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**Bureaucratic Corruption as a Constraint
on Voter Choice**

by

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RÉSUMÉ - ABSTRACT

Dans la littérature économique, il est généralement reconnu que le niveau relatif des taxes d'un pays, la structure de taxation, le niveau de progressivité des impôts et la distribution des revenus après impôts sont des éléments choisis par les électeurs strictement soumis à leurs contraintes budgétaires. Ce texte propose l'idée que, pour certains niveaux de revenu, les décisions sur le niveau de taxation sont aussi déterminées par une asymétrie d'information qui existe entre les élus du peuple (le principal dans le modèle), les officiels percepteurs de taxes (le superviseur) et les électeurs-contribuables (l'agent). Cette asymétrie d'information donne lieu à une corruption bureaucratique qui limite la capacité du système fiscal à générer des revenus par voie de taxes directes et prive ainsi le système fiscal de ressources financières additionnelles. Les éléments théoriques de cet argument sont développés en termes d'un modèle où les électeurs-contribuables maximisent leurs utilités et les élus maximisent les votes. Le modèle est vérifié au plan empirique avec un système d'équations simultanées appliquées à un échantillon de données internationales. Dans ce système, l'effet de distorsion de la corruption bureaucratique est capté par une variable latente définissant la "structure fiscale générale". Les résultats empiriques confirment les attentes théoriques en montrant que la variable latente "structure fiscale générale" explique le niveau de taxation et la distribution des revenus après impôts.

Mots-clés: Corruption bureaucratique, asymétrie d'information, système fiscal, variable latente.

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It has often been assumed that a country's tax level, tax structure, progressivity and after-tax income distribution are chosen by voters subject only to their budget constraints. This paper argues that at certain income levels voters' decisions may be constrained by bureaucratic corruption. The theoretical arguments are developed in terms of an expected vote-maximization model in which an information asymmetry limits the capacity of the fiscal system to generate revenues by means of direct taxes. This hypothesis is tested with a sample of international data by means of a simultaneous-equation model. The distortions resulting from corruption are captured through their effects on a latent variable defined as the overall fiscal structure. Evidence is found of causality running from this latent variable to the level of taxes and the degree of after-tax inequality.

Keywords: Bureaucratic corruption, asymmetry of information, fiscal system, latent variable.

Introduction

How may one explain the differences in fiscal systems among countries? For example, why does the tax level as a share of total income vary from about five per cent in Bangladesh to close to 50 per cent in Denmark? The majority of observers has answered this question by referring to differences in the demand for public spending associated with differences in income levels¹. As will be shown below, one of the difficulties with this approach is that in cross-section, apart from the very poorest countries, the average tax level is relatively insensitive to per-capita income up to a certain level of per-capita income and then rises sharply.²

There is a minority current associated with Musgrave (1969), Riker (1978) and Kau and Rubin (1981) which has explained variations in the level of taxes by constraints on the supply side. According to these authors, the cost of tax collection -- particularly in the case of direct taxes -- may vary with a country's level of development. If this argument is correct, the choices of voters in countries with low levels of per-capita income may be constrained by the capacity of the fiscal system to generate tax revenues.

A problem with this argument is that while the cost of raising tax revenues may indeed vary with a country's level of development, there is

no reason that these cost differences need imply large changes in the share of income devoted to public spending. For example, if the price-elasticity of demand for public goods is close to unity, then cost differences should have little effect on the public share.

There is, however, a supply-side phenomenon which might explain substantial variations in the average tax level across countries. If there is corruption in the fiscal system, the amount paid in bribes would constitute a net loss to the public sector³. The result would be a shortfall in observed tax revenues which taxpayers would refuse to make up even if their price-elasticity of demand for public goods is close to one.

The subject of corruption in fiscal bureaucracies has received scant attention from economists. Rose-Ackerman (1975) attempted to model corruption in the awarding of government contracts. She argued that bribery of officials would be a decreasing function of the degree of competition among submitting firms. As Virmani (1983) pointed out, if one is interested in the tax system, one must also take account of the amount of information available to the tax officials. Yet the crucial point is not so much the information available to these officials as it is asymmetries in information between the latter and the elected representatives to whom they are responsible.

Recently, several researchers have realized that the problem of information asymmetries among individuals at different levels in a bureaucratic hierarchy may be analyzed most usefully by means of a variant of the principal-agent model. Antle (1982,1984) has analyzed the incentives for auditors to reveal the truth in the setting of a three-level hierarchy in which the latter are situated at an intermediate level between a firm's owners and its managers. Tirole (1985) has suggested how this type of analysis might be applied to other hierarchic structures, such as the relation between a firm's owner, its foreman and a worker.

To date, however, there has been no attempt to apply this analysis to fiscal bureaucracies. A problem that arises in this context is that under a democratic regime the taxpayers, who are at the bottom of the fiscal hierarchy, are also those who choose the individual at the top; namely, the elected representative to whom the tax official is responsible. A further problem in analyzing bureaucratic corruption is that of verifying the hypotheses raised by any theoretical model. Since there are no reliable statistics on corruption in any country, any evidence must necessarily be indirect.

This paper will explore the implications of bureaucratic corruption for the structure of a country's fiscal system. Although no attempt will be made to treat information asymmetries explicitly, the study will nevertheless try to model the impact of corruption on the choices of voters. It will be shown that the presence of bribery related to the problems of observing income at certain levels of development will tend to distort the fiscal structure in certain characteristic ways. The problem will then become one of verifying the presence of such distortions.

Before any attempt to model voter choice along these lines, however, it is important to have some idea of how fiscal systems differ among countries. Accordingly, the following section will examine the stylized facts concerning four dimensions of taxation. Then the third section will try to explain the empirical regularities that may be observed by means of a model of bureaucratic corruption. In the fourth section, an attempt will be made to capture the effect of corruption through the manner in which it distorts what will be defined as the overall fiscal structure -- a term which includes the relative importance of direct and indirect taxes as well as the importance of government transfer payments. Since this new variable is itself not directly observable, this section will present an empirical model incorporating a latent variable, to be

estimated by the LISREL method. A final section will present the conclusions.

The Stylized Facts of Fiscal Systems

The question of empirical regularities in individual aspects of taxation has attracted the interest of previous researchers. In his pioneering study, Fiscal Systems, Musgrave (1969) found significant linear cross-section relationships between per-capita income on the one hand and tax level and tax structure on the other. Ahluwalia (1976) and others found a U-shaped relationship between per-capita income and distributive shares. With the recent availability of comparable data on public finance compiled by the International Monetary Fund (1984) and on income distribution compiled by the World Bank (1984), it has now become possible to undertake a detailed cross-section analysis of the complete fiscal system. Accordingly, this study is based on a sample of 39 countries for which data on both income distribution and on taxation for all levels of government may be found for corresponding years⁴. This section will describe how these variables change as per-capita income rises.

Tax Level

Consider first how the level of taxes varies across countries. Figure 1 presents the relationship between the natural logarithm of per-capita G.N.P. and the share of taxes and social security contributions in G.N.P. The curve passing through the individual points is a fourth-order polynomial obtained by regressing the latter variable on the former. As Wagner⁵ suggested, the average tax level tends to rise with the level of development. However, as the graph indicates, there appears to be a definite pause in the tax level in the middle income ranges, followed by a sharp acceleration and leveling off in the upper income range.

