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Institutional flexibility in tax law and enforcement ☆

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ABSTRACT

This paper examines how governments can optimally audit to discourage tax avoidance. We assume that an accounting firm designs and promotes strategies for tax avoidance. This firm adapts the quality and diversity of these strategies in response to shifts in government policies. We investigate when it is more effective to approve some methods while cracking down on others, rather than targeting all tax-avoidance activities uniformly. We find that selectively enforcing against specific methods can be optimal. This approach not only reduces the quality but also limits the variety of tax avoidance activities in the market and positively impacts the government's tax revenue collection. Our analysis provides practical insights, linking the costs of auditing with the interaction between enforcement, the quality of tax avoidance methods, and tax revenue outcomes.

1. Introduction

Tax policies are designed for the pursuit of several objectives, such as redistribution and reduction of inequality, collection of revenue for the supply of public goods, internalization of externalities, and the creation of other incentives to promote or discourage individual activities. Given the complexities necessarily involved in tax regulation, it is impossible to foresee all contingencies, and as such any tax policy is necessarily incomplete and contains so-called 'loopholes.' Taxpayers who want to reduce their tax burden will rationally exploit these loopholes and use tax avoidance methods to reduce their tax liability, often investing considerable resources in doing so.

There is an entire industry devoted to finding loopholes and develop tax-minimization strategies that are arguably within the law. These strategies encompass a wide range of activities, including those that are generally characterized as 'tax planning' and 'tax shelters.'[1] Especially as to taxpayers that are larger corporations, tax avoidance methods are sometimes developed with the involvement of third-party experts, such as lawyers and accountants, who specialize in this sector. This results in a fairly sizable industry devoted to reducing taxpayers' tax liability.

There are several different types of tax avoidance methods, which are of course not mutually exclusive or completely discontinuous, but are helpful to discuss here to set the stage for our analysis.

First, tax avoidance methods include tax shelters. Tax shelters are techniques developed solely for their tax effects, and are used solely or almost solely for that reason. Tax shelters were originally aggressively marketed by third parties, typically law and accounting firms, who not only created the structures, but sometimes even pursued particular potential clients, typically larger companies and wealthy individuals, who they believed could benefit from utilizing such structures. These particular tax avoidance methods were significantly addressed and constrained by some high-profile prosecutions and specific changes in tax law (Curry et al., 2007; Rostain and Regan, 2014).

Second, tax avoidance methods include tax planning utilized by entities for whom appreciable ongoing and prospective efforts to minimize tax liability are worthwhile. These tax avoidance methods will often be developed by, or in consultation with, third party providers of tax or accounting services to the taxpayer, in the course of a broader

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[1] Not infrequently, tax avoidance methods for larger firms also involve non-U.S. regulators, as there are many opportunities to shift income and costs among jurisdictions and use so-called 'tax havens.'

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relationship. The methods are thus not marketed publicly, minimizing the chance they will be detected.

Third, tax avoidance methods may be utilized by those not apt to significantly change the way they conduct their activities or businesses for tax reasons, notably individuals or smaller organizations. This 'planning' (especially as to individuals) might even consist principally of choices made at the time taxes are prepared for filing. For small entities, tax considerations will certainly be taken into account in their choice of organizational form; engaging in certain sorts of businesses or certain sorts of transactions may offer opportunities, and motivation, for tax planning. Accordingly, tax avoidance methods may comprise a wide range of activities, but importantly do not include *all* tax decisions that are in whole or in part motivated by a desire to reduce one's tax liability. For example, the use of an elaborate tax shelter that allows for significant deductions is included in our use of the term 'tax avoidance methods,' while the decision to negotiate to be awarded a year-end bonus payment on January 1 of year 2 rather than December 31 of year 1 is not.

This paper addresses tax avoidance methods that have substantial involvement of third-party legal and/or accounting experts and which can be tackled by policymakers through tax reforms and tax enforcement. The development and use of these methods incur significant costs. This can involve the direct sale of a firm's expertise in a tax avoidance method to another party or the incorporation into a comprehensive suite of services. These services encompass advising corporations or individuals on strategically organizing their activities to achieve the desired tax treatment. Usage of a particular tax avoidance method might be targeted by the government through its choice of tax policy or auditing strategy. Obviously, the reduction in tax revenue caused by the development and use of tax avoidance methods adversely affects the government's ability to pursue its revenue objectives.[2] The government will therefore try to limit tax avoidance behavior with various instruments, among which the adoption of specific tax policies and the imposition of sanctions. The application of sanctions clearly requires the detection of tax avoidance activities. Typically, this involves the use of auditing practices.[3]

There is considerable evidence that a government's policy towards audits is selective. Firms dealing with sophisticated and affluent taxpayers are also aware of certain audit triggers, i.e., what tax avoidance methods to avoid, and, probably to a lesser degree, which ones to utilize. The Internal Revenue Service (IRS) itself announces certain audit triggers.[4] Additionally, many of the popular software companies announce audit triggers, alerting their users about the audit risk of the taxpayer's return (Blank and Osofsky, 2017). The government's approach, flagging the methods that are more likely to yield an audit, in a sense implicitly legitimizes the other methods.

The idea behind this practice is that the resources devoted to develop and combat tax avoidance methods are wasteful. Tax policies devoted to preserving the tax base might impose greater social losses than tax avoidance itself. Tax audits require the expenditure of public resources. In addition to that, tax shelters developers might respond by implementing a new, undetected and/or unregulated tax avoidance method, wasting additional resources in the process and perpetuating the erosion of the tax base.

In this paper, we examine the optimal auditing strategies employed by a government to discourage the adoption of tax avoidance methods. Our analysis explores the specific conditions under which implicitly legitimizing certain methods, while actively pursuing measures against others, leads to a greater reduction in the loss attributed to diminished tax revenue compared to a blanket approach targeting all tax-avoidance activities. We find that, in most of the scenarios we consider, increased enforcement typically tends to reduce the quality of the available methods, thus reducing the government's loss of revenue. This reproduces the perspective of a traditional model, where the main limit to pervasive enforcement is the social loss due to its economic cost. However, a policy of selective enforcement might be optimal because it reduces the quality and the variety of tax avoidance activities available in the market, thus positively impacting tax revenue collection by the government.

Tax planning, tax avoidance, and tax evasion have been extensively discussed in the literature. Key contributions include Allingham and Sandmo (1972), Weisbach (2002a,b), Cowell (2003), and Hines (2004). Slemrod (2007) provides a review of the literature on tax evasion, while Slemrod and Yitzhaki (2002) consider tax evasion and tax avoidance jointly. Wilde and Wilson (2018) offers a recent survey on corporate tax avoidance methods. While most contributions build on the assumption that taxpayers' goal is to minimize their tax burden, there is no consensus as to when and to what extent tax planning or tax avoidance efforts become normatively undesirable. Distortions caused by attempts to minimize tax burdens have been extensively discussed (see, for example, Kaplow, 1990; Weisbach, 2002a). The relationship between what the law provides and the extent to which it is enforced has been considered by Kaplow (1990), with some arguments being made for lesser degrees of enforcement (Lederman and Sichelman, 2013). The literature also considers whether solutions should focus on revenue maximization or assume a fixed budget constraint (Weisbach, 2002a). Keen and Slemrod (2017) present a new summary measure of the effectiveness of the enforcement of tax policy, namely the "enforcement elasticity of tax revenue," which serves the purpose of helping tax authorities to design their optimal tax policies. They adopt a traditional, general equilibrium model with no informational asymmetries and consider only the relationship between the government and the taxpayers, with no accounting firms as intermediaries. Our paper relates and builds on this literature in several ways.

We consider endogenously-determined tax planning methods, modeling not only the government's decision to allow particular methods, but also firms' decisions to develop these methods. In this sense, our approach differs from Kaplow (1990). While Kaplow (1990) centers on the optimal trade off between higher tax rates and enforcement expenditures, we focus on the market for tax avoidance and on how accounting firms react to the government's enforcement policies by changing the characteristics of the tax avoidance methods they develop and their variety.

A key result in our analysis is that although selective audits are an intuitive method for governments to make best use of limited resources, the welfare effects are not always straightforward once the strategic incentives of accounting firms are taken into account. Selective auditing can collapse the separating equilibrium that preparers use to screen clients. Depending on the state of the new pooling equilibrium, avoidance can be either higher or lower than under a generalized audit approach.

For the purpose of our analysis and without loss of generality, we consider the case of a monopolistic market for tax avoidance and we adopt a partial equilibrium analysis. We consider this case for two main reasons. First, the presence of fixed costs and the likely constant marginal costs of supplying tax strategies to consumers may lead to decreasing average costs and natural monopoly situations in the production of tax strategies. Second, although real-life tax consulting firms may face capacity constraints that preclude their expansion into natural monopolies, taxpayers face high switching costs, giving accounting

[2] Tax law is of course used to pursue other objectives as well, such as encouraging certain types of investments. This takes the form of lowering tax liability for the behavior to be encouraged.

