

Tax Structures in Developing Countries: Many Puzzles and a Possible Explanation*

by

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Abstract: *Tax policies seen in developing countries are puzzling on many dimensions, given the sharp contrast between these policies and both those seen in developed countries and those forecast in the optimal tax literature. In this paper, we explore how forecasted policies change if firms can successfully evade taxes by conducting all business in cash, thereby avoiding any use of the financial sector. The forecasted policies are now much closer to those observed.*

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Observed tax structures vary substantially across countries and over time. Why?

To some extent, these differences may simply reflect differences in social preferences for public vs. private goods. Countries differ substantially, for example, in the amount spent on the military, on infrastructure investments, on publicly provided education, or on social insurance. Higher spending levels require higher revenue, leading to higher tax rates.

To some extent, these differences may also reflect differences in the political support for redistribution. More redistribution naturally requires higher tax rates on the rich in order to finance lower tax rates or transfers to the poor. Governments with a stronger preference for redistribution would rely more on progressive personal income taxes, whereas other governments may choose less progressive personal taxes and make more use of proportional taxes such as a value-added tax or a payroll tax.

Other differences, though, are more puzzling based on conventional models of optimal tax structure. Regardless of a country's tastes for public vs. private goods or for more or less redistribution, Diamond and Mirrlees [1971] forecast that the optimal tax structure

will preserve production efficiency under plausible assumptions.¹ This rules out tariffs in any country that lacks market power in international markets. It rules out differential taxes on goods produced domestically in one industry vs. another. Atkinson and Stiglitz (1976) go further and argue that as long as a country can flexibly choose the rate structure under the personal income tax, then it has no reason to choose differential tax rates on the consumption of different goods.² Not only does this rule out differential excise tax rates by good but it also rules out taxes on income from savings, which implicitly impose higher tax rates on goods consumed further into the future. Regarding possible revenue from seignorage, Friedman (1969) argued that a country would optimally choose a deflation rate sufficient to generate a nominal interest rate close to zero, so as to avoid any real costs of liquidity.

While these forecasts of no tariffs, no taxes on capital income, uniform taxes on consumption, and deflation, are not consistent with any existing tax structures, they are not sharply inconsistent with observed tax policies among the most developed countries. With GATT and now the WTO, tariffs are indeed very low among developed countries. At this point, nominal interest rates are very low among most developed countries, even if deflation is rare. While capital income is still subject to tax in various ways, Gordon, Kalambokidis, and Slemrod [2004ab] report evidence that the U.S. collects little or no net revenue from taxes on capital income, and imposes relatively low distortions on investment and savings.³ While even the richest countries maintain some important excise taxes, e.g. on gasoline, cigarettes, and liquor, an argument can easily be made that these specific taxes help internalize various consumption externalities.

Tax policies in developing countries are much more puzzling, however, in light of these forecasts from the optimal tax models. These differences are laid out in more detail in section I. The corporate income tax is a much more important source of tax revenue among developing vs. developed countries, as are tariffs and seignorage. Poorer countries collect much less revenue from personal income taxes, yet it seems puzzling that distributional preferences should systematically be so much weaker among poorer countries.⁴ On net, poorer countries collect on average only two-thirds or less of the amount of tax revenue that richer countries do, as a fraction of GDP. Yet, given the severe needs for investments in say infrastructure and education in these countries, is it plausible that the lack of revenue simply represents differing tastes for public vs. private goods in poor vs. rich countries?

One natural response to these differences between forecasted policies and those observed in developing countries is to conclude that the policies in developing countries should be changed. Newbery and Stern [1987], for example, set out the standard forecasts from optimal tax models as an ideal tax structure that developing countries should emulate. This is also the basis for recommendations, e.g. from the World Bank and IMF, that developing countries should reduce their tariff and inflation rates, and rely more on value-added taxes with a uniform rate across industries, rather than on excise taxes or corporate income taxes.⁵ Poorer countries have indeed shifted towards more use of the value-added tax in recent years, in part based on the advice and assistance of international organizations. But otherwise the puzzling differences remain.

This leaves unanswered why poorer countries so systematically choose the wrong policies, and why these wrong policies have remained so stable over time. Perhaps political economy problems are more severe among developing countries, and some important domestic constituency gains from the policies that standard models find perverse. Yet these puzzling policies are found under many different types of governments, drawing their support from many different constituencies.⁶

Perhaps poorer countries lack the best enforcement methods, e.g. based on modern information technology. Certainly computer technology helps pool information from different sources. Bird (1989) argues, however, that the key problem is acquiring reliable information, not processing it.

In this paper, we explore whether the inconsistency between the forecasts from optimal tax models and the data reflects instead a problem with the models. The starting point for our approach is the observation of greater tax enforcement problems in poorer countries. According to the estimates reported in Schneider and Enste [2002], for example, the informal economy on average is only about 15% of GDP among OECD countries, and thus small enough that it should not be a driving factor in the choice of tax structure. However, among developing countries, the median size of the informal economy they report is 37% of GDP, ranging from 13% in Hong Kong and Singapore to 71% in Thailand and 76% in Nigeria.

With such a large informal sector, any effects of the tax structure, or of government policies more generally, on the size of the informal sector can be of first-order importance in the choice of these policies. Yet at this point, we know relatively little about how policies affect the size of the informal sector, or why the informal sector is so much larger in developing than in developed economies.⁷

One approach to examining the role of the informal sector explored in the past is to assume that only certain goods can be produced in the informal sector.⁸ Taxes on the formal sector then lower demand for goods produced in the formal sector and expand production in the informal sector. This additional behavioral response lowers optimal tax rates, particularly on those goods where this potential response is greater. Piggott and Whalley [2001] use this reasoning to argue for lower taxes on services relative to manufacturing, since services can more readily be provided by informal firms. Emran and Stiglitz [2005] argue that the attraction of a VAT is undermined by this possible shift from the formal to the informal sectors, to the point that tariffs may provide a less distorting source of tax revenue.⁹

These papers, though, do not attempt to explain why the informal sector is larger in developing countries,¹⁰ and provide little help in understanding why certain goods are more likely to be produced in the informal sector. In this paper, we explore the implications of a specific hypothesis about the factors affecting the choice of a firm whether to be part of the formal or the informal economy. We show that adding this hypothesis to an otherwise standard optimal tax model can easily explain many of the

seemingly perverse policies seen in poorer countries, suggesting that these policies may be sensible ways to deal with the economic pressures the countries face.

The key assumption in the paper is that firms can avoid tax payments in any country by shifting entirely to cash transactions and not using the financial sector, thereby avoiding leaving any paper trail.¹¹ When firms make use of the financial sector, in contrast, the government can gain access to their bank records and use this information in enforcing the tax law.¹² Firms then have to choose whether the economic benefits from use of the financial sector are greater or less than the resulting tax liabilities. Poorer countries differ from richer countries under our hypothesis simply because the value firms receive from using the financial sector is much more modest.¹³

When the value from using the financial sector is low, the government needs to worry about possible disintermediation and the resulting loss of its tax base when choosing its tax structure. This threat of disintermediation keeps tax rates low, and results in low tax revenue. Inflation, though, by imposing a cost specifically on the informal sector due to its reliance on cash transactions, not only generates additional revenue¹⁴ but also can induce firms to make use of the financial sector in order to earn high nominal interest rates, in spite of the resulting tax liabilities.

In order to ensure access to the information contained in bank records, the government is pushed to maintain effective monitoring and oversight of the financial sector, restricting for example the entry of any informal banks that help firms avoid monitoring by the tax authorities. The same pressure may result in restrictions on the entry of foreign-owned banks, at least those that take deposits, since these banks may help firms shift their accounts abroad in order to avoid monitoring by the domestic tax authorities.

When industries differ in their reliance on the financial sector, optimal tax rates will differ by industry, as in Piggott and Whalley [2001]. To compensate for these intersectoral distortions, we argue that a country gains by use of tariffs to shift domestic production into the more heavily taxed sectors.¹⁵ Policies to shift bank loans towards firms in the more heavily taxed sectors may make sense.¹⁶ Of course, policies hindering entry of new firms may in the process harm economic growth, as argued by Schumpeter [1942]. Without protecting its tax base, however, a government may not be able to afford basic government services in the present.¹⁷

Only if firms facing a given tax rate vary in the value they receive from using the financial sector does the model forecast the presence of an informal sector in equilibrium. In this case, the government gains from taxing attributes of firms that are associated with a greater dependence on the financial sector. For example, if within each industry capital-intensive firms gain more from use of the financial sector, then we show that taxes on capital (such as the corporate income tax) will be desired even within models that would otherwise argue for a zero tax rate on capital.

