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ON THE TIMELINESS OF TAX REFORM

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ABSTRACT

This paper analyzes efficient reactions of policy makers to unanticipated tax avoidance. The strategy of many governments is to reform their tax laws and regulations to reduce the effectiveness of elaborate tax avoidance techniques as soon as they are identified. This tax reform process can successfully prevent the widespread use of new tax avoidance strategies, and in that way prevents erosion of the tax base. But it also encourages the rapid development of new tax avoidance techniques by innovators whose competitors are thereby unable to copy their methods -- as a consequence of which, there can be a great premium on being the first to develop and use a new tax avoidance method. An activist reform agenda may therefore divert greater resources into tax avoidance activity, and lead to a faster rate of tax base erosion, than would a less reactive government strategy. Efficient government policy therefore often entails a slow and deliberate pace of tax reform in response to taxpayer innovation.

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1. Introduction.

Countries frequently change their tax laws and regulations, being prompted by budgetary needs, general economic conditions, and the politics of the moment.[1] Laws also change in reaction to unanticipated tax avoidance behavior, as governments attempt to close loopholes, limit arbitrage, and otherwise maintain their tax bases. Since tax reform outcomes seldom satisfy all interested parties, there is continuing pressure to reform tax laws even in the absence of changing needs or economic circumstances. Many voice understandable concern that this process of continual reform may itself undermine tax policy objectives, since the behavior of taxpayers is likely to be affected by their expectations that the tax environment tomorrow may not resemble the tax environment today. The temptation to correct perceived problems with existing laws is, however, difficult to resist. Interested parties who would otherwise be concerned about the frequency with which tax laws change might nevertheless support just one more reform if it contains the right provisions.

The realization that taxpayers have discovered effective methods of avoiding what might otherwise be their tax obligations serves as an important spur to tax reform efforts. Somewhat ironically, this often occurs in response to taxpayer reactions to opportunities created by prior tax reforms, when governments attempt to encourage certain behavior by rewarding it with favorable tax treatment, only to discover subsequently that taxpayers take more advantage of the new provisions than was originally envisioned. It is perfectly natural then for governments to want to correct this state of affairs with new legislation designed to remove some or all of the benefits of tax avoidance activity.

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[1] For example, the United States introduced 17 separate corporate tax reforms over the 1953-1985 period, as discussed by Auerbach and Hines (1988).

The purpose of this paper is to analyze the efficient reaction times of governments in reforming tax provisions in order to remove tax avoidance opportunities. Perhaps surprisingly, the efficient policy is generally not to eliminate tax avoidance methods as soon as they are identified. The reason is that the eagerness of the government to restrict tax avoidance indirectly encourages the development and use of new tax avoidance methods. Since it is typically costly to develop such methods, a policy of removing tax avoidance opportunities once they are discovered produces a cycle in which taxpayers are continually expending resources to identify and exploit new tax avoidance opportunities to replace old methods that are no longer allowed. In such an environment, there can exist situations in which the government's reform efforts actually increase the aggregate level of tax avoidance by encouraging development and early adoption of tax avoidance techniques by taxpayers seeking to obtain benefits prior to any reforms that will render them ineffective or illegal.

Efficient government tax reform policy entails considerations other than maximizing tax collections, of course. Since resources devoted to tax avoidance could be profitably deployed elsewhere in the economy, it follows that any welfare analysis of the frequency of tax reform necessarily entails trading off any benefits from reducing tax avoidance with the cost of encouraging taxpayers to devote resources to avoidance activity. To take an extreme example, suppose that taxpayers always are able to reduce their tax burdens by 20 percent through a judicious use of tax planning opportunities. Government policy can make this tax avoidance easy, perhaps almost costless, or alternatively policy can make it very difficult (by closing off easy-to-find loopholes), in which case obtaining a 20 percent tax reduction might cost almost as much as the taxes saved. If taxpayers will ultimately obtain their 20 percent tax reductions (and no more) under either tax policy regime, then an efficient government policy would permit easy

access to well-developed tax avoidance methods, since doing so economizes on resources devoted to tax avoidance without affecting aggregate tax collections.

Recent interest in corporate tax sheltering activity brings some of these issues into stark relief. There are well-publicized examples in which financial innovators develop tax avoidance tactics that they then market to taxpayers in return for fees.[2] This practice generated sufficient alarm in U.S. government circles to warrant special attention in recent legislative activity. At the same time, it is exactly the legislative and regulatory reaction to tax avoidance that creates the incentives to develop the tax avoidance methods in the first place.[3] When taxpayers anticipate that the use of any tax avoidance method will be limited by subsequent government actions that stifle imitation, it follows that innovators will be rewarded with short-term monopolies. The alternative of no government reaction would certainly entail widespread use of new tax avoidance methods once they are developed, but their development and initial use would be greatly discouraged by the ability of competitors to copy successful techniques. Put differently, the inability of taxpayers to obtain patents for successful tax avoidance methods creates a "free rider" situation in which incentives to develop new methods is smaller than it would otherwise be. Government policy limiting the use of well-identified techniques may inadvertently encourage their development by reducing incentives to wait for others to do so.

