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ABSTRACT

Changes in tax policy can affect all aspects of the economy. Not only do firms and individuals change behavior, creating efficiency costs, but government expenditure choices can also change. Unless these expenditure choices had been ``optimal" previously, changes in response to a tax reform affect welfare and should be taken into account when designing tax policy.

This paper develops a specific model of government behavior and then explores the implications of government, as well as private, behavioral responses for tax policy. In particular, we assume that government officials favor expenditure (or regulatory) choices that increase the government's budget. As a result, higher tax rates on a particular activity encourage government behavior that aids the growth of this activity. This response enables tax policy to redirect government activity in desirable directions, but it also makes Pigovian taxes on negative externalities less effective.

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It is well understood that taxes distort the incentives faced by individuals when they make economic decisions. In fact, the resulting efficiency costs have become the central focus in any discussion of optimal tax policy. By now, there is a huge literature measuring the efficiency costs of tax distortions, particularly those affecting labor supply, savings and investment behavior, and corporate financial policy. Discussions of the efficiency implications of tax policy have focused almost exclusively, however, on distortions to the behavior of private individuals and firms, ignoring any implications of taxes for the behavior of government officials. Why?

It is certainly hard to argue that taxes have no effects on the behavior of the government. All aspects of the economy can change in response to the choice of a tax structure — government behavior is no exception. The implicit assumption in any discussion of tax policy is that government expenditure and regulatory choices have been "optimal," based on whatever measure of welfare is chosen. If so, then any changes in government behavior in response to a change in tax structure have no welfare implications at the margin.

Regardless of one's political views, however, it is hard to make a credible case that government allocation decisions have been "optimal." Government decisions are made by individuals, acting as agents for the rest of us, agents who presumably act in their own self-interest. Of course, residents will do their best to design the incentives faced by government officials to induce then to act in the "public interest." But, as with any principal-agent problem, the potential success of such an incentive contract is limited.

Designing an incentive contract for government officials is much harder than doing so for corporate managers. To begin with, officials inevitably have their own idiosyncratic preferences over government policies, so that the incentive problem is not simply to induce sufficient effort. The threat to fire an official for poor performance is also less effective that for a corporate manager. The opportunities for voters to fire officials are very restricted, since elections occur infrequently and at dates outside the control of voters. In addition, voters are likely to be much more poorly informed than corporate Boards of Directors, since each voter has much less at stake than the typical Director and fewer sources of information. The cost to the official of being fired is also unclear, since officials can apparently earn much more from jobs in the private sector than they do in their government positions. In fact, voters often foreclose this option in the case of nonelected officials by setting up civil service protection, preventing officials from being fired. In any case, the principal can face substantial costs of finding a replacement, and has no assurance that the replacement will perform any better than the previous official.[1]

[1]Promotions may be a somewhat more effective means of providing incentives. However, there is no obvious

If as a result, government officials face weak incentives to act in the public interest, then there can be no presumption that the allocation choices they make are "optimal," regardless of the criteria used. As a result, if their allocation choices change in response to a change in the tax structure, then the welfare implications of the resulting changes in allocations should be taken into account when measuring the overall welfare consequences of any tax change. Similarly, when designing an "optimal" tax structure, the efficiency implications of changes in government as well as private behavior should be taken into account.

The key problem in pursuing this argument is that we have no clear model for how government allocation decisions are affected by the choice of tax structure. One simple approach would be to allow the median voter to determine each expenditure decision in sequence, based on the utility gains from the extra expenditures net of the utility losses from that voter's share of the resulting extra taxes. A redesign of the tax structure would then affect the pattern of net gains and losses within the population, changing both the identity of the median voter and his/her preferred level of expenditures on each type of public activity. Only with a benefit tax for each type of expenditure can there be an assurance that the resulting expenditure decisions will be efficient.

Expenditures and regulatory policies are rarely chosen directly by the voters, however. Even the legislature typically chooses only the overall level of expenditures on broad categories of government activity, delegating the specific expenditure choices to government bureaucrats. Specific choices normally require not only detailed information about the range of options available, but also substantial expertise in order to judge their consequences. Neither the public nor the legislature would be in a position to make these decisions, nor are they in a good position to judge ex post whether the right decisions were made.[2] Any contracts linking the pay of bureaucrats to specific measures of performance are therefore unlikely to be effective. They are also very rare in practice.

What then determines the behavior of bureaucrats? Here, models need to be more speculative. Personal preferences on policy, pressures of various sorts from affected parties (legal and illegal), as well as financial incentives can all matter. Since contractual links between pay and performance are rarely present, any financial incentives are mostly indirect, through implications for the bureau's budget.[3] While Niskanen (1971) assumed that budgets are af-

representative of the residents who is in a position to and has the incentives to make these promotion decisions in the interests of the population. For corporations, in contrast, the Board of Directors are in a position to, and because of their large shareholdings, have a strong incentive to act in the interests of shareholders.

[2]Even if they had the expertise, the bureaucrats normally control the relevant sources of information.