Tax Structure

It is difficult to capture the structure of a fiscal system in a single variable. However, one measure which has been used in a recent study⁶ is personal income taxes as a fraction of total tax revenues. Accordingly, Figure 2 plots the share of non-corporate direct taxes in total revenues as a function of per-capita income. A quadratic regression polynomial has been estimated for this relationship. As Musgrave (1969) noted, there is a definite tendency for the use of personal income taxes to rise with per-capita income. However, in the middle ranges of development, there is a pronounced dip in this measure of tax structure.

Progressivity

As has often been recognized⁷, a key determinant of the progressivity of the overall fiscal system is the importance of negative taxes or transfer payments. In Figure 3, transfer payments as a fraction of total taxes and social-security contributions are plotted as a quadratic function of the logarithm of per-capita income. Clearly there is a tendency for transfers to increase in importance as income levels rise. Once again, however, there is a dip in the curve in the intermediate ranges of development.

Income Distribution

The fourth and final empirical relationship to be examined concerns after-tax income distribution and economic development. The graph in Figure 4 plots the income share of the 40 per cent of households in the fifth to eighth deciles (that is, the group above the bottom 40 per cent) as a function of the logarithm of per-capita income. As the quadratic curve illustrates, there is once again an overall positive relationship. However, as Ahluwalia (1976) observed, there is a tendency for the share of the middle-income groups to fall in the intermediate ranges of development.

Figure 1
Tax level and income level

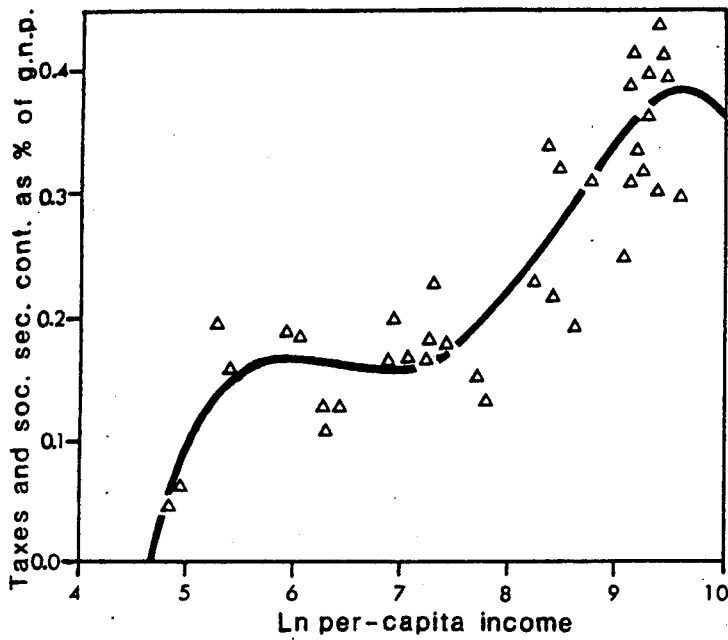


Figure 2
Tax structure and income level

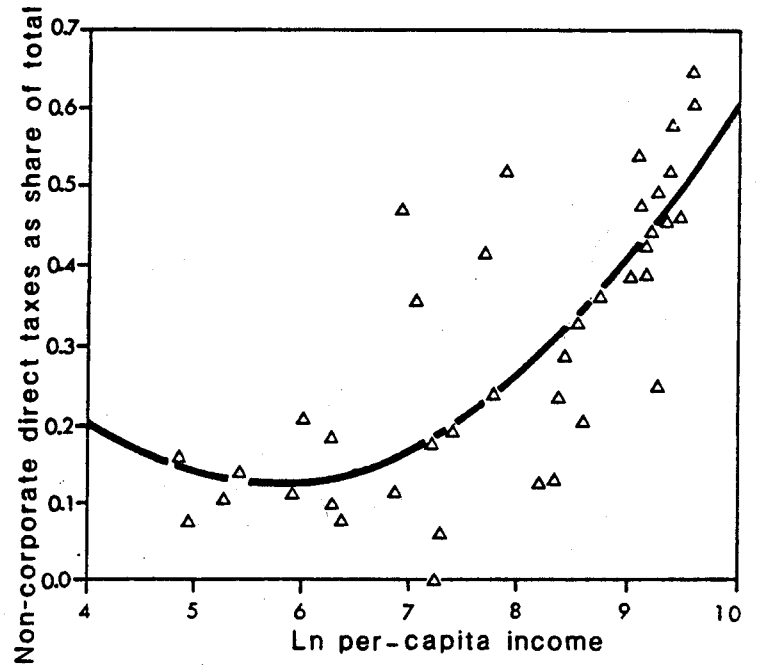


Figure 3
Transfer payments and income level

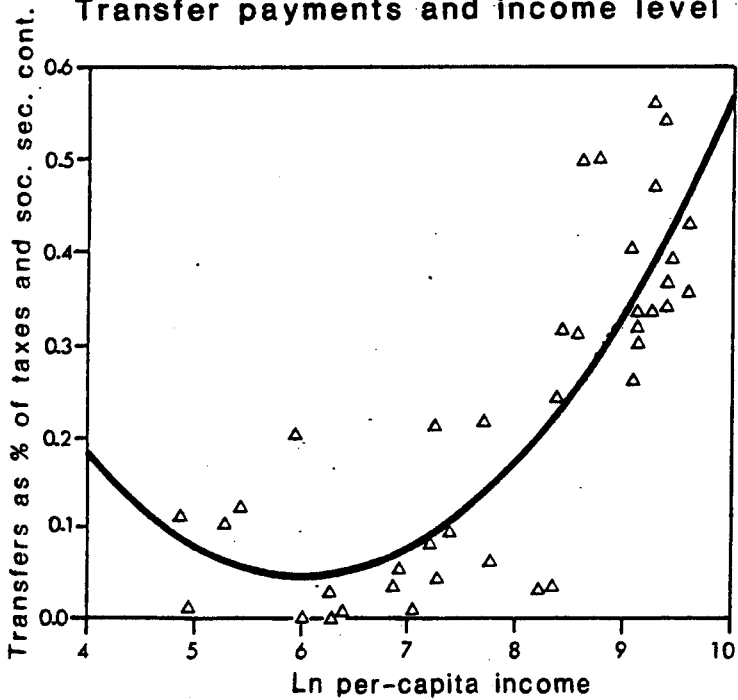
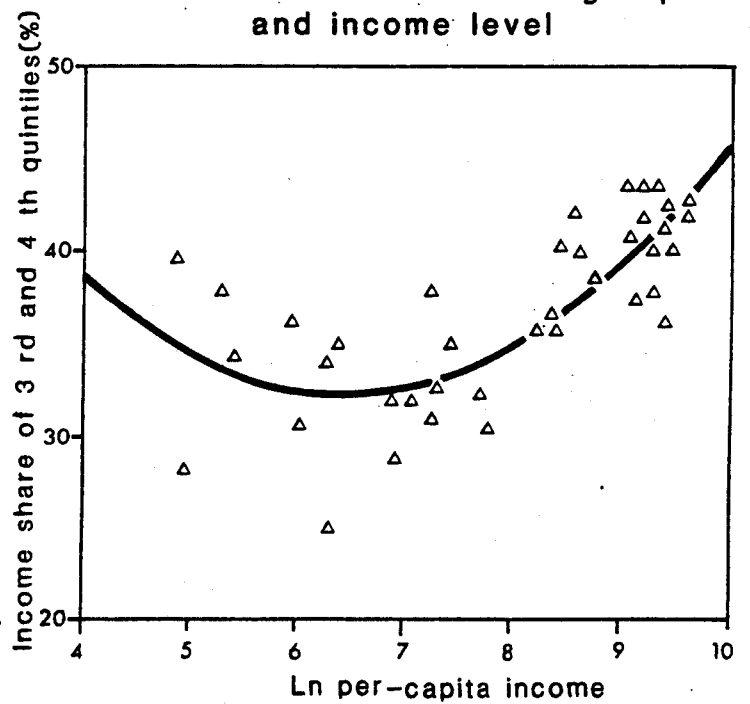


Figure 4
Income share of median group and income level



In short, this brief look at four dimensions of fiscal systems for a cross-section of developed and developing countries has yielded evidence of a common empirical regularity. Overall, there is a tendency for the tax level, the use of personal income taxes and transfers as well as the after-tax share of the middle income groups to rise with per-capita income. In each case, however, there is a movement in the opposite direction in the intermediate range of development. This initial decline is offset only when per-capita income reaches the levels of what are considered developed countries.