Section two of the paper reviews tax policy developments in the United States that illustrate the cycle of tax avoidance and subsequent tax reform. Section three analyzes the properties of a simple model of tax avoidance activity, in which tax savings take the form of reducing the cost of market activity, and in which rapid government reactions can encourage excessive tax avoidance effort. Section four considers a more limited form of tax avoidance that

[2] See the examples discussed in Bankman (1999).

does not reduce the marginal cost of supplying goods to the market, but which nevertheless has the property that reactive tax reform can encourage avoidance beyond the efficient level. Section five analyzes efficient government policy in a setting in which heterogeneous taxpayers differ in the rates at which they prefer to adopt tax avoidance methods developed by others, and an anticipated government reform that prevents new adoption has the effect of encouraging early adoption by others. Section six is the conclusion.

2. Tax avoidance experiences.

While financial innovation of recent years has attracted widespread attention, the cycle of tax reform, tax avoidance, and subsequent tax reform has a very long history. Tax avoidance tactics differ widely in their form, aggressiveness, and impact, and the government's efforts to prevent tax avoidance likewise differ in their effect. This section reviews a number of recent American episodes with tax avoidance and government responses, in an effort to identify some of the major characterizing features of tax reform.

Some of the most spectacular and aggressive tax avoidance methods include techniques designed to locate tax deductions in the hands of high-tax-rate taxpayers, and taxable income in the hands of low-tax-rate taxpayers. Examples include the use of foreign investment vehicles to create high-basis, low-value entities, the use of step-down preferred stock to generate excessive interest deductions, and the adroit use of installment sales plans in partnership agreements to allocate tax losses to highly taxed partners and taxable income to tax exempt partners. The U.S. foreign tax credit rules create separate incentives for taxable investors to hold securities that pay foreign source dividends on which credits can be claimed, thereby creating a sheltering

[3] Bankman (1999) and Bhattacharyya and Nanda (2000) make this point.

opportunity that entails short-term trading of stock around dividend dates. Other types of tax shelters entail issuing new securities that permit owners of appreciated assets to receive tangible benefit from their unrealized capital gains without triggering capital gains tax liabilities. And there are many other popular tax shelters of recent years.[4] The most aggressive and widely practiced of these tax avoidance methods are often ultimately identified by the government, challenged in court, and subsequently discontinued, though of course there can be variation in any government's position.[5] In particular, taxing authorities have at their disposal a number of legal and legislative alternatives when facing situations in which they would like to curtail tax avoidance activity.

There are many ordinary examples of taxpayer innovation followed by subsequent legislative or regulatory reform. These cases typically differ from the aggressive tax sheltering examples in that they represent instances in which taxpayers comply fully with the letter and spirit of the tax laws, but governments come to regret the opportunities created by prior laws.

The U.S. Economic Recovery Tax Act of 1981 (ERTA) offers several examples of the tax reform process. ERTA contained a number of provisions designed to stimulate what was then a sluggish U.S. economy. These provisions included not only tax rate cuts, but also tax base reductions through provisions that included accelerated depreciation of new capital investment, reinstatement of the investment tax credit, favorable treatment of firms with foreign income, reduced taxation of capital gains, and leasing provisions intended to permit taxpayers with net operating loss carryforwards to obtain benefits from new investment incentives. As events transpired, some of these benefits proved only transitory.

[4] See, for example, the discussion in Bankman (1999), Weisbach (1999), and Shaviro (2000a).
[5] The U.S. government's position is articulated in United States Department of the Treasury (1999).

With its focus on short-term economic stimulus, and in the belief that equipment investment offers a more rapid and therefore effective method of combating a recession, Congress provided extremely favorable tax incentives for equipment investment. These incentives included a new investment tax credit for which equipment but not structures were eligible, and extremely rapid depreciation over very short depreciable lifetimes. Investments in structures were also treated more generously under ERTA than they were under prior law (the depreciable lifetimes of new commercial structures were reduced from 48 to 15 years, for example), but the net impact of the structures changes was not as dramatic as those for equipment. Standard King-Fullerton type effective tax rate calculations indicated that effective tax rates on new investment in general industrial equipment were as low as –6.8 percent, while investments in industrial structures faced effective tax rates of approximately 42 percent.[6]

What these calculations do not incorporate, and Congress did not anticipate, was the ability of taxpayers to exploit differences between ordinary and capital gains tax rates to generate tax savings on investments in long-lived structures investments. The ERTA provisions gave taxpayers incentives to "churn" their structures by selling them to other taxable entities after just a few years of ownership. The benefit of "churning" a structure in this way is that new owners are able to depreciate it afresh, and this is valuable if the depreciation deductions thereby obtained exceed those that could have been claimed by previous owners. The cost of "churning" a structure – apart from any costs arising from the transaction itself – is that the taxpayer has to recognize gain, if any, on the difference between the sale price of the structure and its tax basis. Under the law prevailing at the time, this gain was treated as capital gain as long as the taxpayer used straight-line rather than declining balance depreciation. As a result of this very favorable

[6] See Auerbach (1983).