[3]The means by which an individual can benefit from a higher budget are many: fancier offices, free meals and travel, jobs for friends and relatives, or even a higher salary to compensate for the added responsibility of overseeing a larger budget.

fected through a particular form of negotiation between the bureaucracy and the legislature. our starting point is the presumption that a key determinant of the budget to any bureaucratic group is the overall amount of tax revenue available to the government, e.g. a given percent increase in the overall budget results in approximately the same percent increase in each bureau's budget.[4]

The first purpose of this paper is to explore how this assumed link between the tax structure and each bureau's budget can affect the policy choices made by these officials. Since the tax structure itself is set by the legislature, the only way that policy choices can affect the government's budget is through effects on the tax base. Policies that increase the tax base then become more attractive, everything else equal, and conversely.

What incentives this creates depends heavily on the nature of the tax structure. The observation that first stimulated us to pursue this model was the rapid growth and dynamic behavior of the nonstate sector in China. Nonstate firms have faced such high tax rates that private investment incentives should have been minimal. However, their tax payments went primarily to the local government, giving local government officials a strong personal interest in encouraging the growth of this tax base. The support and subsidies provided by these officials have in practice been sufficient to generate the observed rapid growth, in spite of the weak private incentives.

In contrast, governments in many poorer countries (including some of the other transition countries) rely heavily on profits taxes on large (often state–owned) manufacturing firms for their revenue. Given this tax structure, the government has a financial incentive to pursue policies that increase profits of these large firms, whether at the expense of small firms, workers, or consumers. Stories of the resulting protection of these large firms, and harassment of competing smaller firms (if only through endless red tape), are legion.

Similarly, high tax rates on cigarette consumption or pollution emissions generate a perverse incentive on the part of government officials to encourage cigarette consumption and pollution emissions so as to increase their budget, in this case directly contrary to the intent of the policy. Whether a high cigarette tax then reduces cigarette consumption on net depends on the offsetting effects of the higher price vs. the more lenient regulatory restrictions that the government would adopt in response to the greater dependence of its tax revenue on cigarette consumption.

The most familiar example of officials responding to financial incentives is probably the use of "speed traps." Local officials certainly have the financial incentive to set up restrictive

[4]This link becomes stronger if some sources of revenue are earmarked for particular uses, e.g. highway tolls are earmarked for road maintenance and construction.

traffic regulations and then strictly enforce them, in order to gain the additional revenue from fines. In this case, financial incentives may be too strong from a social perspective, though perhaps not from the local community's perspective, given that many of the fines are paid by nonresidents.

The government can find it very costly to ignore the incentives created by the tax structure. For example, when Gorbachev tried to reduce alcohol production in order to reduce drunkenness and so improve productivity, one perhaps unintended consequence was a sharp drop in government revenue. Tax rates on alcohol consumption had been very high, and the drop in consumption brought on by Gorbachev's policy initiative generated a large budget deficit, followed by rapid inflation. The resulting macroeconomic problems were an important factor in the unraveling of the Soviet Union.

Any study of optimal tax policy should then take into account these potential effects of the tax structure on government behavior, as well as effects on private behavior. The efficiency costs of tax distortions to private behavior are normally of second–order importance, given that any small deviations from an efficient allocation have no welfare costs at the margin. Since government behavior is inevitably not optimal, however, the efficiency effects of marginal changes from the behavior that would occur ignoring tax incentives can well be large, so in principle could be a dominant consideration in the design of tax policy. In fact, the changes in government behavior induced by the tax structure can well be efficiency enhancing, making a distorting tax structure attractive even if the government is concerned only with maximizing efficiency.

In section 1, we explore the implications of induced changes in government behavior for tax policy in a simple example, in order to clarify the intuition. In this example, the behavior of government officials is short-sighted. Given their limited time in office, they have too weak an incentive to support longer-term investments. We find that taxing the return to longer-term investments can be justified to compensate for this underlying bias in the behavior of officials.

Section 2 then explores a more general model of optimal taxation, taking into account the resulting effects on government as well as private behavior. The implications more broadly for tax policy are discussed in section 3.

1 Initial Example — Short Job Tenure

Government expenditure decisions can be inefficient for many reasons. One commonly cited reason is that officials have a short job tenure. It is commonly argued that short job tenure

generates short–sighted behavior on the part of officials. Local public officials, for example, commonly seem to invest too little in maintenance activities, infrastructure, and other activities having a longer-term payoff.

In principle, voters should recognize the benefits of both longer-term and shorter-term investments, and take both into account when choosing candidates. If electoral pressures are the sole determinant of the incentives faced by officials, then such short-sighted behavior would be puzzling.

Perhaps voters are poorly informed or themselves myopic. Our hypothesis instead is that this short-sighted behavior results from the implicit incentives created by the tax structure. Officials benefit from being in office in part by receiving personal benefits tied to the tax revenue collected while they are in office. If longer-term investments, in contrast to other expenditures, generate tax revenues more heavily in the future, then they become less attractive.