[3] Auditing is not the only way in which the government can attempt to deter the development of tax avoidance methods. In a previous paper, Curry et al. (2007) discussed several other ways in which a government could disrupt a market for tax avoidance.

[4] See, for instance, https://pro.bloombergtax.com/brief/common-irs-audit-triggers/ (last accessed Jan 30, 2024). Common triggers include, among other examples, familiar ones (albeit mostly applicable to individuals and small businesses), such as the home office deduction, hobby losses, and rental losses.

firms a sort of local monopoly like in the case of "relationship banking." In order to preserve privacy and the secrecy of their financial data and tax-avoiding plans, taxpayers tend to stick with one firm, determining a *de facto* lock-in effect.[5] This lock-in effect is rationally expected by taxpayers and we thus assume that accounting firms are able to charge a monopolistic price to their clients.[6]

Furthermore, not only we assume that there is asymmetric information between the government and the taxpayer, as it is usually assumed in the literature on optimal taxation, but that also the accounting firms cannot fully discriminate between the taxpayers' types.

Weisbach (2002a) had previously argued that some ways in which taxpayers might react to the government's disallowance of particular methods could lead to undesirable results from a welfare perspective. Hines (2004) similarly suggests that targeting or suppressing particular methods may be undesirable, since taxpayers will simply start searching for new methods. We examine these arguments with the aid of a formal analysis of the process by which tax planning becomes possible. We formally consider how the presence of markets for tax planning methods affects the government's strategies for auditing. Auditors can target particular methods with increased audit probabilities. In turn, this allows the government to influence the competitiveness of the market and the viability of particular tax planning methods, influencing the incentives of developing future tax planning methods in potentially interesting ways.

This paper is structured as follows. Section 2, develops a model considering the development and use of tax avoidance methods in a monopolistic context in which taxpayers self-select in their choice of such methods. In Section 3 we discuss the government's objectives and tradeoffs in choosing its policies to counteract tax avoidance. In Section 4, we analyze the government's audit choices, explaining why some loopholes may be legitimized while others are targeted with selective auditing and closed and how that affects the development of tax avoidance methods. In Section 5 we find that it may be optimal for governments to target some tax avoidance methods over others to minimize lost revenue and social welfare losses, which in turn provides some degree of legitimacy to those methods that are not targeted. We discuss the conditions under which this happens. Section 6 summarizes our findings and opens avenues for future research by proposing novel directions and areas warranting further investigation. Selected proofs and extensions are included in Appendix A.

2. Developing tax avoidance methods: The model

This paper delves into the intricate relationship between taxpayers aiming to reduce their tax obligations and the government's endeavors to counteract such efforts. Within this framework, we operate under the assumption that a monopolistic firm designs and promotes strategies for tax avoidance. This firm adapts the quality and diversity of these methods in accordance with shifts in government policies.[7] We can think of an association of business consultants or accountants offering their services to any kind of clients, from individuals or small companies to large and sophisticated corporations. The producer of tax shelters does not observe the final taxpayers' types, and offers a menu of tax strategies and associated prices, allowing taxpayers to self-select based on their preferences.

The producer invests in product quality $s \in \mathbb{R}_+$, which, in our case, represents the 'size' of the loophole that it exploits and the efficacy (in terms of tax savings) of the tax avoidance method. The cost of providing a tax avoidance method of size s to a taxpayer is $c(s)$, with $c'(\cdot) > 0$ and $c''(\cdot) \geq 0$. Such cost is assumed to be constant, irrespective of the number of taxpayers using it.[8]

The firm can sell more than one method. Defining p_i as the price at which the firm sells tax avoidance method i, firm profits from each method are given by $\pi_i = n_i \left[p_i - c(s_i)\right]$, where n_i is the number of taxpayers utilizing the tax avoidance method i.[9]

Taxpayers receive a benefit from using tax avoidance methods.[10] Let the taxpayer's value from using a method of size s be captured by the function $v(s)$, with $v'(\cdot) > 0$ and $v''(\cdot) \leq 0$. The taxpayer surplus from using method i is

$$V_j = v_j(s_i) - p_i \tag{2.1}$$

Taxpayers vary in the value obtained from using a given tax avoidance method. Let us assume that there are two types of taxpayers, differing both in the total and in the marginal benefit they get from tax-avoidance activities. Specifically, $v_1(s) > v_2(s)$ and $v_1'(s) > v_2'(s)$, so that type 1 gets a higher total and marginal benefit from the size of tax avoidance methods than do type 2 taxpayers.[11] There are n_1 taxpayers of type 1 and n_2 taxpayers of type 2.

The firm developing tax avoidance methods cannot observe directly the preferences of the taxpayers seeking their services. However, it will try to screen them, developing two distinct methods, one for each type, trying to extract as much surplus as possible from its customers.[12] The two tax avoidance methods are assumed to be such that they cannot be used simultaneously. Thus, taxpayers have unit demand and will alternatively purchase method 1, method 2, or not purchase at all.

Assume first that the firm is able to perfectly discriminate. Then, it would offer each type of taxpayer a tax avoidance method at a price that maximizes its profits subject to the participation constraints for both types:

$$\max_{\substack{s_i \geq 0 \\ p_i \geq 0}} \sum_{i=1}^{2} n_i \left[p_i - c(s_i)\right] \tag{2.2}$$

subject to:

$$v_1(s_1) - p_1 \geq 0 \tag{2.3}$$

$$v_2(s_2) - p_2 \geq 0 \tag{2.4}$$

We know that under perfect discrimination, the firm is able to extract the entire surplus from buyers, so the participation constraints (2.3) and (2.4) are satisfied as strict equalities. Substituting into the objective function (2.2), we get the perfectly discriminating tax-avoidance methods and the corresponding prices.[13] The perfectly discriminating

[5] We thank an anonymous referee for suggesting that tax avoidance methods are often developed by accounting or legal firms within broader relationships with client taxpayers.

[6] Our results do not hinge upon the presence of monopolistic power in the market for tax shelters, and qualitatively similar results would obtain under competitive market conditions. For a general proof see Appendix B.

[7] In Section 4.1 and in Appendix B we will offer some insights on how the introduction of competition may impact our results.

[8] To avoid unneeded complexities and without loss of generality, we assume away non-linearities in the cost of administering tax avoidance strategies to individual clients. For a discussion of the results that would obtain under economies of scale, see Appendix C.

[9] This price may be the price of the tax avoidance method specifically, or the price of the advice regarding the taxpayer's activities to obtain the desired tax treatment.

[10] In several jurisdictions, including the US, taxpayers can deduct the cost of tax advice from the taxable incomes. This would add an additional benefit from the acquisition of tax avoidance methods, which may exacerbate the taxpayers' incentives to invest in tax planning. We do not formally include this effect in our model, which may increase overall dissipation. We are grateful to an anonymous referee for pointing this out.

[11] The analysis could be easily extended to n types.

[12] See Mussa and Rosen (1978) and Besanko et al. (1987) for a complete analysis of the strategies adopted by a firm discriminating in price and quality in an asymmetric information setting.

[13] Throughout the paper it is assumed that the functions $v(\cdot)$ and $c(\cdot)$ satisfy the regularity assumptions required to ensure that second order conditions hold and an interior maximum to the optimization problem exists.

methods satisfy the conditions:[14]

$$v_i'(s_i^*) = c_i'(s_i^*) \text{ and } p_i^* = v_i(s_i^*) \text{ for } i = 1, 2 \tag{2.5}$$

It can be seen from expression (2.5) that $s_1^* > s_2^*$, since $v_1'(\cdot) > v_2'(\cdot)$. Then $p_1^* > p_2^*$.

We now consider what happens when perfect discrimination is not possible. When the firm does not observe the customer's type, the methods offered and the relative prices must satisfy two extra self-selection constraints, ensuring that each customer type will choose the method s_i that the firm designed for them:

$$v_1(s_1) - p_1 \geq v_1(s_2) - p_2 \tag{2.6}$$

$$v_2(s_2) - p_2 \geq v_2(s_1) - p_1 \tag{2.7}$$

The following Proposition delineates the solution for the firm's maximization problem when it cannot observe the taxpayers' types. The firm maximizes (2.2), subject to constraints (2.3), (2.4), (2.6), (2.7) and $s_i \geq 0$, $p_i \geq 0$, for $i = 1, 2$.