tax avoidance opportunity, structures were commonly "churned" for tax purposes during this period, and the United States experienced a sharp rise in investments in industrial, commercial, and residential structures.[7]

Governmental reaction to this taxpayer activity reflects concerns about these incentives. The U.S. Deficit Reduction Act of 1984 extended the depreciable lifetime of most industrial structures from 15 to 18 years while leaving unaffected the depreciable lifetimes of equipment investments. Subsequent legislation in 1985 extended the depreciable lifetimes of structures investments to 19 years, and the Tax Reform Act of 1986 (TRA) changed the system entirely by introducing a much less generous method of cost recovery for investment, thereby eliminating the incentive to "churn" assets. The TRA contained scores of other provisions similarly motivated to curtail tax avoidance, among them the anti-straddle rules, many of the foreign provisions, and the repeal of the General Utilities doctrine and the completed contract method of accounting.

More distant tax reforms have similar flavor. Prior to 1950, qualifying American nonprofit organizations were exempt from federal income tax on all forms of business profits. In a now famous case, New York University received ownership of the C.F. Mueller Company, a pasta manufacturer, as a gift from an alumnus, this change of ownership effectively exempting Mueller from federal corporate income tax payments. New York University's unwillingness to part with its newly acquired Mueller stock was no doubt the result of many considerations, among them the likely price that a taxable investor would pay for a business whose tax obligations would suddenly increase as a result of the change of ownership. In response, the U.S. government in 1950 introduced the Unrelated Business Income Tax on certain income of

[7] See the evidence reported by Gordon, Hines, and Summers (1987).

qualifying nonprofit organizations, thereby subjecting Mueller, and other business enterprises owned by nonprofit organizations, to taxation at the corporate rate.[8]

One can distinguish four types of governmental reaction to perceived excessive tax avoidance on the part of taxpayers. One reaction is simply to do nothing; as will be argued shortly, this may often be the most efficient policy. A second reaction is to enact new laws or regulations that disallow future use of the tax avoidance method, but to "grandfather" past use (that may carry into the future). The third reaction type is to disallow use of the tax avoidance method henceforth, thereby denying "grandfather" benefits to those already enjoying tax savings. And the fourth, and most aggressive, class of governmental response is one in which all future, present, and past use of the tax avoidance method is disallowed. This fourth type of outcome can be implemented via legislative or regulatory action, or, in some cases, by legal action in which the government argues to a court that current (and past) tax avoidance is inconsistent with a proper interpretation of existing tax rules.

The U.S. Tax Reform Act of 1986 offers a useful insight into the tax reform process. The purpose of the TRA was to reform American tax laws by broadening the tax base and lowering tax rates, as part of what was then a movement among many high-income countries to enact reforms of this type. Some of the changes introduced by the TRA were directed at what were thought to be excessive tax avoidance activities. The Joint Committee on Taxation of the United States Congress offers official explanations of major U.S. tax legislation, including the rationale of Congress (such as it is) in adopting various provisions. Of the 238 separate provisions of the TRA described in U.S Congress, Joint Committee on Taxation (1987) and accompanied by official rationales, 83 list excessive tax avoidance as an important factor in Congress's

[8] See Hines (1999) for an analysis of the impact of the Unrelated Business Income Tax.

motivation to change the law. Table 1 summarizes these provisions, and the type of remedies adopted in the TRA. The TRA changes range from those (*9*) that "grandfather" past avoidance while preventing future avoidance, to a small number (*5*) that apply provisions retroactively.[9] By far the majority of the provisions (*69* of *83*) that are motivated by taxpayer avoidance take the form of prospective changes that take effect immediately but do not affect liabilities for past actions.

3. When tax avoidance reduces production costs.

This section and the two that follow develop simple models of differing aspects of the problems faced by governments that try to prevent widespread avoidance without thereby encouraging excessive innovative activity. The setting in section three has a taxpaying firm contemplating an innovation that would reduce its production costs if successful. An important consideration faced by the firm, however, is that, in the absence of government action, its efforts to reduce its own costs will also reduce the costs of others, with feedback to the innovating firm's profits.

The simplest situation that illustrates these considerations is one in which a taxpaying firm, acting on its own, can expend effort valued (in money terms) by e in the belief that doing so will permit the identification of a tax avoidance opportunity that saves h per unit of output. If the firm's industry is perfectly competitive, and imitation is costless, then the firm will have no incentive to undertake such innovation. The reason is that any successful innovation would be

[9] There is some subjectivity in the author's classification of these changes. For example, the 1986 repeal of the *General Utilities* doctrine (which, prior to 1986, allowed corporations to avoid capital gains taxes on liquidating distributions) permitted any taxpayers that had undertaken liquidating distributions prior to that date to retain the benefits of doing so. Hence, these taxpayers are "grandfathered" by the new law, and the change is so classified in Table 1 – even though other taxpayers that might, prior to 1986, have peformed investments in anticipation of using

immediately copied by its competitors, as a result of which the benefit from the reduced cost of output would be immediately reflected in lower industry prices. Since the industry is competitive, firms earn zero profits in equilibrium, and this must be true both of firms who have innovated to reduce costs in the past, and those who merely copy the innovators. Hence there is no incentive to undertake innovation.