To be concrete, consider a two period model in which the representative resident has an objective function $U + H(G)$, where

$$U \equiv u(C_1) + \frac{u(C_2)}{1+\delta}. \tag{1}$$

Here, δ is the utility discount rate, C_t is real consumption at date t, and G equals the present value of government expenditures. Savings can be divided between investments in domestic firms, where an investment of I yields $f(I)$ in the second period, and investments in the international bond market, where the rate of return is r.[5] The individual faces a consumption tax at rate τ and a tax at rate t on the amount invested in domestic firms. As a result, he makes decisions subject to the following budget constraints

$$(1+\tau)C_1 + (1+t)I + B = Y \tag{2}$$

$$(1+\tau)C_2 = f(I) + B(1+r), \tag{3}$$

where Y is initial income and B is the amount invested in the international bond market.

Ignoring effects of taxes on government behavior, the optimal tax structure would set $t = 0$ and raise revenue solely with the consumption tax. Given our assumption that Y is

[5]For simplicity, assume that the country is a price-taker on the world capital market.

exogenous, a consumption tax is equivalent to a lump-sum tax, whereas t distorts savings decisions.

What effect does the tax structure have on government behavior? Assume that the objective function of the government official is to maximize a weighted sum of the utility of the representative resident and the official's personal income. The official's personal income equals the discounted sum of her yearly salary S while in office, some fraction θ of the tax revenue she oversee while she serves as an official,[6] plus her outside income Y^n if she is no longer in office. We can therefore express her objective function as

$$L \equiv \lambda(U + H) + S + \theta(\tau C_1 + tI) + \frac{\pi(S + \theta\tau C_2) + (1 - \pi)Y^n}{1 + r}. \tag{4}$$

Here, λ is the exogenous weight put on the utility of the representative individual, π is the exogenous probability that the official remains in office in period 2, and r is the market interest rate.

For simplicity, assume that the present value of government revenue, net of the fraction θ kept by the official, must be spent on G, so that

$$G = (1 - \theta)\left(\tau C_1 + tI + \frac{\tau C_2}{1 + r}\right). \tag{5}$$

In addition, however, assume that the official controls a set of regulations, e.g. zoning restrictions, that can limit the amount of investment I. The equilibrium level of investment is therefore the minimum of what the representative individual would choose, and the amount preferred by the government official.

The individual would choose to invest until $f' = (1 + r)(1 + t)$. What level of I would the official prefer? Differentiating her objective function with respect to I, and using the individual's budget constraints to determine the resulting changes in C_1 and C_2, we find that

$$\frac{\partial L}{\partial I} = \lambda\left(\frac{\partial U}{\partial I} + (1 - \theta)t\frac{\partial H}{\partial G}\right) + \theta\left[t - \frac{\tau(1 + t)}{1 + \tau} + \frac{\pi}{1 + r}\frac{\tau f'}{1 + \tau}\right] = 0. \tag{6}$$

Clearly, the outcome depends on the tax structure. If the legislature were to choose the tax structure to maximize the utility of the representative individual, what tax rates would it choose? As t increases, the value of I preferred by the representative individual falls. However, the value preferred by the government official increases. Since the equilibrium value is the minimum of the two, investment is maximized when the two are equal. Since

[6]For the moment, we treat θ as exogenous. This assumption is relaxed in section 2.

even this value is below the efficient value, the second-best optimal tax structure is the one that equates the value of I preferred by the representative individual with that preferred by the official. When the two coincide, $\partial U/\partial I = 0$ and $f' = (1+r)(1+t)$. Substituting these conditions into equation (6) and simplifying, we find that the optimal tax structure satisfies

$$(1-\pi)\frac{\tau}{1+\tau} = \frac{t}{1+t}\left(1+\lambda\frac{\partial H}{\partial G}\frac{1-\theta}{\theta}\right). \tag{7}$$

In particular, if $\pi = 1$ then capital income should not be taxed. In this case, the representative consumer and the official put the same relative weights on consumption in the two periods even without such a tax, so no further correction is needed.

In contrast, if $\pi = 0$, so that the official is in office for just one period, then new investment must be taxed at some positive rate t, $0 < t \leq \tau$, to induce the official to support the efficient amount of new investment.[7] This is equivalent to imposing a comprehensive income tax at rate $t/(1+t)$ in combination with a consumption tax at rate $\tau - t$. To see this, note that consumption plus investment equals labor income plus capital income by an accounting identity. A uniform tax rate on $C_t + I_t$ at rate t is equivalent to a tax at a uniform rate on comprehensive (labor plus capital) income, at a rate $t/(1+t)$.

For intermediate values of π, the optimal tax structure would use a consumption tax more heavily, but still have some use of a comprehensive income tax. The short time horizon of government officials therefore has clear effects on the optimal tax structure. If there were no agency problems, the optimal tax would be a consumption tax, whereas with agency problems it is a weighted average of a consumption tax and a comprehensive income tax.

2 General Implications of Agency Problems for Optimal Taxes

This initial model suppressed a number of important considerations. To begin with, it treated the probability of leaving office as exogenous. Yet voters would attempt to vote elected officials out of office if they are performing poorly. Similarly, they would design employment terms for bureaucrats so that they also lose office (or at least fail to be promoted) if they perform poorly.

To capture this consideration, assume that the probability π that the official keeps her job is a function of the utility of the representative resident, U, giving $\pi(U)$ with $\pi' \geq 0$. We also assume that π is concave in U.

