliance costs on taxpayer behaviour.

III. The *Allingham-Sandmo* Model

In the classic Allingham and Sandmo (1972) paper, an amoral but risk averse taxpayer, with true income Y, chooses the fraction of income to declare to tax authorities to maximize her expected utility of income. The policy environment is given by the legally mandated income tax function, T(Y), the penalty rate on detected but underpaid taxes, π, and the probability of tax audit and detection, p.[15] For simplicity, we assume a proportional tax function with tax rate t here. The fraction of income reported voluntarily to tax authorities (or the level of compliance) is denoted by x. The taxpayer's decision problem can be written as:

$$\underset{x}{\mathrm{Max}}\, E(U) = (1-p)U[Y_N] + pU[Y_C] \qquad (1)$$

Where $Y_N = Y - txY$ and $Y_C = Y - txY - (1+\pi)(1-x)tY$ represent, respectively, net (after tax and penalty) income if evasion remains undetected (**N**ot caught) and is detected (**C**aught) by tax authorities. U[.] is the *Von-Neumann Morgenstern* utility function of the taxpayer, assumed to be strictly concave, implying risk aversion.[16] Utility is assumed to depend only on after-tax income.

This model predicts that, provided the expected additional payment on detection $p(1+\pi)tY$ is below the tax due when income is reported honestly (tY), the taxpayer will not comply fully, choosing to report less than 100 percent of her income. However, there will be greater compliance if there is stricter enforcement either by raising p or π.

In studies attempting to empirically verify the AS model, it has been pointed out that since expected additional payments if evasion is detected observed in practice are always less than taxes due, taxpayers would always evade taxes if they behaved in accordance with the AS model.[17] Tax evasion, however, is not resorted to by all taxpayers, in evidence from countries like the USA. This has prompted an enormous number of extensions of the AS model over the past 30 years, leading to the identification of many of the compliance determinants reviewed above.

IV. The Impact of Compliance Costs in the Absence of Non-Compliance

Slemrod and Yitzhaki (1998) describe a model of Slemrod (1994b) which examines (monetary) voluntary compliance costs or avoidance costs. In his model, avoidance reduces the tax base by S and costs C. The scope for avoidance activity, as discussed, depends on the existence of ambiguities and loopholes in the tax law and on the extent of tax concessions. The model presented here is similar to that of Slemrod (1994b) but omits a labour supply response in order to focus on avoidance effects.

Net of tax income is given by $Y_\alpha = Y - T_j - S$, where S is expenditure on avoidance ("**S**heltering") activity and T_j is the tax paid. The tax function is assumed to have an exemption limit, V_1/t_1 and several marginal tax brackets. $T_j = t_jY - V_j$, where V_j defines the income at which the jth segment of the tax function would have cut the income axis in a graph, in the absence of avoidance.[18] With avoidance $T_j = [t_j(1-\alpha h(S))Y - kS - V_j]$, where $0 \leq k \leq 1$, and k is the fraction of S that is deductible from the tax base. The term $(1- \alpha h(S))$ represents the impact of avoidance expenditure on taxable income. It is assumed that avoidance expenditure is subject to diminishing returns or (using a prime for the first derivative and a double prime for the second) that $h(0) = 0$, $h' > 0$, $h'' < 0$ and $\lim_{S\to\infty} h(S) = H.$ α is a "shift" parameter introduced to permit the comparative static impact of greater avoidance opportunities to be studied. Substituting for T_j into the expression for Y_α gives:

$$Y_\alpha = Y[1-t_j(1-\alpha h(S))] - (1-t_jk)S + V_j. \qquad (2)$$

Given the properties of h(.), Y_α is maximized where the first order condition for a maximum holds provided $Y > Y^* = \max[V_1/t_1, (1-t_1k)S^*/t_1\alpha h(S^*)]$. S^* is the value at which income is at an interior maximum, and t_1 is the lowest marginal tax rate of the tax schedule. The first order condition, which is given by

$$t_i[Y\alpha h' + k] = 1 \tag{3}$$

states that tax savings from the marginal rupee spent on sheltering must equal the rupee spent. Here, $t_i \leq t_j$ is the post-sheltering marginal tax rate.