As the financial sector improves in effectiveness, more firms will be pulled into using it in spite of the tax implications of doing so. With a broader and less elastic tax base, tax

policy can shift towards the types of policies seen in developed countries, and recommended by the traditional optimal tax literature. With a broader tax base, there is less need for policies hindering entry and growth of new firms. Our paper therefore provides an additional rationale for the empirical evidence surveyed in Levine [2004] linking improvements in the financial sector and economic growth. It in fact suggests that improvements in the financial sector may be a prerequisite for fundamental tax reform.

Section I provides a brief summary of the data describing the differences in observed tax policies between developing and developed countries. Section II develops our model for the choice of tax structure, given the threat of disintermediation. Section III provides a brief discussion, while section IV concludes.

I. Data on tax policies in poor vs. rich countries

Table 1 compares the sources of tax revenue among countries of different income levels. To begin with, as seen in the Table, the poorest countries collect two-thirds or less of the revenue collected in the richer countries, as a fraction of GDP, an observation that could reflect differences in preferences for public vs. private goods, but that could also be a symptom of problems in tax collection.

Among the richest countries, the main sources of revenue are the personal income tax (42.7% = 54.3%(1-.178) of revenue) and various types of consumption taxes (32.9% of revenue). Consumption taxes are even more important among developing countries (43.5% of their lower tax revenue), but the personal income tax is of minor importance, collecting only 16.6% of tax revenue. These differences could reflect less interest in redistribution among poorer countries, though we will propose an alternative explanation below.

The corporate income tax is a much more important source of revenue among poorer countries (19.3% of revenue, compared with 9.7% in richer countries), and tariffs are also important (16.4% of revenue, compared with a trivial fraction in richer countries). As seen in the Table, seignorage represents a major nontax source of revenue among the poorest countries (21.8% of tax revenue, compared with 1.7% in richer countries). As a result, inflation rates among the poorest countries on average tend to be much higher. These three aspects of the tax systems in poorer countries all seem puzzling, given standard forecasts from optimal tax models.

Another puzzling symptom is that the lower fraction of GDP collected in tax revenue among poorer countries does not seem to be a result of their choosing lower statutory tax rates. Among a limited set of countries where we have been able to acquire data, listed in Table 2, the average maximum statutory tax rates under the VAT are very close among poor vs. rich countries (14.7% vs. 16.2%). The average maximum corporate tax rates are also very close (26.7% vs. 29.6%), while the maximum personal tax rates are not that different (34.7% vs. 42.8%).

The *effective* tax rates, though, must be very different given the lower fraction of GDP collected by these taxes among poorer countries, presumably due to their much larger informal economies. As seen in Table 1, estimates of the size of the informal economy are on average more than twice as large in poor countries than in rich countries. Note, though, that effective tax rates on the formal economy are also lower in poorer countries, e.g. $14.1/(1-.264) < 25.0/(1-.14)$, again in spite of comparable statutory tax rates.

II. Tax policy when information is limited

A. Optimal Sales Tax Rates

Existing models deriving optimal tax policy typically assume that the government can observe the income earned by all factors and by all firms. How do forecasts for the optimal tax policy change if we take into account the opportunity firms have to evade tax by shifting into the informal economy? In this section, we sketch the key intuition and then in the next section look more formally at optimal tax policy.

Consider the following highly stylized setting. The economy consists of a collection of industries. Firms in industry j have a constant-returns-to-scale production function $f_j(K_j, L_j)$, where f_j denotes industry output, K_j denotes the industry's capital stock, and $L_j = H_j h_j$ its labor inputs, where H_j denotes the hours of work per worker and h_j the average human capital per worker.

There is free entry into each industry, so that each firm earns zero net-of-tax profits in equilibrium. If a firm does not make use of the financial sector,¹⁸ using cash for all transactions, it leaves no paper trail. As a result, we assume that the government does not observe anything about the firm, including its existence, and therefore cannot impose any taxes on it. Profits for such a firm then equal $p_j^* f_j - rK_j - wL_j$, where p_j^* is the output price in industry j , set on the world market,¹⁹ r is the local interest rate, and w is the local wage rate.

If a firm in industry j does use a financial intermediary, doing so increases its output by the fraction a_j , so that output becomes $(1 + a_j)f_j$, and pretax profits become

$(1 + a_j)p_j^* f_j - rK_j - wL_j$. If firms in the industry do choose to use banks, then the government can observe their sales revenue through auditing the banks' records. It can then impose taxes on these sales at rate s_j based on this information.

If the sales tax is collected whether output is sold abroad or on the domestic market, as we assume, then $(1 + s_j)p_j^d = p_j^*$, where p_j^d is the price domestic firms now receive, net of the sales tax payment. The resulting tax revenue equals $\sum_j s_j \beta_j p_j^d f_j = \sum_j s_j^* \beta_j p_j^* f_j$,

where $s_j^* = s_j / (1 + s_j)$ and where $\beta_j = 1$ if the firms in industry j use banks, with $\beta_j = 0$ otherwise. If all firms use banks, then we are back to the standard framework in which the government can observe and tax all sales.

Given these assumptions, each firm acts to maximize expected net-of-tax profits, so chooses factor inputs and β_j based on:

$$\max_{\beta_j, L_j, K_j} \left((1 - \beta_j) p_j^* f_j + \beta_j p_j^* (1 - s_j^*) (1 + a_j) f_j - rK_j - wL_j \right)$$

Firms will choose to use banks if and only if doing so raises their net profits, so if and only if $(1 + a_j)(1 - s_j^*) > 1$, in which case

$$(1) \quad s_j^* < \frac{a_j}{1 + a_j}.$$

Put simply, firms use banks when the economic gain from use of the financial sector outweighs the resulting loss from being subject to the sales tax, even given that these economic gains are themselves subject to the sales tax. If the sales tax rate in industry j violates this inequality, then it would induce disintermediation in this industry, and collect no revenue.

Equation (1) then represents an implicit constraint that optimal sales tax rates should satisfy.²⁰ If the tax rate in any industry is raised high enough to induce disintermediation, then there is a discrete drop in tax revenue from that industry with no resulting gains to firms in the industry, so a Pareto loss. These constraints are the key additional feature characterizing optimal tax rates once the possibility of disintermediation and the resulting tax evasion is taken into account.

We presume that these constraints are more likely to be binding in some industries than others, and also more likely to be binding in poorer than in richer countries. The aim of the rest of the paper is to explore the implications of these binding constraints for tax policy more broadly.

B. Variation in a_j by industry and by country

We now examine more formally the implications of variation in the a_j both within a country by industry and across countries for the basic design of the tax structure. We now assume that the government can monitor the size of the capital inputs as well as the sales revenue of firms in the formal sector, and expand the feasible tax structure to include sales taxes and corporate income taxes, with rates potentially varying by industry, and also tariffs and inflation. The setting is kept as simple as possible while still allowing for the key effects we seek to focus on.

Assume in particular that there are only three industries: one produces a non-tradable good, with output f_0 , and the other two produce tradable goods, with outputs denoted f_j for $j = 1, 2$. Assume for simplicity that both tradable goods are produced, and that factor prices adjust to ensure that both industries break even in equilibrium. Given the resulting factor prices, the output price for the non-tradable good, p_0 , adjusts to ensure that firms in this industry also just break even.

We assume as before that the country is a price taker in the international market for the two tradable goods. Without loss of generality, the second good is imported and is subject to a tariff at rate m_2 . Domestic prices faced by consumers now equal $p_j \equiv p_j^*$, $j = 0, 1$, and $p_2 \equiv p_2^*(1 + m_2)$, while producers face prices $p_j(1 - \beta_j s_j^*)$, where β_j again is a variable indicating whether firms make use of the financial sector.

If firms choose to make use of the financial sector, then their zero-profit condition implies that

$$(2) \quad p_j(1 + a_j)(1 - s_j^*) = c_j(w, r(1 + \tau_j)),$$

where τ_j represents the corporate income tax rate, and c_j represents the unit-cost function. While we also allow for an inflation tax, our assumption is that firms making use of the formal sector avoid any losses from inflation since the nominal interest rate earned on their bank deposits fully adjusts for inflation.

