NATIONAL RESEARCH UNIVERSITY
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BASIC RESEARCH PROGRAM
WORKING PAPERS

SERIES: ECONOMICS
WP BRP 181/EC/2017

A Collateral Tax Sanction: When does It Mimic a Welfare-Improving Tag?

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Abstract

The suspension of a driver's license, the revocation of a passport or a professional license are used by the tax authorities as sanctions for failure to comply with tax obligations and are referred to as collateral tax sanctions. In this paper, I propose a new rationale for why it may be beneficial to use collateral tax sanctions for the purpose of tax enforcement. By affecting consumption and providing enforcement targeted to a group, collateral tax sanctions may allow the government to impose punishment correlated with an individual's earning potential. Such punishment also makes the effective tax rates correlated with an individuals' earning potential and therefore leads to a more effective redistribution of income. I show that the use of collateral tax sanctions could increase the CES social welfare function when the skill distribution of the targeted group first-order stochastically dominates the skill distribution of the other group and the social welfare function is sufficiently concave.

Keywords: collateral sanction, tax enforcement, ability, tag

1 Introduction

Recently, to improve tax compliance, tax authorities have used a new punishment instrument – collateral tax sanctions, which are the revocation of privileges provided by the government,

*I am grateful for comments and advice from Joel Slemrod, Tilman Börgers, Wojciech Kopczuk, James R. Hines Jr., Katherine Cuff, Mark Phillips, Matthew Rablen, Uday Rajan, Suranjali Tandon, and the two anonymous referees. I wish to thank participants at the Michigan Public Finance Free Lunch and Regular Seminars, the National Tax Association Meeting 2015, and International Institute of Public Finance Annual Congress 2016. Any errors or omissions are my own.

imposed for failure to comply with tax obligations. An example of a collateral tax sanction is the suspension of a driver's license for tax noncompliance. Currently, three U.S. states – Louisiana,[1] California,[2] and New York [3] – have established a driver's license suspension program which allow tax departments to suspend a driver's license from persons with delinquent tax liabilities.

Other examples of collateral tax sanctions used by some states are the suspension of vehicle registration,[4] the revocation of a professional license,[5] or the denial of hunting and gaming permits to residents who have failed to satisfy their tax obligations.[6] At the federal level under current and proposed laws, failure to pay taxes owed may result in the loss of ability to obtain federal employment, apply for Federal Housing Authority mortgages, or enter contracts with the federal government. It also may result in the revocation of passports, imprisonment, or deportation from the country.[7]

While collateral tax sanctions have become a popular tool of tax administration, they have not been extensively studied by economic scholars. The existing literature distinguishes monetary fines from non-monetary penalties, but finds monetary fines to be a preferable instrument. Specifically, Becker (1968), Polinsky and Shavell (1984), and Andreoni (1991, 1992) and others show that monetary fines should always be exhausted before non-monetary penalties are imposed, because non-monetary penalties are generally more costly to administer. Though, there is some limited research finding that the use of non-monetary sanctions can be optimal even when the monetary fine is not maximal (D'Antoni and Galbiati (2007)).

A recent law paper by Blank (2014) argues that collateral tax sanctions can promote

[1]See, e.g., Tax Topics, Louisiana Department of Revenue, Volume 24 Number 2 April 2004, available at http://www.revenue.louisiana.gov/forms/publications/tt(04_04).pdf. See also Suspension and Denial of Renewal of Drivers' Licenses (LAC 61:I.1355), Louisiana Department of Revenue, available at http://revenue.louisiana.gov/forms/lawspolicies/LAC61_I_1355.pdf

[2]See, e.g., California to Tax Scofflaws: Pay Up or Lose your Driver's (or CPA) License, AccountingWeb.com, Sept. 20, 2011, available at http://www.accountingweb.com/topic/tax/california-tax-scofflaws-pay-or-lose-your-drivers-license. See also Franchise Tax Board Meeting, September 5, 2012: Delinquent Taxpayer Accountability Act Informational Item available at https://www.ftb.ca.gov/law/meetings/attachments/090512/3.pdf

[3]See, e.g., States target tax scofflaws with incentives and shame, usatoday.com, Oct. 16, 2013 , available at http://www.usatoday.com/story/news/nation/2013/10/16/states-target-tax-scofflaws/2993447/. See also Summary of Budget Bill Personal Income Tax Changes Enacted in 2013, New York State Department of Taxation and Finance, Aug. 8, 2013, available at http://www.tax.ny.gov/pdf/memos/income/m13_4i.pdf

[4]See Jay Soled, Using Driving Privilege to Solve States' Fiscal Crises, 60 STATE TAX NOTES 841 (June 13, 2011)

[5]See, e.g., Wis. Stat. § 73.0301(d)(11) (revocation of law licenses); Min Stat. § 270C.72 (revocation of medical licenses).

[6]See, e.g., Louisiana Dep't of Wildlife and Fisheries, Hunting Licenses, available at http://www.wlf.louisiana.gov/licenses/hunting-licenses (last visited Oct. 22, 2012).

[7]See Blank (2014) for more details.

voluntary tax compliance more effectively than monetary fines. To support this statement, he proposes three arguments. First, collateral tax sanctions may be more salient to individuals. Second, they may provoke feelings of reciprocity. Third they may induce a fear of the stigma of tax noncompliance. These arguments are appealing, but mainly drawn on the behavioral aspects of decision making and do not exhaust all the economic reasons why collateral tax sanctions may be an attractive tax administration tool.

This paper proposes a new economic rationale for the use of collateral sanctions by tax administrators. By affecting consumption and providing enforcement targeted to a group, collateral tax sanctions may allow the government to impose punishment correlated with an individual's earning potential. Such punishment also makes the effective tax rates correlate with individual's earning potential and allows for a more effective redistribution of income. The mechanism, by which a collateral tax sanction improves the redistribution of income, resembles Akerlof's tagging. Similar to a tag, which indicates a taxpayer's category, a collateral tax sanction, if it is correlated with individual earning potential, may reduce the cost of income redistribution and therefore increase social welfare. The cost of redistribution arises when a tax schedule depends on income and not on ability, because such a tax system distorts labor supply decisions.

For the described mechanism, it is essential that collateral tax sanctions affect consumption directly, that is, not through affecting income. Indeed, in contrast to a monetary fine that reduces taxpayer's income, a collateral tax sanction prohibits consumption of a specific good or terminates a specific activity. Given that consumption baskets differ among individuals, only a group of individuals who have that specific good in their baskets are affected by the collateral tax sanction. For example, only people who have an international passport are affected by its revocation. Therefore, a collateral tax sanction provides enforcement targeted to a specific group of taxpayers.

The group of taxpayers targeted by a collateral tax sanction can differ in their skill distribution from the group that is not affected by the collateral tax sanction. For example, the revocation of an international passport mainly affects those people who have opportunities to travel abroad and are likely to have a higher earning potential on average than those who do not have an international passport. This illustrates that collateral sanctions may allow the tax authority to correlate punishment with taxpayer's ability. Though, not all collateral tax sanctions are correlated to individual earning potential.

The next important part of the model is the connection between punishment and effective tax. The model in this paper shows that punishment for tax evasion affects effective tax rates. Moreover, by targeting enforcement to a group of taxpayers, the tax authority raises the effective tax rate for people in that group. Thus, a collateral tax sanction leads to a higher effective tax rate for the targeted group.

There is, however, an important difference between a collateral tax sanction and a tag. Unlike a tag that allows the government to set a separate statutory tax for the tagged group, a collateral tax sanction allows the government to influence the effective tax for the targeted group, but not the statutory tax. Because collateral tax sanctions affect only the effective tax, they are more restrictive than tags and therefore less efficient. However, in practice collateral tax sanctions might be more feasible than tags for political reasons. Note also that unlike a tag, a collateral tax sanction imposes some real cost on the taxpayer and therefore reduces social welfare. For example, the suspension of an international passport restricts an individual's ability to travel, which likely decreases her utility.

The model in this paper examines the welfare and redistribution consequences of the imposition of a collateral tax sanction for tax noncompliance. To measure social welfare, I use the CES social welfare function. The model draws on the model in Cremer, Gahvari and Lozachmeur (2010), which analyzes gains and losses as a consequence of tagging, and inherits its assumption that preferences are quasi-linear and have a constant elasticity of labor supply. In the model, there is a continuum of individuals who are characterized by their skills. By imposing a collateral tax sanction, the government can raise the effective tax rate of the targeted group of taxpayers. I show that as a result social welfare could be improved. Under the CES social welfare function, social welfare increases if the social welfare function is sufficiently concave and the skill distribution in the targeted group first order stochastically dominates the skill distribution in the other group. Under the Rawlsian social welfare function (which is a special case of the CES s.w.f.), social welfare increases when the earning potential of the poorest individual in the targeted group is sufficiently higher than the earning potential of the poorest individual in the rest of the population. This occurs because the new optimal statutory tax rate decreases, which allows an increase in the utility of the rest of population at the cost of decreasing the utility of taxpayers in the targeted group. Note that a tag improves social welfare even in the case when the supports of skill distributions for two groups are the same.

This paper proceeds as follows. Section 2 explains the mechanism through which a collateral tax sanction could provide enforcement correlated with ability and discusses which collateral tax sanctions in practice work like this and which do not. Section 3 presents the model which introduces a collateral tax sanction into a framework with optimal tax and evasion. Section 4 analyzes the welfare and redistribution consequences of the imposition of a collateral tax sanction and derives the conditions when the use of a collateral tax sanction is social welfare beneficial. Section 5 discusses potential concerns and indirect effects of the use of collateral tax sanctions. Section 6 concludes.

2 A Collateral Tax Sanction Works as a Tag If Correlated with Individuals Earning Potential

2.1 From a Collateral Tax Sanction to a Tag

By affecting consumption, collateral tax sanctions have a differential effect on taxpayers. In contrast to a monetary fine which affects income, a collateral tax sanction restricts consumption of a certain good or activity. For example, suspension of a driver's license causes a delinquent taxpayer to stop driving; revocation of an international passport restricts the ability to travel abroad. Not everybody, however, has a driver's license or an international passport. Consumption baskets, however, differ among individuals. Therefore, only the group of people who have the restricted good or activity in their consumption basket are influenced by the collateral tax sanction. For example, only people who have international passports are affected by revocation of an international passport.

The group affected by a collateral tax sanction could have different characteristics than the unaffected group. One important characteristic for taxation and redistribution purposes, which I focus on in this paper, is earning potential or ability. The distribution of abilities within the affected group could be different than within the unaffected group. For example, a revocation of boat registration or suspension of boating safety certificate as a sanction for tax evasion mostly affects wealthy people and fishermen. A revocation of an international passport mainly affects those who have opportunities to travel abroad. In these examples, the people with a boat certificate and people with an international passport are likely to have a higher earning potential than people without those documents.

By affecting only one group of individuals, the collateral tax sanction allows the government to target enforcement to this group and raise their effective tax rate. If the targeted group is characterized by relatively higher earning potential, then a collateral tax sanction allows the government to raise the effective tax rate in the group with higher earning potential. Through this mechanism, such a collateral tax sanction resembles a tag. In the model and its analysis, I investigate when the use of such a collateral tax sanction is socially beneficial. As I show, it could be welfare improving if, for example, in case of utilitarian preferences, the skill distribution of individuals in the targeted group first-order stochastically dominates the skill distribution of individuals in the unaffected group.