There are two interesting predictions of this analysis. First, Y^* is the critical value of Y below which avoidance expenditure will not be undertaken. Whether or not there is actually no avoidance at low income levels depends on the whether Y^* exceeds or is below the tax threshold (or exemption limit), V_1/t_1. A second prediction is that if there exists an income level (Y^*) above the threshold at which avoidance is optimally undertaken, it will be optimal at all income levels above Y^*.

Additional predictions can be obtained from comparative static analysis of equation (3), the first order condition for S. Solving (3) gives the function $S = S(\beta)$, where $\beta = (1-t_ik)/t_i\alpha Y$ and where $dS/d\beta < 0$. This implies that $\partial S/\partial t > 0$, $\partial S/\partial Y > 0$ and $\partial S/\partial k > 0$ With respect to compliance costs, $\partial S/\partial\alpha > 0$, if the marginal tax bracket is unchanged implying that greater avoidance opportunities are, in fact, made use of by taxpayers. The pattern of avoidance will, more generally, not be a smooth function of Y, since jumps will occur when $(1-\alpha h(S^*))Y - kS^*$ crosses the threshold of the next marginal tax bracket.

To summarise, the major predictions are that (i) low income individuals are unlikely to find avoidance optimal, while (ii) avoidance increases with income and with increasing avoidance opportunities. The major policy suggestion from this analysis is the obvious one of closing loopholes and reducing tax concessions.

V. Mandatory Compliance Costs and Tax Compliance

A simple extension of the AS model to allow for mandatory compliance costs, is to assume that

$$Y_N = Y - txY - C(xY) - G \qquad \text{and} \tag{4}$$

$$Y_C = Y - txY - C(xY) - G - (1+\pi)(1-x)tY. \tag{5}$$

The specification assumes a compliance cost function given by $C(xY)+G$, where $G \geq 0$ and $C(xY) \geq 0$, $C(0) = 0$. $C(xY)$ can be assumed to be concave in line with the empirical finding in Chattopadhyay and Das-Gupta (2002). The major conclusions emerging from an analysis of this model are: (a) The minimum penalty necessary to deter non-compliance is greater than in the absence of compliance costs since there are now additional benefits from non-compliance. Consequently, the set of taxpayers who declare zero income or do not file tax returns at all (the latter implying that $x = G = 0$) will be greater than in the absence of compliance costs. (b) For reported income between 0 and 100 percent of true income (i.e. interior x), compliance decreases with both the level of compliance costs and marginal compliance costs. To establish a proper basis for empirical work it is, however, necessary to disaggregate compliance costs into mandatory and voluntary costs.

VI. Mandatory Compliance Costs, Voluntary Compliance Costs and Tax Compliance

The model above is now modified to incorporate tax evasion and both avoidance and mandatory compliance costs, while retaining the same notation. For simplicity, a proportional tax function, tY is assumed.

The substantive difference between the model developed here and that of Alm (1988) is in allowing for compulsory compliance requirements besides the voluntary costs he examines.[19] It is assumed that compulsory compliance costs have revenue benefits by increasing the probability of detection and punishment of non-compliance. Other than this, the standard AS model is used.