It is instructive to contrast that situation with one in which the government enforces a regime in which it outlaws new use of any identified tax avoidance method. Then the innovator receives sole and proprietary use of its tax avoidance method, and will undertake the investment as long as $hq > e$, in which q is the firm's output level. Consequently, the tax policy regime makes innovation possible in this case, and a government that prefers to deter innovation must establish a credible policy of not reacting to innovation by outlawing subsequent imitation. This credibility may need to be obtained at the cost of permitting (out of equilibrium) innovation to produce new tax avoidance methods that are widely adopted.

An alternative tax policy regime that would effectively deter innovation is one in which the government changes its tax laws with retroactive effect. With retroactive tax changes, it is no longer the case that government action indirectly encourages taxpayers to find innovative methods of tax avoidance. The difficulty with such a policy solution, however, is that governments that demonstrate a willingness to impose retroactive taxes run the risk of discouraging economic activity by agents who fear retroactive expropriation through the tax system. It is generally believed that cavalier use of retroactivity carries considerably greater

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the *General Utilities* doctrine to avoid subsequent capital gains taxes, and their option to do so was not "grandfathered."

costs than it confers benefits,[10] and is therefore unlikely to represent an optimal policy. For the purpose of the remainder of the analysis, retroactive enforcement will be taken to be sufficiently undesirable as to be infeasible.

A word about the setup may be in order, since a common tax shelter arrangement of recent years entails development of a financial or other product by a tax avoidance entrepreneur, who then sells the arrangement to one or more taxpayers. On the surface, this arrangement differs considerably from the every-firm-on-its-own feature of the model just analyzed. In practice, however, the differences are more apparent than real. The common feature of tax avoidance methods is that they can almost never become the private property of the innovator. Tax avoidance entrepreneurs who develop sophisticated products must keep them quiet in order to ensure the long-run viability of the developer's market power. Consequently, these entrepreneurs, who are properly thought of as the agents of their clients (albeit ones with short-term relationships), are unlikely to act much differently than would the client on its own.[11] In addition, of course, the vast majority of tax avoidance methods are not the product of unaffiliated agents but instead the result of painstaking effort on the part of taxpayers.

In imperfectly competitive industries it is possible for innovators to receive adequate returns for developing new tax avoidance methods, since cost reductions generally benefit all competitors, including the innovator. Consider the case in which there are n identical firms participating in an industry with linear demand given by $p(Q) = 1 - Q$, in which Q is aggregate

[10] See, for example, Bradford (1984) and Logue (1996). Graetz (1977), Kaplow (1986), Levmore (1993), and Shaviro (2000b) identify circumstances in which it is efficient for governments to enact retroactive changes.
[11] Gergen (2001) identifies institutional features of tax shelter marketing arrangements (such as commitments to pay the legal and other expenses associated with audits by tax authorities) that align the interests of tax avoidance entrepreneurs and their taxpayer clients.

output and p is the market price. Firm i produces its output at constant per-unit cost given by c_i, and therefore has profits equal to:

$$\pi_i = q_i p(Q) - c_i q_i . \tag{1}$$

Differentiating this expression with respect to q_i yields the first-order condition:

$$p(Q) - c_i + q_i p'(Q)(1+\theta) = 0 , \tag{2}$$

in which θ is firm i's conjectural variation, the expected change in the output of other firms conditional on a unit change in firm i's output. This is a standard Cournot-Nash specification of imperfect competition that includes as special cases Nash oligopoly $(\theta = 0)$, monopoly ($\theta = 0$ and $n = 1$), Bertrand competition $(\theta = -1)$, and others.

Imposing that $p'(Q) = -1$, and the symmetry condition that $q_i = \frac{Q}{n}$, it follows from (2) that:

$$q_i = \frac{(1 - c_i)}{(1 + n + \theta)} \tag{3a}$$

$$p = c + \frac{(1+\theta)(1 - c_i)}{(1 + n + \theta)} . \tag{3b}$$

Expressions (3a) and (3b) together imply that firm i's profits are given by:

(4) $$\pi_i = \frac{(1-c_i)^2(1+\theta)}{(1+n+\theta)^2}.$$

From (4), profits rise at lower values of *n* or higher values of θ, both of which are characteristic of collusive settings.[12] If firm *i* innovates to lower its costs, with other firms likewise experiencing cost reductions, it follows that industry profits will rise, as will the profits of firm *i*. The effect, however, is small for large *n* or small θ, since

(5) $$\frac{d\pi_i}{dc_i} = -2\frac{(1-c_i)(1+\theta)}{(1+n+\theta)^2} = -\left(\frac{2}{1-c_i}\right)\pi_i.$$

Hence an oligopolist might be willing to innovate even without proprietary rights to the associated cost reduction, as long as the cost of innovating is sufficiently low to make the enterprise worthwhile. This is most likely to occur in situations in which firms in the industry are profitable due to the small number of competitors and the absence of strong price competition.