How may one explain these nonlinearities? Two alternative explanations may be considered. One possibility is that they reflect differences in the demand for public spending. Since it is difficult to conceive why changes in income or relative prices might cause the observed dips in the intermediate range of developing countries, a more plausible explanation is that they are the result of changes in the supply of tax revenues. The hypothesis that will be explored below is that the supply of tax revenues is somehow constrained in this income range.

Even if one accepts the idea of fiscal constraints on an economy's capacity to transform private goods into public goods, there is a second question which must be answered. Is the observed fiscal shortfall due to tax evasion or bureaucratic corruption? As Allingham and Sandmo (1972) point out, in modeling tax evasion it is necessary to take account of the uncertainty of being caught. Tax evasion may be looked upon as a stochastic discount on the nominal rates set by the tax authorities. Since the money lost to the tax system stays in the pockets of the taxpayers, the latter should be willing to raise nominal tax rates to permit the desired level of public spending. If taxpayers are risk-neutral, therefore, tax evasion should have no net effect on the level of effective tax revenues relative to income. The only result will be a

stochastic gap between nominal and effective tax rates and, possibly, a higher portion of the tax receipts devoted to collection.

The following section will present an alternative hypothesis; namely, that the stylized facts presented above are due to the manner in which bureaucratic corruption constrains voter choice.

The Constrained-Voter Hypothesis

In many contractual relationships, one of the parties (the principal) is unable to observe the behavior of the other (the agent). All that the former can observe is the outcome of the latter's behavior, subject to other uncontrollable factors (the state of nature). In such a situation, there is an incentive for the agent to modify his behavior in a manner which is favorable to him but unfavorable to the principal -- a problem known as moral hazard^a. This section will examine some of the implications of moral hazard for the question of taxation. The object will be to derive testable hypotheses of the impact of bureaucratic corruption on the dimensions of the fiscal system described in the previous section.

The Tax System as a Hierarchy of Contracts

In their restatement of the principal-agent problem, Antle (1982,1984) and Tirole (1985), identify three individuals: the principal, the agent, and a supervisor, hired by the principal to oversee the agent. In the fiscal context, the role of principal should probably be assigned to the elected representative. The agent is then the taxpayer who pays for and consumes the public good. Finally, the role of supervisor should be played by the tax official who assures that the conditions of the contract between the representative (the principal) and the citizen as taxpayer (the agent) are respected; that is, that the citizen pays his due amount of taxes.

In the Antle-Tirole formulation of the problem, there is only one individual at each level of the hierarchy. Moreover, the relationship between the principal and the agent is a simple one (for example, the relationship between a firm's manager and worker). In the case of taxation, however, there is more than one agent or taxpayer. Moreover, under a democratic regime, the relationship between the principal and the

agents is complicated by the fact that the agents as voters collectively choose the principal. As a result, the voter-taxpayers must take account of both roles in calculating their optimal behavior.

The most interesting feature of the hierarchical approach is that when the principal cannot observe completely the behavior of the agent, there arises the possibility of collusion between the supervisor and the agent. The model presented here will assume that bribery of tax officials may be present in any income category and will then proceed to examine its implications for voter choice.

Consider the situation of a set of n voter-taxpayers (agents) with identical preferences who, after the resolution of uncertainty, will find themselves in one of m different states. These states may be ranked in terms of increasing gross income, ranging from a minimum of y_1 in state 1 to a maximum of y_m in state m . The probability distribution of outcomes will generally be different for each voter-taxpayer.

In order to assure the supply of a public good, the voters initially elect a representative (principal) who in turn will produce public goods from tax revenues under a balanced budget. Candidates for the position of representative propose schedules of transactions taxes and income taxes. Once elected, the representative then proceeds to hire an official (supervisor) to collect tax revenues from each taxpayer (agent) once the uncertainty has been resolved. The tax official is assumed to be perfectly informed concerning the transactions and income of each individual after the resolution of uncertainty⁹.

The elected representative, however, is not necessarily as well informed as the tax official. As Tirole (1985) has shown, an asymmetry of information of this sort creates an incentive for the supervisor and the agent (the official and the taxpayer) to collude. Knowing that the representative cannot observe all of the taxpayer's income, the official

can offer to collect a lower amount of taxes than required in return for bribes from the taxpayer. It will be assumed that competition among candidates for the position of official is limited. As a result these bribes imply a net loss of resources to the public sector.

The Voter-Taxpayer's Problem

The next step is to model formally the decisions of the voter-taxpayers. A reasonable approach is to portray candidates for elective office as maximizers of expected votes.¹⁰

Assume that candidates for election as representative present schedules of effective tax shares and levels of public spending. For a given set of effective tax shares and implicit shares of total bribes to officials, the jth voter-taxpayer chooses the amount of public spending which maximizes his expected utility. Let utility in each state i be a weighted sum of the logarithms of public spending, G, and disposable income (after taxes and bribes to the tax officials). Let the individual's share of total taxes and total bribes to officials be considered exogenous for the moment. The agent's problem is as follows:

$$\text{Max}_G \sum_{i=1}^m \pi_{ij} U_i = \sum_{i=1}^m \pi_{ij} \{ \theta \ln G + (1-\theta) \ln [y_i - \sigma_i G - \mu_i k(y^*) G] \} \quad (1)$$

where

π_{ij} = probability of state i for individual j,

y_i = individual's gross income in state i,

σ_i = share of total taxes paid by individual in state i,

μ_i = share of total bribes to officials paid by individual in state i,

$k(y^*)$ = bribes to officials as a ratio of government spending in country with per-capita income y^* .

To solve this problem, differentiate (1) with respect to G and set the resulting derivative equal to zero.

$$\sum_{i=1}^m \pi_{ij} \left[\theta/G - \frac{(1-\theta) (\sigma_i + \mu_i k)}{y_i - (\sigma_i + \mu_i k)G} \right] = 0 \quad (2)$$

or

$$\sum_{i=1}^m \pi_{1j} \left[\frac{\theta - (r_1 + b_1)}{D_1} \right] = 0 \quad (3)$$

where

r_1 = taxes as proportion of individual's gross income in state i ,

$$\text{i.e., } r_1 = \sigma_1 G / y_1$$

b_1 = bribes to officials as fraction of individual's gross income in state i .

$$\text{i.e., } b_1 = \mu_1 k G / y_1$$

$$D_1 = G - (\sigma_1 + \mu_1 k) G^2 / y_1$$

For any given individual, this optimality condition may be satisfied by a large number of tax structures; for example, a linear, a regressive or a progressive tax structure will all satisfy equation (3).