Non-compliance is assumed to be detected and punished with probability p(M), where M is the compliance cost from compulsory compliance requirements imposed on the taxpayer, assumed to be deductible from gross income. Constant mandatory compliance costs are assumed for simplicity. The implications of relaxing this assumption are discussed after presenting the analysis with fixed M. Incomes after taxes and penalties are now given by:

$$Y_N = Y - S - M - T_N \quad \text{and} \tag{6}$$

$$Y_C = Y - S - M - T_N - F \tag{7}$$

depending on whether non-compliance is detected or not. T_N denotes taxes paid voluntarily and F denotes additional taxes and penalty if evasion is detected:

$$T_N = [(1-\alpha h(S))(Y - M) - kS]xt \equiv qxt \tag{8}$$

$$F = qt(1-x)(1+\pi). \tag{9}$$

Expected government revenue is $T = T_N + pF$, while expected after tax income of the taxpayer is

$E(Y) = Y - S - M - T_N - pF = Y - S - M - T$, As in the AS model, the consumer maximises expected utility $E(U) = (1-p)U[Y_N] + pU[Y_C]$. However, besides x, there is now an additional choice variable, S. As in the AS model, it is assumed that the probability of detection and punishment of evasion (p) and the penalty rate (π) are not high enough to deter evasion or that $p(1+\pi) < 1$. In the analysis here, attention to interior solutions at which $1 > x > 0$ and $S > 0$. The latter assumption may not be satisfied at low levels of Y, as discussed earlier, so that, at low income levels, the possibility of pure non-compliance (no avoidance) arises.

Under the assumptions made above, and using the notation $U_C \equiv \partial U/\partial Y_C$ and $h_S \equiv dh/dS$, the first order conditions for the choice of x and S (which are sufficient here to guarantee a maximum) are:

$$p\pi U_C = (1-p)U_N \tag{10}$$

$$t[\alpha h_S(Y-M) + k] = 1. \tag{11}$$

The condition in (10) is identical to that in the simple AS model. If M = 0, the condition in (11) is identical to that in (3), the optimality condition for sheltering in the absence of tax non-compliance! The implication is that *the level of avoidance activity is independent of tax evasion by an individual:* While the evasion decision depends on the level of avoidance chosen, feedback in the reverse direction is absent.[20] The taxpayer's decision process may therefore be viewed as a two stage process: First deciding on avoidance and then deciding on evasion, given the amount of avoidance chosen. This property of the joint avoidance-evasion model is of great help in empirical work, as measured avoidance can be treated as a predetermined variable in empirically modelling determinants of tax evasion.[21]

Conditions (10) and (11) give rise to an optimal avoidance function: $S = S(k,Y,t,\alpha,M)$, with avoidance increasing in k, Y, t, and α and decreasing in M. The important result here is that *other things equal, voluntary compliance costs and mandatory compliance costs are substitutes if mandatory compliance costs are tax deductible.*[22] The behaviour of reported income is more problematic. The optimal reported income fraction is:

$$x = x[\underset{?+}{Y}, \underset{+}{t}, \underset{+}{p}, \underset{-}{\alpha}, \underset{?}{M}, \underset{+}{p}, \underset{-}{S}(\underset{+}{Y}, \underset{+}{t}, \underset{+}{k}, \underset{+}{\alpha}, \underset{-}{M})] \tag{12}$$

Where the signs below parameters indicate signs of the partial effects on x. Exogenous increases in enforcement variables (π,p) have the same qualitative effects as in the AS model. However, other determinants of compliance have (a) *a direct effect* and (b) *an indirect effect through their impact on avoidance costs*. For Y, the sign of the direct effect is indeterminate, but is positive with constant absolute risk aversion.[23] The indirect effect through S can be ignored at low income levels. Consequently, *non-compliance is likely to be increasing with income at low incomes but will, in proportionate though not absolute* *terms, be moderated and may even decrease at higher income levels (given concave compliance costs).* The effect of an increase in the marginal tax rate, t, is indeterminate. For M, ignoring the induced effect through the increase in the probability of detection, the impact is exactly opposite to that of income.[24] Since the impact of an increased probability of detection on non-compliance is negative, as in the AS model, *the impact of mandatory compliance costs on compliance is likely to be positive at low income levels, but may reduce compliance at high income levels.*