In order to provide an explicit structure for the relative gains from use of the financial sector, assume in addition that the gain to firms in industry j in country c from making use of the financial sector equals $a_{jc} = \phi_j \theta_c$, so that these gains vary both by industry and by country. Assume in particular that $\phi_0 < \phi_1 < \phi_2$, so that firms producing non-tradables (mostly services) have the least reliance on the financial sector. For purposes of discussion, we will refer to industry 2 as manufacturing, while industry 1 is all remaining sectors.²¹ Assume in addition that θ_c is a positive function of h_c , so that firms in countries with higher average human capital value use of the financial sector more.²²

Firms that do not make use of the financial sector, and rely on cash transactions instead, avoid paying sales and corporate taxes, but become subject to the inflation tax. Assume that with a cost equal to the fraction $d(\mu)$ of the firm's gross receipts, firms (and those they transact with) can keep their equilibrium cash holdings needed for transactions with the firm down to μ percent of a year's gross receipts, where $d' < 0$ and $d'' > 0$.²³ Since firms have the option to shift to using a foreign currency (e.g. dollars) for its transactions, we assume that $d(0) \ll 1$, so that this option will be taken if the inflation rate becomes

high enough. The per-unit profits of a firm operating in the informal sector are $(1 - i\mu - d(\mu))p_j - c_j(w, r)$, where i is the nominal interest rate.

The firm's optimal choice for cash holdings, denoted by μ^* , is then characterized by $d' = -i$. Higher nominal interest rates lead naturally to smaller cash holdings. A firm is then just indifferent between operating in the formal vs. the informal sectors when

$$(3) \quad (1 + a_j)(1 - s_j^*)p_j - c_j(w, r(1 + \tau_j)) = (1 - \mu^*i - d(\mu^*))p_j - c_j(w, r)$$

We find below that the relative capital/labor ratios used in the three industries will matter for our results. As our base case, assume for any given w and r that the optimal capital/labor ratio is highest in industry 2 and lowest in industry 0.

Each individual lives for two periods, and is identified by her year of birth, t , and her human capital, h . Each individual receives indirect utility that depends simply on her real wage rate: $V_t(wh/g(p_t, \frac{p_{t+1}}{1+r}, \frac{i}{1+r}))$, where p_t and p_{t+1} are both vectors of length three, capturing the prices of the three consumer goods in each period. The function $g(\cdot)$ is a price index, depending on the prices of all the consumption goods. To avoid a number of extraneous complications, we assume that all individuals spend the same fraction of their income on each good, so that the function $g(\cdot)$ does not vary by individual. We treat money as an additional commodity, with a price equal to the nominal interest rate, in order to capture the costs to individuals from any residual demand they have for money even if they trade entirely with the formal sector. Denote the associated demand for money by households by M . The individual's budget constraint equals

$$(4) \quad whL = p_t C_t + \frac{p_{t+1} C_{t+1} + iM_{t+1}}{1+r},$$

where C_t and C_{t+1} are both vectors of length three measuring consumption of the three goods in each period.

The objective function of the government is to maximize

$$(5) \quad \sum_t \frac{V_t}{(1+\rho)^t} +$$

$$R \left[\sum_t \left(\sum_j [(s_j^*(1+a_j)p_{jt} + \tau_j r k_j) \beta_j + (1-\nu/i)(1-\beta_j)i\mu^* p_{jt}] f_{jt} + (1-\nu/i)iM_t + m_2 p_{2t} I_{2t} \right) / (1+r)^t \right]$$

Here, I_2 denotes imports of the second good. The revenue gain from money arises from the nominal interest (the real interest rate not paid on the existing stock of money plus the seignorage gain from issuing new money at a rate equal to the inflation rate) minus the (trivial) cost v of producing money. We express this as an implicit tax rate times the individual's per-period expenditures on money. Here, the function $R(\cdot)$ is a positive concave function that reflects the value of government revenue, taking into account both the gains to individuals from the resulting expenditures and also the additional gains as perceived by officials from their control over this budget.

In order to focus on policies that remain unchanged over time, we assume that $\rho = r$ under the resulting equilibrium, no population growth, and no productivity growth. As a result, the capital stock implicitly satisfies the golden rule, and there is no welfare gain through redistribution across cohorts. This allows us to focus on the nature of the optimal policies at a given date, since optimal policies will be constant across time. What in particular are the implications for optimal policy of the option firms have to shift into the informal sector?

When firms are indifferent between formal and informal activity, we find that the government gains more revenue from formal firms. In particular, when a firm is indifferent between formal vs. informal activity, we find that

$$(6) \quad s_j^*(1+a_j)p_j + c_j(w, r(1+\tau_j)) - c_j(w, r) - \mu^*(i-v)p_j = a_j p_j + dp_j + \mu^* v p_j > 0.$$

Here, the left-hand side approximates the extra tax revenue if a firm is in the formal rather than the informal sectors. The right-hand side measures the net extra real costs that a firm in the informal sector is willing to bear to avoid making these extra tax payments, plus the extra seignorage costs faced by the government. The firm's costs consist of the forgone gains received from use of the financial sector plus the real costs from economizing on use of cash while in the informal sector.

The government should never set tax rates so that firms in an industry choose to operate in the informal sector. If there are informal firms in any industry, then reducing the tax rates in this industry to the point where the firms are just indifferent between the two options has no economic effects, but reducing them a bit further so that firms shift into the formal sector still leaves firm profits unaffected (to first order) but generates a discrete jump in tax revenue. There are no informal firms under the optimal policies.

There is therefore an implicit constraint on tax rates in each industry, generalizing the constraint from equation (1) under the initial model, based on the requirement in each industry, $j \in \{0,1,2\}$, that²⁴

$$(7) \quad s_j^*(1+a_j)p_j + c_j(w, r(1+\tau_j)) - c_j(w, r) - \mu^* i p_j \leq a_j p_j + dp_j$$

In equilibrium, countries will divide into four different groups, depending on how many of these constraints are binding. In the richest countries, θ_c is high enough, and therefore all three a_j are high enough, that none of the constraints in equation (7) are binding. In the second group of countries with somewhat lower θ_c , firms producing non-tradables face a binding constraint from equation (7), while the tax rate on other firms remains unconstrained. In the third group, firms in industry 1 also face a binding constraint on their tax rate, while in the fourth group all firms face a binding constraint.

Consider first countries in group one, where none of the constraints are binding. Here, we find that the optimal tax system involves a uniform sales tax rate on all industries, no corporate income tax, no tariffs, and minimal nominal interest rates.²⁵

To see this, start with this tax system and consider various marginal changes. The initial tax system will be optimal if none of these marginal changes have an impact on the government's objective. Consider first a marginal increase in the corporate tax rate in some industry j , offset by a fall in the sales tax rate in this industry set so as to leave industry profits unchanged in this industry at the existing factor prices. With no change in profits, equations (2) imply that factor prices and the output price for non-tradables all remain unchanged, as does labor supply. Tax revenue is also left unaffected, ignoring any behavioral responses. However, the capital/labor ratio falls in industry j . In order to maintain market-clearing factor markets, the more capital-intensive industry 2 needs to expand to absorb the freed capital, while industry 1 shrinks. To offset these changes in the composition of domestic production, with no changes in domestic consumer demand, imports of good 2 fall as do exports of good 1. These changes in factor proportions in industry j , the reallocation of factors between industries 1 and 2, and the change in trade patterns have no effects on tax revenue under the assumed optimal policies, since corporate tax rates and sales tax rates are equal in all industries and there are no tariffs.

Consider next a drop in the sales tax rate in industry 1 and a compensating increase in the sales tax rate in industry 2 so as to leave tax payments unchanged ignoring any behavioral responses.²⁶ In response to these tax changes, w rises and r falls so as to leave equation (2) satisfied for these two industries. Total factor income from these two

industries remains unchanged, satisfying $\left(\sum_{j=1}^2 L_j \right) dw + \left(\sum_{j=1}^2 K_j \right) dr = 0$. However, if

industry 0 has a lower capital/labor ratio than either of the other two industries, as assumed, then, total unit costs increase for the non-tradables sector. As a result, p_0 increases. When we look at the impact from these combined changes on the budget constraint for all but the initial generation when the policy is announced, we find that the increase in w more than compensates for the fall in r , leaving a net gain of $rLdw$. However, the old generation when the policy change is announced loses from the fall in r by $-Kdr = Ldw$. Given our assumption that $\rho = r$, social welfare is left unaffected by this redistribution from the initial cohort to later cohorts. The one remaining issue is the impact on tax revenue arising from the shift of resources among the three industries. This

shift has no net impact on tax revenue if the corporate tax rate and the sales tax rate are equal in all three industries.