The initial model also assumed that the fraction of the budget, θ, received by the official

[7] If $\lambda = 0$, so that the official does not care about the utility of the resident, then $t = \tau$.

is exogenous. Instead, we will now allow the official to choose the residual amount R to keep for herself, recognizing that a higher R will reduce her chances of remaining in office.

In designing incentives for the official, residents face two related problems. First, they would like to control the total compensation of the official, even though the official has control over R. This problem should be relatively easy to deal with. The total compensation of the official is R plus the stated salary S. As long as R is kept below the total desired compensation through the threat of job loss, then S can be set equal to the total intended compensation minus the expected value of R.[8] Of course, as in the efficiency wage models, the total desired compensation needs to be high, so that the threat of job loss matters to the official.[9]

The main problem faced in designing incentives is that in general the official will have different preferences than the representative agent regarding the optimal composition of public expenditures. For example, given the high skills commonly required by government administrative jobs, officials will have higher skills (and higher incomes) than the representative resident. They will therefore have a bias towards public goods preferred by high income individuals.[10]

The final modeling issue is the range of tools available to the representative resident when designing the incentives faced by government officials. In particular, to what degree can they make the official's salary contingent on performance? Such contractual links are rare, by our reading of the evidence. One explanation may be that residents cannot directly monitor the salary setting process for officials, and so would need to rely on some agent to oversee any link between salary and performance.[11] Yet the incentives of any agent to act in the interests of residents are weak, leaving residents vulnerable to collusion between the agent and the officials whose salaries he is overseeing. This risk of corruption seems to be sufficient that residents commonly impose very tight restrictions on the salary structure of officials, in an attempt to eliminate corruption but in the process also eliminating any links between pay and performance. Given the lack of observed links, we simply assume that the salary S of the official is set before performance is observed. Our model does tie financial incentives to the utility of residents indirectly, though, through the dependence of the probability of the

[8] Added complications arise when R exceeds the total desired compensation, driving S to zero. In some developing countries, government salaries indeed are effectively zero, even relative to salaries elsewhere in the economy. This outcome is not seen in more developed economies, however, so we will not focus on it.

[9] See, for example, Shapiro & Stiglitz (1984) for further discussion.

[10] Another reason for differing preferences is the effects of bribes from various lobbying groups. We will not deal with bribery explicitly, instead allowing them to be captured implicitly through the particular form of the official's preferences.

[11] In contrast, residents can much more easily monitor the design of the tax structure, either requiring a referendum to approve a new tax structure or at least penalizing agents who act against their wishes.

official being fired on the utility of the resident.

The remaining setup of the model is quite conventional. Let the per period utility of the representative resident equal $U(\mathbf{q}, \mathbf{g}, -T)$, where $\mathbf{q}$ is the vector of goods prices, $\mathbf{g}$ is the vector of public goods, and T is a lump–sum tax paid to the government. Also, denote this individual's net demand/supply of goods by $x(\mathbf{q}, \mathbf{g}, T)$.

If the vector of total private outputs equals $\mathbf{y}$, then $\mathbf{y}$ is feasible as long as $F(\mathbf{y}, \mathbf{g}) \geq 0$, for any given vector of public goods $\mathbf{g}$. For simplicity, we assume that this production function has constant returns to scale with respect to the vector $\mathbf{y}$. Public expenditures potentially raise productivity, however, perhaps differently for different goods. Given competitive factor and output markets, we can express the equilibrium prices faced by firms as a function $\mathbf{p}(\mathbf{y}, \mathbf{g})$. To simplify the initial derivations, however, assume that the $\mathbf{p}$ are constant, due to a linear technology that is unaffected by $\mathbf{g}$. Later we will note what changes when $\mathbf{g}$ and $\mathbf{y}$ affect $\mathbf{p}$. To fix the price level, let $p_1 = 1$.

The assumed tax structure consists of the lump–sum tax T along with a vector of commodity tax rates $\mathbf{t}$. Consumer/factor prices therefore satisfy $q_i = (1 + t_i)p_i$.

Let the utility of the government official while in office equal $V(\mathbf{p}, \mathbf{g}, R, S)$.[12] If the official is not in office, however, let her utility instead equal some exogenous value V^n.[13]

Here, we allow incomes R and S to enter the official's utility separately. While we do not make π an explicit function of R, we assume implicitly that the official must go to some effort to disguise R in order to minimize the risks of problems. As a result, R is not normally taken as cash but instead as in-kind benefits, e.g., "perks." We assume that perks are a less efficient way to obtain utility, because the form in which they can be consumed is restricted in order to keep them disguised. The assumed inefficiency of "perks" is represented by the assumption that $V_S \geq V_R$ at all positive S and R (and all possible values of $\mathbf{p}$ and $\mathbf{g}$), with equality only when $R = 0$.[14] In addition, we assume that V_S/V_R increases as perks rise and salary falls.

Implicitly, the model is intended to describe a dynamic process, in which job loss potentially occurs at some point in the future, depending on current job performance. To maintain a one-period model, however, we assume that the official faces a probability $1 - \pi$ of losing

[12] While the official pays $\mathbf{q}$ directly, when buying goods, the taxes paid are then available to the official as part of the government budget. As a result, we choose to simplify here by assuming that the official simply faces the pretax prices $\mathbf{p}$ when buying goods.