2.2 Collateral Tax Sanctions in Practice: Are They Correlated with Individuals Earning Potential?

Not all collateral tax sanctions work as a tag. That is, not all of them are correlated with taxpayer earning potential. For example, suspension of a hunting license may be not a good instrument for imposing a punishment that is correlated with ability. Possession of a hunting license more likely reflects individual preferences. Hence, it cannot be a candidate for a sanction that mimics a welfare-improving tag.

Whether a collateral tax sanction is correlated with individual earning potential or not is an empirical question. But, before I introduce the theory which explores the usefulness of collateral tax sanctions with such a property, we want to be sure that in practice there are at least some collateral tax sanctions that are correlated with individual's earning potential. Given that I have used the suspension of an international passport as the main example of a collateral tax sanction correlated with individual abilities, it is reasonable to ascertain whether the abilities of people who posses an international passport are higher than abilities of others.

2.2.1 Who Have International Passports?

While I do not have data describing international passport owners, there are survey statistics of U.S. resident travelers visiting overseas destinations collected by the National Travel & Tourism Office.[8] Certainly, not all people who have international passports travel overseas. However, one of the main purposes to obtain a passport is to go abroad. Therefore, U.S. residents traveling abroad are a substantial and important sub-sample of people with international passports.

Unsurprisingly, no data on individual earning potential are available. To proxy for earning potential, I take advantage of the correlation between earning potential and income, and use data on income. Survey statistics from "Profile of U.S. Resident Travelers Visiting Overseas Destinations" provide information on the median income of those traveling abroad. In 2014, this median income was \$100,000. For comparison, U.S. median household income for the whole population in 2014 was \$53,657. So, we see that a median traveler earns almost twice

[8] The National Travel & Tourism Office is located in the International Trade Administration of the Department of Commerce.

Table 1: Distribution of occupations of U.S. resident travelers visiting overseas destination

Occupation	2014	2013	2012
Management, Business, Science, & Arts	42%	43%	45%
Retired	15%	15%	13%
Service Occupations	11%	11%	10%
Student	10%	11%	9%
Sales and Office	7%	6%	7%
Homemaker	5%	6%	5%
Military/Government	3%	3%	3%
Natural Resources, Construction, & Maintenance	3%	2%	2%
Prod., Transportation, & Material Moving	3%	2%	2%

Source: National Travel & Tourism Office, International Trade Administration, Department of Commerce

as much as a median household in U.S. While this fact is not sufficient to provide conclusive evidence, it is an indication that international travelers have a higher earning potential.

Another characteristic of people traveling abroad provided in the survey can be used as a proxy for earning potential is occupation. Table 1 describes the distribution of occupations of travelers for 2012-2014. More than 40% of the travelers belong to the category of Management, Business, Science, & Arts. People in this category are likely to have a graduate level education, which is an indication of a high earning potential.

Overall, both facts provide support for the supposition that people traveling abroad on average have higher earning potential than others. If the main reason for obtaining an international passport is to travel abroad then we also have some evidence for the presence of a positive correlation between possession of an international passport and earning potential.

3 Model

In this section, I give more structure to the ideas above and introduce a collateral tax sanction into a model with optimal tax and evasion. I start by describing the distribution of skills in the population. Then, I specify the individual budget constraint. Finally, I characterize the individual preferences. In Section 4, I use this model to determine when it is socially optimal to use a collateral tax sanction.

3.1 Skill Distribution

Assume that the government can use a collateral tax sanction which affects the consumption of a certain good. I refer to the group of individuals that do not have this good in their consumption basket as group 1 and the group of individuals that do have this good in their consumption basket as group 2. Assume also that individuals are characterized by a skill level, w, (equal to the wage rate). Denote the skill distribution function for the entire population by $F(w)$ and its corresponding density by $f(w)$. Denote also the skill distribution function for group i by $F_i(w)$ and the corresponding density by $f_i(w)$, where $i = 1, 2$. Assuming that these two groups of individuals have equal size, the distribution and the density for the entire population are related to the distribution and the density for the two groups according to the following formulas:

$$F(w) = \frac{F_1(w) + F_2(w)}{2},$$

$$f(w) = \frac{f_1(w) + f_2(w)}{2}.$$

It is helpful to think about group 2 as a group with higher average skills than group 1. But, at this point, I do not impose any assumption on the skill distributions for these two groups.

By providing a differential effect on individuals, a collateral tax sanction allows the government to target group 2, which enables the raising of the effective tax rate for group 2. In the following subsections, I explain in details why this occurs and why it is useful.

3.2 Budget Constraint: A Connection between Collateral Sanctions and Effective Tax Rates

I start characterizing individuals by introducing their budget constraints with a main goal of showing how collateral sanctions affect the size of the effective tax rates. The logic is simple. Effective tax rates usually differ from statutory tax rates. The taxpayers are able to evade taxes and reduce the amount of taxes they pay, which makes effective tax rates lower than statutory tax rates. Thus, effective tax rates depend on statutory tax rates and on how costly it is to evade taxes. The cost of evasion depends, among other things, on the size of the punishment for tax evasion. Because the collateral tax sanction affects taxpayers in group 2 and not taxpayers in the other group, it makes the effective tax rate for group 2 higher.

To show this, I adopt the assumptions from the model by Kopczuk (2001). I presume that individuals who are characterized by a skill level, w, enjoy leisure and consumption goods, C, which are financed from compensation received for providing labor, L. They can also engage in evasion which decreases the amount of income, $I \equiv wL$, subject to taxation by E at the cost of $D(I, E)$. I assume that tax system is linear, that is, it is described by the marginal tax rate, t, and the lump-sum transfer, G. The budget constraint for an individual is

$$C = I + G - t(I - E) - D(I, E). \tag{1}$$

Evasion, E, affects only the budget constraint. Hence, the evasion which maximizes consumption is

$$E^*(t, I) = \underset{E}{argmax}\, I - t(I - E) - D(I, E). \tag{2}$$

The optimal evasion, $E^*(I, t)$, is determine by the FOC: $t = \frac{\partial D(I,E^*)}{\partial E}$. Plugging this optimal evasion into equation (1), we can rewrite the budget constraint as:

$$C = I + G - \eta(I, t)tI - D(I, E^*(I, t)) = I + G - \theta(I, t)tI, \tag{3}$$

where $\eta(I, t) \equiv 1 - \frac{E^*(I,t)}{I}$ is the share of statutory taxes that is paid to the government. I call η the net effective tax factor. I also define $\theta(I, t) \equiv 1 - \frac{E^*(I,t)}{I} + \frac{D(I,E^*(I,t))}{tI}$. I call θ the gross effective tax factor. It shows the share of taxes paid and the cost associated with paying taxes out of statutory taxes.

For example, suppose that the cost of evasion is proportional to the probability of being caught, $\alpha\frac{E}{I}$, which rises with the amount of evaded income and declines with true income, and is proportional to the amount of evaded taxes, $t\pi E$, where $\pi > 1$ is gross penalty rate. That is, the cost of evasion, when a monetary penalty is used, is $D(I, E) = \alpha\pi t\frac{E^2}{I}$. In this case, the optimal evasion is $E^*(I, t) = \frac{I}{2\alpha\pi}$, the net effective tax factor is $\eta = 1 - \frac{1}{2\alpha\pi}$, and the gross effective tax factor is $\theta = 1 - \frac{1}{4\alpha\pi}$.

Note that the difference between the gross effective tax factor and the net effective tax factor (i.e., $\theta - \eta$) shows the cost of evasion as a share of statutory taxes. While a taxpayer spends θ dollars to pay her taxes, the tax authority receives only η dollars out of that amount.

Let us now consider the effect of the use of a collateral tax sanction in this setting. The collateral tax sanction raises the cost of evasion for taxpayers in group 2 ($D_2(I, E)$) making it higher than that in group 1 ($D_1(I, E)$). Specifically, I assume that the imposition of a collateral tax sanction raises the marginal evasion cost, that is, $\frac{\partial D_2(I,E)}{\partial E} > \frac{\partial D_1(I,E)}{\partial E}$. Under this assumption, both the net and the gross effective tax factors are higher for group 2 than for group 1. Proposition 1 states this formally.

> ***Proposition 1***. *Assume that $D_i(I, E)$ for $i = 1, 2$ is increasing and strictly convex in E, $D_i(I, 0) = 0$ for $i = 1, 2$, and $\frac{\partial D_2(I,E)}{\partial E} > \frac{\partial D_1(I,E)}{\partial E}$. Then $\eta_2(I, t) > \eta_1(I, t)$ and $\theta_2(I, t) > \theta_1(I, t)$.*

Proof. See proof in Appendix A.

To illustrate this proposition, let us build on our previous example. Presume that in group 1 the monetary penalty is used and hence the cost of evasion is $D_1(I, E) = \alpha\pi t\frac{E^2}{I}$. In group 2, in addition to a monetary penalty, a collateral tax sanction is imposed. Suppose that its imposition occurs with the same probability of being caught, $\alpha\frac{E}{I}$, and it raises the cost of evasion by ξI, where $\xi > 0$.[9] Hence, $D_2(I, E) = \alpha\pi t\frac{E^2}{I} + \alpha\frac{E}{I}\xi I$. Therefore, the optimal evasion in group 1 and 2 are $E_1^*(I, t) = \frac{I}{2\alpha\pi}$ and $E_2^*(I, t) = \frac{I}{2\alpha\pi} - \frac{\xi I}{2t\pi}$, the net effective tax factors are $\eta_1 = 1 - \frac{1}{2\alpha\pi}$ and $\eta_2 = 1 - \frac{1}{2\alpha\pi} + \frac{\xi}{2t\pi}$, and the gross effective tax factors are $\theta_1 = 1 - \frac{1}{4\alpha\pi}$ and $\theta_2 = 1 - \frac{1}{4\alpha\pi} + \frac{\xi}{2t\pi} - \frac{\alpha\xi}{4t^2\pi}$.

As this example shows, the gross and net effective tax factors in general could depend on the tax rate and individual income. However, to make the problem tractable, I impose the assumption *that the gross effective tax factor, θ, and the net effective tax factor, η, are constants that do not depend on the tax rate and individual income.* In Appendix B, I relax the assumption that θ and η do not depend on t and show that this does not change the results. Also, the assumption that θ and η do not depend on income is not critical if θ and η do not decrease too fast with income. However, adding this dependence would significantly complicate the calculations.

Additionally, this example demonstrates a difference between monetary and non-monetary sanctions such as collateral sanctions. Namely, non-monetary sanctions, for given level of compliance, imply a larger social cost. As seen from the example, while the imposition of a collateral tax sanction helps to raise the amount of taxes received by the tax authority ($\eta_2 > \eta_1$), this comes at a relatively higher cost on taxpayers, that is,

$$\frac{\eta_2}{\theta_2} < \frac{\eta_1}{\theta_1}. \tag{4}$$

The reason for this is that a monetary sanction is a payment to the government and a collateral sanction is not. This difference will play a role in the welfare analysis of the use of collateral tax sanction, which I conduct later.