4. Inframarginal cost reductions.

The results described in section 3 correspond to cases in which innovations that reduce tax liabilities do so by reducing production costs. Since market forces then translate reduced

[12] Profits rise with θ only if $n > (1+\theta)$, a restriction that Seade (1980) imposes on the basis of the nature of conjectural variations as well as industry stability.

production costs into depressed output prices, it follows that innovation incentives in the absence of government restrictions may be small or nonexistent.

Some tax-avoidance methods have a different character, in that they correspond to situations in which taxpayers have opportunities to reduce tax obligations in ways that do not affect their marginal incentives to earn taxable income. An example might be that a firm is able to use a depreciation technique for assets acquired years earlier; this technique saves the firm $10 million in taxes. Efficient government policy in such a setting then reflects tradeoffs between incentives to devote resources to innovation and the cost of permitting widespread adoption. Greater resources devoted to innovation are socially costly for three reasons: they increase the likelihood, as well as the magnitude, of successful tax avoidance; they are tax deductible, and therefore reduce tax collections even if unsuccessful; and they represent an unproductive use of society's resources.[13]

In order to analyze the welfare effects of resources allocated to tax avoidance, this section considers a model in which *n* risk-neutral identical taxpayers have probabilistic chances of developing a new tax avoidance method of value *M*, but collectively it is certain that exactly one of them will be successful.[14] The magnitude of *M* is potentially a function of the extent of effort devoted to its development. Specifically, suppose that firm *i* devotes effort worth *e* to developing a new method of avoiding taxes, and that other $(n-1)$ firms in the industry devote

[13] Kaplow's (1990) analysis of the optimal level of tax enforcement effort addresses these issues in a somewhat different context, while Shaviro (2000a) notes the inefficiency of tax enforcement regimes that merely entail greater taxpayer expense but no less avoidance. Another possibility, not explored here, is that tax avoidance improves social welfare by reducing the effective rates at which economic activity is taxed. This possibility – which is not an issue when tax reductions are inframarginal, as in this section – depends critically on tax rates.

[14] This section abstracts from any resource costs associated with stricter government enforcement, which are likely only to contribute to the government's desire for limited enforcement. Kaplow (1990) offers an analysis of the tradeoffs involved.

(identical) effort of $\bar{e}$. Firm *i*'s probability $p(e,\bar{e})$ of being the successful innovator is an increasing function of *i*'s effort and a decreasing function of the efforts of others.

One of the critical aspects of tax avoidance activity is that successful avoidance can be imitated, albeit at times imperfectly. The ability to imitate is captured by the parameter α, in which $0 < \alpha < 1$: if a taxpayer fails to innovate but another taxpayer succeeds, then the taxpayer who is unsuccessful nevertheless (in expectation) receives a tax benefit equal to $\alpha M(\bar{e})$, in which $\bar{e}$ is the effort level of the successful innovator, and $M(\bar{e})$ the associated avoidance. Government policy determines the value of α, since rapid reform of the tax laws in response to innovation corresponds to a smaller value of α, while more permissive government policy corresponds to larger values of α. This specification imposes that the extent (α) to which unsuccessful innovators are able to benefit from the avoidance of others is unaffected by their own avoidance efforts.

The taxpayer's optimal choice of *e* entails maximizing:

$$p(e,\bar{e})M(e) - e(1-\tau) + [1 - p(e,\bar{e})]\alpha M(\bar{e}), \tag{6}$$

in which the expression incorporates the fact that expenditures *e*, that include employee salaries, payments for legal and accounting advice, the cost of management attention that could be devoted to earning taxable profits, and others, are themselves tax-deductible. Differentiating (6) with respect to *e* yields the following first-order condition for a profit-maximizing interior choice of *e* (taking the actions of other taxpayers to be unaffected by one's own):

(7) $$\frac{\partial p(e,\bar{e})}{\partial e}[M(e)-\alpha M(\bar{e})]+p(e,\bar{e})M'(e)=(1-\tau).$$

In a symmetric equilibrium with identical taxpayers, it follows that the effort levels of all taxpayers are identical, so $e=\bar{e}$, $M(e)=M(\bar{e})$, and $M'(e)=M'(\bar{e})$.[15] Furthermore, when $e=\bar{e}$, it must be the case that $p(e,\bar{e})=\frac{1}{n}$, and therefore that $\frac{\partial p(e,\bar{e})}{\partial e}+\frac{\partial p(e,\bar{e})}{\partial \bar{e}}=0$. Differentiating both sides of (7) with respect to α, and imposing these conditions, as well as $\frac{de}{d\alpha}=\frac{d\bar{e}}{d\alpha}$, implies:

(8) $$\frac{de}{d\alpha}=\frac{\frac{\partial p(e,\bar{e})}{\partial e}}{\left[\frac{\partial^2 p(e,\bar{e})}{\partial e^2}+\frac{\partial^2 p(e,\bar{e})}{\partial e\partial \bar{e}}+\frac{\partial p(e,\bar{e})}{\partial e}\frac{M'(e)}{M(e)}\right](1-\alpha)+\frac{M''(e)}{nM(e)}}.$$

Suppose that the government chooses α with the goal of maximizing social welfare, which is a function of individual welfare and total tax collections. Letting $(1+\lambda)$ denote the shadow value of a dollar of tax revenue (so that one might think of λ as representing the marginal excess burden associated with raising a dollar of tax revenue),[16] it follows that the government's problem is to choose α to minimize Ω, defined as:

(9) $$\Omega\equiv\lambda M[1+\alpha(n-1)]+(1+\tau\lambda)ne.$$

[15] It is possible for this model to exhibit asymmetric equilibria, but they are not considered here.