What about the overall level of the corporate tax rate? A uniform corporate tax rate implies no factor price changes, given equations (2), so is equivalent to a uniform tax rate on household income from savings. Consider then an increase in the corporate tax rate, compensated by a suitable cut in the uniform sales tax rate in the previous period. Given our assumptions, savings equal the same fraction of household income for all households, so that utility is unaffected for each household. Behavior does change, however. With these combined tax changes, the price of consumption in the second period goes up, and savings fall. For these combined tax changes to have no effect on welfare, government revenue should be unaffected by this fall in savings. This requires that the corporate tax rate equal zero.²⁷

Consider next either an increase in the tariff in industry 2 (raising the price of the third consumption good in each period) or an increase in the inflation rate (raising the price of the final consumption good), in each case with a compensating fall in the uniform sales tax rate so as to leave overall utility unaffected.²⁸ Tax revenue is left unaffected if we ignore any behavioral responses. Behavioral responses, though, have no effect on tax revenue, implying that the policies are optimal, if the effective tax rate is the same on the expenditures on each of the four goods (including money). Effective tax rates are equal if there is a uniform sales tax rate on the three commodities, the same tax rate on money, e.g. $s_j^* = 1 - v/i$, and no tariff. This closely approximates the result in Friedman (1969) that the optimal nominal interest rate is zero.²⁹

What about for countries in group two? For this group, the tax rates on non-tradables are kept below their optimal values due to a binding constraint from equation (7).

New considerations certainly affect the choice of inflation rate. The binding constraint on tax rates on nontradables can be relaxed by increasing $\mu^* i + d(\mu^*)$. The optimal inflation rate trades off the gain from increasing $\mu^* i + d(\mu^*)$ with the cost from unduly discouraging household expenditures on money.³⁰

With inflation, the country needs to allow for a steady depreciation of the value of its currency in international markets. Any attempts to stabilize the currency, e.g. through a peg to the dollar or the euro, will undermine use of inflation for domestic purposes.³¹

Would the optimal policies still consist of a uniform sales tax rate on the remaining two industries, no corporate tax, and no tariff? Behavioral responses to a compensated set of tax changes now increase tax revenue to the extent that expenditures shift away from non-tradables, where the tax rates are kept low due to the binding constraint.

Consider first an increase in the sales tax rate in industry 2 and an offsetting fall in the sales tax rate in industry 1 so as to leave utility unaffected. We saw before that these tax changes lead to a rise in the equilibrium wage rate, a fall in the interest rate, and an

increase in the equilibrium value of p_0 . Previously, the resulting shifts in the composition of output had no net effect on tax revenue, given equal tax rates in all industries. However, due to the binding constraint on tax rates in industry 0, tax revenue now rises to the extent that expenditures on non-tradables fall relative to expenditures on the remaining goods. The rise in p_0 causes a fall in expenditures on non-tradables if the compensated price elasticity is greater than one, as we presume. The fall in the interest rate, raising the price of future consumption, affects demand for non-tradables to the extent that future consumption is a relative complement or substitute for non-tradables, compared with current consumption. If the elderly consume more services than the young, an increase in the cost of consumption while old should cause a net fall in consumption of services. If so, then for both reasons consumption of services likely falls due to an increase in the sales tax rate in industry 2 relative to industry 1, implying a net welfare gain from raising the sales tax rate in industry 2 above that in industry 1.

Consider next increasing the corporate tax rate and cutting the sales tax rate in industry j (so as to leave profits unaffected), causing a drop in the capital/labor ratio in industry j , no change in factor prices or p_0 , but a shift in equilibrium output from industry 1 to industry 2 and offsetting changes in trade patterns. These changes in the allocation of factors across industries, and the resulting changes in trade patterns, have no effect on tax revenue if there are equal corporate tax rates in all industries and no trade distortions, so that $(1 + m_2)(1 - s_2^*) = (1 - s_1^*)$. The tariff then adjusts to offset the effects on trade incentives of the higher sales tax rate in industry 2, as occurs under a VAT.

What about the size of the uniform corporate tax rate? Consider increasing the corporate tax rate, and offsetting the resulting revenue by cutting both the tariff rate and s_2 in tandem so as to leave trade undistorted, maintaining $(1 + m_2)(1 - s_2^*) = (1 - s_1^*)$. In order to continue to satisfy equations (2), the factor prices firms face remain unchanged, so that r falls to fully offset the rise in τ , leaving p_0 unaffected. These tax changes leave the present values of utility unaffected, since the effects of the lower price for good 2 just offsets the effects of the lower interest rate. The proposed policies are optimal only if tax revenue remains unchanged as well. Consumers now face a lower price for good 2 and a higher price for consumption in their second period. Shifts between consumption of good 1 and good 2 have no effect on tax revenue if trade is undistorted. Changes in savings have no effect on revenue if the corporate tax rate is zero. The key issue then is what happens to consumption of good 0. Here, consumption is left unaffected if good 2 vs. good 1 and future vs. present consumption are equally complements or substitutes for good 0. However, we previously presumed that future consumption is a complement with services, suggesting a positive optimal corporate tax rate.

Surprisingly, perhaps, we cannot say anything in general about how a binding constraint in the tax rate in industry 0 affects the overall level of the optimal sales tax rates in the remaining two industries. Consider in particular an increase in both s_1 and s_2 chosen so as to leave trade undistorted: $\partial s_2^* / \partial s_1^* = 1 / (1 + m_2)$. In response to this increase in sales

tax rates in the tradables sectors, factors shift into the non-tradables sector, which expands to absorb them because of a fall in its unit-cost of production. The government's first-order condition for s_1^* equals

$$(8) \quad (R' - V_Y)(p_1 f_1 + p_2 f_2) = -w \frac{\partial L}{\partial s_1} \left(\delta_0 s_0^* + \delta_1 s_1^* + \delta_M (1 - v/i) + (1 - \sum \delta_i) s_2^* \right) \\ + \frac{\partial \delta_0}{\partial s_1} (s_2^* - s_0^*) + \frac{\partial \delta_M}{\partial s_1} (s_2^* - (1 - v/i)) + \frac{\partial \delta_1}{\partial s_1} (s_2^* (1 + m_2) - m_2 - s_1^*)$$

Here, each of the δ 's represents the fraction of individual income spend purchasing one of the commodities, while V_Y represents the marginal utility of income. For governments in group 1, the last three terms in this equation equal zero since all of the sales tax rates are equal. The expression inside the parentheses in the first term on the right-hand side then equals the optimal uniform sales tax rate. For governments in group 2, various things change. For one, due to a binding constraint on tax rates limiting tax revenue, R' is higher at any given set of tax rates while V_Y is smaller, making the left-hand side of equation (8) larger, suggesting a higher optimal tax rate. The efficiency cost from a drop in labor supply is probably smaller since the weighted average tax rate paid on earnings should be less due to the binding constraint, again suggesting a higher optimal tax rate. However, the next term reflects added efficiency costs as long as the share of expenditures on non-tradables goes up in response to the drop in its relative price. Demand for money should fall, since incomes fall. Money is heavily taxed for group 2 countries, implying that the third term also adds to the excess burden. With no trade distortions, the fourth term is zero. On net, it is unclear whether tax rates will be higher or lower in group 2 countries compared to group 1 countries. Note that with a Cobb-Douglas utility function, expenditure shares do not respond to relative consumption prices. In this case, the last three terms are zero, and optimal tax rates increase.

Together, with these six first-order condition and six policies to solve for (two sales tax rates, three corporate tax rates, and the tariff), we find that the optimal sales tax rate is now higher in industry 2 than in industry 1, tariffs are set so as to eliminate any trade distortions, while the presumed corporate tax is positive. It is unclear whether the binding constraint on taxes in industry 0 cause rates in the other two industries to go up or down.

For countries in group 3, tax rates in industry 1 also face a binding constraint. Inflation now relaxes the constraints from equation (2) in two separate industries, making this consideration more important relative to implications for the price of money for households. Inflation should therefore be higher than in group 2 countries.

What about the remaining policies? We explore marginal changes from a tax structure that leaves trade undistorted, so that $(1 - s_2^*)(1 + m_2) = (1 - s_1^*)$, and has no corporate tax.

Consider raising both the tariff rate and s_2^* simultaneously while preserving undistorted trade (as occurs with an increase in a VAT rate), leading to a first-order condition analogous to equation (8). Again, both the left-hand side and the first term on the right-hand side of this equation suggest a higher tax on consumption of good 2 than in group 1 countries. If trade is undistorted, the last term again equals zero. However, the remaining terms again suggest additional distortion costs from a higher tax rate. In spite of the greater need for revenue, we again find that tax rates may not necessarily be higher.