Further extension of the model, to allow the taxpayers to choose the extent of compliance with mandatory requirements, is easily done but yields no additional insights. Assume that (a) a penalty proportional to the extent of non-compliance with mandatory requirements is applied if the taxpayer is audited, but that (b) the increase in the probability of detection from greater compliance with mandatory requirements exhibits diminishing returns.[25] Diminishing returns to the government implies increasing returns to non-compliance with mandatory requirements for the taxpayer. Consequently, either full compliance with mandatory requirements or full-non-compliance results. The latter case is that of non-filers. In the former case, the model reduces to that analysed here. If mandatory compliance costs also depend on declared income, compliance with mandatory requirements is still zero-one, but other model predictions are even more uncertain and context dependent. This underlines the importance of empirical work in understanding the compliance and compliance cost link.

The existence of tax withholding has not been taken into account above. Withholding reduces the scope for non-compliance by salary earners and others from whom taxes are withheld. The analysis of Yaniv (1988) suggests that under-reporting of other income *not* subject to withholding (such as dividends in some countries, capital gains, and some royalty and honorarium payments) increases in this situation. Intuitively, since a chunk of income is no longer "at risk", greater risks can be taken with the rest of one's income, while keeping overall risk and expected income unaltered in comparison with the situation without tax withholding.

VII. Bribe Costs and Compliance

Mookherjee and Png (1995)[26] develop a theory of bribe paying and tax evading taxpayers and tax officials who accept bribes. Bribes are of two kinds. They are either beneficial to both parties (at the expense of government revenue) or are a coercive extraction by officials. The latter is a form of harassment. Both types of bribe costs have been found in the survey of Indian income taxpayers described in Chattopadhyay and Das-Gupta (2002). In the coercive case, bribe costs have effects similar to mandatory compliance costs except that an increase in these costs need not increase the probability of detection. For the former case, Mookherjee and Png model the situation as a (simultaneous move) game between a non-compliant taxpayer and a bribe accepting tax official.

Taxpayers behave as in the AS model, except that they pay a bribe if non-compliance is detected rather than getting penalised. However, the maximum bribe they are willing to pay will not exceed extra taxes and penalties they would have had to pay if they chose not to pay a bribe. Tax officials, on the other hand, will not accept a bribe that is lower than the expected cost to them if their bribe taking is detected by a "vigilance" unit.[27] The equilibrium bribe is a fraction of the "surplus available" or the difference between the maximum bribe the taxpayer will pay and the minimum bribe acceptable to the tax official. Given this equilibrium bribe rule, the (risk neutral) taxpayer chooses the level of evasion and the (risk neutral) tax official, who prefers not to work other thing equal, simultaneously chooses the work effort he puts in to detect evasion. The probability of detection increases with additional effort. This determines an equilibrium level of non-compliance and an equilibrium bribe. *The equilibrium bribe and equilibrium non-compliance turn out to be positively related* as would be expected, while *tax revenue decreases if non-compliance increases*.

VIII. More Than on Tax

Co-existence of sales (or excise) and income taxes is now examined to assess to what extent estimates of cost of compliance with one tax and its impact are affected by the existence of additional taxes. Possible empirical problems arise from two sources: (a) in direct estimates of compliance costs it may be difficult to separate out costs associated with different taxes[28] and (b) compliance effects of compliance requirements for both taxes may be affected by changes in compliance requirements of either tax.

An assumption made here is that there is no exchange of information between sales tax and income tax departments. However, sales declared to the sales tax department are assumed to form the basis of income declared to the income tax department so that, in the taxpayer's books, reported sales and reported income are consistent.[29] Attention is restricted to mandatory compliance requirements, assumed to be exogenously given and fully complied with. There are now four possible income levels:

Income when no evasion is detected $= Y_N = R(Q) – H(Q) – M – T_N - T_{NS}$

Income when sales tax evasion is detected $= Y_S = R(Q) – H(Q) – M – T_N - T_{NS} - F_S$

Income when income tax evasion is detected $= Y_I = R(Q) – H(Q) – M – T_N - T_{NS} - F$