The Representative's Problem

The representative's problem is to maximize his probability of being elected. To do so, he must attempt to satisfy condition (3) for all voters. In addition, to be feasible, the proposed programme must also satisfy the overall budget constraint:

$$\sum_{j=1}^n \sum_{i=1}^m \pi_{1j} r_1 y_1 = G \quad (4)$$

If all people are identical, it is possible to find a G to satisfy equations (3) and (4) whatever the degree of progressivity of the tax structure. However, if the π_{1j} are different for different individuals, j , this result no longer holds. For example, if the tax structure is progressive, a "poor" individual (one with high probabilities of finding himself in the lower income states) will desire a higher level of public spending than a "rich" person (one with high probabilities of finding himself in the higher income states). The only way to satisfy (3) and (4)

for all individuals in this case is to set the effective tax rate such that:

$$r_1 = \theta - b_1. \quad (5)$$

In other words the effective tax rate should be equal to the ideal share of taxes in income, θ , less the share of income paid in bribes to the official. It may therefore be seen that if the share of income paid in bribes is exogenous, determined by the structure of the economy, the individual's share of taxes is determined endogenously.

Tax Structure

The fiscal corruption that has just been described is due to the inability of the elected representative to observe the tax base. However, this ability to observe the transactions and income of taxpayers may vary between types of taxes and across income states for any given tax.

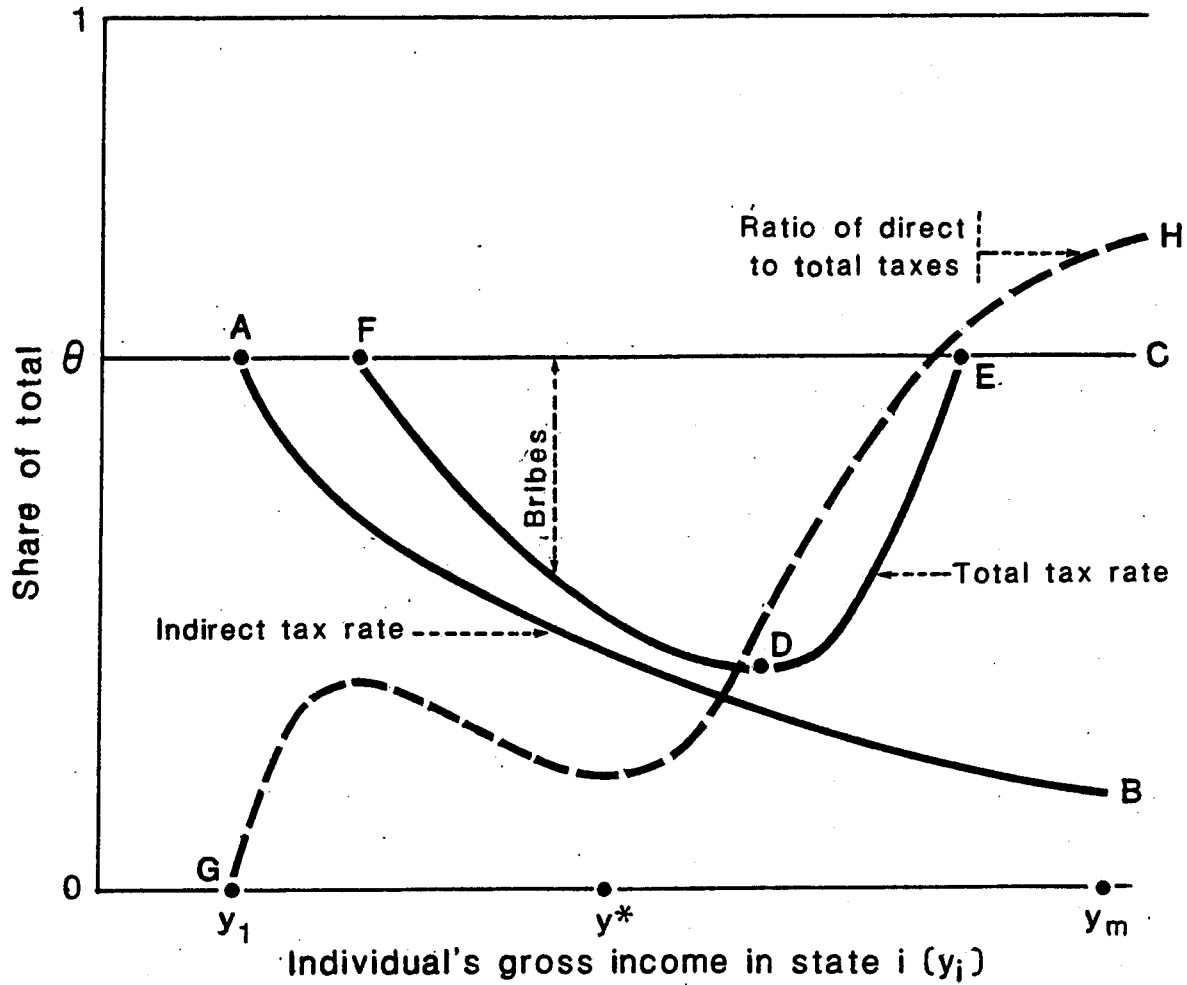
Indirect taxes tend to be levied on transactions; for example, on the purchase of cigarettes or the import of coffee. Because of differences in the commodity composition of consumption as income rises (for example, relatively fewer easily-observable purchases of goods and more of easier-to-hide services in the higher income states), the portion of transactions which is observable will tend to fall as income rises. As a result, $p(y_1)$, the indirect tax rate in income state i , will be assumed to be a non-increasing function of y_1 :

$$p'_1 \equiv dp(y_1)/dy_1 \leq 0 \quad (6)$$

To the extent that the proportion of observable transactions decreases with income, therefore, transactions taxes will be regressive. As shown in Figure 5 by the curve AB, the average indirect-tax rate as a fraction of gross income will be set at the level θ for the minimum income level, y_1 , and will decline as income rises beyond this level.

Figure 5

Indirect and direct taxes as a fraction of gross income and direct taxes as a fraction of total taxes, by income state



Transactions taxes are well-suited to a simple economy in which the bulk of production consists of a small number of homogeneous products. However, as an economy becomes urbanized, it tends to produce an increasingly wide range of heterogeneous products and services. Most governments therefore levy direct taxes on income in addition to indirect taxes on transactions. However, the ability to observe incomes will vary with the level of an individual's income.

At low levels of income, the bulk of direct-tax revenue originates within the public sector -- largely from income taxes on the civil service and the military. As income rises, however, the percentage of income which comes from urban self-employment tends to increase, as the probability that an individual finds himself in small-scale production and services rather than in agriculture increases. Since this income is hard to observe, losses to the tax system because of bureaucratic corruption tend to increase. It is only at high income levels that this trend is reversed as the probability of being employed within larger producing units within the urban setting (where income is more easily observed) rises. As a result of this process, the fraction of potential direct tax revenues lost to corruption will tend first to rise with the individual's income and then to fall as a higher proportion of total income becomes observable.