Proposition 2.1. *The profit maximizing 'sizes' $\hat{s}_i$, and prices of the tax avoidance methods $\hat{p}_i$ ($i = 1, 2$) are given by:*

$$v_1'(\hat{s}_1) = c'(\hat{s}_1) \tag{2.8}$$

$$v_2'(\hat{s}_2) = c'(\hat{s}_2) + \frac{n_1}{n_2}\left[v_1'(\hat{s}_2) - v_2'(\hat{s}_2)\right] \tag{2.9}$$

$$\hat{p}_1 = v_1(\hat{s}_1) - \left[v_1(\hat{s}_2) - v_2(\hat{s}_2)\right] \tag{2.10}$$

$$\hat{p}_2 = v_2(\hat{s}_2) \tag{2.11}$$

Proof. See Appendix A. ■

The solution to this profit maximization problem will lead to a separating equilibrium in which each taxpayer type is offered a distinct method and price. Since Eqs. (2.5) and (2.8) are identical, it is immediate to see that type 1 taxpayers are offered the same method they get under perfect discrimination ($\hat{s}_1 = s_1^*$). The price will however be lower. In fact, comparing Eqs. (2.5) and (2.10) we can see that $\hat{p}_1 = p_1^* - \left[v_1(\hat{s}_2) - v_2(\hat{s}_2)\right]$, and $\hat{p}_1 < p_1^*$, since $\left[v_1(\hat{s}_2) - v_2(\hat{s}_2)\right] > 0$. Moreover, comparing Eqs. (2.5) and (2.9), the size of the avoidance method offered to type 2 taxpayers is smaller than under perfect price discrimination, and its price will also be lower. In fact, $v_1'(s) > v_2'(s)$, which, together with $v_i''(\cdot) \leq 0$ and $c''(\cdot) \geq 0$ ensures that the condition in expression (2.9) is solved by a lower value of s_2 than the condition in (2.5). Given $\hat{s}_2 < s_2^*$, from (2.11) it follows that $\hat{p}_2 < p_2^*$.

So far, we have assumed that it is optimal for the firm to offer a tax avoidance method to both groups. However, as we are going to see in the remainder of the paper, there might be cases in which clients from either group are excluded.[15] This occurs either when group 1's willingness to pay for the firm's services is sufficiently high relative to group 2, or when group 2's size is sufficiently small.

3. The government's choice of tax policy

Due to their effect on tax revenue, tax-avoidance methods reduce the opportunity to pursue government's policy objectives and to supply welfare-enhancing public goods. The lost tax revenue becomes a social cost preventing the accomplishment of governmental goals, or forcing the government to secure revenue through other less desirable and cost-effective venues. Additionally, the cost of developing and providing tax avoidance methods are a form of unproductive dissipation which counts as a loss from a social welfare point of view.[16]

The government is assumed to be a benevolent social welfare maximizer, choosing T_i, the tax collected from each taxpayer, its auditing policy a_i, and sanctions S_i ($i = 1, 2$), to minimize the aggregate loss for society. The government's objective therefore is

$$\min_{T_i, a_i, S_i} \mathcal{L}(T_i, L(T_i, a_i, S_i), D(T_i, a_i, S_i)) \tag{3.1}$$

where $L(T_i, a_i, S_i)$ represents losses due to reduction in tax revenues and $D(T_i, a_i, S_i)$ is the cost of developing the tax avoidance method, with $\frac{\partial \mathcal{L}}{\partial L}, \frac{\partial \mathcal{L}}{\partial D} > 0$. Both types of losses can be affected by the government's choice of tax and auditing policy T_i and a_i, and by sanctions S_i.[17] The interplay between government, developers of tax avoidance methods and taxpayers goes as follows. First, the government chooses its tax policy and the level of applied sanctions to minimize (3.1). Then, the firm develops tax avoidance methods s_i and chooses their prices p_i. Finally, taxpayers choose whether to engage in tax avoidance and which avoidance method to use. Rather than tackling the problem of tax avoidance with tax policies only, the government may apply a system of audits and sanctions to disincentivize the development and the use of tax avoidance systems.[18] To detect tax avoidance, the government sets up auditing practices, which are the object of the following section.

4. Auditing

With auditing, a last stage is added to the timing of the game, in which the government checks all taxpayers conditional on them having adopted a tax-avoidance method (observable by the government).

To begin, consider the simplest case in which the government adopts random audit strategies, auditing all taxpayers with equal probability, and denies taxpayers the benefits of any tax avoidance method used. Suppose that the probability of an individual being identified as using a tax avoidance method is linearly determined by the level of auditing, a.[19] Note that, with auditing, a taxpayer's expected benefit from using a tax avoidance method decreases. When taxpayer j purchases a tax avoidance method of size s, they obtain tax savings of $v_j(s)$ only in the event that they are not audited and denied the benefits of the method. A taxpayer's willingness to pay for such a tax avoidance method is therefore reduced to $(1 - a)\, v_j(s)$. In this way, we can examine the firm's pricing and development decisions as presented previously in Section 2.

The firm maximizes the profit function (2.2) subject to the participation and self-selection constraints, that now become, for type 1 and type 2 taxpayers respectively:

$$(1 - a)v_1(s_1) - p_1 \geq 0 \tag{4.1}$$

[14] By necessity, we are dealing with a second-best equilibrium. Resources expended in tax avoidance and enforcement are a form of dissipation, so that an ideal first-best would necessitate reaching full compliance without enforcement.

[15] The proof of Proposition 2.1 in Appendix A reports the condition for this to happen when the firm is able to discriminate between markets. It may also happen that the market conditions are such that the incentive compatibility constraints of both groups cannot be satisfied simultaneously, which eliminates the separating equilibrium we have here characterized (see Lemma 4.4).

[16] On this point see discussion of Eq. (5.1) later.

[17] While some tax policies might actually reduce the losses from tax avoidance and the incentive to develop new methods, others might have countervailing effects, increasing both tax avoidance and development activities, thereby increasing consequent social losses. Similarly, countervailing effects can be triggered by sanctions (see Carbonara et al., 2012).

[18] Tax revenue reduction and welfare losses are nor necessarily in a one-to-one relationship. Although we are assuming that the tax revenue by a benevolent policymaker positively affects social welfare, we are not assuming any specific relationship between the two. Taxpayers naturally use their "tax savings"in ways that generate surplus to them, which adds to social welfare in the aggregate. For a discussion of the impact of tax policies and administration, also in terms of the actual reduction in revenue losses that they allow, see Keen and Slemrod (2017) and Slemrod and Yitzhaki (2002).

[19] Given this linearity assumption, we can thus refer to a interchangeably as auditing level and detection probability.

$$(1-a)v_2(s_2) - p_2 \geq 0 \tag{4.2}$$

for participation and

$$(1-a)v_1(s_1) - p_1 \geq (1-a)v_1(s_2) - p_2 \tag{4.3}$$

$$(1-a)v_2(s_2) - p_2 \geq (1-a)v_2(s_1) - p_1 \tag{4.4}$$

for self-selection.

The solution to the firm's maximization problem is given by the following Proposition, proven in Appendix A.

Proposition 4.1. *With auditing, the profit maximizing 'sizes' s_i^a, and prices of the tax avoidance methods p_i^a $(i = 1, 2)$ are given by:*

$$v_1'(s_1^a) = \frac{c'(s_1^a)}{1-a} \tag{4.5}$$

$$v_2'(s_2^a) - \frac{n_1}{n_2}\left[v_1'(s_2^a) - v_2'(s_2^a)\right] = \frac{c'(s_2^a)}{1-a} \tag{4.6}$$

$$p_1^a = (1-a)\left[v_1(s_1^a) - v_1(s_2^a) + v_2(s_2^a)\right] \tag{4.7}$$

$$p_2^a = (1-a)v_2(s_2^a) \tag{4.8}$$

Proof. See Appendix A. ■

First of all, note that once again $s_1^a > s_2^a$, for the same reasons discussed in previous sections. Moreover, given $a < 1$, direct comparison of $\hat{s}_1$ from (2.8) and s_1^a from (4.5) shows that $s_1^a < \hat{s}_1$, so that $p_1^a < \hat{p}_1$. Similarly, from (2.9) and (4.6), $s_2^a < \hat{s}_2$ and $p_2^a < \hat{p}_2$.

Auditing diminishes the quality of tax avoidance strategies generated, consequently lowering their prices. Quality decreases due to auditing's impact on the expected benefit for taxpayers and their inclination to invest in tax avoidance. Considering the diminishing marginal benefit of s and the rising marginal cost ($c'(s)$) for the firm, it becomes suboptimal to raise s in response to the implementation or escalation of auditing.[20]

Not only auditing decreases the equilibrium quality of both methods ($s_1^a < \hat{s}_1$ and $s_2^a < \hat{s}_2$). If high enough, auditing can even push the quality offered to type 1 below the level offered to type 2 in the absence of auditing. This result is contained in the following Lemma.

Lemma 4.2. *There exists a level of auditing $\hat{a} \in (0, 1)$, such that $\hat{s}_2 > s_1^a > s_2^a$ if $a > \hat{a}$.*

Proof. See Appendix A. ■

Lemma 4.2 shows that this result occurs in case a is sufficiently high. Attaining the auditing threshold $\hat{a}$ may, nonetheless, prove prohibitively costly, potentially undermining the government's intended reduction in tax avoidance activities.