[13] V^n can well be affected by government policies. However, we assume that the policies that are implemented if the official is replaced are unaffected by the policies that had previously been proposed by the official.

[14] Even without agency problems, of course, "perks" are nonzero, simply because people want a comfortable life on as well as off the job. Here, we define "perks" as noncash compensation above the amount that would occur without agency problems.

her job immediately upon announcing her planned expenditure package, so ends up with expected utility W equal to

$$W = \pi V(\mathbf{p}, \mathbf{g}, R, S) + (1 - \pi)V^n. \tag{8}$$

For simplicity, assume that the public goods $\mathbf{g}$ are produced using the numeraire good as the sole input, with constant returns to scale. Any one public good g_i has a marginal (and average) cost equal to c^i. Total costs of public good production therefore equal $\mathbf{c}'\mathbf{g}$.

The budget constraint faced by the official equals

$$\sum_i t_i p_i x_i + T = \mathbf{c}'\mathbf{g} + S + R \tag{9}$$

The official chooses $\mathbf{g}$ and R, subject to the budget constraint (9) to maximize her utility, given S, T, and $\mathbf{t}$. Facing this behavioral response of the official, the representative resident then chooses S, T, and $\mathbf{t}$ to maximize social welfare. Including the utility of both the official and the resident, social welfare is measured by $U + W$. In analyzing this problem, we start by examining the behavior of the official, and then explore the implications for the optimal tax structure.

2.1 Allocation decisions of the bureaucrat

The official chooses $\mathbf{g}$ to maximize her utility, W, conditional on the behavioral responses of the representative resident, conditional on S, T, and $\mathbf{t}$, and subject to the budget constraint (9).

Samuelson (1954) showed that the supplies of public goods are optimal, if they are financed with lump–sum taxes and the distribution of income is optimal, when

$$\mathrm{MRS}_i^g + \mathrm{MRS}_i^r = \mathrm{MRT}_i, \tag{10}$$

i.e. if the sum of the relative marginal benefits to both the government official (MRS_i^g) and the resident (MRS_i^r) of additional g_i vs. additional private goods equals the relative marginal costs, MRT_i.[15] Lump–sum taxes are available in our model, so that ignoring agency problems an analogous condition should hold in our setting as well. Instead, because of the agency

[15]Since the overall population is large relative to the number of officials, we assume that $\mathrm{MRS}_i^r >> \mathrm{MRS}_i^g$, capturing the population weights implicitly.

problems, the official's first–order condition for g_i equals

$$\frac{V_S}{V_R}\left[\text{MRS}_i^g + \frac{\pi'}{\pi}(V - V^n)\text{MRS}_i^T\frac{U_I}{V_S}\right] = \text{MRT}_i - \sum_j t_j\left[p_j\frac{\partial x_j}{\partial g_i}\right] \tag{11}$$

where $\text{MRS}_i^g = [\partial V/\partial g_i]/V_S$, $\text{MRS}_i^T = [\partial U/\partial g_i]/U_I$, $\text{MRT}_i = c^i$, and $U_I = -\partial U/\partial T$.

Clearly equation (11) in general is very different than equation (10), implying that agency problems have important effects on the pattern of expenditures. To clarify the sources of the differences, assume that $U_I = V_S$, so that the income distribution is optimal as assumed by Samuelson. If, in addition, only lump–sum taxes are used, then at least the right-hand sides of the two equations are the same. In general, though, the left-hand sides remain very different. Note that the official takes into account the marginal benefits to the resident only to the extent that $\pi'(V - V^n)/\pi > 0$. This requires that officials be provided higher utility than they can receive elsewhere. The implied extra payments to officials, to induce them to take into account the preferences of residents, result from the agency problems that Samuelson assumed away. These extra payments by residents to officials reduce social welfare below the first-best level, even if the incentives they create lead to efficient behavior.

The presumption in our analysis, however, is that the threat of job loss is insufficient in itself to induce the official to give adequate weight to the preferences of the residents. This presumption implies that $\pi'(V - V^n)/\pi < 1$. Therefore, what is spent will be allocated too heavily towards those goods preferred by the official. In addition, ignoring the term V_S/V_R, too little is spent on public goods. (In principle, however, V_S/V_R could be high enough to offset this bias towards too little public spending.)

2.2 Optimal tax policy

How then do agency problems affect the optimal tax structure? In the above model, ignoring agency problems only lump-sum taxes would be used. The level of the tax would be set so that equation (10) holds, so that the sum across people of the relative marginal value of public vs. private goods equals the relative marginal costs.

With agency problems, in contrast, distorting taxes may well serve as a second-best device to induce the bureaucrat to supply both more and a better composition of public goods. Consider, for example, an increase in some tax rate t_k and a compensating fall in the lump–sum tax rate T, starting from the optimal policies, chosen to leave tax revenue unaffected, given existing values of $\mathbf{g}$. With tax revenue unaffected, the utility of the official

is also unaffected.[16] At the optimum, therefore, the utility of the resident should also be unaffected at the margin.