Let bribes to officials as a proportion of income in state i be equal to the proportion $\alpha(y_i)$ of the gap between the ideal tax rate, θ , and the indirect tax rate, $p(y_i)$.

$$b_i = \alpha(y_i)[\theta - p(y_i)]$$

This equation may be written more compactly as:

$$b_i = \alpha_i[\theta - p_i] \quad (7)$$

In the light of the above discussion, let y^* be the income state at which the derivative of α with respect to income changes sign. Then

$$\alpha'_1 \geq 0, \quad \forall y_1 \leq y^*$$

$$\text{and } \alpha'_1 \leq 0, \quad \forall y_1 \geq y^*, \quad \text{where } \alpha'_1 = d\alpha(y_1)/dy_1.$$

Consider now how the tax structure, $s_1 \equiv s(y_1)$, defined as the ratio of direct taxes to total taxes in state i will vary with income.

$$s_1 = (1 - \alpha_1)(\theta - p_1)/\theta \tag{8}$$

Differentiate with respect to y_1

$$ds_1/dy_1 = - (1 - \alpha_1)p'_1/\theta - \alpha'_1(1 - p_1/\theta) \tag{9}$$

The right side of equation (9) is made up of two terms. The first term expresses the impact on tax structure of the decline in the indirect-tax base which occurs as income rises. Since direct taxes must fill the gap between the yield on indirect taxes and the desired tax level, this term is positive; that is, the relative importance of direct taxes rises with individual income. The second term expresses the effect of changes in the degree of bureaucratic corruption. Initially, as the urban private sector expands with development, this term is negative. If this second effect is sufficiently important, it may offset the positive first term. Intuitively, the difficulty of observing the direct tax base in the urban private sector as income levels begin to rise leads to an increase in corruption and a decline in the relative importance of direct taxes.

At still higher income levels, the second term on the right side of equation (9) changes sign. With both terms now positive, the tax

structure changes rapidly, with direct tax revenues rising sharply as a percentage of total taxes in each income state.

At low income levels, where a relatively small part of all transactions and income is readily observable, the combined effect of these two types of taxes will lead to a regressive overall tax structure, as indicated by the curve AFD. However, as individual income rises further it becomes more readily observable and the degree of corruption (the distance between AC and AFDEC) falls. As a result, in this income range, the tax system becomes progressive. Finally, in the highest income range, the tax system becomes linear.

The overall implications of the information asymmetry discussed in this section for tax structure may be seen in the ratio of direct to total taxes. As indicated by the curve GH in Figure 5, this ratio varies in nonlinear fashion with the individual's gross income. Although the relative importance of direct taxes rises with income, there is a dip in the intermediate income levels due to the presence of bureaucratic corruption.

Implications for Comparing Tax Systems

The simple model which has just been described has interesting implications for comparing tax systems. Not only does it provide a coherent structure for examining simultaneously the various dimensions of taxation, but also it offers a possible explanation for the empirical regularities noted in the previous section. In order to pass from the individual to the country it is necessary to aggregate across income states, weighting each state by the percentage of households found in that state.

Consider first the poorest countries, in which the majority of individuals are in the lowest income states. The bulk of tax revenues

will come from indirect taxes on the relatively homogeneous goods produced and imported.

In countries at an intermediate level of development, with higher mean incomes, there will be a large number of individuals in income states around y^* . Easily-taxable transactions have decreased as a percentage of total income but, because of and self-employment and the high cost of processing information, incomes are not easily observed. In such countries there will be considerable loss of potential tax revenues into bribes to officials. Tax systems will be highly regressive, with indirect taxes continuing to account for a large part of total revenues.

Finally, in developed countries, the majority of individuals will be in the upper income states. Although indirect taxes on transactions will be decline as a fraction of income as income rises, this regressivity will be offset by progressive direct taxes on income. The resulting structure will be linear.

In short, the model suggests that the choices of tax level, tax structure, progressivity and after-tax income distribution available to voters are constrained by the loss of potential tax revenues which results from bureaucratic corruption. If this **constrained-voter** hypothesis is correct, one would expect to see evidence of the manner in which corruption distorts the structure of the tax system. These distortions would in turn affect the overall level of taxes and the incidence of the tax system on income distribution.

Empirical Analysis

In the previous section it was suggested that inter-country differences in tax structure are determined, in part at least, by the degree of corruption in the administration of the tax system. If this analysis is correct, one would expect to find that an economy's tax level and after-tax income distribution are explained by its tax structure, as determined in turn by its level of development. This constrained-voter hypothesis contrasts sharply with the usual approach in public-choice theory that the level of taxes is determined by voter demand as explained, for example, by the average income level. It also runs counter to recent theorizing that the distribution of income determines voters' preferences for public spending and for tax structure and progressivity. To test the constrained-voter hypothesis therefore requires a flexible simultaneous-equation functional form within which alternative hypotheses may be nested.

Although the degree of corruption cannot be measured directly, one may nevertheless be able to observe the manner in which it distorts the structure of the tax system. To capture this distortion empirically, it is necessary to take into account not only the relative importance of direct and indirect taxes, as explained in the previous section, but also the importance of governmental transfer payments. Accordingly, this section defines the notion of "overall fiscal structure", which includes the effects of negative taxes or transfer payments as well as those of direct and indirect taxes.

Since this new variable is itself not directly observable, this section will present an empirical model that treats it as a latent variable, to be estimated by the LISREL method. Because of the more general problem of errors in variables, this section also treats income distribution as a latent variable.

The LISREL Model

The LISREL model incorporates latent (unobservable) variables within a linear structural model. Although econometricians and statisticians have recognized this approach as a major breakthrough in errors-in-variables or models involving latent variables, LISREL has been largely ignored by economists until quite recently¹¹. Let \underline{Y} and \underline{X} be vectors of p observable endogenous and q exogenous variables respectively. The model consists of three equations¹²:

the structural equation,

$$\underline{\eta} = \underline{\beta}\underline{\eta} + \underline{\Gamma}\underline{\xi} + \underline{\zeta}; \quad (10)$$

the measurement equation for \underline{Y} ,

$$\underline{Y} = \underline{A}\underline{\eta} + \underline{\epsilon}; \quad (11)$$

and the measurement equation for \underline{X} ,

$$\underline{X} = \underline{A}^*\underline{\xi} + \underline{\delta}; \quad (12)$$

where $\underline{\eta}$ and $\underline{\xi}$ are random vectors of latent (non-observable) endogenous and exogenous variables respectively. It is assumed that $\underline{\zeta}$ is uncorrelated with $\underline{\xi}$, that $\underline{\epsilon}$ is uncorrelated with $\underline{\eta}$, that $\underline{\delta}$ is uncorrelated with $\underline{\xi}$, and that $\underline{\zeta}$, $\underline{\epsilon}$ and $\underline{\delta}$ are mutually uncorrelated. In addition, it is assumed that $\underline{\beta}$ has zeros in the diagonal and that $\underline{I}-\underline{\beta}$ is non-singular.

With the above structure and other restrictions on the parameters for the model to be identified, the idea behind LISREL is to compare a sample covariance matrix, \underline{S}_{data} , with the parametric structure, $\underline{\Sigma}_{model}$, imposed on it by the hypothesized model. Full information maximum-likelihood estimators are obtained under the assumption that the observed variables (\underline{Y}' , \underline{X}'), have a multinormal distribution and by minimization of the criterion:

$$\ln|\underline{\Sigma}_{model}| + \text{tr}(\underline{S}_{data} \underline{\Sigma}_{model}^{-1}) - \ln|\underline{S}_{data}| - (p+q).$$

When one imposes appropriate restrictions, the LISREL model reduces to any one of a number of well-known models. For example, if one ignores equation (10), the model reduces to factor analysis; if one assumes that $\Lambda^y = \Lambda^x = I$ and $\text{var}(\epsilon) = \text{var}(\delta) = 0$ in equations (11) and (12), LISREL is reduced to a traditional system of linear simultaneous equations.

An additional feature of LISREL is that it permits the calculation of modification indices which show how the specification might be changed so as to improve the overall fit. For each parameter in the model which is fixed (generally set equal to zero, thereby implying omission of the corresponding variable), the modification index indicates the expected decrease in the model's χ^2 statistic if the parameter were left free.