4.1. Selective auditing

If auditors did not observe anything about taxpayers and how they prepared their taxes, auditing all taxpayers equally would be the only option. But this is generally not the case. While true income may not be observable, reported income is, and auditors can make audit probabilities contingent upon that. The very use of tax avoidance methods differentiates taxpayers and can reveal additional information that an auditor can use to determine which tax avoidance methods to target and attempt to close.

For instance, authorities may employ a risk management framework to identify and address tax evasion and non-compliance, focusing resources on areas with higher perceived risks (Khwaja et al., 2011). This might imply the development of risk assessment models that analyze various financial parameters and transactions to identify potential red flags associated with prohibited tax avoidance methods.[21]

Different tax avoidance methods may in fact have particular features that act as a "red flag" that the government can use to target its auditing efforts. As Blank (2009) notes, the more an advisor uses a particular tax avoidance method, the more likely their clients are to get identified by the tax authorities.[22]

Moreover, the US Internal Revenue Service (IRS) implements a "listed transactions" policy, requiring taxpayers to disclose their use of certain sheltering techniques, at pain of significant penalties for non-compliance.[23] Taxpayers who use different tax avoidance methods may thus face different probabilities of being audited and being denied the benefits of their tax avoidance.

Suppose now that a taxpayer who uses the tax avoidance method 1 is audited and denied the benefits with probability a_1 and the corresponding probability of being audited for a taxpayer using method 2 is a_2. In particular, we assume that $a_2 = 0$, so that the government audits only taxpayers using method 1.

As before, we determine the participation and self-selection constraints of the two types of taxpayers. The participation and self-selection constraints for type 1 taxpayers in this case become, respectively

$$(1-a_1)v_1(s_1) - p_1 \geq 0 \tag{4.9}$$

$$(1-a_1)v_1(s_1) - p_1 \geq v_1(s_2) - p_2 \tag{4.10}$$

Because type 2 taxpayers are not audited, their participation constraint is given by expression (2.4), whereas the self-selection constraint becomes:

$$v_2(s_2) - p_2 \geq (1-a_1)v_2(s_1) - p_1 \tag{4.11}$$

Again, the firm maximizes the profit function (2.2) subject to the constraints above.

Proposition 4.3. *With selective auditing:*

1. *the equilibrium size $\bar{s}_i$ and price $\bar{p}_i$ $(i = 1, 2)$ of the tax avoidance methods offered to taxpayers are:*

$$v_1'(\bar{s}_1) = \frac{c'(\bar{s}_1)}{1-a_1} \tag{4.12}$$

$$v_2'(\bar{s}_2) - \frac{n_1}{n_2}\left[v_1'(\bar{s}_2) - v_2'(\bar{s}_2)\right] = c'(\bar{s}_2) \tag{4.13}$$

$$\bar{p}_1 = v_2(\bar{s}_2) + (1-a_1)v_1(\bar{s}_1) - v_1(\bar{s}_2) \tag{4.14}$$

$$\bar{p}_2 = v_2(\bar{s}_2) \tag{4.15}$$

2. *We have that $\bar{s}_1 = s_1^a$ and $\bar{s}_2 = \hat{s}_2$.*

Proof. The proof of part 1. follows exactly the steps of the proofs of Propositions 2.1 and 4.1 and is therefore omitted.

Part 2. is proven by noticing that Eq. (4.12) is equal to Eq. (4.5), whereas Eq. (4.13) is equal Eq. (2.9). ■

[20] In fact, applying the implicit function theorem to Eq. (4.5),

$$\frac{ds_1^a}{da} = \frac{v_1'(s_1^a)}{(1-a)v''(s_1^a)_1 - c''(s_1^a)} < 0$$

because $v'' < 0$ and $c'' > 0$.

[21] The use of data analytics and artificial intelligence might enhance the efficiency of such risk assessment models. See https://www2.deloitte.com/content/dam/Deloitte/us/Documents/Tax/us-tax-data-analytics-a-new-era-for-tax-planning-and-compliance.pdf (last accessed Jan 30, 2024).

[22] Taxpayers that are larger and more sophisticated, typically large corporations, often develop their own tax avoidance methods, but the "red flag" problem remains, given the extent to which organizations face similar challenges in minimizing their tax liability, have similar tools available, and therefore adopt similar solutions.

[23] See https://www.irs.gov/businesses/corporations/abusive-tax-shelters-and-transactions (last accessed Jan 30, 2024).

Given the equilibrium values of s_i $(i = 1, 2)$, the analysis of the participation and incentive compatibility constraints reveals the following results.

Lemma 4.4. *There exists a level of auditing $\tilde{a}$, such that type 2's incentive compatibility constraint is violated for $a_1 > \tilde{a}$. We have that $\hat{a} > \tilde{a}$.*

Proof. See Appendix A. ■

The intuition for Lemma 4.4 can be provided as follows: when a_1 is very low (that is, $a_1 < \tilde{a}$), type 2 prefers the quality specifically designed for them, because s_1^a is sensibly larger than $\hat{s}_2$ and is also priced much higher. As a_1 increases, s_1^a becomes lower and lower and gets close to $\hat{s}_2$. The price of type 1's quality decreases too, reflecting the decrease in type 1's willingness to pay for the tax avoidance method s_1. At some point (at $a = \tilde{a}$) type 2's incentives change: the higher quality s_1^a sold at a lower and lower price makes it convenient for type 2 to switch, and the firm's separating equilibrium collapses.[24]

Lemma 4.4 implies that a separating equilibrium with selective auditing exists as long as it is not too severe, meaning that a_1, the level of auditing and resulting probability of detection, should not be too high (i.e., it should not be higher than $\tilde{a}$). When $a_1 > \tilde{a}$, the firm cannot sell two differentiated tax avoidance methods, and therefore it is not able to screen between the two types of taxpayers. This choice is analyzed in the next section.

4.2. Pooling with $a_1 > \tilde{a}$

When the government chooses a policy $a_1 > \tilde{a}$, the firm is forced to pool, offering a unique tax avoidance method. It can either choose to serve both types, producing a method s that is purchased by type 1 and type 2 taxpayers, or it can serve the high type only. Let us consider the various cases separately.

The firm serves both types. It sets a price p_s such that type 2's participation constraint is satisfied as strict equality: $p_{s_2} = v_2(s)$. It then chooses s to maximize its profit: $(n_1 + n_2)[v_2(s) - c(s)]$. The first order condition is $v_2'(s) = c'(s)$, that is equal to the expression in (2.5), implying that the solution to this pooling problem involves the firm offering tax avoidance method $s = s_2^*$ (type 2's first best) to both types. However, this solution is feasible if and only if $s_2^* < s_1^a$, otherwise it would trigger auditing. In fact, the government audits all taxpayers using method $s \geq s_1^a$.[25]

If $s_2^* > s_1^a$, the firm will adopt a "corner solution", offering the quality $s = s_1^a$ to both types. The firm would serve all taxpayers, setting $p'_{s_2} = (1 - a_1)v_2(s_1^a)$, with profits $(n_1 + n_2)[(1 - a_1)v_2(s_1^a) - c(s_1^a)]$.

The firm serves type 1 only. Alternatively, the firm can offer a unique method to type 1 only, with a price that type 2 cannot afford. However, $p_{s_1} = v_1'(s)$ and $s = s_1^*$, that solves $v_1'(s_1^*) = c'(s_1^*)$ is not feasible, since $s_1^* > s_1^a$. Thus, the firm would offer $s = s_1^a$ to type 1 taxpayers, who are audited with probability a_1. The price is $p'_{s_1} = (1 - a_1)v_1(s_1^a)$, and profits are $n_1[(1 - a_1)v_1(s_1^a) - c(s_1^a)]$.

In general the firm prefers to serve type 1 only if n_1 and $v_1(s)$ are sufficiently larger than n_2 and $v_2(s)$ respectively.

In conclusion, selective auditing has several effects on the design and supply of tax avoidance methods. First of all, when the firm can discriminate between taxpayer types, offering two distinct methods, selective auditing increases the "power" or "size" of the tax avoidance method designed for low-value types compared to the case with generalized auditing, increasing tax avoidance for that group. The tax avoidance method devised for high-value types does not change, but tax revenues from them are likely to increase, given auditing. When high enough, selective auditing might even reduce the number of available tax avoidance methods (pooling). The final impact on social losses depends on many factors, including the cost of the audit system. We are going to discuss these factors in the next Section.

Competition. Before moving to the analysis of the impact of different auditing policies on welfare, it may be interesting to discuss how generalized vs. selective auditing impacts the number of available tax avoidance methods and their qualities when the incumbent firm faces potential entry and competition.

So far we have assumed that taxpayers had no alternative providers of tax advice. By extending the analysis to consider possible competition, an especially relevant case arises when the incumbent firm sells only high-quality methods at a high price, forcing the type 2 taxpayers out of the methods' market. In this case, absent barriers to entry, a competitor might enter to cater specifically to the lower needs of type 2 taxpayers.