Consider next raising s_2^* without any change in the tariff, again starting from undistorted trade. In response to the higher tax rate, output in industry 2 contracts. Factor prices adjust so that other industries absorb the released factors, while continuing to satisfy equation (2) for industry 1. The result is a fall in the interest rate and a rise in the wage rate, which leads to an increase in the market-clearing price for non-tradables. In response to the lower real wage rate, reflecting the higher tax payments, labor supply can drop, generating an offsetting excess burden, though here the response depends on the uncompensated price elasticity. The increase in the price for non-tradables, though, leads to an increase in tax revenue to the extent that expenditures shift to other goods. This occurs if the price elasticity for non-tradables is greater than one.³² If so, then we find that equilibrium trade is distorted, "unduly" discouraging domestic production of good 2.³³

What about the corporate tax rates? Consider as before raising the corporate tax rate in an industry while reducing the sales tax rate in that industry so as to leave profits unaffected. The result as before is a drop in the capital/labor ratio in this industry, no change in factor prices or in p_0 , but an expansion in the size of industry 2 relative to industry 1 and an offsetting change in trade patterns. If trade were undistorted, these shifts would have no revenue consequences. But our previous result suggests a higher tax rate on domestic production of good 2 than on imports of good 2, in which case these shifts in domestic production raise revenue.

On net, therefore, we forecast a trade distortion so that $(1 - s_2^*)(1 + m_2) < (1 - s_1^*)$, but a positive corporate tax rate in order to shift production back into industry 2. As before, there are no clear forecasts for the level of the tax rates that remain unconstrained.

Finally, what about countries in group 4? Here all three industries face binding constraints. Now the optimal inflation rate would be yet higher, since it relaxes all three constraints.

The only other sources of extra revenue are tariffs and the corporate tax rate. Consider an increase in the tariff rate, starting from the rate that implies no trade distortions. This increase in the tariff rate leads in part to conventional trade-offs, generating extra tax revenue on imports but excess burden terms due to any fall in labor supply due to an uncompensated fall in the real wage rate, and a fall in expenditures on good 2 to the extent its price elasticity exceeds one. In addition, though, production shifts into industry

2. Given the resulting increase in the interest rate and fall in the wage rate, needed so that industry 1 remains competitive, the price for non-tradables falls. The result is a shift in production away from industry 1 towards both industry 2 and industry 0. Starting from balanced trade, the former shift has no revenue effects, but the latter shift implies a net revenue loss. In general it is unclear whether tariffs will penalize or encourage trade on net.

What about the corporate tax rate? Consider raising the corporate tax rate uniformly in all three industries. In order for equation (7) to continue to hold, market interest rates must fall to fully absorb the increase in the corporate tax rate. This implies an increase in the price of future consumption, implying a fall in the real wage rate. Labor supply falls to the extent that the uncompensated labor supply elasticity is positive. To the extent that consumption shifts away from services, this implies a revenue gain. If trade were undistorted, then a shift between the other two goods has no revenue consequences, but otherwise this would have revenue consequences as well.

On net, the forecast is for a positive corporate tax rate with less clear implications for trade distortions.

C. Implications for the treatment of the financial sector

In the above model, the financial sector plays a critical role in the functioning of the tax structure. The working assumption had been that the government has access to the bank records of each firm, and can make use of this information in enforcing the tax law.

Why should banks be willing to provide this information, however? In particular, any bank that can reduce the taxes that its customers owe has a competitive advantage. In order to have access to bank records, the government cannot rely on market forces.

One approach is use of bank regulations, whereby any bank that refuses to cooperate with the tax authorities loses its license to function as a bank. Market forces should still lead to the creation of an informal banking sector that circumvents these regulations, providing financial intermediation without exposing customers to tax liabilities. In order to preserve its revenue base, governments would be expected to oppose the development of such an informal financial sector. When it develops nonetheless, it will likely facilitate tax evasion. Banks in the formal financial sector would also face an incentive to circumvent information sharing with the government, in order to attract more customers. In addition to direct monitoring of banks and sufficient fines for violators to induce compliance, another response is state ownership of banks, something commonly seen in poorer countries.

State ownership also gives the government a mechanism to control the allocation of credit. By shifting credit from firms facing low (or zero) tax rates to firms facing high tax rates, the government collects more in taxes on the resulting extra output. In order to

induce the highly taxed firms to borrow and invest more funds, these loans must be subsidized. While the government loses directly from the subsidized loans, it gains from the resulting extra taxes on the new investment, and new production. Even if the subsidy fully offsets the revenue collected in present value on the new capital investment, for example, the government can continue to collect revenue on existing output while leaving undistorted the decision to purchase additional capital.³⁴ These subsidies confined to firms in the formal economy can also induce more firms to join the formal economy.

In order to maintain access to bank records, governments may impose capital controls making it difficult for firms to shift their deposits abroad, into foreign banks. These foreign deposits are presumably outside the purview of the tax authorities, so use of foreign banks undermines the tax system.

To what degree should the government encourage or discourage branches of foreign banks from operating in the domestic economy? For one, the best of the foreign banks could provide much more value to customers (yield higher a_j), so pull more firms into the taxed sector. Such banks can gain a further competitive advantage, however, by enabling firms to shift their financial records abroad, into branches of the bank based in other countries, where they can no longer be monitored by the domestic tax authorities.³⁵ It is not surprising, given the model here, that governments often express concern about the entry of branches of foreign banks into the country, since these banks can undermine the entire domestic tax system. Under the above model, preventing foreign banks from taking deposits is sufficient to prevent tax evasion. In fact, domestic-owned banks with foreign branches create the same risks unless the bank regulation is effective enough.

The tax treatment of banks also interacts critically with the tax system more broadly. If the banking sector is competitive, any taxes on banks in equilibrium must be passed on to customers, reducing the gain, a_j , from using banks, and thereby lowering the feasible taxes that can be collected directly from firms. Taxes on banks should crowd out other taxes on firms dollar for dollar.

To see this, consider a representative firm that has bank deposits of D and bank loans of N , where in equilibrium $N=D$. A competitive banking sector must break even, in spite of any taxes, implying in equilibrium that $r_N N - r_D D - T_B = 0$, where r_N (r_D) is the interest rate on loans (deposits) and T_B represents the bank's overall tax payments.

The firm then chooses how much use to make of banks, given these interest rates. Assume that the percent net gain, a , from use of banks is a concave function $a(N/pf, D/pf)$,³⁶ so that the overall net profits if the firm operates in the formal sector equals

$$(9) \quad (1 - s^*)(1 + a)pf - wL - rK - r_N N + r_D D .$$

The firm then chooses its deposit and borrowing behavior in order to maximize equation (9). Solving this yields some value $N^* = nf$, given interest rates. These interest rates adjust so that in equilibrium $N^* = D^*$.

Given these choices, the maximum feasible sales tax rate at which the firm is just willing to operate in the formal sector satisfies

$$(10) \quad s^* = \frac{a - (r_N - r_D)n}{1 + a}.$$

The maximum feasible tax revenue then equals $s^* (1 + a)pf + T_B = apf$, so is unaffected by the taxes paid by the banking sector. Everything else equal, therefore, the more that revenue is collected directly from banks the lower are the feasible tax rates on firms, so that adding bank taxes to the previous model implies no real changes to the resulting equilibrium. Bank taxes in some cases may be easier to collect, though, since the government must monitor fewer organizations.

This analysis assumes that only firms in the formal sector make use of banks. Households, though, can also make use of banks, raising additional complications. For one, when households withdraw cash from banks, this suggests that they are purchasing from the informal sector. In addition, households that engage in informal business activity may use the banking sector without registering this activity as a business. Since informal firms engage in cash transactions, this would be reflected in frequent household deposits and withdrawals of cash. As a result, taxes on household withdrawals of cash from the banking sector discourage informal sector activity.³⁷

D. Implications of variation in the value of a_j within each industry

By adding the assumption that only firms that make use of the financial sector are subject to tax, and that the value of using the financial sector is low in poorer countries, the model is able to explain a variety of observations seen in the data for developing countries that would otherwise be puzzling. In particular, the threat of disintermediation keeps tax revenue low. It can lead to sharply different tax rates by sector, as seen through the frequent use of selective excise taxes. Trade distortions should be expected, with the direction depending on the relative capital/labor ratios in different sectors. Inflation should also be expected as a tool for discouraging firms from operating in the informal (cash) economy. State-owned banks provide a mechanism to redirect credit towards the most heavily taxed firms, and to better assure the government access to information about the tax base among firms in the formal sector.

The model, as it stands, has a number of counterfactual forecasts, however. Most importantly, given our focus on the informal economy, it forecasts no informal sector.³⁸

In this section, we now assume that firms within each industry vary in the value, a_j , they receive from use of the financial sector. The government cannot identify a firm's own value of a_j , seeing instead only the firm's n-digit industry. As a result, when the government sets a sales tax rate for any given industry, some firms will satisfy the constraint in equation (7) and remain in the formal sector whereas others (those with lower values of a_j) will instead choose to operate in the informal sector. In setting this tax rate, the government must then trade off higher revenue from those firms that remain in the formal sector with the loss in revenue due to some firms shifting in response into the informal sector. Except for unusual circumstances, the optimal tax rate will generate at least some informal activity.