Holding the supplies of public goods fixed, the resident is made worse off due to the greater reliance on distorting taxes. The resident's welfare can remain unchanged, therefore, only if supplies of public goods improve by enough to compensate.

More formally, the change in welfare from this tax change, starting from the optimal policies, must equal zero. Differentiating the sum of utilities of the official and the resident with respect to the combined tax changes, we infer that

$$\sum_i t_i p_i dx_i + \sum_j \mathrm{MRS}_j^T dg_j = 0, \tag{12}$$

where dx_i is the change in demand for x_i brought about by the combined changes in t_k, T, and $\mathbf{g}$, and where dg_j is the change in the supply of g_j induced by this change in tax policy. If the dg_j are all zero, then this equation can hold only when $\mathbf{t} = 0$, i.e. without agency problems only lump-sum taxes will be used.

What can we say about how this shift in tax policy will affect the official's choice for $\mathbf{g}$, as determined by equation (11)? Since U is unaffected at the margin, π remains unchanged. Also, V does not change at the margin, given that the official's budget is fixed. If $\mathbf{g}$ were to remain unchanged, then V_S, V_R, and MRS_j^g all remain unchanged, though MRS_j^T may change due to compensated cross-price effects. The key change, however, is the increase in t_k on the right-hand side of the equation. This increase makes supplying public goods that are complements (substitutes) to x_k more (less) attractive, since the resulting changes in x_k now have larger effects on tax revenue.

To the extent that a higher skilled official undersupplies those public goods preferred by the lower skilled residents, distorting taxes can be used to offset this bias.[17] Assume, for example, that certain taxable private consumption expenditures of particular individuals can substitute for public goods, e.g., private schools substitute for public schools, or private expenditures on security alarms substitute for better police protection. Then taxes on the substitute goods purchased by high income individuals, and subsidies on the substitute goods purchased by poorer individuals, can offset the inherent bias officials would otherwise have towards favoring the public goods benefiting high income individuals. That is, extra expen-

[16] The official's choice for $\mathbf{g}$ certainly changes, but by the envelope theorem marginal changes in $\mathbf{g}$ have no effect on utility.

[17] Given the efficiency costs of using distorting taxes to offset the unrepresentative tastes of a higher skilled official, another alternative would be to employ somewhat lower skilled officials than would otherwise be optimal.

ditures on public goods that benefit high income individuals would result in a drop in private expenditures on the goods they find a close substitute, resulting in a drop in tax revenue. Conversely, extra expenditures on the goods favored by lower income individuals would result in less spent on subsidies to the substitute goods these individuals would otherwise purchase. Taxes can also be used simply to strengthen incentives to provide public goods, e.g. taxing automobiles or gasoline usage encourages investments in road improvements, and higher or more progressive tax rates on labor income encourage more expenditures on education.

As long as distorting taxes induce at least some favorable change in the supply of public goods, then they should be used, at least to some extent. In particular, if the second term in equation (12) is positive, then distorting taxes will be increased to replace lump–sum taxes until the first term is negative enough to offset the second term.[18]

Similarly, the first–order condition for the optimal salary for the public official, holding T and t fixed, equals

$$(V_S - V_R) + \sum_j \frac{\partial U}{\partial g_j} dg_j = 0, \tag{13}$$

where once again the envelope theorem allows us to hold g fixed when calculating the first-order change in V. Everything else equal, it is better to pay the official through cash rather than through perks, given that the official values cash more highly. In equilibrium, however, this benefit will be just offset by a resulting deterioration in the level and/or composition of public goods supplies, as viewed from the perspective of the resident. In particular, the rise in the utility of the official just offsets the resulting fall in the utility of the resident.

What can we learn from equation (11) about the effect of a change in the form of compensation on $\mathbf{g}$? The key way that this change in compensation shows up in equation (11) is in the ratio V_S/V_R. By assumption, this ratio falls if the official is no longer forced to concentrate her consumption so much in "perks." Since "perks" are now more highly valued at the margin, public goods expenditures as a whole become less attractive. However, the official will put more weight on the preferences of the resident when choosing the composition of public goods, since the rise in V and the fall in U imply that $\pi'(V - V^n)/\pi$ rises. In equilibrium, the fall in the overall level must more than offset any improvement in the composition of expenditures.

Finally, consider the effects of a marginal increase in the lump–sum tax rate. The resulting

[18]The first–term is zero if $\mathbf{t} = 0$, implying that distorting taxes must be nonzero in equilibrium.

first–order condition is

$$(V_R - U_I) + V_R \sum_i t_i p_i \frac{\partial x_i}{\partial T} + \sum_j \frac{\partial U}{\partial g_j} \frac{\partial g_j}{\partial T} = 0. \tag{14}$$

Here, the first term is negative under our assumption that $U_I = V_S > V_R$. There is a strong presumption that the second term is negative when the taxes are levied on the goods consumed by the resident, since an additional lump-sum tax causes consumption to fall on net.[19] Therefore, lump-sum taxes should be increased only if these costs are offset by a sufficient improvement in the level and/or composition of public goods supplies, as judged from the perspective of the resident.