Let us consider the cases $s_1^a > s_2^*$ and $s_1^a < s_2^*$ separately.

When $s_1^a > s_2^*$ and the incumbent serves only the high type 1, offering $s = s_1^a$, a competitor might enter the low type 2 market, offering s_2^* at $p_2^c = v_2(s_2^*)$. For this setting to be possible, it must be that $(1 - a_1)v_1(s_1^a) - p_{s_1} \geq v_1(s_2^*) - v_2(s_2^*)$. Therefore, the incumbent cannot charge $p'_{s_1} = (1 - a_1)v_1(s_1^a)$ as in the no-competition case addressed above, but it must lower the price charged to type 1 taxpayers so that $(1 - a_1)v_1(s_1^a) - p_{s_1} \geq v_1(s_2^*) - v_2(s_2^*)$, implying $p''_{s_1} = (1 - a_1)v_1(s_1^a) - [v_1(s_2^*) - v_2(s_2^*)]$, $p''_{s_1} < p'_{s_1}$. The reduction in profit due to the lower price might induce the incumbent to choose to supply s_2^* to both types, foreclosing the low demand market. Therefore, selective auditing might have the effect of eliminating the market for sophisticated tax avoidance methods, both under monopoly (when the incumbent chooses to supply both types with the same method s_2^*) and with competition.

When $s_1^a < s_2^*$ and the incumbent serves only the high type 1, offering $s = s_1^a$, the competitor might enter the low type 2 market, offering some $s_2' < s_1^a$, and pricing at $p_2^{c'} = v_2(s_2')$. Again, this setting is feasible if and only if $(1 - a_1)v_1(s_1^a) - p_{s_1} \geq v_1(s_2') - v_2(s_2')$. The incumbent must therefore lower its price to $p''_{s_1} = (1 - a_1)v_1(s_1^a) - [v_1(s_2') - v_2(s_2')]$, $p''_{s_1} < p'_{s_1}$. Again, facing potential entry in the low market, the firm may choose to serve s_1^a to the entire market. In this case, the less sophisticated method disappears. However, in this case, (potential) competition implies that not only type 1, but all taxpayers adopt method s_1^a, with an increase in the loss of tax revenue.[26]

[24] From an intuitive point of view, we would expect the incentive compatibility constraint of type 1 to be violated as a_1 increases. The higher risk associated to the use of method s_1^a would induce type 1 to switch and adopt method $\hat{s}_2$. This does not occur because, in equilibrium, the firm chooses p_1 to satisfy type 1's incentive compatibility constraint as a strict equality. This effect is therefore shifted to the remaining constraints of the optimization problem, in particular to the incentive compatibility constraint of type 2. It is possible to prove that an alternative scheme, that guarantees participation to type 1 (satisfying its participation constraint as a strict equality), and is incentive compatible for type 2 (satisfying its incentive compatibility constraint as a strict equality) does not exist. Incentive compatibility for type 2 would require

$$p_2 = (1 - a_1)[v_1(s_1) - v_2(s_1)] + v_2(s_2)$$

but then the participation constraint for type 2 would be

$$v_2(s_2) - p_2 = v_2(s_2) - (1 - a_1)[v_1(s_1) - v_2(s_1)] - v_2(s_2) < 0.$$

[25] Comparing the first order conditions (2.5) and (4.5), that define s_2^* and s_1^a respectively, we find that there exists a unique value $\mathring{a}$, such that

$$s_1^a \geq s_2^* \text{ if and only if } a \leq \mathring{a}$$

Note that $\mathring{a} < \hat{a}$. In fact, $\hat{s}_2 < s_2^*$ and s_1^a is decreasing in a. Assume $a = \mathring{a}$ and $s_1^a = s_2^* > \hat{s}_2$. If we increase a, so that $a > \mathring{a}$, then $s_1^a < s_2^*$. However, if a is still close to $\mathring{a}$, $\hat{s}_2 < s_1^a < s_2^*$. If a increases further, and $a = \hat{a}$, then $s_1^a = \hat{s}_2 < s_2^*$.

[26] The assumption we have made in our analysis is that the cost of providing the services are the same for both firms and equal to $c(s)$. Different production technologies might alter the impact of selective auditing on the production of tax avoidance methods. Moreover, we have also assumed that competitors produce differentiated goods, whereas there might be cases of large accounting firms competing in both markets (Boik and Takahashi, 2020; Rochet and Stole, 2002). The analysis of these possible extensions is left for future research.

5. The welfare effects of auditing

In Section 3 we stated that the government chooses its tax policy to minimize the aggregate losses resulting from tax avoidance activities. Tax avoidance activities yield a welfare loss $L(\cdot)$ due to the reduction in tax revenues. They also create a cost $D(\cdot)$ related to the production and development of the tax avoidance method. Finally, there is the cost of auditing and enforcing the tax policy, A.

To assess the extent of these losses we follow standard first-best analysis, that typically defines social welfare as the sum of consumers' and producer's surplus (Caillaud et al., 1988). Public expenditure enters this definition of social welfare when it is utilized to provide public goods. Social welfare therefore is:

$$W = \sum_{i=1}^{2} n_i \left[v_i(s_i(a)) - p_i - T_i\right] + \sum_{i=1}^{2} n_i[p_i - c(s_i(a))] + \lambda \left[\sum_{i=1}^{2} n_i[T_i - v_i(s_i(a))] - A\right] \tag{5.1}$$

where T_i is the tax collected from each taxpayer, A is the cost of auditing (in the form of the budget allocated to it), and $\lambda \geq 1$ is the net marginal value that society attaches to public expenditure (public goods and social impact investments). The value of λ depends on the uses that the government does (public goods or, more generally, investments). Obviously, higher tax revenues come at a cost, because greater tax obligations create distortions. These distortions are captured by the net marginal value of public expenditures λ, given the sensitivities of economic activities to taxation.

From Eq. (5.1) we can see that the taxpayers' payment for tax avoidance services p_i is a mere transfer to tax firms, whereas the cost of producing the method, $c(s_i)$, faced by the firm, is a real social cost.

We can rewrite Eq. (5.1) as follows:

$$W = (\lambda - 1)\sum_{i=1}^{2} n_i T_i - (\lambda - 1)\sum_{i=1}^{2} n_i v_i(s_i(a)) - \sum_{i=1}^{2} n_i c(s_i(a)) - \lambda A \tag{5.2}$$

From (5.2), given T_i, it can be seen that the maximization of social welfare is equivalent to the minimization of the social loss from tax avoidance and auditing activities:

$$\mathcal{L}(s_i, a_i, A) = (\lambda - 1)\sum_{i=1}^{2} n_i v_i(s_i(a)) + \sum_{i=1}^{2} n_i c(s_i(a)) + \lambda A \tag{5.3}$$

The coefficient $\lambda - 1$ presents analogies with the concept of social costs of public funds, related to the fact that raising and transferring funds through taxation and other public channels has a cost, and yet a benefit, for society. Although each dollar raised through taxes costs society more than one dollar, because taxation can be distortionary (Atkinson and Stiglitz, 1980; Green and Laffont, 1979),[27] in our model, each dollar raised through taxes costs \$1 to taxpayers and yields a social value of \$$\lambda$ (net of the costs of distortionary taxation). The net social value of a dollar of tax revenue is \$$(\lambda - 1) > 0$. Each dollar subtracted to tax revenue through tax avoidance thus induces a positive loss to society.

We are now in a position to discuss how the various auditing strategies affect social welfare in the presence of tax avoidance.

First of all, note that the loss would be highest if the firm could provide taxpayers their first-best tax avoidance methods, s_i^* $(i = 1, 2)$ in the absence of auditing $(A = 0)$. In that case the loss is

$$\mathcal{L}(s_1^*, s_2^*, 0, 0) = (\lambda - 1)\left[n_1 v_1(s_1^*) + n_2 v_2(s_2^*)\right] + \left[n_1 c(s_1^*) + n_2 c(s_2^*)\right] \tag{5.4}$$

The loss with second-best tax avoidance methods, when perfect discrimination is not possible, is:

$$\mathcal{L}(\hat{s}_1, \hat{s}_2, 0, 0) = (\lambda - 1)\left[n_1 v_1(\hat{s}_1) + n_2 v_2(\hat{s}_2)\right] + \left[n_1 c(\hat{s}_1) + n_2 c(\hat{s}_2)\right] \tag{5.5}$$

Comparing (5.4) with (5.5), we can easily check that

$$\mathcal{L}(s_1^*, s_2^*, 0, 0) > \mathcal{L}(\hat{s}_1, \hat{s}_2, 0, 0) \tag{5.6}$$

because $s_1^* = \hat{s}_1$ and $s_2^* > \hat{s}_2$, so $n_2 v_2(s_2^*) > n_2 v_2(\hat{s}_2)$ and $n_2 c(s_2^*) > n_2 c(\hat{s}_2)$.