LISREL is limited to linear structures and assumes that all observed variables are jointly normally distributed. The procedure also assumes independence of observations -- a serious shortcoming for the analysis of dynamic models. Despite these restrictions, many extensions can be considered, as discussed in Aigner, Hsiao, Kapteyn and Wansbeek (1984).

The Econometric Specification of the Model

As explained above, although bureaucratic corruption may not be observed directly, its effects may be seen in the way it distorts what may be defined as the overall fiscal structure (OFS). The latter variable is an unobservable or latent variable which reflects the relative importance of direct taxes as well as that of transfer payments. It will be considered as endogenous in the model. In addition, there will be two other endogenous variables; namely, tax level (TL) and income distribution (ID). The former variable will be assumed to be observable, while the latter will be considered unobservable. Thus the vector of endogenous variables is

$$\eta' = [\text{OFS}, \text{TL}, \text{ID}]', \quad (13)$$

and the vector of structural residuals becomes

$$\zeta' = [\zeta_1, \zeta_2, \zeta_3]'. \quad (14)$$

To complete the measurement equation (11) for \underline{Y} , define

$$\underline{Y} = \begin{bmatrix} \text{TXPRP} \\ \text{TRANF} \\ \text{TXRV} \\ \text{MED40} \end{bmatrix} \quad \underline{A}^y = \begin{bmatrix} 1 & 0 & 0 \\ \lambda_1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad \underline{\epsilon} = \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \epsilon_3 \\ \epsilon_4 \end{bmatrix} \quad (15)$$

In this specification TXPRP, the ratio of personal income taxes to total taxes, and TRANF, the ratio of transfer payments to total taxes including social-security contributions (S.S.C.), are used as instruments to measure the overall fiscal structure, OFS. The after-tax income share of the population in the fifth to eighth deciles, MED40, is used as an instrument to measure ID. Finally, TXRV, defined as total taxes including S.S.C. as a fraction of G.N.P. is, assumed to measure the tax level, TL, directly, with $\text{var}(\epsilon_3)=0$.

Up to this point, the only exogenous variable that has been mentioned in the model is the level of per-capita income. However, in order to take account of the numerous other determinants which have been suggested in the literature on taxation and distribution and to permit identification of the model, it is necessary to add several other explanatory variables.

All exogenous variables in the model will be treated as observable. In terms of equation (12), this means that

$$\xi' \equiv \underline{X}' = [\text{GROUP}, \text{EDUC2}, \text{LNY}, \text{LNY2}, \text{EXREV}, \text{URPOP}, \text{MILY}]' \quad (16)$$

with $\underline{A}^x = \underline{I}$ and $\text{var}(\delta)=0$.

In this equation, GROUP is a variable intended to capture the effect of interest groups on distribution, as suggested by Olson (1982). It is defined as the natural logarithm of the number of years since a major

disruption such as war or independence. If Olson is correct, the rents captured by interest groups over time should lead to a less equal income distribution; accordingly GROUP should have a negative impact on income equality. The inclusion of EDUC2, the number of students attending secondary school as a proportion of the relevant age group, is suggested by the human capital model¹³. URPOP, the urban population as a percentage of the total, take account of the effects of the structural changes associated with urbanization on income distribution.

To capture the effects of the level of development on the three dependent variables, it was decided to use LNY, the natural logarithm of G.N.P. per capita in 1980 U.S. dollars, and LNY2, the square of LNY. The variable EXREV, the ratio of exports of goods and services to G.N.P., is intended to take account of the availability of alternative tax bases in the overall-fiscal-structure equation, while MILY, the ratio of military expenditures to G.N.P.¹⁴, is a component of the demand for public spending in the tax-level equation.

Finally, the structural coefficients of equation (10) are specified as follows:

$$\tilde{\beta} = \begin{bmatrix} 0 & \beta_{12} & \beta_{13} \\ \beta_{21} & 0 & \beta_{23} \\ \beta_{31} & \beta_{32} & 0 \end{bmatrix} \quad \tilde{\Gamma} = \begin{bmatrix} 0 & 0 & \gamma_{13} & \gamma_{14} & \gamma_{15} & 0 & 0 \\ 0 & 0 & \gamma_{23} & \gamma_{24} & 0 & 0 & \gamma_{27} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} & \gamma_{34} & 0 & \gamma_{36} & 0 \end{bmatrix} \quad (17)$$

One of the principal objectives of this paper is to test the directions of causality among the overall fiscal structure (OFS), tax level (TP) and income distribution (ID). The usual public-finance approach, beginning with Wagner and including Kuznets (1955), suggests that these three variables are determined separately, that is, that

$$\tilde{\beta} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

The more recent current associated with Romer(1975), Peltzman(1980)

and Meltzer and Richard (1981) and others suggests that causality runs from income distribution to tax level and the progressivity component of the overall fiscal structure.

$$\underline{\beta} = \begin{bmatrix} 0 & 0 & \beta_{13} \\ 0 & 0 & \beta_{23} \\ 0 & 0 & 0 \end{bmatrix} \quad (19)$$

Finally, the constrained-voter hypothesis as developed by Musgrave (1969), Kau and Rubin (1981) and in the preceding section of this study, suggests that causality runs from what has been defined as the overall fiscal structure to tax level and income distribution.

$$\underline{\beta} = \begin{bmatrix} 0 & 0 & 0 \\ \beta_{21} & 0 & 0 \\ \beta_{31} & 0 & 0 \end{bmatrix} \quad (20)$$

The Empirical Results

Constrained in this way, the econometric model described in equations (10) to (12) was estimated by means of the LISREL (VI) program of Jöreskog and Sörbom (1984) for a sample of 39 developed and developing countries. The model was initially estimated with the set of constraints on $\underline{\Gamma}$ described in equation (18), subject to the requirements for convergence and identification. Any exogenous variable found to be nonsignificant was then omitted from the relevant equation and the model was reestimated. The final choice of exogenous variables to be included in each equation was determined by the modification indices. Elements of the $\underline{\Gamma}$ matrix corresponding to excluded variables were therefore set equal to zero, while the others were estimated directly. However, all six off-diagonal elements of the $\underline{\beta}$ matrix were estimated.

The results, as reported in Table 1, tend to support a supply-side explanation of the tax system, with causality running from the latent variable, the overall fiscal structure, to the tax level and income

distribution. The overall-fiscal-structure variable is a highly-significant determinant of the tax level and is significant (under a one-tailed test) at the 10 per cent level as a determinant of the distribution of after-tax income. (As the note to Table 1 indicates, both the ratio of direct to total taxes and the importance of transfer payments were significant in determining this variable). The only variables which had any significant impact on the overall fiscal structure itself were the logarithm of per-capita income and the square of this variable. The signs of the parameter estimates for these variables indicate a squeeze on the capacity of the fiscal system to raise revenues by means of direct taxes in the intermediate ranges of development.

The fact that the level of per-capita income appears to have no significant independent effect on the tax level leads one to question conventional demand-oriented public-choice models inspired by Wagner's "law". The highly-significant coefficient for export revenues as a determinant of tax level provides additional support for a supply-oriented approach. However, the presence of the degree of urbanization and the level of military spending in the final specification of the tax-level equation imply that changes in the structure of the economy or in the degree of external threat may be expected to have an impact on the demand for public spending.

It is also worth noting that per-capita income has no significant independent impact on income distribution. Apart from the characteristics of the overall fiscal structure, the only other factors which affect income distribution significantly are the level of secondary education (positively) and the presence of interest groups (negatively, as expected). It would appear that Kuznets' U-shaped curve may be explained by a distortion in the fiscal structure in the intermediate levels of development, along with the formation of pressure groups as the economy evolves without major disruption.