Close inspection of equation (11) shows that an increase in T should improve both the level and the composition of public goods. The only alternative to spending the extra money on public goods is to raise R. This causes V_S/V_R to rise, making it attractive to spend at least some of the extra funds on public goods. In addition, the increase in T clearly causes V to rise and U to fall. This raises $\pi'(V - V^n)/\pi$, resulting in more weight on the preferences of the resident. The composition of public goods should therefore also improve.

2.3 Extensions

The previous derivation ignored several potentially important complications. For one, we initially assumed that public expenditures provided consumption benefits to residents, but had no effect on firm productivity.[20] In addition, our initial derivation assumed a linear technology, implying that prices cannot be affected by the choice of public expenditures. With a more general production function, in contrast, a change in government expenditures affects the entire general equilibrium for the economy, and so can affect all prices.

How do our previous results change if public expenditures affect firm productivity and equilibrium prices? If we rederive the first-order condition characterizing the choice of g_i, we would now find that

$$\frac{V_S}{V_R}\left[\mathrm{MRS}_i^g + \frac{\pi'}{\pi}(V - V^n)\left(\mathrm{MRS}_i^T - \sum_j (1 + t_j) x_j \frac{dp_j}{dg_i}\right)\frac{U_I}{V_S}\right]$$

[19] With a labor income tax rather than a consumption tax, however, a lump-sum tax would normally cause an increase in tax revenue. Labor supply is sufficiently inelastic, however, that we presume the sum of the first two terms remains negative.

[20] See Aschauer (1989) for evidence to the contrary.

$$= \text{MRT}_i - \sum_j t_j \left(p_j \frac{dx_j}{dg_i} + x_j \frac{dp_j}{dg_i} \right) \tag{15}$$

Comparing equations (11) and (15), we find two differences. First, the added term on the left-hand side, $-\sum_j (1+t_j) x_j (dp_j/dg_i)$, measures the value of the productivity gain resulting from the added infrastructure expenditures. As before, these benefits are given too little weight in decision-making, everything else equal, when $\pi'(V - V^n)/\pi < 1$. In addition, the change in equilibrium prices implies additional changes in tax revenue. A distorting tax on good j now induces more expenditures on g_i to the extent that $x_j(dp_j/dg_i) > 0$ as well as $p_j(dx_j/dg_i) > 0$.

The first-order condition for the optimal mixture of distorting vs. lump-sum taxes now becomes

$$\sum_j t_j p_j dx_j + \sum_i \left(\text{MRS}_i^T - \sum_j (1+t_j) x_j \frac{dp_j}{dg_i} \right) dg_i = 0. \tag{16}$$

The value to the resident of the productivity gains from any infrastructure investments must now be taken into account. As before, dx_j is the change in demand brought about due to the combined changes not only in t_k, T, and $\mathbf{g}$, but also in $\mathbf{p}$.

To understand the implications of these added complications, consider the government's decision regarding the level of an infrastructure investment g_i that raises productivity in industry j. As a result of added g_i, output of industry j will expand until prices readjust to make any further expansion unprofitable. If the economy is small and open, so that it is a price taker in both the goods market and the capital market, then the only price that can change is the wage rate. The wage rate will therefore rise, causing output in other sectors to fall, and eventually leading to an end to the expansion of industry j.

How would the tax structure best be designed to provide incentives to invest in g_i? As a result of the added g_i, output x_j rises while output elsewhere falls, and the wage rate and (presumably) labor supply rise. Capital investment in industry j rises, while investment in other industries falls.[21] Taxes on x_j or capital (income) in industry j, subsidies to output and capital in other industries, and taxes on labor income can all help to raise the government's incentive to produce g_i.

The offsetting costs in each case arise from the excess burden expression $\sum_i t_i p_i dx_j$.[22]

[21] The net change in capital investment is ambiguous, since it depends on the relative capital intensities of production in the various industries.

[22] An additional potential cost is a drop in expenditures on other public goods.

These costs can often be small. For example, if labor supply is totally inelastic, then a tax on labor income induces more investment in g_i without creating any excess burden in the process. The labor tax should increase until the utility gains from the added expenditures on g_i are just offset by the utility loss from a change in expenditures on other public goods.

Even if the demand for x_j has a nontrivial price elasticity, however, the term dx_j reflects as well the effects of changes in government expenditures. Consider the behavioral response to an increase in some tax rate, t_j, e.g. an increased tax rate on output in industry j, that induces higher expenditures on those g_i that cause an increase in x_j. The direct effect of such a tax increase would be a fall in the tax base x_j, while the indirect effect through changing g_i raises the tax base, resulting in a smaller net drop (or even a rise) in x_j. For example, an increased tax rate on agricultural production in an isolated region can make it attractive for the government to build better road access to this region. Even if the tax base still falls on net, the efficiency cost of using distorting taxes may be much lower, given the feedback effects arising from the change in government expenditures.

3 Discussion

Even if correct in principle, are these effects of the tax structure on government expenditures important enough in practice to matter? This has yet to be shown.[23] The objective of this paper in part is to point out the value of empirical work examining the effects of the tax structure on government as well as private behavior.