Income when both types of evasion are detected $= Y_C = R(Q) – H(Q) – M – T_N - T_{NS} – F_S – F$

R(Q) and H(Q) are respectively the net revenue and cost of producing output, Q, with H(Q) being assumed to include sales tax compliance costs (which are not deductible as, for example, in India). Income before tax and income tax compliance costs, Y, is R(Q) – H(Q). The tax revenue terms are:

$T_N = (Y- M - T_{NS})xt$, $F = (Y – M – T_{NS})(1-x)t(1+\pi)$, $T_{NS} = R(Q)x_St_S$ and $F_S = R(Q)(1 – x_S)t_S(1+\pi_S)$. M is interpreted as including all compliance costs, including for sales taxes. The two types of compliance requirements are distinguished in the model since only sales tax compliance costs enter H(Q). The probability of detection of sales tax evasion is q and, as before, the probability of detecting income tax evasion is p.[30]

Assuming interior evasion for both taxes, the three first order conditions of the taxpayer (for Q, x and x_S) are:

$$MR(1-t_S) = MC \quad \text{and}$$

$$E(U') = p[(1-q)U_I + qU_C](1+\pi) = q[(1-p)U_S+pU_C](1+\pi_S) = 0.$$

In the equations above E(U') is the expected marginal utility of income. That the output decision does not depend on enforcement parameters (given interior evasion) has been demonstrated in the context of sales taxes alone by Marelli (1984). *In addition, this analysis suggests that, provided production remains profitable in the presence of taxation, compliance costs do not further distort output decisions.* The major impact of compliance costs on output will be through its effect on the viability of marginal firms. Further analysis of these equations shows that increased compliance costs with either tax can affect both sales tax and income tax compliance and that sign of the impact is indeterminate. Consequently, when both taxes are present, the impact of compliance costs on compliance behaviour cannot be predicted *a priori.*

Two additional points to note are, firstly, that, the base of actual income taxes on business income is not economic profit (after sales tax) but also the return to capital, as pointed out by Arnold Harberger (1962).[31] While this is important for empirical purposes, the independence of the output decision from enforcement policy remains unaffected with interior evasion. Secondly, the independence property breaks down for price taking firms in zero profit equilibrium, thus making an assessment of the impact of additional compliance costs even more difficult.[32]

IX. Concluding Comments

Implications for empirical modelling: From equation (12) there can be no a *priori* sign expectation of the impact of mandatory compliance requirements on compliance behaviour. Furthermore, in empirical modelling, voluntary and mandatory costs need to be separated out. However, as mandatory compliance costs may induce non-filing behaviour, this suggests that empirical specifications will suffer from a selection *bias* problem in the absence of data on non-filers. Unfortunately, since the nature of the specification *bias* depends on the distribution of risk aversion in the population, there is little hope of correcting this *bias* by statistical means if data on non-filers are not available. An additional requirement is to empirically distinguish taxpayers who have taxes withheld and those who do not. For bribe costs, a negative relation with compliance and tax revenue is to be expected from the Mookherjee and Png analysis, though the potential endogeneity of bribes has to be taken into account in choosing the empirical estimation method.

The impact of compliance costs on tax revenue, $T = T_N + pF$, can also be studied directly in empirical work instead of first examining the impact of compliance costs on compliance. Since $T = T(Y, t, \pi, p, x, S, M, \alpha, k)$ and since x and S are themselves endogenous, no a *priori* sign predictions on the impact of most determinants emerge.[33]

As will be clear, besides compliance cost, income and tax data, data on effective penalty rates, factors influencing detection probabilities and tax savings through avoidance are, ideally, needed.