A word of caution is necessary in interpreting the effects of income distribution on the other endogenous variables in the model. The measure used here, the after-tax share of the fifth to eighth deciles, is appropriate in assessing the impact of other variables on distribution. However, to explain the effect of distribution on other variables, it is the before-tax share which is of interest. To the extent that after-tax inequality is reduced but not eliminated by differences in the overall fiscal structure, the estimated coefficients will exaggerate the effect of distribution on the elements of the overall fiscal structure¹⁵.

TABLE 1
PARAMETER ESTIMATES FOR A SIMULTANEOUS-EQUATION MODEL OF TAXATION
FOR 39 DEVELOPED AND DEVELOPING COUNTRIES

Dependent variable	Endogenous explanatory variable			
	R ²	Overall fiscal structure (OFS)	Tax level (TL)	Income distribution (ID)
Overall fiscal structure	.999		-.202 (-1.15)	.215 (1.22)
Tax level	.909	.606 (2.66)		.072 (.35)
Income distribution	.973	.357 (1.50)	.167 (.96)	

Dependent variable	Exogenous explanatory variable						
	GROUP	EDUC2	LN Y	LN Y ²	EXREV	URPOP	MILY
Overall fiscal structure			-3.22 (-3.95)	3.88 (4.29)			
Tax level					.349 (6.05)	.213 (2.28)	.144 (2.49)
Income distribution	-.241 (-2.76)	.496 (3.01)					

Figures in parentheses are t-statistics.

Maximum modification index for omitted variables: 2.52 for wage to income ratio in the income-distribution equation.

χ^2 for whole model = 30.87 (probability level of 0.473).

The estimate for λ_1 in equation (15) was 0.969 (t-statistic 7.36).

Var(ζ_2) was set equal to 0.001 to prevent a negative variance estimate.

GROUP is the natural logarithm of the number of years since a major disruption such as war or independence; EDUC2 is the number of students attending school as a proportion of the relevant age group; LN Y is the natural logarithm of G.N.P. per capita in 1980 U.S. dollars; LN Y² is LN Y²; EXREV is the ratio of exports of goods and services to G.N.P.; URPOP is the urban population as a percentage of the total and MILY is the ratio of military expenditures to G.N.P.

To appreciate the relative importance of the explanatory variables, consider Table 2, which presents the total effect of each of these variables on the three endogenous variables. Since all variables are standardized, the total effects are comparable. Particularly interesting are the effects of the log of per-capita income and its square. Comparison of these results with those of Table 1 shows clearly that their effect on income distribution and tax level occurs through the latent variable, overall fiscal structure, which has a sizeable effect on each. These findings explain why, in single-equation models, per-capita income is generally found to be an important determinant of the tax level and of income distribution.

To sum up these empirical findings, a simultaneous-equation model of the overall fiscal structure, tax level and after-tax income distribution yields results which are compatible with the presence of a supply-side constraint on the revenue-generating capacity of the fiscal system at intermediate levels of development.

TABLE 2

TOTAL EFFECTS OF EACH EXPLANATORY VARIABLE ON THE ENDOGENOUS VARIABLES

Dependent variable	Endogenous explanatory variable		
	Overall fiscal structure	Tax level	Income distribution
Overall fiscal structure	.095	.017	.236
Tax level	.700	.023	.225
Income distribution	.507	.177	.122

Dependent variable	Exogenous explanatory variable						
	GROUP	EDUC2	LN Y	LN Y2	EXREV	URPOP	MILY
Overall fiscal structure	-.057	.117	-3.52	4.24	.006	.004	.003
Tax level	-.054	.111	-2.25	2.71	.357	.218	.148
Income distribution	-.271	.557	-1.63	1.97	.062	.038	.026

For definitions of exogenous variables, see Table 1.

Conclusion

This paper has attempted to explain variations among countries in the tax level, in the importance of progressive taxes and transfers and in the after-tax share of middle-income groups. Particular attention was paid to the declines in each of these variables which are observable in cross-section data in the intermediate ranges of development. It was argued that these phenomena are difficult to explain by variations in the demand for public spending or in the degree of tax evasion.

The hypothesis set out in this paper was that these nonlinearities are a result of the inability of elected representatives to observe taxable activities at certain levels of income. The result is a loss of potential tax revenues through bribes to officials. Such bribes, it was suggested, are most likely in the income brackets where total income is increasing rapidly in developing countries. A theoretical model based on expected vote maximization by political candidates indicated that voter-taxpayers will be unwilling to make up the shortfall by additional taxes. To the extent that the problem of observing taxable activities is more serious for direct than for indirect taxes, direct tax revenues should fail to keep pace with total income in the early stages of development.

The presence of supply-side constraints on the capacity of the fiscal system to generate direct-tax revenues was tested by means of a simultaneous-equation model. Since in practice transfer payments or negative taxes form an important part of the direct tax system, it was necessary to include them in the empirical analysis. It was decided to define an unobservable variable, the overall fiscal structure, which reflects the effects of both tax structure and transfer payments. Use of the LISREL technique allowed this new variable to be treated as a latent variable in statistical estimation.

The results indicated that overall fiscal structure varied in

nonlinear fashion with the logarithm of per-capita income, as the theoretical model predicted. This variable was found in turn to be a significant determinant of the level of taxes and the distribution of after-tax income. Little evidence was found of feedback from these other variables to the overall fiscal structure. These findings were interpreted as being consistent with the hypothesis that voter choices may be constrained by the revenue-generating capacity of the fiscal system if a significant portion of taxable activities is not easily observable.

¹The argument that the overall level of taxation depends on the level of income goes back at least to the nineteenth-century. The German economist Adolf Wagner (see Bird, 1971) argued that as a state progressed, its administrative and protective functions along with its cultural and welfare expenditures would increase in importance.

²See Figure 1 below.

³This statement assumes that there is imperfect competition among recipients of bribes.

⁴The actual year chosen for each country was that of the most recent census from which income distribution data have been compiled. A list of the 39 countries and the reference years is presented in Appendix A. For a description of the variables and the data sources, see Appendix B.

⁵See footnote 2 above.

⁶See Hettich and Winer (1984).

⁷For example, King (1980) demonstrates that for the United States, the United Kingdom and Sweden, differences between before- and after-tax inequality are due in large part to transfer payments.

⁸See Shavell (1979) for an analysis of the issues raised by this type of relationship.

⁹Under a democratic regime, electoral competition will be assumed to prevent corruption on the part of the representative. Note, however, that in the empirical section below no attempt is made to differentiate countries by their types of government.

¹⁰See Mayhew (1974, 40-49) for a cogent portrayal of the U.S. congressman as an expected vote maximizer, subject to certain restrictions. Hettich and Winer (1985) apply this approach to modeling tax policy.

¹¹For example, Schmidt (1983) uses LISREL to consider time and ability as latent variables in a production function for education, while Gärtner (1985) stresses the importance of treating labor militancy as a latent unobservable variable in a model of trade unionism and wage growth. A comprehensible compact discussion of LISREL can be found in Aigner, Hsiao, Kapteyn and Wansbreek (1984).

¹² The notation and discussion follow Jöreskog and Sörbom (1977, 1984).

¹³See Montmarquette (1974).

¹⁴In addition to the exogenous variables mentioned in the text, other variables included in the estimates were the annual rate of population growth over the preceding five years, the proportion of total government revenues collected by the central government, and the ratio of the hourly manufacturing wage to per-capita G.N.P. None of these variables proved to be statistically significant in any of the equations.

¹⁵A given change in the overall fiscal structure will be explained by a smaller change in distribution, leading to a coefficient which is upward-biased in absolute value.