Should we really expect to see noticeable effects? If public expenditures simply provide consumption benefits to residents, and if the utility function is separable between private goods and public goods, e.g. takes the form $U(C) + H(G)$ as is commonly assumed, then G would seem to have no effect on observable behavior (except perhaps through changes in equilibrium producer prices), implying that the tax structure cannot be used to affect the choice of G.

Even in this case, however, distorting taxes can help improve incentives when people are mobile across jurisdictions. Choices of G that raise the utility of residents will make the jurisdiction a more attractive place to live. If the housing stock is fixed in the short term, then property values would be bid up to reflect the utility gain to residents, suggesting that a property tax is an effective incentive device. If the housing stock can easily adjust, then the

[23] In extreme cases, we feel that the evidence of taxes affecting government behavior seems transparent. See Oi (1995) and Gordon (1990), for example, for a discussion of how the design of the local tax structure made Chinese township and village governments strongly supportive of the entry and growth of new nonstate firms.

number of residents would presumably expand, making a tax tied to the number of people. e.g. a labor income tax, attractive.[24] A higher marginal tax rate on property values, or labor income, offset perhaps by added exemptions to keep revenue unchanged, then provides more high–powered incentives to government officials to provide additional public expenditures. This gain in public incentives must be traded off with added distortions to private incentives.

There is a much stronger presumption for the use of distorting taxes to improve the incentives government officials face to provide infrastructure investments. Activities that benefit from infrastructure investments should expand in response, so that taxes on these activities are effective in providing incentives to government officials. The more closely tied the officials' budget is to the benefits resulting from added public investment, the better aligned the incentives.

The incentive effects of taxes on government behavior can easily become important when the tax base is more narrow. Whenever some sectors are taxed at higher rates than other sectors, government officials have an incentive to encourage a shift in resources from the less heavily taxed to the more heavily taxed sectors. For example, in many developing countries the existing income taxes apply mainly to large manufacturing firms, where income can be most easily monitored. The government then faces an incentive to favor this highly taxed sector, whether through tariff protection of these large firms or through red tape hindering the activity of the rest of the economy. These distortions to government behavior push in the opposite direction from the distortions to private behavior, with one causing the taxed sector to expand and the other to contract, suggesting the possibility of smaller efficiency costs from such narrow tax bases once the effects on government activity are taken into account.

Another important example of a narrow tax base is the use of Pigovian taxes to discourage externality-generating activities. Pigovian taxes are in principle an effective means to restore efficiency when some activities generate negative externalities. As Goulder, Parry & Burtraw (1997) point out, Pigovian taxes should dominate direct regulation, given that the resulting revenue can be used to finance a reduction in other tax rates. These arguments assume, however, that the government behaves optimally. When activities that generate negative externalities are taxed, government officials have a perverse incentive to encourage more such activity. If this perverse effect on government behavior is important enough, then regulations may dominate Pigovian taxes.

Similarly, Polinsky & Shavell (1984) argued that fines dominate punishment as a deterrent to crime. Both impose private costs on criminals. However, fines generate extra government

[24]See Glaeser (1996), Hoxby (forthcoming), and Wilson & Gordon (1998) for a closer examination of these cases.

revenue, whereas punishment can generate a loss in government revenue. Polinsky & Shavell (1984) ignore, however, the effects of fines vs. punishment on the behavior of government officials. Government officials must decide how much effort to exert in identifying and prosecuting criminals. The use of fines rather than punishment encourages more effort, but perhaps too much effort. In particular, not only will officials set up "speed traps," but they can be too quick to find someone guilty, in order to collect the fine. Facing such a strong incentive, they can also credibly use the threat of an inappropriate guilty verdict to extort money from innocent parties. If fines generate excessive enforcement incentives, then punishments may be a preferable means of discouraging criminal activity.

References

Aschauer, D. (1989). Is public expenditure productive?, *Journal of Monetary Economics* **23**: 177–200.

Glaeser, E. L. (1996). The incentive effects of property taxes on local governments, *Public Choice* **89**: 93–111.

Gordon, R. H. (1990). Economic reform of the people's republic of china, 1979-1988, *in* M. Boskin & C. McLure (eds), *World Tax Reform*, ICS Press, pp. 189–204.

Goulder, L., Parry, I. & Burtraw, D. (1997). Revenue-raising versus other approaches to environmental protection: The critical significance of preexisting tax distortions, *Rand Journal of Economics* **28**: 708–31.

Hoxby, C. (forthcoming). The productivity of schools and other local public goods producers, *Journal of Public Economics* .

Niskanen, W. (1971). *Bureaucracy and Representative Government*, Aldine-Atherton, Chicago.

Oi, J. C. (1995). The role of the local state in china's transitional economy, *China Quarterly* **0**: 1132–49.

Polinsky, A. M. & Shavell, S. (1984). The optimal use of fines and imprisonment, *Journal of Public Economics* **24**: 89–99.

Samuelson, P. (1954). The pure theory of public expenditure, *Review of Economics and Statistics* **36**: 387–9.

Shapiro, C. & Stiglitz, J. (1984). Equilibrium unemployment as a worker discipline device. *American Economic Review* **74**: 433–444.

Wilson, J. D. & Gordon, R. H. (1998). Expenditure competition. unpublished.

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