The global optimum could in theory involve very high tax rates with a very narrow tax base, depending on the shape of the distribution of the a_j . For example, if one set of firms would always use the banking system, then a very high s_i^* in principle can collect substantial revenue from these firms at the cost of collecting little or nothing from other firms. Lowering the tax rate by enough to pull more firms into the tax base may lower overall tax revenue too much to be attractive. Optimal tax rates can be very high, in spite of the threat of disintermediation.

With variation in the a_j within each industry, and the presence of an informal sector, a variety of other policies may now be appropriate. In particular, the government has an incentive to make use of any observable indicators that provide information about a firm's value of a_j . By using this information to increase the tax rate on firms within an industry that have high a_j , and lowering the tax rate on firms within the industry that have low a_j , the government has the potential to both increase revenue and increase its tax base (by pulling in more firms from the informal sector). We consider below several such policies.

1. *Corporate income taxes*

Assume, for example, that capital-intensive firms value more the use of financial intermediaries. To be more concrete, assume that firms in an industry have a production function $A(b)K^bL^{\gamma-b}$, with b varying by firm, where a firm's gain from use of the financial sector, a , is an increasing function of b : $a = \alpha(b)$. In order to maintain an equilibrium in spite of heterogeneous firms in each industry, we assume decreasing returns to scale for each firm, e.g. $\gamma < 1$.

Why is it plausible that a is increasing in b ? Maintaining accounts with a bank allows the bank to monitor the firm's performance, giving the bank information about the firm as well as potential collateral. Both facilitate future lending to the firm. Loans are relatively more valuable to a firm the greater the amount of capital it needs to finance. Use of banks is also presumably more valuable the greater the physical distance at which

a firm engages in market transactions, since banks are designed to facilitate financial transactions at a distance. Capital-intensive firms likely trade more at a distance, because the minimum efficient size of a firm tends to be larger the greater its capital intensity. Also, since capital-intensive firms have greater sales revenue per employee, capital-intensive firms will be more concerned about allowing cash transactions, given the threat of internal theft by employees, leading to a preference to have transactions flow instead through the financial sector.

Corporate taxes can then help collect additional revenue while leaving unchanged or reducing the degree of disintermediation. Since the firms just indifferent to using banks are more labor intensive than those already using banks, the marginal firms are relatively more concerned about sales tax rates, compared with capital tax rates, than the inframarginal firms. Cutting sales tax rates and raising capital tax rates therefore can raise revenue without inducing disintermediation. This provides another motivation for corporate income taxes in developing countries.³⁹

More formally, for any given initial sales tax rate s_j^* in an industry, there should be some value of b , denoted b_j^* , at which a firm is just indifferent to using banks. Any firm k in this industry with $b_{jk} > b_j^*$ will use banks, and conversely.⁴⁰

Starting from $\tau_j = 0$, consider a marginal increase in τ_j , with a compensating marginal cut in s_j^* just sufficient to leave net profits (and tax payments) unchanged for firms with $b = b_j^*$. Given the Cobb-Douglas assumption, this implies that $\partial s_j^* / \partial \tau_j = -b_j^* (1 - s_j^*)$.

With these combined tax changes, firms with $b = b_j^*$ by construction remain indifferent to using banks.

Tax payments by any firm k with $b_{jk} > b_j^*$ go up, however, due to these combined tax changes. Starting from $\tau = 0$, the marginal change in tax payments equals

$$rK_{jk} + p_j^*(1 + a_j) \left[f_{jk} \frac{\partial s_j^*}{\partial \tau_j} + s_j^* \frac{\partial f_{jk}}{\partial \tau_j} \right] = p_j(1 + a_j) [(b_{jk} - b_j^*)(1 - s_j^*) f_{jk} + s_j^* \frac{\partial f_{jk}}{\partial \tau_j}],$$

given that $rK_{jk} = b_{jk}(1 - s_j^*) p_j^*(1 + a_j) f_{jk}$ with a Cobb-Douglas production function.

Since by construction $b_{jk} > b_j^*$, the first term is positive. This outweighs the second term as long as the effective tax rate on firm k is below the rate at the top of the Laffer curve. Intuitively, since these other firms are more capital intensive, the cut in the sales tax rate is not sufficient to offset the increase in the tax on capital expenditures. This marginal tax change will not induce any disintermediation, since these firms discretely gained from use of banks. Introducing a corporate tax raises more revenue from firms already in the tax base in industry j while leaving unchanged the extent of disintermediation.

General equilibrium factors still matter: This distortion to capital/labor ratios in industry j again causes a shift of capital to other industries, and an expansion of industry 2 relative to industry 1. As before, these reallocations can create further efficiency effects to the extent that corporate tax rates differ by industry, and to the extent that trade is distorted. Variation in a_j within an industry therefore simply introduces additional pressures favoring a corporate tax.

The same argument implies that labor taxes will be counterproductive, since they shift the tax burden away from firms that are necessarily part of the tax base towards firms that can more easily shift into the informal sector. Even if payroll were observable to the government, we therefore forecast very limited use of personal income taxes in developing countries.

Highly skilled workers, though, may also tend to work in firms that have a high a_j , given the high return to overseeing well the use of expensive capital equipment. If so, the government likely gains from taxing both indicators (capital and skilled labor). To the extent that personal income taxes exist in developing countries, they do seem to focus on those with very high incomes.

A related question is why poorer countries provide less social insurance, be it Social Security, unemployment insurance, or medical insurance. Ignoring social insurance, workers face the same equilibrium net wages in the formal vs. informal sector. With social insurance, they have an incentive to shift to the formal sector when they are a net beneficiary, and to shift to the informal sector when they are a net contributor. This adverse selection of workers in the formal sector undermines any social insurance program, an adverse selection avoided if all firms are part of the formal sector.

2. Anti-competitive policies

If the taxed industries consist of a few capital-intensive firms and a competitive fringe of labor-intensive firms, then the government has a financial incentive to adopt policies that give the capital-intensive firms monopoly power, driving out the competitive fringe. This makes output of the taxed (capital-intensive) firms less sensitive to tax rates, since the taxed firms can no longer be undercut by the competitive fringe. Any resulting monopoly profits can in principle be taxed away, so the key role of such policies is simply to help shift output from the untaxed competitive fringe into the taxed share of each industry.⁴¹

3. Policies towards FDI

What does the above model imply about government policies towards FDI?

Consider the economic effects of a new subsidiary opened by a multinational, using its own capital but domestic workers. First what can we say about the firm's tax payments? Multinationals can easily shift the firm's taxable income abroad, e.g. by selling the firm's

output at an artificially low price to a subsidiary in another country, and would have an incentive to do so as long as it has a subsidiary facing a lower statutory tax rate, suggesting little resulting tax revenue.⁴² Offsetting this, the multinational may have less scope for tax evasion due to the greater scrutiny it faces from auditors in the firm's home country. If it produces more output with the same inputs, due to a superior technology, this in itself adds to sales tax revenue, though may not add to corporate profits due to the extra royalties to the parent firm. On net, tax payments should be positive, but at least based on U.S. evidence will be lower than for an equivalent domestic firm.⁴³

There are additional general equilibrium considerations, though. If the multinational imports its own capital, the capital stock available for the domestically owned economy remains the same, but the labor force in the domestically owned economy falls. In equilibrium, the response is a contraction of industry 1 and an expansion of industry 2, with no change in factor prices.

If the tax rates are the same in these two industries, as in group 2 countries, then tax revenue from the rest of the economy falls due to the drop in labor inputs. On net, multinationals raise tax revenue only if they pay more taxes on the output and profits generated by their labor and capital inputs than were lost from the lower labor inputs to the tradables industries. Given the low effective tax rates paid by multinationals at least in the U.S., the net effect is likely to be negative.

When the tax rate in industry 2 is higher than in industry 1, as in group 3 and group 4 countries, then there can be an offsetting revenue gain arising from multinationals due to the resulting expansion of industry 2. This may make multinationals relatively more attractive in the poorest countries where this offsetting effect is likely to be strongest.

4. Red tape

Another common observation about tax policy in developing countries is the much higher level of red tape and a high level of corruption among tax officials. Is there any way to provide some explanation for such outcomes given the above model?

When the government does not observe each firm's a_j , one alternative response is to hire tax inspectors in order to gain further information about each firm's a_j . If the cost of inspector's time per firm is small enough relative to the value of the resulting information in improving tax collection, then hiring such inspectors makes sense. In particular, the social value of the extra tax revenue collected must be enough to cover not only the cost of hiring the inspector but also the loss to residents from the extra tax payments.