This subsection shows the transition from the taxpayer problem specified using the cost of evasion to one specified using effective tax factors. Given that we explained this transition here, in what follows I specify a taxpayer problem using the effective tax factors (which presumes that maximization over evasion is carried out). Additionally, this subsection explains

[9] This presumes that the cost associated with collateral sanction are proportional to income. For instance, suspension of an international passport is more costly for an individual with a high earning potential. In general, there is not much known about how the cost from the imposition of a collateral tax sanction depends on individual earning potential and hence on income.

that the imposition of a collateral tax sanction raises the effective tax factors in group 2. I rely on this result when we analyze the welfare implications of the imposition of collateral tax sanctions.

3.3 Individuals Preferences and the Maximization Problem

We now turn to specifying individuals preferences. Following the approach used by Cremer, Gahvari and Lozachmeur (2010), I assume that individuals have identical preferences that depend on consumption, C, positively, and on labor supply, L, negatively. The wage rates, which represent the skill levels, are distributed on $[\underline{w}, \overline{w}]$ according to $F(w)$ (as discussed earlier). Preferences are represented by the quasi-linear utility function:

$$u = C - \varphi(L), \tag{5}$$

where φ is strictly convex.

Recall that the tax system is linear and described by the marginal tax rate, t, and the lump-sum transfer, G. As derived earlier, an individual budget constraint can be represented as

$$C = I + G - \theta t I, \tag{6}$$

where $\theta < 1$ reflects that the effective tax rate is less than the statutory tax rate.

Combining (5) and (6), we have

$$u = G + I(1 - \theta t) - \varphi(\frac{I}{w}). \tag{7}$$

Income, $I(w)$, which maximizes this utility is determined by the FOC:

$$(1 - \theta t) = \frac{1}{w}\varphi^{'}(\frac{I(w)}{w}). \tag{8}$$

This FOC implicitly defines optimal income, $I(w)$, as a function of w, t and θ.

Integrating the local incentive compatibility constraint, $\frac{\partial u}{\partial w} = \frac{I(w)}{w^2}\varphi^{'}(\frac{I(w)}{w})$, we have

$$u(w) = \underline{u} + \int_{\underline{w}}^{w} \frac{I(s)}{s^2}\varphi^{'}(\frac{I(s)}{s})ds, \tag{9}$$

where $\underline{u} = u(\underline{w})$ is the utility of the poorest individual. As Cremer et al. (2010) note, the second term on the right-hand side of equation (9) shows the "information rent" one has to leave for an individual with $w > \underline{w}$ to reveal her type. By using FOC (8), "information rent" can be expressed as $\int_{\underline{w}}^{w} \frac{I(s)}{s}(1-\theta t)ds$, which shows that for a given tax rate, t, an increase in θ reduces "information rent". Because "information rent" is positive, an individual with the lowest skill, $\underline{w}$, receives the lowest utility.

With this we finish the description of the model and move to the clarification of the difference between tagging and targeted enforcement.

3.4 Tagging and Targeted Enforcement

Previous subsections show that a collateral tax sanction by making the enforcement targeted to a group of taxpayers raises the effective tax rate in this group. Because of this, a collateral tax sanction resembles tagging. However, it is critical to clarify the difference and the similarity between tagging and targeted enforcement, which I do in this subsection.

In his paper, Akerlof (1978) argues that conditioning taxes on a "tag" indicating the taxpayer's category increases social welfare, because this helps to mitigate the trade-off between redistribution and efficiency. The redistribution achieved through income tax improves welfare. But, this gain in welfare comes at a cost: income tax creates inefficiency by distorting labor decisions. Tagging reduces the cost of income redistribution because it allows the provision of transfers only to tagged people and not to everybody, which in turn allows a reduction in the marginal tax rates. Thus, Akerlof's tagging is a way to improve the design of a tax system by conditioning taxes based on some inherent characteristic correlated with earning potential.

The subsequent research on tagging has generalized Akerlof's model and explored who gains and loses as a result of tagging. In particular, Cremer et al. (2010) consider a model with a continuum of individuals who can be divided into two groups (referred to as l and h) with different ability distributions over the same support. They show that tagging always improves social welfare when the two groups have different distributions of skills. If the skill distribution in group h first-order stochastically dominates the distribution of skills in group l, then tagging leads to a redistribution from group h to group l (under Rawlsian social welfare and a utilitarian social welfare function with decreasing weights in skills provided that preferences are quasi-linear). Additionally, they show that if the hazard rates (i.e., $\frac{f_i(w)}{1-F_i(w)}$ where $i = l, h$) in the two tagged groups do not cross, every individual in the group with lower average skills would benefit from tagging (assuming that preferences are quasi-linear and the social welfare function is Rawlsian).

The use of a collateral tax sanction is, to some extent, similar to tagging. By targeting a group of taxpayers, a collateral tax sanction allows the conditioned enforcement on a characteristic correlated with earning potential. The difference with tagging is that a collateral tax sanction affects punishment for noncompliance rather than taxes directly. However, as we saw in the previous subsection, punishment plays a role in determining the effective tax rate. Thus, a collateral tax sanction is another way to condition taxes based on ability. If a collateral tax sanction affects some taxpayers more than others, then the former taxpayers have a higher effective tax rate. If a collateral tax sanction is correlated with ability, then the effective tax rate is correlated with ability.

While both collateral tax sanctions and tagging help to make the redistribution of income among people with different earning potentials more efficient, they achieve this effect through different mechanisms. When a tag is available, it allows the government to subdivide people into those with and without the tag and to choose separate taxes for each group. When a collateral tax sanction is used, the taxpayers in the group targeted by the collateral tax sanction have a higher effective tax rate, but the government still has to choose the same statutory tax rate for both groups.

Note that when I refer to tagging I presume that the government observes the tag and can condition on this tag all its income tax instruments. Specifically, in case of a linear tax system, it implies that both the marginal tax rate and the lump-sum transfer can be conditioned on the tag. If this is the case then tagging is a more efficient instrument than a collateral tax sanction. It is because tagging gives the government more flexibility in the sense that any equilibrium achieved with the collateral tax sanction can be replicated by using tagging. However, if the government can condition only the lump-sum transfers on the tag then it is not necessary that this type of tagging dominates the collateral tax sanction.

The fact that a collateral tax sanction enables an alteration of the effective tax rate but not all tax instruments (the statutory tax rate and the lump-sum transfer) reduces the effectiveness of collateral tax sanctions. For example, within the group that is targeted by the collateral sanction (group 2) people with low earning potentials would also experience a high effective tax rate and thus pay higher taxes than their equally-skilled counterparts in group 1. The government, however, cannot adjust the lump-sum transfer for group 2 to compensate for this effect. This makes the redistribution from group 2 to group 1, which is achieved through a higher effective tax rate, less efficient. Therefore, the decision, whether we want to have targeted enforcement or not, depends on the skill distribution within each group. In section 4, I investigate the welfare application of imposing a collateral tax sanction and identify conditions when it is socially beneficial.

4 Welfare and Redistribution

Here I analyze the welfare and redistribution consequences of the imposition of a collateral tax sanction, which is modeled as an increase in the effective tax rate in group 2 (as discussed in the previous section). To do this, I first derive the optimal income tax structure for the case when there is no collateral tax sanction and both groups of taxpayers have the same effective tax rates characterized by the gross effective tax factor which I denote as θ_0. Then, I consider the case when the government imposes a collateral tax sanction and raises the gross effective tax factor in group 2 from θ_0 to θ_2.

To analyze social welfare, I use the CES social welfare function:

$$SWF_{CES} = (\int u(w)^{1-\rho} f(w)dw)^{1/(1-\rho)}. \tag{10}$$

This function is convenient because as parameter ρ increases, the social welfare function becomes more convex and transforms from the pure utilitarian ($\rho = 0$) to the Rawlsian social welfare function ($\rho = \infty$). Moreover, to simplify the derivation, I can rely on the following monotone transformation of the CES social welfare function:

$$SWF_0 = \int \frac{u(w)^{1-\rho}}{1-\rho} f(w)dw. \tag{11}$$

Because social welfare function (11) is a monotone transformation of SWF_{CES} for any ρ, solutions to maximization problems of SWF_{CES} under some constraint set coincide with solutions to problems of SWF (11) under the same constraint set for any ρ.[10]

Given this social welfare preferences, the government's problem is to maximize

$$SWF_0 = \int \frac{\Big(I(w)(1-\theta_0 t) - \varphi(\frac{I(w)}{w}) + G\Big)^{1-\rho}}{1-\rho} f(w)dw, \tag{12}$$

by choosing t and G, subject to the revenue constraint:

$$\int \eta_0 t I(w) f(w)dw = G + R, \tag{13}$$

where R is the external revenue requirement and η_0 is the net effective tax factor corresponding to θ_0.

[10]For a detailed discussion of the properties of this monotone transformation of the CES SWF see Iritani and Miyakawa (2002).

Derive G from revenue constraint (13) and plug it into the above social welfare function, then maximize (12) and simplify the first-order condition to get

$$\frac{\theta_0 t_0}{1-\theta_0 t_0} = \frac{\eta_0 \hat{I} - \theta_0 \widetilde{I}}{\eta_0 \hat{\epsilon} \hat{I}}, \tag{14}$$

where t_0 denotes the optimal tax rate for this case, $\hat{I} = \int I(w)f(w)dw$ is the average income, $\widetilde{I} = \int \beta(w)I(w)f(w)dw$ is the "socially-weighted" income with weights $\beta(w) = \frac{u(w)^{-\rho}}{\int u(w)^{-\rho} f(w)dw}$, and $\hat{\epsilon} = \int \epsilon(w)\frac{I(w)}{\hat{I}}f(w)dw$ is the income-weighted average elasticity, where $\epsilon(w) = \frac{\varphi'(\frac{I}{w})}{\varphi''(\frac{I}{w})\frac{I}{w}}$ is equal to the wage elasticity of the labor supply for a w-type individual.

This expression for t_0 implies that the optimal marginal tax rate is proportional to the difference between the average income multiplied by η_0 and the "socially-weighted" income multiplied by θ_0 and is inversely proportional to the income-weighted average elasticity multiplied by the average income and by η_0.[11]

The weights $\beta(w) = \frac{u(w)^{-\rho}}{\int u(w)^{-\rho} f(w)dw}$ in equation (14) can be interpreted as weight on $u(w)$ in the social welfare function (SWF_0 can be expressed as $\int \beta(w)u(w)f(w)dw$). They are the only variables in equation (14) that depend on parameter ρ which reflects social preferences. Therefore, it is insightful to analyze the behavior of these weights at the limits, that is, when the social welfare function represents the pure utilitarian ($\rho = 0$) and the Rawlsian social welfare functions ($\rho = \infty$). This is done in Lemma 1.

