A Political Economy Model of Tax Evasion

Zsófia L. Bárány, London School of Economics and CEP

January 31, 2009

[PRELIMINARY AND INCOMPLETE]

Abstract

Tax evasion seems to be a persistent phenomenon: no matter how effective the tax enforcement, or how simple the rules of taxation become, it remains present in all countries. The variation in its estimates for different economies suggests that politicians might be turning a blind eye to tax evasion in order to gain popularity. The tax rates and the enforcement structure implicitly define the benefits from evading taxes. However, the society is heterogenous in the sense that some members can take advantage of these benefits while others cannot. This heterogeneity implies that the presence of tax evasion changes tax incidence significantly. This paper outlines a model where taxes, enforcement and public good are determined in an electoral competition. The model predicts two different equilibria: a *"bad equilibrium"* and a *"good equilibrium"*. In the "bad equilibrium" a big fraction of the population evades taxes, with low public good provision. In the "good equilibrium" relatively fewer, more wealthy people evading taxes, with higher public good provision, but here redistribution is from the middle income group to the rich and the poor. In a dynamic setting these two paths can be self maintaining in the sense, that once in the "bad equilibrium" it only gets worse, with more and more people evading and the economy turning greyer, while starting from the "good equilibrium" the economy gets whiter, although perfect compliance is never achieved.

JEL Classification: E620, H240, H230

Contact email: barany@lse.ac.uk
Contact phone: +447726446564, +36702931717

1 Introduction

Tax evasion seems to be a persistent phenomenon: no matter how effective the tax enforcement, or how simple the rules of taxation become, it remains present in all countries. The existing literature has extensively studied both the determinants of individual evasion behaviour and the optimal tax policy in the presence of evasion. In this paper I take a different perspective: I examine tax evasion as the equilibrium outcome of voting on taxes and enforcement.

Countries have diverse tax systems with different levels of taxes and of enforcement. Even though tax evasion is present in all economies, the extent of evasion can vary significantly, both in terms of what fraction of the population is involved and in terms of which income groups are affected. Perfect compliance cannot be achieved in any tax system, but the estimated magnitude of evasion in some cases suggests that this phenomenon is not only about the inability to enforce perfect compliance. In 2001 the US net tax gap was estimated to be 13.7 percent, with 57 percent of the nonfarm proprietor income not reported (Slemrod 2007). In the United Kingdom it is estimated that on average about one third of self-employment income is not reported to the tax authorities (Pissarides and Weber 1989). The magnitude of tax evasion is smaller in Sweden, it was estimated to be 9 percent in 1997 and 8 percent in 2000 (Slemrod 2007). Tax evasion seems to be exceptionally widespread in Italy: the underground economy is estimated to be between 27 and 48 percent of the official GDP, and entrepreneurs are estimated to underreport their income by at least 40 percent (Fiorio and d'Amuri 2005). These estimates suggest that politicians might be turning a blind eye to tax evasion as a means of gaining popularity.

The tax rates and the enforcement structure implicitly define the benefits from evading taxes. However, the society is heterogenous in the sense that some members can take advantage of these benefits while others cannot: a civil servant, whose payroll taxes are deducted at origin has much lower potential gains than someone who is self-employed. This heterogeneity has an impact on tax incidence, redistribution and public good provision. The nature of this heterogeneity can vary among countries, but it is well known to the politicians and the population. Hence, when implementing a tax system, which comprises of taxes *and* enforcement, it will clearly favour some groups at the cost of others. In this paper I model tax evasion as the equilibrium outcome of a voting game, where politicians try to win in an election by implicitly *determining the gains from evading taxes* for certain groups.

The evasion decision of the agents is based on the deterrence model from the seminal paper by Allingham and Sandmo (1972). In their model agents regard tax evasion as a gamble: given the probability of detection and the extent of the punishment taxpayers choose the optimal level of tax evasion to maximize expected utility. This simple model has since then been extended in many ways, here I focus on the versions that are relevant to the model presented here.[1]

This model has been criticized on the grounds that it predicts too much evasion: given their setup, either everyone will evade, or nobody will. Baldry (1986) provided some experimental evidence that tax evasion is not regarded as a simple gamble, while Slemrod and Yitzhaki showed using US data for the audit probability and the fines that if tax evasion was regarded as a gamble, then everybody should be evading to some extent, which contradicts the evidence (Slemrod and Yitzhaki 2002, p. 1341). While this model treats agents as atomistic actors, in reality people exist in a society. hence, it is easy to imagine that social norms and interactions influence the evasion behaviour of agents. Gordon (1989) and Myles and Naylor (1996) build models where agents derive some utility for adhering to the standard pattern of the others' behaviour, whereas Erard and Feinstein (1994) build on the role of guilt and shame.