Incorporating non-compliance and imperfect enforcement in normative tax design research: Extension of optimal tax theory to incorporate non-compliance and imperfect tax enforcement requires two other types of policy parameters to be considered, in addition to tax schedules. These are the probability of detection and the penalty schedule. A limited beginning has been made, for example in the work of Chander and Wilde (1992), and Cremer and Gavhari (1994, 1995, 1995a). These analyses shows that some, though not all, of the tax design results of optimal tax theory in the absence of evasion and enforcement continue to hold. One striking contrary finding, for example in Chander and Wilde (1992), is that optimal income taxes should be regressive in the presence of tax evasion. However, it is still too early for practical policy to draw lessons from this research, given the rudimentary modelling of the tax enforcement and the economic environment. Furthermore, this research has yet to incorporate insights from parallel research on the design of optimal penalties and enforcement.[34] A related strand of research which is yet to be integrated into optimal tax design work is into optimal organisation and incentive design for tax administration.[35]

End Notes

[1] Excellent reviews are in Mookherjee (1989), Cowell (1990), and Andreoni *et. al*. (1998). The review here draws extensively on Das-Gupta and Mookherjee (1997). Theories of tax evasion behaviour from other social science disciplines are reviewed, for example, in Roth, Scholz, and Witte (1989).

[2] This distinction, basic to economic theory, is empirically examined by Wallschutzky (1988) who finds individual attitudes rather than opportunities to be more important for Australian taxpayers.

[3] Most empirical studies confirm the positive effect of penalties on compliance. A particularly interesting study is Wallschutzky (1988).

[4] The first important study with this finding was Clotfelter (1983). *See* the review in *de Juan*, Lasheras and Mayo (1993) for other studies. For the Indian income tax, the negative impact of high tax rates is confirmed by Das-Gupta, Lahiri, and Mookherjee (1995).

[5] *See* Hinrichs (1966), and Slemrod (1990).

[6] For the Indian context, Acharya *et. al*. (1985) is still the definitive study. *See* also Das-Gupta and Mookherjee (1998).

[7] *See* Das-Gupta (1994), and also Drazen (1978).

[8] *See*, for example, Vazquez-Caro, Reid, and Bird (1992).

[9] *See* Tanzi (1980), Crane and Nourzad (1986) and, for the personal income tax in India, Das-Gupta, Lahiri, and Mookherjee (1995).

[10] *See* Alm (1988), Alm, Bahl, and Murray (1990), Erard (1993) and Hasseldine (2000).

[11] *See* the papers in Slemrod (1992) especially those by Beron, Tauchen, and Witte, Hessing *et al*, Sheffrin and Triest, and Steenbergen, McGraw, and Scholz. *See* also Witte and Woodbury (1983) and *de Juan*, Lasheras and Mayo (1993), Erard and Feinstein (1994), and Hasseldine (2000). An earlier study is by Dean, Keenan, and Kenny (1980).

[12] *See* Bolton (1987), and Hasseldine (2000). The latter cites an example from the UK where an attempt at simplification *via* a simplified tax return for small taxpayers backfired as small traders under-reported their income to reduce their compliance costs. This example shows that "simplification" of tax forms may not always result in tax simplification!

[13] *See* Cowell and Gordon (1988), Wallschutzky (1988), Alm (1992), Bordignon (1994), and Pommerehne, Hart and Frey (1994).

[14] *See* Alm (1988), Hite (1989), Mayshar (1991), Carroll (1992), Smith (1992), Slemrod (1994), and Chattopadhyay and Das-Gupta (2002a).

[15] The original model assumed the penalty to be on undeclared income. The modification of the penalty function considered here, which corresponds to Indian law, is as in Yitzhaki (1974).

[16] While the expected utility paradigm of choice under uncertainty underlying the AS model is still used almost universally in economics, it suffers from descriptive limitations. *See*, for example, Hogarth and Reder (1986). Till a widely accepted alternative emerges, such as models based on prospect theory developed by the 2002 Nobel Memorial Prize winner, Daniel Kahnemann, there is little choice. However, a pioneering attempt to use prospect theory to analyse tax compliance is in Yaniv (1999).

[17] The major studies are reviewed in Mookherjee (1989) and Andreoni *et. al*. (1998).