Lemma 1. *Assume* $\beta(w) = \frac{u(w)^{-\rho}}{\int u(w)^{-\rho} f(w)dw}$. *Assume that skill density function* $f(w)$ *is positive and bounded on* $[\underline{w}, \overline{w}]$, *that is,* $f(w) = \begin{cases} > 0, & if\ w \in [\underline{w}, \overline{w}] \\ = 0, & if\ w \notin [\underline{w}, \overline{w}] \end{cases}$ *where* $\underline{w} \geq 0$ *and* $\overline{w} > \underline{w}$ *(*$\overline{w}$ *could be equal to infinity).*

[11] Note that the total tax revenue increases with the effective tax rate, $\frac{\partial TR}{\partial \theta_0 t_0} = \frac{\eta}{\theta}\int_{\underline{w}}^{\overline{w}}(I(w) - \theta_0 t_0 \frac{\partial I(w)}{\partial \theta_0 t_0})f(w)dw = \widetilde{I} > 0$. However, the tax revenue collected from a w-type individual may not increase with the effective tax rate, because $\frac{\partial TR(w)}{\partial \theta_0 t_0} = \frac{\eta_0}{\theta_0}\left(I(w) - \theta_0 t_0 \frac{\partial I(w)}{\partial \theta_0 t_0}\right) = \frac{\eta_0}{\theta_0}\left(I(w) - \theta_0 t_0 \frac{w^2}{\varphi''(\frac{I}{w})}\right) = \frac{\eta_0}{\theta_0} I(w)\left(1 - \epsilon(w)\frac{\eta_0 \int_{\underline{w}}^{\overline{w}} I(w)f(w)dw - \theta_0 \widetilde{I}}{\eta_0 \int_{\underline{w}}^{\overline{w}} \epsilon(w)I(w)f(w)dw}\right)$, which could be positive or negative depending on the size and behavior of $\epsilon(w)$. The reason for this is that an increase in the effective tax rate has two effects on the tax revenue. The first effect is a mechanical effect: an increase in the tax rate gives a higher tax revenue from each dollar of income. This effect increases the tax revenue. The second effect is a labor supply effect: an increase in the tax rate reduces the labor supplied by an individual. This second effect decreases the tax revenue. The total effect of an increase in the tax rate on the tax revenue is determined by the size of those two effects. Note that if the inverse of the wage elasticity of labor supply is constant (i.e., $\epsilon(w) = \epsilon = const$) then the tax revenue collected from a w-type individual increases with the effective tax rate for all w, $\frac{\partial TR(w)}{\partial \theta_0 t_0} = I(w)\frac{\widetilde{I}}{\int_{\underline{w}}^{\overline{w}} \epsilon(w)I(w)f(w)dw}$.

i) $\underset{\rho=0}{lim}\beta(w) = 1$

ii) $\underset{\rho=\infty}{lim}\beta(w) = \begin{cases} \infty, & if\ w = \underline{w} \\ 0, & if\ w \neq \underline{w} \end{cases}$ *with the property* $\int h(w)\beta(w)f(w)dw = h(\underline{w})$ *for any continuous function* $h(w)$*. That is,* $\beta(w - \underline{w})f(w - \underline{w})$ *is the Dirac delta function.*

Proof. See proof in Appendix A.

As Lemma 1 shows, the case of the utilitarian s.w.f. is trivial and all the weights is equal to one. The case of Rawlsian s.w.f. is more interesting. Applying the result of Lemma 1 to equation (14) in the case of Rawlsian s.w.f. ($\rho = \infty$) leads to the following transformation of this equation:

$$\frac{\theta_0 t_0}{1 - \theta_0 t_0} = \frac{\eta_0 \hat{I} - \theta_0 I(\underline{w})}{\eta_0 \hat{\epsilon} \hat{I}}. \tag{15}$$

Before I turn to the analysis of the influence of the collateral tax sanction on social welfare, I need to clarify an implicit assumption about monetary fines. Note that while a monetary fine is not directly present in the model, I presume it is imposed on everyone in the population. Moreover, the value of the monetary fine determines the relationship between the net (η) and gross (θ) effective tax factors. An increase in the monetary fine raises both the net and gross effective tax factors but the magnitudes of those increases in the net and gross effective tax factors could be different depending on the value of the monetary fine. Importantly, if the increase in η is sufficiently large compared to the increase in θ, then a more socially beneficial statutory tax policy can be implemented when a higher monetary fine is imposed. It is a benefit of promoting additional voluntary compliance across the entire population. In Lemma 2 below, I specify the exact conditions when this occurs. To abstract from this effect and focus on the tagging benefit of the collateral tax sanction, later on I impose the assumption that the monetary fine is imposed at the optimal value so that a further increase in the monetary fine would not lead to an improvement in social welfare.

Lemma 2*. Assume that preferences are quasi-linear and the social welfare function is CES. Then,*

i) if $\frac{\partial \eta_0}{\partial \theta_0} > \frac{\eta_0}{\theta_0}$ *then a marginal increase in* θ_0 *increases social welfare;*

ii) if $\frac{\partial \eta_0}{\partial \theta_0} < \frac{\eta_0}{\theta_0}$ $(\frac{\partial \eta}{\partial \theta} = \frac{\eta}{\theta})$ *then a marginal increase in* θ_0 *decreases (does not change) social welfare.*

Proof. See proof in Appendix A.

According to Lemma 2, an increase in θ_0, which occurs due to an increase in the monetary fine, is socially beneficial if $\frac{\partial \eta_0}{\partial \theta_0} > \frac{\eta_0}{\theta_0}$. Thus, to ensure that the monetary fine (imposed on everyone in the population) is set at the optimal value and its further increase would not lead to an improvement in social welfare, I impose *the assumption that*

$$\frac{\partial \eta_0}{\partial \theta_0} = \frac{\eta_0}{\theta_0}. \tag{16}$$

4.1 Optimal Policy with the Collateral Tax Sanction

Consider now the imposition of a collateral sanction that raises the gross effective tax factor in group 2 from θ_0 to $\theta_2 > \theta_0$. Correspondingly, the net effective tax factor in group 2 rises from level η_0 to some level $\eta_2 > \eta_0$ The gross effective tax factor in group 1 stays the same. For symmetry, I denote it by θ_1 ($\theta_1 = \theta_0$). The rest of the structure of the model is the same.

An individual in group i ($i = 1, 2$) maximizes now $u_i = I(1 - \theta_i t) - \varphi(\frac{I}{w}) + G$. Optimal income, $I_i(w)$, that maximizes group i's individual utility, u_i, is determined by the FOC:

$$1 - \theta_i t = \frac{1}{w}\varphi^{'}(\frac{I_i(w)}{w}),\ i = 1, 2. \tag{17}$$

The government now maximizes:

$$SWF = \int \frac{u_1(w)^{1-\rho}}{1-\rho}\frac{f_1(w)}{2}dw + \int \frac{u_2(w)^{1-\rho}}{1-\rho}\frac{f_2(w)}{2}dw \tag{18}$$

by choosing t and G, subject to the revenue constraint:

$$\int_{\underline{w}}^{\overline{w}} \eta_1 t I_1(w)\frac{f_1(w)}{2}dw + \int_{\underline{w}}^{\overline{w}} \eta_2 t I_2(w)\frac{f_2(w)}{2}dw = G + R. \tag{19}$$

Plug the expression for individual utility (17) and the expression for G derived from revenue constraint (19) into the social welfare (18) and then maximize it and simplify the first-order condition to get

$$\frac{\theta_1 t}{1 - \theta_1 t}\eta_1 \hat{\epsilon}_1 \hat{I}_1 + \frac{\theta_2 t}{1 - \theta_2 t}\eta_2 \hat{\epsilon}_2 \hat{I}_2 = (\eta_1 \hat{I}_1 - \theta_1 \widetilde{I}_1) + (\eta_2 \hat{I}_2 - \theta_2 \widetilde{I}_2) \tag{20}$$

where t denotes the optimal tax rate in the case with collateral tax sanction, $\hat{I}_i = \int I_i(w)\frac{f_i(w)}{2}dw$ is the average income in group i, $\widetilde{I}_i = \int \beta_i(w) I_i(w)\frac{f_i(w)}{2}dw$ is the "socially-weighted" income in group i with weights $\beta_i(w) = \frac{u_i(w)^{-\rho}}{\int u_1(w)^{-\rho}\frac{f_1(w)}{2}dw + \int u_2(w)^{-\rho}\frac{f_2(w)}{2}dw}$, and $\hat{\epsilon}_i = \int \epsilon_i(w)\frac{I_i(w)}{\bar{I}_i}f(w)dw$ is the income-weighted average elasticity in group i, where $\epsilon_i(w) = \frac{\varphi'(\frac{I_i}{w})}{\varphi''(\frac{I_i}{w})\frac{I_i}{w}}$ is equal to the wage elasticity of labor supply for a w-type individual in group i.

To determine what happens to social welfare, I assume that labor supply elasticity exhibits a constant wage elasticity, that is, $\varphi(L) = L^{1+1/\epsilon}$, where ϵ is the labor supply elasticity and the strict convexity of φ implies $\epsilon > 0$. This assumption leads to a closed-form solution for optimal incomes, for $i = 1, 2$, which is:

$$I_i(w) = \left(\frac{1-\theta_i t}{1+1/\epsilon}\right)^{\epsilon} w^{1+\epsilon}. \tag{21}$$

The closed-form solution for $I_i(w)$ helps to simplify equation (20) determining t:

$$\begin{gathered}\frac{\theta_1 t}{1-\theta_1 t}\epsilon\eta_1\left(\frac{1-\theta_1 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_1 + \frac{\theta_2 t}{1-\theta_2 t}\epsilon\eta_2\left(\frac{1-\theta_2 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_2 = \\ = \left(\frac{1-\theta_1 t}{1+1/\epsilon}\right)^{\epsilon}(\eta_1\hat{W}_1 - \theta_1\widetilde{W}_1) + \left(\frac{1-\theta_2 t}{1+1/\epsilon}\right)^{\epsilon}(\eta_2\hat{W}_2 - \theta_2\widetilde{W}_2),\end{gathered} \tag{22}$$

as well as equation (14) determining t_0:

$$\frac{\theta_0 t_0}{1-\theta_0 t_0} = \frac{\eta_0\hat{W} - \theta_0\widetilde{W}}{\eta_0\epsilon\hat{W}}, \tag{23}$$

where $\hat{W}_i = \int w^{1+\epsilon}\frac{f_i(w)}{2}dw$, $\widetilde{W}_i = \int \beta_i(w)w^{1+\epsilon}\frac{f_i(w)}{2}dw$, $\hat{W} = \int w^{1+\epsilon}f(w)dw = \hat{W}_1 + \hat{W}_2$, and $\widetilde{W} = \widetilde{W}_1 + \widetilde{W}_2$, where $\beta_i(w) = \frac{u_i(w)^{-\rho}}{\int u_1(w)^{-\rho}\frac{f_1(w)}{2}dw + \int u_2(w)^{-\rho}\frac{f_2(w)}{2}dw}$.

Let us now analyze the effect of a small increase in the effective tax rate in group 2 starting from level θ_0, which reflects the effect of the imposition of a collateral tax sanction at the margin.

Using the closed-form solution for $I_i(w)$, we can simplify the expression for individual utility which is now:

$$u_i = \frac{1}{\epsilon}\left(\frac{1-\theta_i t}{1+1/\epsilon}\right)^{1+\epsilon} w^{1+\epsilon} + G. \tag{24}$$

By differentiating the social welfare (18) w.r.t. θ_2 and estimating the derivative at $\theta_2 = \theta_0$, we can determine how a small increase in the effective tax factor in group 2 (starting from level θ_0) affects social welfare. In doing this, remember that $\frac{\partial SWF}{\partial t} = 0$ and that η_2 rises with

θ_2 ($\frac{\partial \eta_2}{\partial \theta_2} > 0$). The derivative of (24) w.r.t. θ_2 can be expressed as:

$$\left.\frac{\partial SWF}{\partial \theta_2}\right|_{\theta_2=\theta_0} = t\left(\frac{1-\theta_0 t}{1+1/\epsilon}\right)\zeta \hat{W}_2\left[\left.\left(\frac{\widetilde{W}}{\hat{W}}-\frac{\widetilde{W}_2}{\hat{W}_2}\right)\right|_{\theta_2=\theta_0}+\left(\left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0}-\frac{\eta_0}{\theta_0}\right)\right], \tag{25}$$

where $\zeta = \int u_1(w)^{1-\rho}\frac{f_1(w)}{2}dw + \int u_2(w)^{1-\rho}\frac{f_2(w)}{2}dw$.