The problem is inspecting the inspectors. If the monitors cannot themselves be monitored, e.g. there is no independent source of information from financial records, the government cannot in practice collect revenue based on what a bureaucrat learns firm by firm. However, it can collect an ex ante amount, based on say the size of the sector over

which the bureaucrat has authority, and then allow this ex ante payment to be set by market forces.

In equilibrium, competition among potential bureaucrats for the job would lead to an ex ante net payment equal to the expected tax revenue collected minus the opportunity cost of the bureaucrat's time. This is simply a form of tax farming.

A bureaucrat in such a position, however, would want to maximize the revenue currently collected (net of opportunity costs), rather than to maximize the government's objective function. In the static setting of our model, this suggests using such tax farming only for sectors where the constraint in equation (7) would be binding for most all firms if all the a_j were known and the tax rate could vary by firm, so that the government's desired tax rate equals the maximum rate the bureaucrat can effectively charge a firm. To the extent that equation (7) is nonbinding for some firms, the bureaucrat will collect more than the government would prefer, lowering the benefit from such tax farming.

Rather than inspecting each firm, the bureaucrat could be used instead simply to create red tape, creating a delay for firm entry, new investment by a firm, or any other decision that can be monitored. If those with higher a_j lose more from any given delay and will pay more to jump the queue, then this red tape again provides some further information whose value may be sufficient to justify the efficiency cost arising from the time delays and the cost of the bureaucrat.

III. Discussion

Our assumption that the government can fully observe sales and capital for firms that use banks is clearly heroic, particularly given the major problems even the U.S. government has in controlling tax avoidance by large corporations. A weaker assumption is that the government simply knows of the *existence* of a firm if it uses a bank. Inspectors can then visit the firm to learn more, in the process perhaps observing only K_j and the *number* of workers, say N_j .⁴⁴ Since we argued above that the optimal tax structure would likely involve heavy taxation of K_j , even if f_j and L_j were also observable, the outcome can be close to those above.⁴⁵ If only the number of workers is observed, though, and not L_j or f_j , this does undermine effective use of a sales tax.⁴⁶

Many results can easily remain if we consider other stylized descriptions of the source of information for the government tax authorities. Consider for example the alternative assumption that the government observes a business only if it owns land (e.g. a mine or oil deposit) and/or operates out of a factory or office building, giving it a visible fixed location.⁴⁷ To translate previous notation, let $\beta_j = 1$ if a firm has a visible fixed location, and assume that having such a fixed place of business raises output by the

fraction a_j . If a business is “visible,” assume again that the government can observe its entire capital stock, K_j , and its number of workers, N_j . Then the formal considerations affecting the choice of the tax structure again remain close to those above.

IV. Summary

The key hypothesis of this paper is that governments need to rely on the information available from bank records in order to identify taxable entities and to measure the amount of their taxable activity. Firms then become subject to tax if they choose to make use of the financial sector. When tax rates are high enough, firms instead may forego the economic benefits from use of banks in order to avoid these taxes.

This threat of disintermediation may be of little import in the richest countries, where the value provided by financial intermediation is considerable. In poorer countries, however, this threat of disintermediation may be a key factor both limiting the government’s ability to collect tax revenue and shaping government policy more generally.

In particular, based on this hypothesis about the role of banks in tax enforcement, we have derived the following forecasts for countries where banks provide only modest value added:

- a) Tax revenue as a share of GDP will be low, constrained by the threat of disintermediation.
- b) The tax base will be narrow, confined to firms that particularly value the use of financial intermediaries.
- c) If capital-intensive firms gain more from use of the financial sector, then the optimal tax structure will include capital income taxes, in order to focus the tax burden on those firms least willing to forego use of the financial sector.
- d) Tariffs will be used to compensate for tax differences across tradable industries. Net trade distortions will be used to shift production away from more lightly taxed sectors.
- e) Inflation will be used as an indirect means of taxing the untaxed (cash) economy.
- f) Entry of foreign firms may be restricted.
- g) Entry of foreign banks will be particularly discouraged, given the ease with which foreign banks can facilitate tax evasion by domestic firms.
- h) Red tape may provide a mechanism to shift the tax burden onto those firms that gain the most from being in the formal sector.

According to the model, all of these policies are optimal, given a standard government objective function, to the extent that the threat of disintermediation (and the resulting tax evasion) is important, raising questions about recommendations to avoid such policies. In sum, it is important to understand why tax policies are so different in developing countries before having confidence in any recommendation for how best to reform them.

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Table 1
Sources of Government Revenue (1996-2001)

| GDP per capita | Tax Revenue (% of GDP) | Income Taxes (% of Revenue) | Corporate Income Tax (% of income taxes) | Consumption and Production Taxes (% of Revenue) | Border Taxes (% of Revenue) | Inflation Rate | Seignorage Income (% of Revenue) | Informal Economy (% of GDP) |
|----------------|------------------------|-----------------------------|--|---|-----------------------------|----------------|----------------------------------|-----------------------------|
| < \$745 | 14.1 | 35.9 | 53.7 | 43.5 | 16.4 | 10.6 | 21.8 | 26.4 |
| \$746-2,975 | 16.7 | 31.5 | 49.1 | 51.8 | 9.3 | 15.7 | 24.9 | 29.5 |
| \$2,976-9,205 | 20.2 | 29.4 | 30.3 | 53.1 | 5.4 | 7.4 | 6.0 | 32.5 |
| All developing | 17.6 | 31.2 | 42.3 | 51.2 | 8.6 | 11.8 | 16.3 | 30.1 |
| > \$9,206 | 25.0 | 54.3 | 17.8 | 32.9 | 0.7 | 2.2 | 1.7 | 14.0 |

Notes: Authors' calculations based on available data between 1996 and 2001 from Government Finance Statistics [IMF, 2004a], International Finance Statistics [IMF, 2004b], and World Development Indicators [World Bank, 2003]. The ranges for GDP per capita follow the World Bank 2003 classification of low income, lower middle income, middle income and high income countries. Seignorage is measured as the increase in reserve money and currency in circulation. Estimates of the size of the informal economy in 1999 in Column (9) are from Friedrich Schneider [2002], who uses the currency demand approach in estimation. Data within each cell are weighed averages. Tax revenue (% of GDP), inflation rate, and the size of the informal economy (% of GDP) are weighted by GDP of each country. Corporate income tax (% of income taxes) is weighed by the total income tax revenue of each country. All other data are weighted by the tax revenue of each country.

Table 2
Maximum Statutory Tax Rates, by Country

| Country | Tax Revenue (% of GDP) | Corporate Tax Rate | Personal Tax Rate | VAT |
|-----------------------|---------------------------|-----------------------|----------------------|--------------|
| Argentina | 17.2% | 35.0% | 35.0% | 17.0% |
| Bulgaria | 21.4% | 19.5% | 29.0% | 20.0% |
| Brazil | 24.3% | 34.0% | 20.0% | 0.0% |
| China | 12.6% | 33.0% | 45.0% | 17.0% |
| Czech Republic | 21.7% | 28.0% | 32.0% | 19.0% |
| Egypt, Arab Rep. | 15.8% | 40.0% | 20.0% | 0.0% |
| Estonia | 23.2% | 0.0% | 26.0% | 18.0% |
| Hungary | 25.9% | 16.0% | 40.0% | 25.0% |
| Indonesia | 15.5% | 30.0% | 30.0% | 10.0% |
| India | 12.3% | 36.8% | 40.0% | 0.0% |
| Lithuania | 23.5% | 15.0% | 35.0% | 18.0% |
| Latvia | 22.3% | 15.0% | 25.0% | 18.0% |
| Morocco | 23.5% | 35.0% | 41.5% | 20.0% |
| Mexico | 14.5% | 33.0% | 35.0% | 15.0% |
| Malta | 21.9% | 35.0% | 35.0% | 18.0% |
| Pakistan | 12.9% | 35.0% | 35.0% | 15.0% |
| Philippines | 15.2% | 32.0% | 34.0% | 10.0% |
| Poland | 23.8% | 19.0% | 40.0% | 22.0% |
| Romania | 18.7% | 25.0% | 60.0% | 19.0% |
| Russian Federation | 23.9% | 24.0% | 13.0% | 20.0% |
| Slovak Republic | 21.2% | 19.0% | 19.0% | 23.0% |
| Thailand | 15.7% | 30.0% | 37.0% | 7.0% |
| Turkey | 20.3% | 33.0% | 40.0% | 18.0% |
| Vietnam | 17.0% | 28.0% | 60.0% | 20.0% |
| South Africa | 26.5% | 30.0% | 45.0% | 14.0% |
| Zambia | 17.9% | 15.0% | 30.0% | 0.0% |
| All developing | 19.6% | 26.7% | 34.7% | 14.7% |
| Belgium | 30.6% | 34.0% | 55.0% | 21.0% |
| Canada | 32.5% | 36.6% | 31.0% | 7.0% |
| Cyprus | 20.3% | 15.0% | 30.0% | 15.0% |
| Germany | 23.6% | 25.0% | 45.0% | 16.0% |
| Denmark | 47.6% | 30.0% | 60.0% | 25.0% |
| Spain | 21.9% | 35.0% | 56.0% | 16.0% |
| Finland | 33.6% | 29.0% | 35.0% | 22.0% |
| France | 28.3% | 34.3% | 54.0% | 20.6% |
| United Kingdom | 29.7% | 30.0% | 40.0% | 17.5% |
| Greece | 25.9% | 35.0% | 40.0% | 18.0% |
| Ireland | 21.1% | 12.5% | 42.0% | 21.0% |
| Israel | 33.2% | 36.0% | 49.0% | 17.0% |
| Italy | 30.1% | 33.0% | 45.0% | 20.0% |
| Luxembourg | 30.5% | 30.0% | 46.0% | 15.0% |
| Netherlands | 36.9% | 34.5% | 60.0% | 17.5% |
| Norway | 32.2% | 28.0% | 28.0% | 23.0% |
| Portugal | 24.3% | 27.5% | 40.0% | 17.0% |
| Singapore | 15.6% | 22.0% | 22.0% | 0.0% |
| United States | 21.5% | 35.0% | 35.0% | 0.0% |
| All Developed | 28.4% | 29.6% | 42.8% | 16.2% |