When the government audits all taxpayers at level a, the social loss becomes

$$\mathcal{L}(s_1^a, s_2^a, a, A) = (\lambda - 1)\left[n_1 (1 - a) v_1(s_1^a) + n_2 (1 - a) v_2(s_2^a)\right] + \left[n_1 c(s_1^a) + n_2 c(s_2^a)\right] + \lambda A \tag{5.7}$$

Comparing (5.7) to (5.5), and noting that $s_i^a < \hat{s}_i$ for $i = 1, 2$, we can conclude that

$$\mathcal{L}(s_1^a, s_2^a, a, A) < \mathcal{L}(\hat{s}_1, \hat{s}_2, 0, 0) \tag{5.8}$$

as long as A is not too high, which is definitely an unsurprising result. We therefore assume that A is low enough to render auditing efficient. Moreover, given that both s_1^a and s_2^a are decreasing in a, a (moderate) increase in the budget A further reduces the loss from tax avoidance activities, keeping $\mathcal{L}(s_1^a, s_2^a, a, A) < \mathcal{L}(\hat{s}_1, \hat{s}_2, 0, 0)$.[28]

With selective auditing, assuming that the selected tax avoidance method is observable, only taxpayers choosing s_1 are audited. From Lemma 4.4, we know that the firm produces two tax avoidance methods, screening between types, if and only if $a_1 < \tilde{a}$.

The social welfare loss when $a_1 < \tilde{a}$ will therefore be:

$$\mathcal{L}(\bar{s}_1, \bar{s}_2, a_1, A) = (\lambda - 1)\left[n_1 (1 - a_1) v_1(\bar{s}_1) + n_2 v_2(\bar{s}_2)\right] + \left[n_1 c(\bar{s}_1) + n_2 c(\bar{s}_2)\right] + \lambda A \tag{5.9}$$

In order to understand whether selective auditing can be preferable to generalized auditing, we have to compare Eqs. (5.7) and (5.9).

Leaving momentarily aside A, assume that the government carries out the same level of auditing under generalized or selective auditing, i.e., $a_1 = a$. For $a_1 = a$, selective auditing increases the welfare loss from tax avoidance activities compared to generalized auditing, because the level of tax avoidance is unchanged for type 1, but it increases for type 2 (according to Proposition 4.3, $\bar{s}_2 = \hat{s}_2 > s_2^a$). In fact, if the level of auditing dedicated to type 1 taxpayers is the same with selective and generalized auditing, the welfare loss from these taxpayers will be $(\lambda - 1) n_1 (1 - a_1) v_1(s_1^a)$, regardless of the type of auditing, whereas the loss from type 2 taxpayers will be $(\lambda - 1) n_2 v_2(\hat{s}_2)$ with selective auditing, and $(\lambda - 1) n_2 v_2(s_2^a)$ with generalized auditing. Being $\hat{s}_2 > s_2^a$, we have

$$(\lambda - 1) n_2 v_2(\hat{s}_2) > (\lambda - 1) n_2 v_2(s_2^a) \tag{5.10}$$

When we consider A, with selective auditing all budget A is devoted to type 1 taxpayers, and we will thus have $a_1 > a$, because $a_1 = \frac{A}{n_1} > a$. As a_1 increases, type 1's tax avoidance decreases, while type 2's avoidance remains unaffected. If a_1 is high enough, the welfare loss from type 1 becomes small and this reduction more than compensates the higher loss from type 2.

In sum, from the point of view of minimizing the losses from tax avoidance, selective auditing is preferable to generalized auditing, when the level of generalized auditing a is comparatively small, possibly due to a limited budget A and there is a very high number of taxpayers of both types. Sometimes, if a_1 is small with budget A, a limited increase in the budget might be desirable if the gains from more audits on high demanders are bigger than the losses from fewer audits on low demanders, and such gains more than compensate for the increase in the social cost of auditing.

[27] Typically, the cost of public funds can be obtained in general equilibrium models (see, e.g., Mirrlees, 1976) and is the marginal deadweight loss of public funds. In a partial equilibrium model, like ours, the cost of public funds is assumed exogenous.

[28] In footnote 4.1 we have proven that s_1^a is decreasing in a. In a similar fashion, we can prove also that s_2^a is decreasing in a.

At times, however, the budget allocated to auditing is high and $a_1 > \tilde{a}$. In this case the firm offers a unique tax avoidance method, as discussed in Section 4.2. Consider first the case in which $s_2^* < s_1^a$. The firm then could either offer s_2^* to all types or serve type 1 only with s_1^a.

If the firm offers s_2^* to both, the social loss is

$$\mathcal{L}(s_2^*, a_1, A) = (\lambda - 1)\left[n_1\, v_1(s_2^*) + n_2\, v_2(s_2^*)\right] + (n_1 + n_2)\, c(s_2^*) + \lambda\, A \quad (5.11)$$

If the firm offers s_1^a to type 1 only, the social loss becomes

$$\mathcal{L}(s_1^a, a_1, A) = n_1[(\lambda - 1)v_1(s_1^a) + c(s_1^a)] + \lambda\, A \quad (5.12)$$

Comparing (5.12) with (5.7), assuming $a_1 = a$ to start with, one can see that the loss is definitely lower when the government applies selective audit with a_1 high enough that the firm is not able to discriminate. This is even truer when $a_1 > a$ and the level of tax avoidance with selective screening is lower.

Different is the case in which selective screening ends up with both types using tax avoidance method s_2^*. In that case, comparison of (5.11) with (5.7) shows that while the loss from type 1 decreases, that from type 2 increases, which means that, if s_2^* is large and n_2 high enough, selective screening may not be a desirable policy.

Finally, when $s_1^a < s_2^*$, the firm produces method s_1^a, either selling it to both types or to type 1 only. When it sells to type 1 only, the social loss is given by Eq. (5.12) and the previous considerations still hold: selective screening is desirable, because it reduces the social loss compared to uniform screening.

When the firm sells method s_1^a to both types, the social loss is

$$\mathcal{L}(s_1^a, a_1, A) = (\lambda - 1)\left[n_1\, v_1(s_1^a) + n_2\, v_2(s_1^a)\right] + (n_1 + n_2)\, c(s_1^a) + A \quad (5.13)$$

Again, assuming initially that $a_1 = a$, from (5.7) one can see that the loss from type 2 individuals is higher, which would render selective screening problematic in this case. However, if $a_1 > a$, s_1^a is reduced compared to the uniform screening case, which reduces the loss from type 1's, offsetting the increased loss from type 2's (who are now forced to use tax avoidance method $s_1^a > s_2^a$), with a resulting lower social loss.

6. Conclusions

Tax avoidance can be socially detrimental. Significant resources are expended in developing and using tax avoidance methods; this yields a dissipation of resources on several margins. The development and use of tax avoidance methods is in itself costly. Structuring business activities to obtain desired tax treatment often may lead to distortions and suboptimal firm organization and yield social costs. We have modeled the market for tax avoidance activities as a market in which an accounting firm serves different taxpayer types, offering them specifically tailored methods. A benevolent government chooses its auditing strategies to minimize the loss from tax avoidance, that comprises lost tax revenues, the cost to develop and implement tax avoidance methods and the government's costs of auditing and enforcement. The accounting firm responds to government's auditing and enforcement by changing the characteristics and the variety of the tax avoidance methods available to taxpayers, to reduce the extent of detection (for instance, substituting new methods to those targeted by auditing) and to accommodate the reduced demand for tax avoidance methods by taxpayers, given the risk of auditing and enforcement. While our findings suggest that a policy of generalized auditing is always successful in reducing both the quality of the tax avoidance methods offered to taxpayers, and the resulting loss in tax revenue, often selective auditing may be preferable. With selective auditing, governments only target and close some methods, implicitly legitimizing others. The intuition for this result lies in the impact that selective auditing has on the ability of the accounting firm to screen its customers. In general, selective auditing reduces this ability, thereby enhancing the appeal of simpler tax avoidance methods over their more complex and extensively audited counterparts. If there is a large difference between the degree of auditing applied to different tax avoidance activities (in particular, one activity is audited with a very high probability while the other is never audited), the market for the activity audited with high frequency might collapse and the firm may end up selling a unique tax avoidance method. We may then have three possible scenarios. In the first scenario, only the quality preferred by the low-demand type is offered to all taxpayers; in the second scenario, the quality tailored for heavily audited, high-demand taxpayers is offered to everybody (in this case, quality is lower than the first best quality of low demand types). Finally, in the third scenario, only high-demanders are served. While the first two scenarios involve higher social losses than generalized auditing, the last scenario involves lower social losses. A high level of selective auditing, that legitimizes the lighter tax avoidance methods, may therefore be preferable because it eliminates the firm's interest to serve the low demanders, thus reducing the number of tax avoiders, while keeping avoidance by high demanders low due to high auditing.

The extent to which the government should recur to selective auditing, *de facto* legitimizing tax avoidance methods, hinges upon the relative effect of these policies on tax avoidance and on the range of tax avoidance methods made available to taxpayers. Differently from traditional tax models, our approach has the advantage of modeling explicitly the "supply side" of tax avoidance, showing the reaction of accounting firms to tax enforcement policies in terms of quality and variety of available methods.