As equation (25) implies, there are two effects of the imposition of a collateral tax sanction. The first term in brackets in equation (25) represents the targeting benefit of the collateral tax sanction which arises when the redistribution from group 2 to group 1 occurs. The second term represents the voluntary compliance effect. This effect leads to a loss in social welfare because the collateral tax sanction has a higher social compliance cost than the monetary fine (meaning $\frac{\partial \eta_2}{\partial \theta_2} < \frac{\partial \eta_0}{\partial \theta_0}$) and because the monetary fine is assumed to be chosen optimally (meaning $\frac{\partial \eta_0}{\partial \theta_0} = \frac{\eta_0}{\theta_0}$). Thus, $\left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} < \frac{\eta_0}{\theta_0}$.

Because $\left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} - \frac{\eta_0}{\theta_0} < 0$, for the derivative $\left.\frac{\partial SWF}{\partial \theta_2}\right|_{\theta_2=\theta_0}$ to be positive, it should be that

$$\left.\left(\frac{\widetilde{W}}{\hat{W}}-\frac{\widetilde{W}_2}{\hat{W}_2}\right)\right| > \frac{\eta_0}{\theta_0} - \left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0}. \tag{26}$$

Proposition 2 summarizes this result.

> ***Proposition 2***. *Assume that preferences are quasi-linear and the social welfare function is CES. There are two groups of individuals of equal size, each with a continuum of skills. Assume that the wage elasticity of labor supply is constant and identical for the group 1 and 2. Then, a small increase in the effective tax factor in group 2 starting from level θ_0 leads to an increase in social welfare if condition (26) is satisfied.*

Let us now explore the meaning of condition (26). For it to be true, $\widetilde{W}/\hat{W} - \widetilde{W}_2/\hat{W}_2$ should be sufficiently positive, which is equivalent to $\widetilde{W}_1/\hat{W}_1 - \widetilde{W}_2/\hat{W}_2$ being sufficiently positive. Recall that $\hat{W}_i = \int w^{1+\epsilon}\frac{f_i(w)}{2}dw$ and $\widetilde{W}_i = \int \beta_i(w) w^{1+\epsilon}\frac{f_i(w)}{2}dw$. That is, $2\hat{W}_i$ is the average before-tax income in group i and $2\widetilde{W}_i$ is the "socially-weighted" before-tax income in group i. Thus, for $\widetilde{W}_1/\hat{W}_1 - \widetilde{W}_2/\hat{W}_2 \gg 0$ to be true, the ratio of the "socially-weighted" income to the average income in group 1 should be higher than that in group 2. The following lemma presents some sufficient conditions for $\widetilde{W}_1/\hat{W}_1 - \widetilde{W}_2/\hat{W}_2 > 0$.

> ***Lemma 3***. *Assume that skills in group 1 are distributed over $[\underline{w}_1, \overline{w}_1]$ with p.d.f. $F_1(w)$ and skills in group 2 over $[\underline{w}_2, \overline{w}_2]$ with p.d.f. $F_2(w)$, where $\underline{w}_1 > 0$*

and $\underline{w}_2 > 0$. *Then, condition* $\frac{\widetilde{W}_1}{\hat{W}_1} - \frac{\widetilde{W}_2}{\hat{W}_2} > 0$, *where* $\hat{W}_i = \int w^{1+\epsilon} \frac{f_i(w)}{2} dw$, $\widetilde{W}_i = \int \beta_i(w) w^{1+\epsilon} \frac{f_i(w)}{2} dw$, *is satisfied if*

i) parameter ρ *in the social welfare function is sufficiently large, that is,* $\rho \geq \rho_0$, *where* $1 < \rho_0 < \infty$, *meaning the social welfare function is sufficiently convex. The skill distribution in group 2 first-order stochastically dominates the skill distribution in group 1, that is* $F_1(w) \geq F_2(w)$ *for all* w, *with strict inequality for some* w.

ii) parameter ρ *in the social welfare function is equal to* ∞, *that is, s.w.f. is Rawlsian. The lowest skill in group 2,* $\underline{w}_2$, *is larger than the lowest skill in group 1,* $\underline{w}_1$, $(\underline{w}_2 > \underline{w}_1)$.

Proof. See proof in Appendix A.

Overall, the collateral tax sanction can be beneficial due to the targeting benefit even if the monetary fine is chosen optimally and the collateral tax sanction has a higher social compliance cost than the monetary fine. Together, Lemma 3 and Proposition 2 imply that the use of a collateral tax sanction could improve social welfare when the social welfare function is sufficiently concave (i.e., social weights are sufficiently decreasing) and the skill distribution in group 2 first-order stochastically dominates the skill distribution in group 1. Additionally, for the collateral tax sanction to be socially beneficial, it should not impose a very high compliance cost and hence a social cost on taxpayers, that is $\left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} - \frac{\eta_0}{\theta_0}$ should not be too negative. One important thing to note is that I only explore the marginal effect of the imposition of a collateral tax sanction (a small increase in θ_2). If the impact of the collateral tax sanction is large (θ_2 is much larger than θ_0) then an additional examination of its benefit is needed.

I now focus on the Rawlsian s.w.f. directly because in that case we can not only determine the impact on social welfare but establish what happens to the welfare of individuals with different skills in each group.

4.2 Rawlsian Social Welfare

In the case of the Rawlsian s.w.f., we know from Lemma 3 and Proposition 2 that the use of a collateral tax sanction could improve social welfare when the lowest skill level in group 2 is larger than the lowest skill level in group 1 ($\underline{w}_2 > \underline{w}_1$). Moreover, in the case of the Rawlsian s.w.f., we can go further and examine how the imposition of a collateral tax sanction would impact the welfare of individuals with different skills in the two groups. To do this, first, Lemma 2 shows how formula (22) for the optimal tax rate transforms in the case of the Rawlsian s.w.f.. It does so not only for a small increase in θ_2 but for any increase as long as $(1-\theta_2)\underline{w}_2 > (1-\theta_1)\underline{w}_1$. Second, Proposition 3 below establishes that a small increase in the effective tax factor in group 2 from θ_0 to θ_2 redistributes income from group 2 to group 1 through a decrease in the tax rate, t. It also shows that everyone in group 2 receives a loss in their welfare and everyone in group 1 receives a gain in their welfare as a result of an increase in the effective tax factor in group 2.

Lemma 4. *Assume that individual preferences are quasi-linear and φ is strictly convex. There are two groups of individuals of equal size, each with a continuum of skills distributed over different supports: in group 1 over $[\underline{w}_1, \overline{w}_1]$ and in group 2 over $[\underline{w}_2, \overline{w}_2]$.*

i) Assume that $\underline{w}_2$ is sufficiently larger than $\underline{w}_1$, specifically, $(1-\theta_2)\underline{w}_2 > (1-\theta_1)\underline{w}_1$. Then, $\underline{u}_1 < \underline{u}_2$.

ii) Assume that the social welfare function is Rawlsian ($\rho = \infty$). Assume that the wage elasticity of the labor supply is constant and identical for group 1 and 2. Assume that $(1-\theta_2)\underline{w}_2 > (1-\theta_1)\underline{w}_1$. Then, the optimal tax rate is determined by

$$\begin{aligned} &\tfrac{\theta_1 t}{1-\theta_1 t}\epsilon\eta_1\left(\tfrac{1-\theta_1 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_1 + \tfrac{\theta_2 t}{1-\theta_2 t}\epsilon\eta_2\left(\tfrac{1-\theta_2 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_2 = \\ &= \eta_1\left(\tfrac{1-\theta_1 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_1 + \eta_2\left(\tfrac{1-\theta_2 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_2 - \theta_1\left(\tfrac{1-\theta_1 t}{1+1/\epsilon}\right)^{\epsilon}\underline{W}_1, \end{aligned} \tag{27}$$

where $\hat{W}_i = \int_{\underline{w}}^{\overline{w}} w^{1+\epsilon}\frac{f_i(w)}{2}dw$ and $\underline{W}_1 = \underline{w}_1^{1+\epsilon}$.

Proof. See proof in Appendix A.

Proposition 3. *Assume that preferences are quasi-linear and the social welfare function is Rawlsian. There are two groups of individuals of equal size, each with a continuum of skills distributed over different supports: in group 1 over $[\underline{w}_1, \overline{w}_1]$ and in group 2 over $[\underline{w}_2, \overline{w}_2]$, where $\underline{w}_2$ is larger than $\underline{w}_1$. Assume that the wage elasticity of labor supply is constant and identical for group 1 and 2. Assume that the average skill level is sufficiently higher than the lowest skill level. Precisely, assume that $\frac{\eta_0}{\theta_0}(\hat{W}_1+\hat{W}_2) - 2\underline{W}_1 > 0$. Assume also that $\frac{\eta_0}{\theta_0} > \left.\frac{\partial\eta_2}{\partial\theta_2}\right|_{\theta_2=\theta_0} > \frac{\eta_0}{\theta_0} - \frac{\underline{W}_1}{\hat{W}_1+\hat{W}_2} > 0$.[12] Then, a small increase in the effective tax factor in group 2 starting from level θ_0 leads to:*

[12]Note that this condition is condition (26) in the case of Rawlsian s.w.f. which implies that the imposition of the collateral tax sanction is socially beneficial.

i) a decrease in the tax rate, which allows the government to redistribute income from group 2 to group 1;

ii) an increase in the utility for each individual in group 1;

iii) a decrease in the utility for each individual in group 2.

Proof. See proof in Appendix A.

Thus, as proposition 3 shows in the case of Rawlsian s.w.f. when the lowest skill level in group 2 is larger than the lowest skill level in group 1 ($\underline{w}_2 > \underline{w}_1$) the use of a collateral tax sanction could not only improve social welfare, it could raise the welfare of everyone in group 1 and reduces the welfare of everyone in group 2.

I would like to conclude this section by addressing a potential concern that the benefit from a collateral tax sanction under the assumption of linear income tax could arise because collateral tax sanction substitutes for the progressivity of income tax. Given that a collateral tax sanction is correlated with income through its correlation with ability, this indeed might seem concerning. However, this is not the true reason for the collateral tax sanction being beneficial. Recall that a collateral tax sanction helps to improve the design of the tax system by conditioning punishment (effective taxes) based on some characteristic correlated with earning potential. Hence, a collateral tax sanction is beneficial with a nonlinear tax when the cost of the sanction is related to goods whose consumption is increasing in the ability conditional on the level of income.

5 Some Concerns

One might wonder why we need collateral tax sanctions if we have tags. In practice, it might be easier to implement collateral tax sanctions than tags for political reasons. If we want to tax based on ability, then we might want to tax based on the possession of an international passport. But, it might be impossible to do, because it is illegal to restrict your right to travel. However, when a person violates the law, it could be legal to use broader instruments and revoke the passport.