[18] This is the same as the exemption limit for the lowest marginal tax rate in the tax schedule but will exceed it for higher pieces of piecewise linear tax schedules, such as that prevailing for the personal income tax in India.

[19] Mayshar (1991) also incorporates both avoidance time and involuntary time compliance costs in his paper on taxpayer behaviour, allowing for flexibility of labour supply and hence income. The model considers a taxpayer who derives utility from net income and disutility from labour. Income is derived from labour only and is given by w[L – s – m(E)] – T(w(L-s-m(E), S,E), where w is the wage rate, L is total labour hours, s is hours spent on avoidance activity and m(E) is compliance time. E is a vector of revenue instruments. The function T(.) represents taxes paid which depends on gross income, but also on avoidance and compliance. The taxpayer chooses L and S to maximize U(Y,L). Unequivocal predictions about compliance behaviour from this model are even more limited than from the model presented here.

[20] This result breaks down if the individual is reporting zero income - i.e. attempting to evade all taxes. This neutrality result is one of a series of neutrality propositions in tax evasion theory, the first one concerning the independence of the profit maximizing decision of a firm in the presence of sales tax evasion, due to Massimo Marelli (1984). For the current problem, this result is also in Alm (1988).

[21] Furthermore, this is strengthened in India by tax deductions having to be taken before the end of the financial year, while tax returns can be filed up to 3 months — more in recent years — after the end of the financial year.

[22] Since $\frac{dS}{dM} = \frac{h_S}{h_{SS}(Y-M)}$, the extent of substitution between S and M is indeterminate, depending on the third derivative of h(S). A linear empirical specification, implying perfect substitution is a reasonable first approximation. Secondly, for salaried taxpayers in India, S is independent of M since compliance expenses are not tax deductible separately but are included in the standard deduction.

[23] Using primes and double primes to denote first and second derivatives, $A(.) = -U''(.)/U'$ is the Arrow-Pratt coefficient of absolute risk aversion. It is generally thought that absolute risk aversion is decreasing (abbreviated DARA) with income or at best constant (CARA). This implies that the amount (*not* proportion) of income an individual is willing to risk in a gamble, at favourable odds, is constant or increasing with income. In particular, non-increasing absolute risk aversion here implies that $A_N \equiv A(Y_N) \leq A_C \equiv A(Y_C)$.

[24] The exact expression is

$$\frac{dx}{dM} = \frac{(A_n - Ac)[xt(1-\alpha h)-1]}{qt(A_n + A_c\pi)} - (1-\alpha h)(1-x)(\frac{q_s}{q}) + \frac{p'(U_n + pU_c)}{p\pi U_c}, \text{ where}$$

$q_S \equiv \partial q/\partial S$, is negative.

[25] Assumption (a) is in line with Indian law.

[26] A somewhat simplified exposition is in Mookherjee (1997).

[27] Mookherjee and Png also consider rewards to tax officials for detected evasion. These are currently irrelevant for the Indian income tax.

[28] *See*, for example, Sandford *et. al*. (1989).

[29] Anecdotal evidence suggests that both these assumptions are realistic in the Indian context.

[30] Given the lack of effective coordination between indirect and income tax administrations, p and q are assumed to be unrelated. This may not be true in countries where there is effective coordination between officials administering both taxes.

[31] Additional discussion of the incidence of the corporation tax is in Atkinson and Stiglitz (1979).

[32] An analysis of evasion by competitive firms and regulatory requirements imposed on them is in Palda (2001).

[33] The direct effect of increasing M or α on revenue is negative due to increased deductions (M) or decreased taxable income (α). The indirect impact through changed avoidance is positive for increased M and negative for increased α. However, no clear cut prediction emerges for the impact through changed compliance behaviour.

[34] *See*, for example Mookherjee and Png (1994), and Polinsky and Shavell (2000).

[35] *See* for example Mookherjee (1997).

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