An interesting question would then be to explore empirically the effectiveness of auditing, especially selective auditing. Resource constraints, among other reasons, prevent governments from deterring the use of all tax avoidance methods. While the U.S. government has had considerable success with closing domestic tax shelters (Dharmapala, 2008), other tax avoidance methods involving foreign jurisdictions have come into greater use. Dharmapala (2008) suggests, while the U.S. has had success in clamping down on tax shelters, there is little evidence that the government is collecting more revenue. This might point out to a prevalence of the first two scenarios illustrated above, or it might be related to the structure of the market for tax avoidance methods.

A possible extension of our analysis could more formally introduce competition in the model. We have briefly argued that competition might increase the quality of the tax avoidance methods offered to taxpayers, with a detrimental effect of tax revenue and social welfare. Competition may also increase diversification of tax avoidance methods and decrease the effectiveness of selective auditing. Another interesting extension would be to consider endogenous market structures, where the government's auditing and enforcement policies would affect economies of scale and scope in the development and implementation of tax avoidance methods. Further, it may be interesting to examine the effect of tax avoidance within the context of optimal taxation, such as the work of Mirrlees (1971). The extent to which the benefits of tax avoidance are correlated with one's wealth would seem to play an important role in the design of optimal redistributive taxes (Kopczuk, 2001). On the one hand, the greater the correlation of benefits and wealth, the more sensitive redistributive taxes would have to be to tax avoidance costs. On the other hand, the less correlated they are, the less effective tax policy would be in redistribution.

In conclusion, how much the government is able to 'close the tax gap' is difficult to assess. Certainly, the considerable market for tax avoidance methods is likely to continue. The incentive to attribute income to a corporation rather than an individual in the common case where the corporate tax rate is lower than the individual tax rate, will surely motivate organizational restructuring and investments to that end. Additionally, the ability of global entities to engage in extra-jurisdictional tax avoidance by shifting their operations to tax havens (Bruner, 2013; Desai and Hines, 2002) also assures that appreciable tax avoidance methods will continue to be developed. Global cooperation may improve matters; indeed there are some recent initiatives in that

regard, including the approval by all G-20 countries of an agreement on a global minimum tax.[29]

While there are certainly many other issues to be discussed, we hope that this paper may encourage both researchers in tax policy and policymakers to account for the social cost of tax avoidance and for the effects of enforcement policies, especially selective ones, into their analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

Appendix A. Proofs

Proof of Proposition 2.1. In characterizing the profit-maximizing tax avoidance methods and prices we will follow Besanko et al. (1987) and assume that constraints (2.3) and (2.7) are slack. We will then maximize (2.2) subject to constraints (2.4) and (2.6) and given $s_i \geq 0$ and $p_i \geq 0$, $(i = 1, 2)$. Finally, we will check whether the solution to the reduced problem solves the constraints (2.3) and (2.7). If that is the case, the solution to the reduced problem will be the solution to the original problem too.

We start by noticing that the objective function (2.2) is increasing in p_1 and p_2, so that the firm will set it as highest as possible compatibly with the constraints. Hence, both constraints will be binding in equilibrium, with the firm choosing the highest values of p_1 and p_2 that still satisfy type 1's self-selection constraint and type 2's participation constraint respectively. So, from (2.6), we get:

$$p_1 = v_1(s_1) - v_1(s_2) + p_2 \tag{A.1}$$

and from (2.4)

$$p_2 = v_2(s_2) \tag{A.2}$$

Substituting (A.1) and (A.2) into (2.2), we obtain the first order conditions for s_1 and s_2:[30]

$$v_1'(\hat{s}_1) = c'(\hat{s}_1) \tag{A.3}$$

$$v_2'(\hat{s}_2) - \frac{n_1}{n_2}\left[v_1'(\hat{s}_2) - v_2'(\hat{s}_2)\right] = c'(\hat{s}_2) \tag{A.4}$$

and the prices, derived from (A.1) and (A.2), are:

$$\hat{p}_1 = v_1(\hat{s}_1) - \left[v_1(\hat{s}_2) - v_2(\hat{s}_2)\right] \tag{A.5}$$

$$\hat{p}_2 = v_2(\hat{s}_2) \tag{A.6}$$

As argued in Section 2, the first order conditions (A.3) and (A.4), given the characteristics of $v_i(\cdot)$ and $v_i'(\cdot)$, imply:

$$\hat{s}_1 = s_1^* > s_2^* > \hat{s}_2 \tag{A.7}$$

so that:

$$\hat{p}_1 > \hat{p}_2 > 0 \tag{A.8}$$

We now verify that the solution to the simplified maximization problem satisfies also constraints (2.3) and (2.7) as strict inequalities. In fact, substituting the equilibrium value of $\hat{p}_1$ into (2.3), the participation constraint for type 1 taxpayers becomes:

$$v_1(\hat{s}_1) - v_2(\hat{s}_2) > 0$$

since $v_1(s) > v_2(s)$. Furthermore, using equilibrium prices $\hat{p}_1$ and $\hat{p}_2$ from (A.5) and (A.6) and substituting into constraint (2.7), we can rewrite it as

$$\left[v_1(\hat{s}_1) - v_2(\hat{s}_1)\right] - \left[v_1(\hat{s}_2) - v_2(\hat{s}_2)\right] > 0$$

which is true because we assumed that $v_1'(\cdot) > v_2'(\cdot)$ and $v_1(s) - v_2(s)$ is increasing in s:

$$\frac{\partial}{\partial s}\left[v_1(s) - v_2(s)\right] = v_1'(s) - v_2'(s) > 0$$

Before concluding the proof, we consider the possibility of a corner solution, in which only one group is served. To make sure $\hat{s}_2 \geq 0$ we need that:

$$v_2'(0) - c'(0) - \frac{n_1}{n_2}[v_1'(0) - v_2'(0)] \geq 0 \tag{A.9}$$

Similarly, $\hat{s}_1 \geq 0$ if and only if:

$$v_1'(0) - c'(0) \geq 0 \tag{A.10}$$

We should note that satisfaction of condition (A.9) implies condition (A.10), but the opposite is not true. Hence, when the firm serves group 2, it also serves group 1. There might be cases, however, in which group 1 is served but group 2 is not. ■

Proof of Proposition 4.1. As in Proposition 2.1, we start assuming that constraints (4.1) and (4.4) are slack, and we maximize (2.2) subject to constraints (4.2) and (4.3), given $s_i \geq 0$ and $p_1 \geq 0$ $(i = 1, 2)$. As before, we set p_2 to satisfy type 2's participation constraint (4.2) and p_1 to satisfy type 1's self-selection constraint (4.3) as strict equalities, so that:

$$p_2 = (1 - a)v_2(s_2) \tag{A.11}$$

and

$$p_1 = (1 - a)[v_1(s_1) - v_1(s_2) + v_2(s_2)] \tag{A.12}$$

Substituting into (2.2), in equilibrium s_1 and s_2 solve:

$$v_1'(s_1^a) = \frac{c'(s_1^a)}{1 - a} \tag{A.13}$$

$$v_2'(s_2^a) - \frac{n_1}{n_2}\left[v_1'(s_2^a) - v_2'(s_2^a)\right] = \frac{c'(s_2^a)}{1 - a} \tag{A.14}$$

where, given the characteristics of $v(\cdot)$ and $v_i'(\cdot)$, $i = 1, 2$:

$$\hat{s}_1 > s_1^a \tag{A.15}$$

$$\hat{s}_2 > s_2^a$$

Moreover, given (A.15),

$$\hat{p}_1 > p_1^a \tag{A.16}$$

$$\hat{p}_2 > p_2^a \quad ■$$

Proof of Lemma 4.2. Consider $s_1^* = \hat{s}_1 > \hat{s}_2 > s_2^a$. When $a = 0$, then $s_1^a = s_1^* > \hat{s}_2$. When $a \to 1$, then $s_1^a \to 0$ from (4.5). As shown in footnote 4.1, s_1^a is decreasing in a. At the same time, $\hat{s}_2$ does not vary with a. So, there exists $\hat{a} \in (0, 1)$, such that $s_1^a \geq \hat{s}_2$ for $a \leq \hat{a}$ and $s_1^a < \hat{s}_2$ for $a > \hat{a}$.

Fig. A.1 below illustrates this process.

■

[29] See https://home.treasury.gov/news/press-releases/jy0447, last accessed on 25 Jan 2024.

[30] We have left out the non-negativity constraints on p_i, $i = 1, 2$, because they are always satisfied by the solution to our maximization problem, as it will become evident later.