The first term on the right side of (9) is the welfare cost of lost tax revenue due to avoidance. It is premultiplied by λ because a pure transfer of resources from taxpayers to the government has welfare consequences only to the extent that λ is nonzero. The term in brackets reflects that one taxpayer will receive the full benefits of the innovation, while the *(n-1)* other taxpayers obtain only the reduced benefits accruing to those who imitate the successful developers. The second term on the right side of (9) reflects the tax and real resource costs associated with the development of new tax avoidance methods.

Differentiating (9) with respect to α, and imposing (8), yields:

$$(10) \qquad \frac{d\Omega}{d\alpha} = \frac{\frac{\partial p(e,\bar{e})}{\partial e}\{\lambda[1+\alpha(n-1)]M'(e)+n(1+\tau\lambda)\}}{\left[\frac{\partial^2 p(e,\bar{e})}{\partial e^2}+\frac{\partial^2 p(e,\bar{e})}{\partial e\partial\bar{e}}+\frac{\partial p(e,\bar{e})}{\partial e}\frac{M'(e)}{M(e)}\right](1-\alpha)+\frac{M''(e)}{nM(e)}} + (n-1)\lambda M(e).$$

An optimal interior choice of α is one for which the expression on the right side of (10) is zero. This expression is most easily interpreted by considering simple cases, such as that in which *M* takes a fixed value, so that $M'(e)=M''(e)=0$, and $p(e,\bar{e})$ takes the form:

$$(11) \qquad p(e,\bar{e}) = \frac{e}{e+(n-1)\bar{e}}.$$

In a symmetric equilibrium with identical taxpayers, (11) entails:

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[16] For a definition and various applications of the concept of the shadow value of government revenue, see, for

(12a) $$\frac{\partial p(e,\bar{e})}{\partial e} = \frac{(n-1)}{n^2 e}$$

(12b) $$\frac{\partial^2 p(e,\bar{e})}{\partial e^2} = -\frac{2(n-1)}{n^3 e^2}$$

(12c) $$\frac{\partial^2 p(e,\bar{e})}{\partial e \partial \bar{e}} = -\frac{(n-1)(n-2)}{n^3 e^2}.$$

Together, (12a) and (7) imply that the tax avoidance effort function takes the form:

(13) $$e = M\frac{(1-\alpha)}{(1-\tau)}\frac{(n-1)}{n^2}.$$

Then (10)-(13) imply:

(14) $$\frac{d\Omega}{d\alpha} = \left[M\frac{\lambda(n-1)}{n}\right]\left[n - \frac{\left(\frac{1}{\lambda}+\tau\right)}{(1-\tau)}\right].$$

The sign of equation (14) depends on its rightmost term, which is a function of n, λ and τ. If $\frac{d\Omega}{d\alpha}$ is positive, then the government can improve welfare by reducing α, while if $\frac{d\Omega}{d\alpha}$ is negative, then the government improves welfare by increasing α. A small value of λ increases the chance that the expression is negative, which is sensible, since small values of λ correspond

example, Drèze and Stern (1990).

to situations in which the welfare consequences of lost tax revenue due to avoidance pale compared to the welfare cost of encouraging excessive devotion of resources to avoidance.

Equation (14) can be used to evaluate simple examples with parameters corresponding to actual U.S. corporate tax settings. Consider, for example, the case in which $\lambda = 0.25$ and $\tau = 0.35$; this yields a term in brackets equal to $[n - 6.7]$. Hence it follows that, if there are fewer than 7 firms in the industry, the government improves welfare by permitting widespread adoption of newly created avoidance methods, while if there are more than 7 firms in the industry, the government improves welfare by reducing imitation as much as possible. The number of firms influences the desirability of rapid policy reform because greater numbers of potential imitators creates costs (to the government) of widespread dissemination that exceed the benefits associated with (reduced) endogenous innovation effort.

The solution presented in (14) has a knife-edged character, since, if taken literally, the government would want either to maximize α or to minimize α, depending on the (unaffected by α) sign of $\frac{d\Omega}{d\alpha}$. Given the very stylized nature of this example, it would be a mistake to draw such a strong conclusion on its basis. In a more general application of (10) the aggregate magnitude of potential tax saving is endogenous to the total innovative effort. In such cases, it would follow that the government's optimal choice of α is likely to be interior, though subject to the considerations made apparent by (14).