Note: Statutory tax rates are from <http://www.worldwide-tax.com/index.asp#partthree>.
The rates do not include local taxes, if they exist.

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¹ In particular, this conclusion requires access to separate tax rates on expenditures on different goods and on income from the supply of different factors.

² This conclusion follows if the utility function is weakly separable between leisure and consumption.

³ Similar results have been found for a number of European countries.

⁴ Similar polices in fact were observed in the past in the U.S. and other currently richer countries. As documented for example in Hinrichs (1966), until the 1930's the U.S. relied for revenue primarily on tariffs, selective excise taxes, seignorage, and eventually a corporate income tax.

⁵ See Gillis (1989) for similar advice from tax academics who have advised developing countries on their tax policies. Here, the key focus is on establishing a uniform rate value-added tax, in order to eliminate tax-induced distortions to the composition of consumption.

⁶ In Gordon and Li [2005], we explore a particular political economy model, based on Grossman and Helpman [1994], and find we are unable to explain any of the puzzling policies described above.

⁷ See Lemieux, Fortin, and Frechette (1994), though, for some empirical evidence on the how taxes affect the size of the informal sector.

⁸ Piggott and Whalley [2001] assume, for example, that one good (manufactured products) must be produced in the formal (taxed) sector, whereas a second (services) can be produced in either the formal or the informal sector. Emran and Stiglitz [2005] assume instead that the second good is only produced in the informal sector.

⁹ Keen (2006), however, notes that a VAT includes a tax on imported goods, with a credit received only for firms that are part of the formal sector. Taking into account this aspect of a VAT, he shows that tariffs are not appropriate.

¹⁰ Piggott and Whalley [2001] in fact focus on tax policy in Canada.

¹¹ Cash transactions are extremely hard to monitor even in the richest countries. Likely for this reason, illegal activity seems to rely heavily on cash transactions.

¹² Among the richest countries, governments rely on firms to provide information about individual wage and dividend incomes, and rely on accounting reports and tax audits both to double-check these reports by firms on individual earnings and to document each firm's own earnings. Accounting firms and tax audits, in turn, rely heavily on the records of a firm's transactions through the financial sector, making these records a key underlying source of information supporting most forms of taxes.

¹³ The quality of services provided by the financial sector in poor countries may be worse. Alternatively, firms with lower productivity may have less need for the financial sector, perhaps because they rely less on long-distance payments and also perhaps because they are less capital intensive and have less need for bank loans.

¹⁴ Campillo and Miron [1997], for example, note that inflation provides a valuable source of revenue when other sources of revenue are constrained.

¹⁵ More conventionally, tariffs also provide an additional source of tax revenue.

¹⁶ Policies may also sensibly encourage or hinder investments by multinationals, depending on the government's ability to tax multinationals vs. the competing domestic firms whose production is crowded out by the multinational.

¹⁷ For an examination of this trade-off in a developing country between current welfare and economic growth, see Gordon (2008).

¹⁸ We simplify the analysis by assuming that firms in an industry use banks for either all or none of their transactions.

¹⁹ We assume the country is small, so is a price taker in world markets. While we allow for free trade in goods, we assume no capital flows and for the moment no foreign direct investment.

²⁰ Note, though, that in industries where equation (1) is satisfied no firms will choose to operate in the informal sector, an issue we return to below.

²¹ Andreoni et al (1998) report, based on U.S. audits of taxpayers, that the evasion rate varies dramatically by industry, and is particular high for the service sector.

²² Firms with more productive entrepreneurs, for example, may sell to a wider market and use a more capital-intensive technology, in both cases creating more of a need to make use of the financial sector.

²³ For simplicity, we assume that this function $d(\cdot)$ is the same in all industries.

²⁴ Note that these constraints simply imply that tax payments must be below some fraction of sales revenue, so that any model generating this form of constraint will replicate some of our results. Results differ though when considering policies that ease these constraints, e.g. inflation or bank regulation.

²⁵ These results are standard, and the model was designed to replicate them when there is no threat of informal activity, so that any deviations from these policies are due to this threat.

²⁶ The same analysis would arise with offsetting changes in sales tax rates in some other pair of industries.

²⁷ This line of reasoning corresponds directly to that in Kaplow (2006) and Laroque (2005).

²⁸ With an increase in the inflation rate, offset by a fall in the sales tax rate, we again have redistribution across cohorts, with the old generation when the policy is first implemented losing while later generations gain slightly. With $\rho = r$, we again have no net effect on the discounted sum of utilities.

²⁹ Illegal activity, e.g. the drug trade, relies heavily on cash transactions to maintain anonymity. Inflation would provide a way to discourage such illegal activity, and one that may be cheaper at the margin than additional resources invested in drug interdiction. This might be one rationale for a nontrivial nominal interest rate, in spite of the above results.

³⁰ The resulting inflation rate, though, will be kept low enough that firms do not shift to using a foreign currency instead. Since this currency substitution provides no further shift in resources towards the taxed sector but leads to a discrete fall in seignorage revenue, the optimal inflation rate is capped due to this threat of currency substitution.

³¹ We thank Haizhou Huang for pointing out this connection to exchange rate policies.

³² The fall in the interest rate also plausibly shifts consumption away from services.

³³ If the capital/labor ratio were instead higher for non-tradables than the overall capital/labor ratio for the remaining two industries, then this result reverses and tariffs should discourage rather than encourage trade.

³⁴ See Gordon (2003) for further discussion.

³⁵ Since the bank can charge up to the domestic taxes avoided for this service, helping firms shift their accounts abroad can be particularly profitable.

³⁶ The value of a reflects in part the benefits from saving during some time periods and borrowing during others.

³⁷ This may explain, for example, the economic rationale for bank transactions taxes, as used in a number of Latin American countries. While these taxes result in substantial disintermediation, as documented in Coelho et al (2001), the optimal tax rate may even be above the rate that maximizes bank transactions tax revenue, given the

additional revenue gain from inducing a shift in economic activity from the informal to the formal sector.

³⁸ More accurately, it forecasts that only industries with $a_j < 0$ operate in the informal sector.

³⁹ The common use of depreciation rather than expensing for capital under the VAT in poorer countries is also consistent with this argument.

⁴⁰ Firms with $b_{jk} < b_j^*$ then evade taxes.

⁴¹ See Auriol and Warlters [2005] for a similar argument.

⁴² Many multinationals have subsidiaries in a tax haven, providing them ample opportunity for such income shifting.

⁴³ Even in the U.S., as documented by Grubert, Goodspeed, and Swenson [1993], foreign subsidiaries pay much less in taxes than seemingly equivalent domestic firms.

⁴⁴ The value of output would be more difficult to observe, particularly in industries with heterogeneous products.

⁴⁵ If the size of bank deposits provides no useful information, however, then the need for bank supervision is restricted to monitoring the identity of firms maintaining accounts. Also, inflation has no role other than to provide an additional source of revenue.

⁴⁶ If in addition the government can monitor the quantity produced, then it can infer sales revenue if it also knows market prices. This inference is easiest if the output is homogeneous, e.g. tons of coal.

⁴⁷ Mining raises special issues. A corporate tax on a mine with full expensing for capital investments is equivalent to a land tax. With no comparable alternative use for the land, the tax rate can be very high and still not distort behavior.