As discussed earlier, an important feature of collateral tax sanctions is that their imposition affects consumption directly. Often, it forces the consumption of a certain good/activity to be reduced to zero. How pronounced the effect of such a restriction is depends on individual preferences. Certainly, some collateral tax sanctions could be very restrictive and could significantly affect a taxpayer's utility.

A sanction which produces a high utility cost has its benefits and downsides. On the one hand, it could be effective if it produces a large deterrence effect. That is, it creates strong incentives for taxpayers to pay their taxes in order to avoid the sanction, so that many taxpayers would pay their taxes and would not be subject to the sanction. On the other hand, if the produced deterrence effect is low, then many taxpayers would be subject to the sanction. Hence, the sanction would substantially reduce social welfare.

It is also necessary to acknowledge that this paper explores only one channel through which collateral tax sanctions affect people. There are many other channels. In addition to affecting evasion behavior, some collateral tax sanctions might actually discourage labor supply. For example, the suspension of a driver's or a professional license may impose some restriction on people's ability to earn money. Second, whenever there is a shadow economy, collateral tax sanctions might stimulate some shadow consumption. The size of those effects is unclear and empirical work is needed to estimate it.

Additionally, the model presumes that the introduction of a collateral tax sanction is accompanied by an optimal adjustment in the tax rate and lump-sum transfer so that the revenue requirement is held fixed. In the real-world, collateral tax sanctions have often been implemented without other tax reforms. In theory, the introduction of a collateral tax sanction without a change in the tax rate and lump-sum transfer would lead to higher tax revenue. Hence, we would need to properly account for the benefit from an increase in tax revenue as well as for a benefit from improved redistribution. To do this, a more sophisticated model and additional assumptions about the value of tax revenue spending is required, which can be considered as a next step on this path.

Finally, this paper analyzes the benefits of the use of collateral tax sanctions only from the social welfare perspective without accounting for various issues in political economy. Certainly, the use of collateral sanctions for tax purposes gives the government additional power, which in the case of a corrupt government might be detrimental (Tanzi (1998)) or in the case of benevolent and more informed government could help to teach taxpayers (D'Antoni and Galbiati (2007)). This concern is important and should be taken into consideration when a tax enforcement policy is chosen.

6 Conclusion

This paper analyzes a collateral tax sanction – the revocation of a privilege provided by the government, imposed for a failure to comply with tax obligations. This paper proposes a new rationale for why it may be beneficial to use collateral tax sanctions for the purpose of tax enforcement. Collateral tax sanctions are a way to impose punishment correlated with a taxpayer's ability and, as a result, can increase social welfare by making the redistribution of income through the tax system more efficient. In other words, a collateral tax sanction might work as a tag. It does this by affecting consumption rather than income, which makes the enforcement targeted to a group of taxpayers. When earning potentials in the targeted group are higher than in the rest of the population, social welfare is raised by the imposition of a collateral tax sanction which helps to redistribute income from the former to the latter group.

The paper develops a model that explores the welfare and redistribution consequences of the imposition of a collateral tax sanction for tax noncompliance. In the model, individuals are heterogeneous in their skills. By imposing a collateral tax sanction correlated with individual earning potential, the government can raise the effective tax rate of a targeted group of taxpayers. Under the CES social welfare function, social welfare increases if the social welfare function is sufficiently concave and the skill distribution in the targeted group first order stochastically dominates the skill distribution in the other group. Under the Rawlsian social welfare function (which is a special case of the CES s.w.f.), social welfare increases when the earning potential of the poorest individual in the targeted group is sufficiently higher than the earning potential of the poorest individual in the rest of the population. This occurs because of a decrease in the new optimal statutory tax rate, which allows an increase in the utility of the rest of population at the cost of decreasing the utility of taxpayers in the targeted group.

Appendix

A Proofs

Proof of Proposition 1

The FOCs the determines the optimal evasion levels $E_1(I,t)$ and $E_2(I,t)$ are $t = \frac{\partial D_1(I,E_1^*)}{\partial E}$ and $t = \frac{\partial D_2(I,E_2^*)}{\partial E}$. Because $D_i(I,E)$ for $i = 1,2$ strictly convex and $\frac{\partial D_2(I,E)}{\partial E} > \frac{\partial D_1(I,E)}{\partial E}$, these FOCs imply that $E_1^* > E_2^*$. Hence, $\eta_2 - \eta_1 = \frac{1}{I}(E_1^* - E_2^*) > 0$ and $\theta_2 - \theta_1 = \frac{1}{I}(E_1^* - E_2^*) - \frac{1}{tI}(D_1(E_1^*) - D_2(E_2^*)) = \frac{1}{tI}[t(E_1^* - E_2^*) - (D_1(E_1^*) - D_1(E_2^*) + D_1(E_2^*) - D_2(E_2^*))] > \frac{1}{tI}[t(E_1^* - E_2^*) - \frac{\partial D_1(E_1^*)}{\partial E}(E_1^* - E_2^*) + (D_2(E_2^*) - D_1(E_2^*)) = \frac{1}{tI}[(D_2(E_2^*) - D_1(E_2^*)] > 0$, where $D_1(E_1^*) - D_1(E_2^*) < \frac{\partial D_1(E_1^*)}{\partial E}(E_1^* - E_2^*)$ because $D_1(\cdot)$ is strictly convex in E, and $(D_2(E_2^*) -$

$D_1(E_2^*) > 0$ because $D_i(I,0) = 0$ $i = 1,2$, and $\frac{\partial D_2(I,E)}{\partial E} > \frac{\partial D_1(I,E)}{\partial E}$. ■

Proof of Lemma 1

Note first that from equation (9) it follows that utility function $u(w)$ is strictly increasing on $[\underline{w}, \overline{w}]$ because "information rent" is positive. That is, $\underset{w}{min} u(w) = u(\underline{w})$.

i) When ρ converges to zero, the result is straightforward. Indeed,

$$\underset{\rho=0}{lim}\beta(w) = \underset{\rho=0}{lim}\frac{u(w)^{-\rho}}{\int u(w)^{-\rho} f(w)dw} = \frac{u(w)^0}{\int u(w)^0 f(w)dw} = \frac{1}{\int f(w)dw} = 1.$$

ii) Consider ρ converges to ∞. Define function $\gamma(w) = \frac{u(\underline{w})}{u(w)}$. Because $u(\underline{w})$ is strictly increasing on $[\underline{w}, \overline{w}]$, function $\gamma(w)$ is strictly decreasing on $[\underline{w}, \overline{w}]$ and $\gamma(\underline{w}) = 1$.

Consider $w = \underline{w}$. Then,

$$\underset{\rho=\infty}{lim}\beta(\underline{w}) = \underset{\rho=\infty}{lim}\frac{\gamma(\underline{w})^\rho}{\int \gamma(s)^\rho f(s)ds} = \underset{\rho=\infty}{lim}\frac{1}{\int \gamma(s)^\rho f(s)ds} = \frac{1}{0} = \infty.$$

Let me show that $\underset{\rho=\infty}{lim} \int \gamma(s)^\rho f(s)ds = 0$. By the definition of the limit, we need to show that $\forall \varepsilon > 0$ $\exists \rho_0$ such that $\forall \rho \geq \rho_0$ $\int_{\underline{w}}^{\overline{w}} \gamma(s)^\rho f(s)ds \leq \varepsilon$. Indeed, define $f_H = \underset{w \in [\underline{w}, \overline{w}]}{max} f(w)$. By the assumptions, f_H is positive and bounded. For any given $\varepsilon > 0$, define ρ_0 such that $\gamma(\underline{w} + \frac{\varepsilon}{2f_H})^{\rho_0} \leq \frac{\varepsilon}{2}$. Such ρ_0 exists because $0 < \gamma(\underline{w} + \frac{\varepsilon}{2f_H}) < 1$. Then, for $\forall \rho \geq \rho_0$ $\int_{\underline{w}}^{\overline{w}} \gamma(s)^\rho f(s)ds = \int_{\underline{w}}^{\underline{w}+\frac{\varepsilon}{2f_H}} \gamma(s)^\rho f(s)ds + \int_{\underline{w}+\frac{\varepsilon}{2f_H}}^{\overline{w}} \gamma(s)^\rho f(s)ds \leq \gamma(\underline{w})^\rho f_H \frac{\varepsilon}{2f_H} + \gamma(\underline{w} + \frac{\varepsilon}{2f_H})^\rho \int_{\underline{w}}^{\overline{w}} f(s)ds = \frac{\varepsilon}{2} + \frac{\varepsilon}{2} = \varepsilon$.

Consider $w > \underline{w}$. Then, $\underset{\rho=\infty}{lim}\beta(w) = \underset{\rho=\infty}{lim}\frac{\gamma(w)^\rho}{\int \gamma(s)^\rho f(s)ds} = \underset{\rho=\infty}{lim}\frac{1}{\int (\gamma(s)/\gamma(w))^\rho f(s)ds} = \frac{1}{\infty} = 0$. Let me now show that $\underset{\rho=\infty}{lim} \int_{\underline{w}}^{\overline{w}} (\gamma(s)/\gamma(w))^\rho f(s)ds = \infty$. Indeed, $\underset{\rho=\infty}{lim} \int_{\underline{w}}^{\overline{w}} (\gamma(s)/\gamma(w))^\rho f(s)ds = \underset{\rho=\infty}{lim} \int_{\underline{w}}^{w} (\gamma(s)/\gamma(w))^\rho f(s)ds + \underset{\rho=\infty}{lim} \int_{w}^{\overline{w}} (\gamma(s)/\gamma(w))^\rho f(s)ds = \infty + 0 = \infty$, where the second limit $\underset{\rho=\infty}{lim} \int_{w}^{\overline{w}} (\gamma(s)/\gamma(w))^\rho f(s)ds$ converges to zero because for $s > w$ $\gamma(s)/\gamma(w) < 1$ and the same consideration as in the previous case are applied. On the other hand, the first limit $\underset{\rho=\infty}{lim} \int_{\underline{w}}^{w} (\gamma(s)/\gamma(w))^\rho f(s)ds$ converges to ∞ because for $\underline{w} \leq s < w$ $\gamma(s)/\gamma(w) > 1$. Let me show this formally by relying on the definition of the limit. Define $f_L = \underset{w \in [\underline{w}, \overline{w}]}{min} f(w)$. By the assumptions, f_L exists and is positive. For any given $\varepsilon > 0$, define ρ_0 such that $(\gamma(\frac{\underline{w}+w}{2})/\gamma(w))^{\rho_0} f_L \frac{w-\underline{w}}{2} > \varepsilon$. Then, for $\forall \rho \geq \rho_0$ $\int_{\underline{w}}^{w} (\gamma(s)/\gamma(w))^\rho f(s)ds > (\gamma((w + \underline{w})/2)/\gamma(w))^\rho \int_{\underline{w}}^{(w+\underline{w})/2} f(s)ds + \int_{(w+\underline{w})/2}^{w} f(s)ds \geq (\gamma((w + \underline{w})/2)/\gamma(w))^\rho f_L \frac{w-\underline{w}}{2} + f_L \frac{w-\underline{w}}{2} > \varepsilon$.
■