5. Tax reform and the timing of avoidance.

There are many possible specifications of the adoption of tax-saving innovations, each corresponding to different taxpayer situations. In the models analyzed in sections 3 and 4,

adoption is costless and more or less automatic, albeit incomplete in some cases. This section considers a model in which there is a publicly available tax avoidance opportunity, but firms might not want to exploit this opportunity immediately (or ever). Tax reform consisting of a terminal date beyond which the tax avoidance opportunity is no longer available then gives rise to instructive dynamics. In this setting, as in those examined in sections 3 and 4, optimal government policy typically does not take the form of the most stringent possible methods to prevent diffusion and adoption of tax avoidance methods.

Consider the case in which a taxpayer owns an asset that yields income of D_t per unit of time, which grows in perpetuity at a constant rate g. It is possible to shield all of this income from taxation, though at a cost. The government and taxpayers use a common discount rate $r > g$. A tax avoidance technology is available at cost c, which is (of course) tax-deductible; this avoidance method, if adopted, would remove all taxation on income generated by the asset. The taxpayer has the option of using the tax avoidance technology at any time, but of course may prefer to wait or perhaps never adopt, depending on circumstances. Denoting the period of adoption by A, the taxpayer's after-tax value (V) is given by:

$$V = \int_{t=0}^{A} (1-\tau) D_0 e^{gt} e^{-rt} dt - (1-\tau) c e^{-rA} + \int_{t=A}^{\infty} D_0 e^{gt} e^{-rt} dt \,. \tag{15}$$

Evaluating this expression and rearranging yields:

$$V = (1-\tau)\frac{D_0}{(r-g)} + \frac{\tau D_0}{(r-g)} e^{-(r-g)A} - (1-\tau) c e^{-rA} \,. \tag{16}$$

The first-order condition corresponding to the value-maximizing choice of A is:

$$\tau D_0 e^{gA} = r(1-\tau)c \,. \tag{17}$$

This condition reflects the taxpayer's incentives in a sensible way. Given that D_t grows without bound while c remains constant, it is simply a matter of time before anyone chooses to adopt the avoidance technology. The timing of adoption is determined by equating the one-period cost of resources devoted to the avoidance technology (the after-tax user cost of capital) with the value of avoidance for that period.[17] For simplicity, taxpayers are assumed to differ only in their initial tax-avoidable income levels D_0, and not in the growth rate (g), which is instead taken to be common to all taxpayers.

The government has the ability to enforce an adoption regime in which taxpayers are unable to adopt the tax avoidance technology after date T. Such a policy might correspond to a decisionmaking or enforcement lag, measured in calendar time, or equivalently, a rule or practice in which adoption opportunities are removed after a selected fraction of the population has taken advantage of the new technology. The impact of the T rule is to hasten adoption of the tax avoidance technology by some taxpayers, while preventing certain others from ever doing so.

The incentives facing an individual taxpayer in this regulatory regime are clear. If the taxpayer would adopt the avoidance technology prior to T in the absence of any restriction, then its adoption policy is unaffected by the restriction. For other taxpayers, the choice becomes

whether to adopt in period *T* or never. Those in this category have incentives to adopt in period *T* if:

$$\tau \frac{D_0 e^{gT}}{(r-g)} \geq (1-\tau)c, \tag{18}$$

and eschew the possibility of adopting if this condition is not met.

From the standpoint of the government, the efficient choice of *T* requires a comparison of the costs of encouraging some early adoption of the tax avoidance technology with the benefits of preventing others from ever adopting. Fortunately, the relatively simple structure of the model permits this otherwise rather involved problem to be analyzed in a simple way. Normalizing the population to equal one, the fraction of the population (cumulative distribution) of taxpayers with values of $D_0 \leq x$ is given by *F(x)*, and *f(x)* is the corresponding marginal distribution, defined so that $f(x) \equiv F'(x)$. Values of D_0 are continuously distributed in a bounded and finite support between *0* and *y*. For convenience, it is useful as well to define the function $G(x) \equiv \int_0^x zf(z)dz$.

Consider first the impact of a small change in *T* on the number of taxpayers electing to adopt the avoidance technology. The critical value of D_0 (denoted D_0^*), for taxpayers at the margin of electing whether or not to adopt the technology is, from (18),

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[17] There is nothing intrinsic to the constant-growth process for D_t in generating this outcome, since the user cost of capital interpretation applies to any interior solution to the optimal adoption program, regardless of the pattern of

(19) $$D_0^* = e^{-gT}\,\frac{(r-g)(1-\tau)c}{\tau}.$$

Hence, the change in the critical value of D_0 is given by:

(20) $$\frac{dD_0^*}{dT} = -gD_0^*.$$

Consequently, a small change in the value of T changes the number of taxpayers who never adopt the avoidance technology by:

(21) $$-gD_0^* f\left(D_0^*\right)dT\,.$$

Taxpayers who are at the margin of whether to adopt the avoidance technology, and who do so, are costly to society in three ways. Such taxpayers incur resource costs of c (in year T) in adopting the avoidance technology, they reduce tax collections by $(c\tau)$ in deducting their avoidance expenses, and they thereby reduce future tax collections, the present value of which is (from (18)): $(1-\tau)c$. Hence the total cost (in period T values) of changing T to reduce the number of taxpayers who adopt the innovation is given by:

(22) $$gc(1+\lambda)D_0^* f\left(D_0^*\right)dT\,.$$

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anticipated future D_t s.