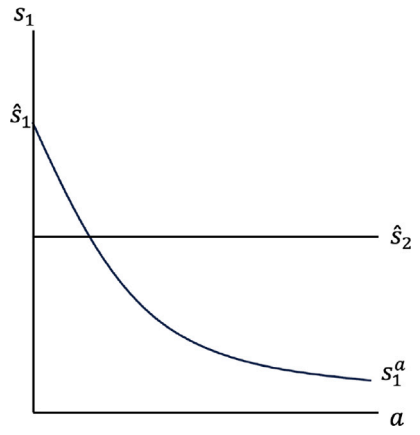

Fig. A.1. s_1^a and $\hat{s}_2$.

Proof of Lemma 4.4. Type 2's incentive compatibility constraint is given by Eq. (4.11). The left hand side of the inequality is zero, because type 2's price is set to satisfy their participation constraints and the left hand side is equal to the participation constraint. We then concentrate on the right hand side of (4.11):

$$(1-a_1)v_2(s_1)-p_1 \tag{A.17}$$

Type 2's incentive compatibility constraint is satisfied (as strict inequality) if Eq. (A.17) is non-positive. Substituting p_1 from Eq. (4.14) and rearranging, Eq. (A.17) becomes:

$$v_1(s_2)-v_2(s_2)-(1-a_1)(v_1(s_1)-v_2(s_1)) \tag{A.18}$$

Eq. (A.18) is non-positive if and only if:

$$(1-a_1)\left[v_1(s_1)-v_2(s_1)\right] \geq v_1(s_2)-v_2(s_2) \tag{A.19}$$

We have argued in Section 4.1 that, in equilibrum with selective auditing, $s_1 = s_1^a$ and $s_2 = \hat{s}_2$. Then the r.h.s. is positive and does not depend on a_1, because $\hat{s}_2$ is invariant with respect to a_1 (see Eq. (2.9)).

Given that $\left[v_1(s)-v_2(s)\right]$ is increasing in s and s_1^a is decreasing in a_1, the left hand side of Eq. (A.19) is monotonically decreasing in a_1.

When $a_1 = 0$, $s_1^a = \hat{s}_1$. Since $\hat{s}_1 > \hat{s}_2$, then $v_1(\hat{s}_1)-v_2(\hat{s}_1) > v_1(\hat{s}_2)-v_2(\hat{s}_2)$. When $a_1 = 1$, the l.h.s. of Eq. (A.19) is equal to zero.

Therefore, there exists a unique value of a_1, defined as $\tilde{a} \in (0,1)$, such that $(1-a_1)\left[v_1(s_1^a)-v_2(s_1^a)\right] \geq v_1(\hat{s}_2)-v_2(\hat{s}_2)$ for $a_1 \leq \tilde{a}$ and $(1-a_1)\left[v_1(s_1^a)-v_2(s_1^a)\right] < v_1(\hat{s}_2)-v_2(\hat{s}_2)$ for $a_1 > \tilde{a}$. Type 2's incentive compatibility constraint is satisfied if and only if $a_1 \leq \tilde{a}$.

We now prove that $\tilde{a} < \hat{a}$.

Consider first the case in which $\tilde{a} = \hat{a} < 1$ and assume $a_1 = \tilde{a}$. Then, by definition of $\hat{a}$, $\bar{s}_1(\tilde{a}) = \bar{s}_2$ and

$$(1-\tilde{a})\left[v_1(\bar{s}_1(\tilde{a}))-v_2(\bar{s}_1(\tilde{a}))\right] = v_1(\bar{s}_1(\tilde{a}))-v_2(\bar{s}_1(\tilde{a})) \tag{A.20}$$

which reduces to

$$1-\tilde{a}=1 \tag{A.21}$$

The above equality is satisfied for $\tilde{a}=0$, that contradicts our finding that $\tilde{a} \in (0,1)$.

Consider next the case $1 > \tilde{a} > \hat{a} > 0$, and, again, $a_1 = \tilde{a}$. Because $1 > \tilde{a} > \bar{a} > 0$, then $\bar{s}_1(\tilde{a}) < \bar{s}_2$. By definition of $\tilde{a}$, from (A.19), we would have

$$1-\tilde{a} = \frac{v_1(\bar{s}_2)-v_2(\bar{s}_2)}{v_1(\bar{s}_1(\tilde{a}))-v_2(\bar{s}_1(\tilde{a}))} \tag{A.22}$$

The r.h.s. of expression (A.22) is greater than 1, which would require $\tilde{a} < 0$. Again, this would contradict our initial finding $\tilde{a} \in (0,1)$.

Then $\tilde{a} < \hat{a}$. ■

Appendix B. Competition

In Section 4.2 we discussed what would happen if a competitor enters the market left by the incumbent monopolist (so, if the monopolist serves type 1 only, a competitor would enter to serve type 2). Here we provide an analysis of perfect competition, showing that the outcomes would not differ much from those discussed in Section 4.

Consider a perfectly competitive market for tax avoidance. Since profits must be zero for all s, $P(s) = C(s)$. Given this price schedule, consumers self-select the quality that maximizes their utility, setting $v_i'(s) = P'(s)$, which becomes $v_i'(s) = C'(s)$. Then, both types buy their first-best quality level. The high type maintains the same level as under monopoly, whereas the low type increases it (compared to the non-perfectly discriminating monopolist). The introduction of auditing decreases the quality of all tax avoidance methods, as it happens under monopoly. In fact, the first-order conditions become

$$(1-a)v_i'(s) = c'(s)$$

With selective auditing, only taxpayers using method 1 are audited. Then s_1 solves

$$(1-a_1)v_1'(s_1) = c'(s_1)$$

whereas s_2 solves $v_2'(s_2) = C'(s_2)$ and is again equal to the first-best level for type 2. Now, there exists a level for a, define it a', such that $(1-a')v_1'(s_1) = v_2'(s_2)$ when $s_1 = s_2$. When that happens, the quality level of the two types is the same in equilibrium, so type 1 might choose to adopt s_2 directly, eschewing auditing and obtaining marginal benefit $v_1'(s_2) > (1-a')v_1'(s_1)$. This outcome holds also for all $a > a'$. This case is analogous to the result in Lemma 5.4, where a single method survives in the market (in Lemma 5.4 it happened because an incentive compatibility constraint was violated, here it is dictated by a process of utility maximization. The mechanics is different but the logic is similar).

A different case is contemplated at the end of Section 4.1, where it is discussed the case of the monopolist that, reacting to selective auditing by the government, chooses to serve only the high end of the market (type 1). In that case, a competitor may enter in the low end. Again, albeit by a different mechanism, competition may increase the number and quality of methods available in the market or it may lead to a single method surviving.

Appendix C. Adding economies of scale

To explore the implications of economies of scale in our setup, consider the more general case in which the cost of providing the service to a taxpayer depends on the complexity of the method s and on the number of taxpayers requesting that particular method. The simplest way to model it is to assume that $c(s)$ is the cost of producing/designing the tax avoidance method with complexity s. The marginal cost of serving an extra customer is constant and equal to $c > 0$. So, the per-capita cost of serving an extra customer is $\frac{c(s)}{n_i} + c$, which is decreasing in n_i, indicating economies of scale.

The monopolist's objective function in this case differs from Eq. (2.2) and is

$$\sum_{i=1}^{2}\left[n_i\left(p_i-c\right)-c(s_i)\right] = \sum_{i=1}^{2} n_i\left[p_i - c - \frac{c(s_i)}{n_i}\right] \tag{C.1}$$

Consider first the case with perfect discrimination. The first order conditions in Eq. (2.5) become

$$v_i'(s_i') = \frac{c'(s_i')}{n_i} \tag{C.2}$$

Comparing it with (2.5), we can see that $s_i' > s_i^*$. The reduction in the cost of serving an extra taxpayer (unsurprisingly) induces the monopolist to increase the first-best level of complexity of the tax avoidance system provided. The system complexity increases with the number of taxpayers adopting it. If $n_2 > n_1$, the effect of scale economies may be so large that $s_2' > s_1'$, which, we feel, is not a particularly realistic result. The quality/complexity of the tax avoidance system is higher for the taxpayers with lower marginal valuation for it (since $v_1'(s) > v_2'(s)$, $\forall s$ in the admissible range).

When we consider asymmetric information, the problem above is mitigated by the introduction of the incentive compatibility constraint. In that case, with economies of scale, the first order conditions become

$$v_1'(\hat{s}_1') = \frac{c'(\hat{s}_1')}{n_1} \tag{C.3}$$

$$v_2'(\hat{s}_2) = \frac{c'(\hat{s}_2')}{n_2} + \frac{n_1}{n_2}\left[v_1'(\hat{s}_2') - v_2'(\hat{s}_2')\right] \tag{C.4}$$

and $\hat{s}_2' < \hat{s}_1'$ in order for the incentive compatibility constraint of type 1 to hold in equilibrium. What we notice, however, is that the greater n_2, the smaller the r.h.s. of (C.4) and therefore the larger $\hat{s}_2'$. This characteristic holds true also in Eq. (2.9) in the paper, but in this scenario is emphasized.

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