Proof of Lemma 2

The derivative of the social welfare function w.r.t. θ_0 is

$$\frac{\partial SWF}{\partial \theta_0} = (\frac{\partial SWF}{\partial t_0} - \frac{\partial SWF}{\partial \eta_0}\frac{\eta_0}{t_0})\frac{\eta_0}{\theta_0} + \frac{\partial SWF}{\partial \eta_0}\frac{\partial \eta_0}{\partial \theta_0} = \frac{\partial SWF}{\partial \eta_0}(\frac{\partial \eta_0}{\partial \theta_0} - \frac{\eta_0}{\theta_0}) =$$
$$= \int u_1(w)^{1-\rho} t\hat{I} f(w)dw(\frac{\partial \eta_0}{\partial \theta_0} - \frac{\eta_0}{\theta_0}),$$

where $\hat{I} = \int I(w)f(w)dw$ is the average income. Thus, $\frac{\partial SWF}{\partial \theta_0}$ is greater, equal or less than zero if $\frac{\partial \eta_0}{\partial \theta_0}$ is greater, equal or less than $\frac{\eta_0}{\theta_0}$. ■

Proof of Lemma 3

i) First, because distribution $F_2(w)$ first-order stochastically dominates distribution $F_2(w)$ and function $w^{1+\epsilon}$ is strictly increasing, it follows that $\hat{W}_2 > \hat{W}_1$. Hence, $\widetilde{W}_1/\hat{W}_1 - \widetilde{W}_2/\hat{W}_2 > 0$. Second, define $\rho_0 = 1 + \frac{G_0}{\alpha_0 \underline{w}_1}$, where $G_0 = \eta_0 t_0 \left(\frac{1-\theta_0 t_0}{1+1/\epsilon}\right)^{\epsilon} \sum_{i=1,2} \int w^{1+\epsilon} \frac{f_i(w)}{2} dw - R$ and $\alpha_0 = \frac{1}{\epsilon}\left(\frac{1-\theta_0 t_0}{1+1/\epsilon}\right)^{1+\epsilon}$ then $\beta_i(w)|_{\theta_2=\theta_0} = \frac{(\alpha_0 w^{1+\epsilon}+G_0)^{-\rho}}{\zeta}$, where $\zeta = \sum_{i=1,2}\int u_i(w)^{1-\rho}\frac{f_i(w)}{2}dw$. Let me now show that if $\rho \geq \rho_0$ then $\beta(w)w^{1+\epsilon}$ is strictly decreasing function. Indeed, $\frac{\partial(\beta(w)w^{1+\epsilon})}{\partial w} = \frac{\partial}{\partial w}(\frac{\zeta w^{1+\epsilon}}{(\alpha_0 w^{1+\epsilon}+G_0)^{\rho}}) = \frac{\zeta(1+\epsilon)w^{\epsilon}}{(\alpha_0 w^{1+\epsilon}+G_0)^{\rho+1}}(G_0 - (\rho-1)\alpha_0 w^{1+\epsilon}) < 0$ for $\rho \geq \rho_0$. Because distribution $F_2(w)$ first-order stochastically dominates distribution $F_2(w)$ and $\beta(w)w^{1+\epsilon}$ is strictly decreasing function, it follows that $-\widetilde{W}_1 < -\widetilde{W}_2$ and $\hat{W}_2 > \hat{W}_1$. Hence, $\widetilde{W}_1/\hat{W}_1 > \widetilde{W}_2/\hat{W}_1 > \widetilde{W}_2/\hat{W}_2$.

ii) According to Lemma 1, $\underset{\rho=\infty}{lim}\beta_1(w) = \begin{cases} \infty, & if\ w = \underline{w}_1 \\ 0, & if\ w > \underline{w}_1 \end{cases}$ and $\underset{\rho=\infty}{lim}\beta_2(w) = 0$ for $w \in [\underline{w}_2, \overline{w}_2]$ because $\underline{w}_1 = min\{\underline{w}_1, \underline{w}_2\}$. Hence, $\widetilde{W}_2 = 0$ and $\widetilde{W}_1 > 0$. Therefore, $\widetilde{W}_1/\hat{W}_1 - \widetilde{W}_2/\hat{W}_2 > 0$. ■

Proof of Lemma 4

i) According to (8), the FOCs are $1 - \theta_i t = \frac{1}{\underline{w}_i}\varphi'(\frac{I_i(\underline{w}_i)}{\underline{w}_i})$, for $i = 1, 2$. Because φ is strictly convex and $(1-\theta_2)\underline{w}_2 > (1-\theta_1)\underline{w}_1$, these FOCs imply $L_2(\underline{w}_2) > L_1(\underline{w}_1)$. Then, $u_2(\underline{w}_2) - u_1(\underline{w}_1) = I_2(\underline{w}_2)(1-\theta_2 t) - I_1(\underline{w}_1)(1-\theta_1 t) - [\varphi(L_2(\underline{w}_2)) - \varphi(L_1(\underline{w}_1))] > I_2(\underline{w}_2)(1-\theta_2 t) - I_1(\underline{w}_1)(1-\theta_1 t) - (1-\theta_2 t)\underline{w}_2(\frac{I_2(\underline{w}_2)}{\underline{w}_2} - \frac{I_1(\underline{w}_1)}{\underline{w}_1}) = ((1-\theta_2 t)\underline{w}_2 - (1-\theta_1)\underline{w}_1)\frac{I_1(\underline{w}_1)}{\underline{w}_1} > 0$, where I have used that $\varphi(L_2(\underline{w}_2)) - \varphi(L_1(\underline{w}_1)) < \varphi'(L_2(\underline{w}_2))(L_2(\underline{w}_2) - L_1(\underline{w}_1))$.

ii) If $(1-\theta_2)\underline{w}_2 > (1-\theta_1)\underline{w}_1$, then according to part i) of this lemma $\underline{u}_1 < \underline{u}_2$. Hence, according to Lemma 1, $\underset{\rho=\infty}{lim}\beta_1(w) = \begin{cases} \infty, & if\ w = \underline{w}_1 \\ 0, & if\ w > \underline{w}_1 \end{cases}$ and $\underset{\rho=\infty}{lim}\beta_2(w) = 0$ for $w \in [\underline{w}_2, \overline{w}_2]$. Therefore, formula (22) reduces to (27). ■

Proof of Proposition 3

Note that formula (27) for t_0 when $\theta_1 = \theta_2 = \theta_0$ reduces to

$$\theta_0 t_0 = \frac{\eta_o(\hat{W}_1 + \hat{W}_2) - \theta_o \underline{W}_1}{(1+\epsilon)\eta_o(\hat{W}_1 + \hat{W}_2) - \theta_o \underline{W}_1}, \tag{A.1}$$

where I used that $\int_{\underline{w}}^{\overline{w}} w^{1+\epsilon} f(w)dw = \int_{\underline{w}}^{\overline{w}} w^{1+\epsilon}\frac{f_1(w)}{2}dw + \int_{\underline{w}}^{\overline{w}} w^{1+\epsilon}\frac{f_2(w)}{2}dw$.

To determine the sign of the change in the tax rate as a result of an increase in the effective tax factor, differentiate (27) w.r.t. θ_2 and estimate the derivative $\frac{\partial t}{\partial \theta_2}$ at $\theta_2 = \theta_0$ to get

$$\begin{aligned} \left.\frac{\partial t}{\partial \theta_2}\right|_{\theta_2=\theta_0} = \frac{t_0 \hat{W}_2}{\theta_0(\hat{W}_1+\hat{W}_2)} \left[\frac{-(\frac{\eta_0}{\theta_0}(\hat{W}_1+\hat{W}_2)-2\underline{W}_1)-\theta_0 t_0(1+\epsilon)\underline{W}_1}{(\frac{v_0}{\theta_0}(\hat{W}_1+\hat{W}_2)-\underline{W}_1)}\right] - \\ -\frac{t_0\hat{W}_2}{\eta_0(\hat{W}_1+\hat{W}_2)}\frac{(1-\theta_0 t_0)\theta_0\underline{W}_1}{(\eta_0(\hat{W}_1+\hat{W}_2)-\theta_0\underline{W}_1)}\left(\frac{\eta_0}{\theta_0} - \left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0}\right), \end{aligned} \tag{A.2}$$

where the last term in the above equation is negative because $\left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} - \frac{\eta_0}{\theta_0} < 0$.

For $\left.\frac{\partial t}{\partial \theta_2}\right|_{\theta_2=\theta_0}$ to be negative, it is sufficient to have $\frac{\eta_0}{\theta_0}(\hat{W}_1 + \hat{W}_2) - 2\underline{W}_1 > 0$.[13] This implies that the average skill level should be sufficiently higher than the lowest skill level. If so, the optimal tax rate decreases with an increase in the effective tax factor, implying that tax revenue collected from taxpayers in group 1 decreases. The effective tax rate in group 2, however, increases, because $\left.\frac{\partial \theta_2 t}{\partial \theta_2}\right|_{\theta_2=\theta_0} = \frac{t_0}{\hat{W}_1+\hat{W}_2}\left(\hat{W}_1 + \frac{\epsilon\theta_0 t_0 \hat{W}_2 \underline{W}_1^2}{(\frac{\eta_0}{\theta_0}(\hat{W}_1+\hat{W}_2)-\underline{W}_1)^2}\right) - \frac{t_0\hat{W}_2}{(\hat{W}_1+\hat{W}_2)}\frac{\epsilon\theta_0 t_0 \hat{W}\underline{W}_1}{(\frac{\eta_0}{\theta_0}(\hat{W}_1+\hat{W}_2)-\underline{W}_1)^2}\left(\frac{\eta_0}{\theta_0} - \left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0}\right) > \frac{t_0\hat{W}_1}{\hat{W}_1+\hat{W}_2} > 0$ assuming that $\left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} > \frac{\eta_0}{\theta_0} - \frac{min\{\underline{W}_1,\underline{W}_2\}}{\hat{W}_1+\hat{W}_2}$.[14] When the effective tax factor in group 2 increases, the lump-sum transfer also increases, because $\left.\frac{\partial G}{\partial \theta_2}\right|_{\theta_2=\theta_0} = (1+\frac{1}{\epsilon})^{-\epsilon}(1-\theta_0 t)^{\epsilon}(1-\epsilon\frac{\theta_0 t_0}{1-\theta_0 t_0})\frac{\epsilon\eta_0\theta_0\hat{W}_2\underline{W}_1^2}{(\eta_0(1+\epsilon)(\hat{W}_1+\hat{W}_2)-\theta_0\underline{W}_1)^2} > 0$ presuming $\left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} = \frac{0}{\theta_0}$. This means that the increase in the taxes paid by taxpayers in group 2 outweighs the decrease in the taxes paid by taxpayers in group 1.

The expression for $\underline{u}_i(w)$ and for $u_i(w)$ for $i = 1, 2$ are now

$$\underline{u}_i = (1+\frac{1}{\epsilon})^{-\epsilon}\left(\eta_1 t(1-\theta_1 t)^{\epsilon}\hat{W}_1 + \eta_2 t(1-\theta_2 t)^{\epsilon}\hat{W}_2 + \frac{1}{1+\epsilon}(1-\theta_i t)^{1+\epsilon}\underline{w}_i^{1+\epsilon}\right) - R, \tag{A.3}$$

[13] Note that this condition is easily satisfied if $\underline{w}_1$ is close to zero.