This expression is positive, so reducing T has the expected effect of reducing costs by discouraging some taxpayers from ever avoiding taxes in this way.

This analysis so far omits the other effect of reducing T, which is to hasten the incursion of adoption costs by certain taxpayers, and correspondingly lengthen the time during which their asset returns are untaxed. The fraction of the population adopting at period T represents those with values of D_0 such that:

$$e^{-gT}\frac{r(1-\tau)c}{\tau} \geq D_0 \geq e^{-gT}\frac{(r-g)(1-\tau)c}{\tau}. \tag{23}$$

This fraction of the population equals:

$$F\left(\frac{r}{(r-g)}D_0^*\right) - F\left(D_0^*\right). \tag{24}$$

There are two costs associated with earlier adoption by this segment of the population. The first is that they incur adoption costs sooner than they otherwise would, and this cost is given by:

$$-rc(1+\lambda\tau)\left[F\left(\frac{r}{(r-g)}D_0^*\right) - F\left(D_0^*\right)\right]dT\ . \tag{25}$$

The second cost of earlier adoption is one of enjoying avoidance benefits for longer than would otherwise be the case. Since the (flow) tax reduction associated with having adopted the tax

avoidance method is given by $\tau D_0 e^{gT}$ for an individual taxpayer, it follows that the aggregate cost of lost tax revenue from this source is given by:

$$(26) \qquad -\lambda \pi e^{gT}\left[G\left(\frac{r}{(r-g)}D_0^*\right)-G\left(D_0^*\right)\right]dT\ .$$

The optimal (interior) choice of *T* is one for which the sum of (22), (25), and (26) equals zero. While it is difficult to characterize this solution for general distributions of population D_0s, it is clear that the considerations that determine the optimal *T* consist in trading off the benefits of reducing aggregate tax avoidance activity with those of encouraging activity to take place earlier than it would otherwise have done so. Of course, it is also not possible to rule out multiple or endpoint solutions. While an endpoint solution such as $T = 0$ presents itself as an attractive possibility in this setup, this option is typically infeasible for governments that must react with some lags to the actions of taxpayers. Consequently, an interior solution is to be expected, and one that embodies the tradeoffs implicit in efficient decisionmaking.

6. Conclusion.

It is entirely natural for governments to attempt to hinder tax avoidance whenever they become aware of it. Since the development and adoption of tax avoidance methods are endogenous to the reactive policy of the government, it follows that the course that comes most easily to tax reformers is not necessarily the efficient strategy to pursue. In particular, it might make sense for tax reformers resolutely to ignore the innovative practices of firms in competitive markets, or even to publicize their tax avoidance tactics, in the hope of discouraging others from

subsequently developing other methods. Normative prescriptions are somewhat murkier in noncompetitive markets, in cases in which tax avoidance methods affect inframarginal but not marginal production costs, and those in which firms differ in their natural speeds of adopting new methods of avoiding taxes. What is common to all of these cases, however, is the absence of a clear implication that efficient tax policy entails the government acting as quickly as possible to stem tax avoidance whenever and wherever it appears.

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Table 1
Reasons and Remedies in the U.S. Tax Reform Act (TRA) of 1986

TRA Provisions	# tax changes listing reasons	# citing tax avoidance	REMEDIES IN THE TRA *Grand-father*	*Pro-spective*	*Retro-active*
Individual Income Tax	14	5		5	
Capital Cost Provisions	11	2		2	
Capital Gains and Losses	4	1		1	
Agriculture, Resources, Energy	13	2		2	
Tax Shelters & Interest	3	2		2	
Corporate Taxation	16	8	7	1	
Minimum Tax Provisions	1	1		1	
Accounting Provisions	11	4		3	1
Financial Institutions	5	2		2	
Insurance Products & Companies	14	2		1	1
Pensions, Benefits, ESOPs	45	12	1	10	1
Foreign Tax Provisions	30	21		20	1
Tax-Exempt Bonds	2	1			1
Trusts and Estates	8	4	1	3	
Compliance & Administration	44	14		14	
Nonprofit Organizations	6	0			
Miscellaneous Provisions	11	2		2	
Total	*238*	*83*	*9*	*69*	*5*

Note to Table 1: The table reports numbers of tax changes introduced by the U.S. Tax Reform Act of 1986 (TRA) for which the U.S. Congress Joint Committee on Taxation (JCT) (1987) provides official reasons. The first column is simply a count of the number of tax changes introduced by the TRA and described separately by the JCT. The second column indicates the number of these changes for which the JCT explains that Congress was motivated by a desire to prevent tax avoidance. Columns 3-5 report numbers of different types of remedies adopted in the TRA. "Grandfather" indicates the number of reform provisions for which prior avoidance was permitted to persist, as long as certain acts were undertaken by the commitment date, while future avoidance using those methods was disallowed. "Prospective" changes are those that took effect immediately but did not affect liabilities for past actions. And "retroactive" changes are those that applied to tax liabilities for future, present, and past actions.