APPENDIX A
LIST OF COUNTRIES AND REFERENCE YEARS

Country	Year	Country	Year	Country	Year
AUSTRALIA	1976	IRELAND	1973	PHILIPPINES	1971
BANGLADESH	1974	ISRAEL	1980	PORTUGAL	1974
BELGIUM	1975	ITALY	1977	SPAIN	1974
CANADA	1977	JAPAN	1979	SRI LANKA	1973
COLOMBIA	1970	KENYA	1976	SWEDEN	1979
COSTA RICA	1971	KOREA	1976	THAILAND	1976
DENMARK	1976	MALAYSIA	1973	TRINIDAD	1976
FINLAND	1977	MEXICO	1977	TURKEY	1973
FRANCE	1975	NEPAL	1977	UN. KINGDOM	1978
GERMANY	1978	NETHERLANDS	1977	UNITED STATES	1978
HONDURAS	1967	NORWAY	1970	SWITZERLAND	1978
INDIA	1976	PANAMA	1970	VENEZUELA	1970
INDONESIA	1976	PERU	1972	ZAMBIA	1973

APPENDIX B
DATA SOURCES¹

Symbol	Variable	Source
MED40	After-tax income share of the population in the fifth to eight deciles.	World Bank, <u>World Development Report</u> , Oxford Univ. Press, Washington 1979-84
TXPRP	(Total income tax minus indirect and corporate income taxes)/Total taxes.	<u>Yearbook of National Accounts Statistics</u> , United Nations N.Y., 1970, 1976, 1981. <u>Government Financial Statistics Yearbook</u> , IMF, 1984.
TXRV	(Total taxes + Social security contributions) /G.N.P.	<u>International Financial Statistics</u> , Yearbook, IMF, Washington 1984. See also TXPRP.
TRANF	Transfer payments/(Total taxes + Social security contributions)	<u>Yearbook of National Account Statistic</u> , United Nations, N.Y. 1970, 1976, 1980. See also TXRV
GROUP	Interest group variable.	Black, C.E., <u>The Dynamics of Modernization: A Study in Comparative History</u> , Harper and Row, N.Y. 1966.
EDUC2	Proportion of students of secondary school age attending school.	<u>B.I.R.D., Rapport sur le Developpement</u> Washington, 1978-1983
LN Y	The natural logarithm of G.N.P. in 1980 U.S. dollars.	See TXRV
LN Y2	The square of LN Y.	See LN Y
EXREV	Ratio of Exports to G.N.P.	<u>International Financial Statistics</u> , Yearbook, IMF, Washington, 1985.
URPOP	The Urban population as percentage of total	<u>Demographic Yearbook</u> , United Nations, N.Y., 1982, 1984.
MILY1	Ratio of Military expenditures over G.N.P.	<u>World Armaments and Disarmament</u> , SIPRI Yearbook, Intl. Pub. Service, N.Y., 1974-1984

¹For some variables, approximations and extrapolations were required for certain countries. Full details and all data are available from the authors.

REFERENCES

- Ahluwalia, Montek S.
(1976) Income Distribution and Development: Some Stylized Facts. American Economic Review. Papers and Proceedings, 66:2 128-35.
- Aigner, D.J., C. Hsiao, A. Kapteyn, and T. Wansbeek.
(1984) Latent Variables Models in Econometrics. Handbook of Econometrics, vol.2, eds. Z. Griliches and M.D. Intriligator.
- Allingham, Michael G. and Agnar Sandmo.
(1972) Income Tax Evasion: A Theoretical Analysis. Journal of Public Economics, 1: 323-28.
- Antle, Rick.
(1982) An Agency Model of Auditing. Journal of Accounting Research, 20: 503-527.
- Antle, Rick.
(1984) Auditor Independence. Journal of Accounting Research, 22: 1-20.
- Bird, Richard M.
(1971) Wagner's "Law" of Expanding State Activity. Public Finance, 26: 1-26.
- Cukierman, Alex and Allan H. Meltzer.
(1985) A Positive Theory of Progressive Income Taxation (Discussion paper, G.S.I.A., Carnegie-Mellon University).
- Gärtner, M.
(1985) Political and Industrial Change in a Model of Trade Union Militancy and Real Wage Growth. Review of Economics and Statistics, 67: 322-326.
- Hettich, Walter and Stanley Winer.
(1984) A Positive Model of Tax Structure. Journal of Public Economics, 24: 67-87.
- (1985) An Approach to the Economic and Political Foundations of Tax Structure. Carleton University, Ottawa, Canada.
- International Monetary Fund.
(1984) Government Finance Statistics Yearbook. Washington.
- Jöreskog, K.G. and D. Sörbom.
(1977) Statistical Models and Methods for Analysis of Longitudinal Data. Latent Variables in Socio-Economic Models, eds. D.J. Aigner and A.S. Goldberger. Amsterdam: North-Holland.
- and -----
(1984) LISREL VI Analysis of Linear Structural Relationships by the Method of Maximum Likelihood. User's Guide. Uppsala, Sweden: Department of Statistics, University of Uppsala.

- Katz, C.J., V.A. Mahler and M.G. Franz.
(1983) The Impact of Taxes on Growth and Distribution in Developed Capitalist Countries: A Cross-National Study. American Political Science Review, 87:1-886.
- Kau, James B. and Paul H. Rubin.
(1981) The Size of Government. Public Choice, 37: 261-74.
- King, Mervyn A.
(1980) How Effective Have Fiscal Policies Been in Changing the Distribution of Wealth and Income? American Economic Review, Papers and Proceedings, 70:2, 72-76.
- Kuznets, Simon.
(1955) Economic Growth and Income Inequality. American Economic Review, 45: 1-28.
- Mayhew, David R.
(1974) Congress: the Electoral Connection. New Haven: Yale University Press.
- Meltzer, A.H. and S.F. Richard.
(1981) A Rational Theory of the Size of Government. Journal of Political Economy, 89: 914-27.
- and-----
(1983) Tests of a Rational Theory of the Size of Government. Public Choice
- Montmarquette, Claude.
(1974) A Note on Income (Labor) Inequality: Income Tax Systems and Human Capital Theory. Journal of Political Economy, 82: 620-25.
- Musgrave, Richard A.
(1969) Fiscal Systems. New Haven: Yale University Press.
- Olson, Mancur
(1982) The Rise and Fall of Nations. New Haven: Yale University Press.
- Peltzman, Sam.
(1980) The Growth of Government. Journal of Law and Economics 23: 209-88.
- Riker, William.
(1978) The Cause of Public Sector Growth: Resources and Minority Advantage (University of Rochester, mimeo).
- Romer, T.
(1975) Individual Welfare, Majority Voting and the Properties of a Linear Income Tax. Journal of Public Economics, 4: 163-85.
- Rose-Ackerman, Susan.
(1975) The Economics of Corruption. Journal of Public Economics, 4: 187-203.
- Schmidt, R.M.
(1983) Who Maximizes What? A Study of Student Time Allocation. American Economic Review, 73: 23-28.
- Shavell, S.

- (1979) Risk Sharing and Incentives in the Principal and Agent Relationship. Bell Journal of Economics. 10: 55-73.
- Tirole, Jean.
(1985) Hierarchies and Bureaucracies: On the Role of Collusion in Organizations. (Discussion paper, Massachusetts Institute of Technology).
- Virmani, Arvind.
(1983) The Microeconomics of a Corrupt Tax Bureaucracy (Report No. DRD54, Development Research Department, World Bank, Washington, D.C.).
- World Bank.
(1984) World Development Report. Washington.