[14] The tax revenue paid by taxpayers in group 2 is $TR_2 = \rho_2 t\left(\frac{1-\theta_2 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_2$, and it could increases or decrease because $\frac{\partial TR_2}{\partial \theta_2} = \left(\frac{1-\theta_2 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_2\left[\frac{W_2}{\hat{W}_1+\hat{W}_2}\left.\frac{\partial \theta_2 t}{\partial \theta_2}\right|_{\theta_2=\theta_0} - t_0\left(\frac{\rho_0}{\theta_0} - \left.\frac{\partial \rho_2}{\partial \theta_2}\right|_{\theta_2=\theta_0}\right)\right] \gtreqless 0$ depending of the size of $\left.\frac{\partial \rho_2}{\partial \theta_2}\right|_{\theta_2=\theta_0}$. It is positive if $\left.\frac{\partial \rho_2}{\partial \theta_2}\right|_{\theta_2=\theta_0}$ is not much less than $\frac{\rho_0}{\theta_0}$.

$$u_i = \underline{u}_i + (1+\frac{1}{\epsilon})^{-\epsilon}\frac{1}{1+\epsilon}(1-\theta_i t)^{1+\epsilon}(w^{1+\epsilon} - \underline{w}_i^{1+\epsilon}). \tag{A.4}$$

By differentiating the above utilities w.r.t. θ_2, we can determine how an increase in the effective tax factor in group 2 affects the utilities of individuals in each group. In doing this, remember that now $\frac{\partial \underline{u}_1}{\partial t} = 0$, because t is chosen to maximize $\underline{u}_1$. The derivatives of the utilities w.r.t. θ_2 are

$$\left.\frac{\partial \underline{u}_1}{\partial \theta_2}\right|_{\theta_2=\theta_0} = (1+\frac{1}{\epsilon})^{-\epsilon} t_0 (1-\theta_0 t_0)^{\epsilon} \left[\frac{\hat{W}_2 \underline{W}_1}{\hat{W}_1 + \hat{W}_2} - \hat{W}_2 \left(\frac{\eta_0}{\theta_0} - \left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} \right) \right] > 0, \tag{A.5}$$

$$\left.\frac{\partial u_1}{\partial \theta_2}\right|_{\theta_2=\theta_0} = \left.\frac{\partial \underline{u}_1}{\partial \theta_2}\right|_{\theta_2=\theta_0} + (1+\frac{1}{\epsilon})^{-\epsilon}(1-\theta_0 t_0)^{\epsilon}\theta_0 \left(- \left.\frac{\partial t}{\partial \theta_2}\right|_{\theta_2=\theta_0} \right) (w^{1+\epsilon} - \underline{w}_1^{1+\epsilon}) > 0, \tag{A.6}$$

$$\begin{aligned} \left.\frac{\partial \underline{u}_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} = (1+\tfrac{1}{\epsilon})^{-\epsilon} \tfrac{t_0(1-\theta_0 t_0)^{\epsilon}}{\hat{W}_1+\hat{W}_2} \left[-\hat{W}_1 \underline{W}_2 - \tfrac{(1-\theta_0 t_0)\hat{W}_2 \underline{W}_1^2 (\underline{W}_2 - \underline{W}_1)}{\frac{\eta_0}{\theta_0}(\hat{W}_1+\hat{W}_2)(\frac{\eta_0}{\theta_0}(\hat{W}_1+\hat{W}_2) - \underline{W}_1)} \right] - \\ -(1+\tfrac{1}{\epsilon})^{-\epsilon} t_0 (1-\theta_0 t_0)^{\epsilon} \hat{W}_2 \left(\tfrac{\eta_0}{\theta_0} - \left.\tfrac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} \right) < 0, \end{aligned} \tag{A.7}$$

$$\left.\frac{\partial u_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} = \left.\frac{\partial \underline{u}_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} + (1+\frac{1}{\epsilon})^{-\epsilon}(1-\theta_0 t_0)^{\epsilon} \left(- \left.\frac{\partial \theta_2 t}{\partial \theta_2}\right|_{\theta_2=\theta_0} \right) (w^{1+\epsilon} - \underline{w}_2^{1+\epsilon}) < 0, \tag{A.8}$$

where the estimate of the sign of $\left.\frac{\partial \underline{u}_1}{\partial \theta_2}\right|_{\theta_2=\theta_0}$ presuming that $\left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0}$ is not too small, specifically, that $\left.\frac{\partial \eta_2}{\partial \theta_2}\right|_{\theta_2=\theta_0} > \frac{\eta_0}{\theta_0} - \frac{min\{\underline{W}_1, \underline{W}_2\}}{\hat{W}_1+\hat{W}_2}$.

These derivatives imply that everyone in group 2 receives a loss in their welfare and everyone in group 1 receives a gain in their welfare as a result of an increase in the effective tax factor in group 2. Because the Rawlsian social welfare function in this case is equal to $\underline{u}_1$, social welfare increases. ■

B Relaxation of the Assumptions

I now relax the assumption that the gross effective tax factor and the net effective tax factor do not depend on the tax rate, that is, I now presume that $\theta(t)$ and $\eta(t)$. To separate the influence of the tax rate on θ and η from the influence of the collateral tax sanction, I denote the collateral tax sanction by s. I assume that when the collateral tax sanction is imposed ($s > 0$), we have $\frac{\partial\theta_2}{\partial s} > 0$ ($\frac{\partial\eta_2}{\partial s} > 0$) and $\frac{\partial\theta_1}{\partial s} = 0$ ($\frac{\partial\eta_1}{\partial s} = 0$).

First, note that the FOC describing the solution of the individual problem does not change, that is, $(1 - \theta_i(t)t) = \frac{1}{w}\varphi'(\frac{I_i(w)}{w})$. However, the derivative of income w.r.t. the tax rate is now $\frac{\partial I_i}{\partial t} = -\frac{\theta_i + t\frac{\partial\theta_i}{\partial t}}{1-\theta_i t}\epsilon(w)I_i(w)$.

Second, under the assumption that the labor supply elasticity exhibits a constant wage elasticity ($\varphi(L) = L^{1+1/\epsilon}$, $\epsilon > 0$), the FOC characterizing the optimal tax rate is now

$$\frac{(\theta_1 + t\frac{\partial\theta_1}{\partial t})t}{1-\theta_1 t}\epsilon\eta_1\left(\frac{1-\theta_1 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_1 + \frac{(\theta_2 + t\frac{\partial\theta_2}{\partial t})t}{1-\theta_2 t}\epsilon\eta_2\left(\frac{1-\theta_2 t}{1+1/\epsilon}\right)^{\epsilon}\hat{W}_2 =$$
$$= \left(\frac{1-\theta_1 t}{1+1/\epsilon}\right)^{\epsilon}((\eta_1 + t\frac{\partial\eta_1}{\partial t})\hat{W}_1 - (\theta_1 + t\frac{\partial\theta_1}{\partial t})\widetilde{W}_1) + \left(\frac{1-\theta_2 t}{1+1/\epsilon}\right)^{\epsilon}((\eta_2 + t\frac{\partial\eta_2}{\partial t})\hat{W}_2 - (\theta_2 + t\frac{\partial\theta_2}{\partial t})\widetilde{W}_2), \tag{A.9}$$

and equation (23) determining t_0 is now

$$\frac{(\theta_0 + t\frac{\partial\theta_0}{\partial t})t_0}{1-\theta_0 t_0} = \frac{(\eta_0 + t\frac{\partial\eta_0}{\partial t})\hat{W} - (\theta_0 + t\frac{\partial\theta_0}{\partial t})\widetilde{W}}{\epsilon\eta_0\hat{W}}, \tag{A.10}$$

where $\hat{W}_i = \int w^{1+\epsilon}\frac{f_i(w)}{2}dw$, $\widetilde{W}_i = \int \beta_i(w)w^{1+\epsilon}\frac{f_i(w)}{2}dw$, $\hat{W} = \int w^{1+\epsilon}f(w)dw = \hat{W}_1 + \hat{W}_2$, and $\widetilde{W} = \int \beta(w)w^{1+\epsilon}f(w)dw = \widetilde{W}_1 + \widetilde{W}_2$.

Finally, the derivative of (24) w.r.t. s can be expressed as:

$$\left.\frac{\partial SWF}{\partial s}\right|_{\theta_2=\theta_0} = \frac{\partial\theta_2}{\partial s}t\left(\frac{1-\theta_0 t}{1+1/\epsilon}\right)\hat{W}_2\left[\left.(\frac{\widetilde{W}}{\hat{W}} - \frac{\widetilde{W}_2}{\hat{W}_2})\right|_{\theta_2=\theta_0} + (\left.\frac{\partial\eta_2}{\partial\theta_2}\right|_{\theta_2=\theta_0} - \frac{\eta_0 + t\frac{\partial\eta_0}{\partial t}}{\theta_0 + +t\frac{\partial\theta_0}{\partial t}})\right]. \tag{A.11}$$

This equation is analogous to equation (25) and leads to the following condition for the collateral tax sanction to be socially beneficial:

$$\left.(\frac{\widetilde{W}}{\hat{W}} - \frac{\widetilde{W}_2}{\hat{W}_2})\right|_{\theta_2=\theta_0} > \frac{\eta_0 + t\frac{\partial\eta_0}{\partial t}}{\theta_0 + +t\frac{\partial\theta_0}{\partial t}} - \left.\frac{\partial\eta_2}{\partial\theta_2}\right|_{\theta_2=\theta_0}. \tag{A.12}$$

Thus, the use of the collateral tax sanction could improve social welfare when the social welfare function is sufficiently concave and the skill distribution in group 2 first-order stochastically dominates the skill distribution in group 1.

References

Akerlof, George A. 1978. “The Economics of ”Tagging” as Applied to the Optimal income Tax, Welfare Programs, and Manpower Planning.” *The American Economic Review*, 68(1): 8–19.

Andreoni, James. 1991. “Reasonable Doubt and the Optimal Magnitude of Fines: Should the Penalty Fit the Crime?” *The RAND Journal of Economics*, 22(3): 385–395.

Andreoni, James. 1992. “IRS as Loan Shark: Tax Compliance with Borrowing Constraints.” *Journal of Public Economics*, 49: 35–46.

Becker, Gary S. 1968. “Crime and Punishment: An Economic Approach.” *Journal of Political Economy*, 76(2): 169–217.

Blank, Joshua D. 2014. “Collateral Compliance.” *162 University of Pennsylvania Law Review.*

Cremer, Helmuth, Firouz Gahvari, and Jean-Marie Lozachmeur. 2010. “Tagging and Income Taxation: Theory and an Application.” *American Economic Journal: Economic Policy*, 2(1): 31–50.

D’Antoni, Massimo, and Roberto Galbiati. 2007. “A signaling theory of nonmonetary sanctions.” *International Review of Law and Economics*, 27: 204–218.

Iritani, Jun, and Toshiji Miyakawa. 2002. “A Note on the Monotone Transformation of CES Social Welfare Functions.” *Kobe University Economic Review*, 48: 19–28.

Kopczuk, Wojciech. 2001. “Redistribution When Avoidance Behavior Is Heterogeneous.” *Journal of Public Economics*, 81(1): 51–71.

Polinsky, A. Mitchell, and Steven Shavell. 1984. “The Optimal Use of Fines and Imprisonment.” *Journal of Public Economics*, 24: 89–99.

Tanzi, Vito. 1998. “Corruption Arround the World: Causes, Consequences, Scope, and Cures.” *IMF Staff Papers*, 45: 559–94.

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