Cowell and Gordon (1988) closed the model by adding public good provision: through the balanced budget requirement of the government evasion influences the amount of public good provided, which in turn can have an affect on the evasion decision of the individual (see Becker et al. (1987) for experimental evidence).

I relax the assumption of a benevolent government and replace it with office-motivated politicians who compete in an election. The behaviour of individuals who can evade taxes is based on the optimal tax evasion literature: tax evasion is modeled as a gamble. In this model I analyze taxes, enforcement and public good provision as the equilibrium outcome of electoral competition.

This paper builds on a line of research that determines the level and direction of redistribution in an economy based on the relative size and political power of different income groups. I extend this idea by incorporating the heterogeneous possibility of tax evasion into these models. In most countries it is evident that tax evasion is present, while it is also relatively clear at every moment in time which are the occupations that can involve tax evasion or alternatively tax avoidance. Also, the relative size and income of these groups is more or less known. Adding these observations to the probabilistic voting model when politicians compete for the votes of citizens, it is natural that besides the tax rates, tax enforcement can also be an important feature.

This model seeks to answer the following questions: How does the relative size and power of the potential evaders and the non-evaders determine taxes, enforcement and public good provision? How does the relative income of evaders and non-evaders affect the policy outcome? How does their political commitment affect the policy outcome?

[1] For an overview of the extensions see Slemrod and Yitzhaki (2002), Andreoni et al. (1998) or Cowell (1990).

2 Model

2.1 Agents

Consider an economy with a continuum of heterogeneous agents, where the mass of the population is normalized to unity. Agents differ in two dimensions: in their income, denoted by y and in their ability to evade taxes (E or N).

This heterogeneity in the ability to evade taxes implies that some agents are capable of hiding their entire income, or any fraction of it from the tax authorities. Other agents do not have any means to underreport their income. This assumption builds on its observed counterpart: different occupations involve different opportunities to evade or avoid income taxation. For example there are occupations, such as being an employee of a multinational company or of a big organization, being a public or civil servant, where the payroll tax is deducted at the origin, i.e. by the employer. If this is the only or main source of income for the agent, then tax evasion is impossible, or its extent is minimized. On the other hand there are many occupations such as running a small shop or cafe, self-employment, providing household services where the opportunity to evade some of the income taxes is present. There are also some activities where tax avoidance rather than tax evasion is more prominent, such as privately owned small and medium companies. In this model tax evasion and tax avoidance are treated under the same category, since from the point of view of the analysis the main feature of both activities is that the individuals fail to pay the amount of tax that is intended by the law. The class of occupations for which it is possible to evade taxes greatly varies across countries, but in a given country it changes very slowly. Therefore, in this model the division of occupations into ones with the possibility of tax evasion and the ones without is treated as exogenous.

The income y of the agents is heterogenous and is given exogenously in this model. It seems reasonable to assume that the income level and the occupation are correlated and hence there is also some correlation between the income level and the possibility to evade taxes. This however, is probably not a perfect correlation, i.e. none of the income levels is exclusive to an occupation which involves the possibility of evading taxes and vice versa. Hence in all income categories there will be members of different occupations: some of which can evade taxes, some of which cannot.

To simplify calculations, assume that there are three income categories, rich, middle income and poor, with $y^R > y^M > Y^P$ respective income levels. Denote by $\alpha^{I,J}$ the fraction of the population with income y^I and belonging to group $J \in \{E, N\}$, so for example the fraction of the population that had middle income level and cannot hide any of their income is $\alpha^{M,N}$, and $\sum_I \sum_J \alpha^{I,J} = 1$.

2.2 Tax Authority

The income of the agents is not known by the government or the tax authority, and hence the tax authority cannot tell from the amount of tax paid by any single individual whether that agent complied to the taxes or not. In order to verify the tax reports the tax authority has to audit some individuals. In this model it is assumed that the tax authority audits a fixed proportion π of the population. This probability represents the tax authority's capacity to review and audit tax return forms. It is also assumed that all individuals have this same probability π of being audited. This might seem as an unreasonable assumption, since probably the tax authorities in most countries have a well-defined selection criteria which leads to auditing individuals from certain income and occupation categories more often than others. These occupational and income categories might differ significantly across countries due to differences in the type of occupations that can easily evade, and the motivations of the tax agency (for example: profit maximization, influence from lobbies, corruption, etc). However, the tax authority also has an incentive to keep the selection method for audits hidden from the agents, otherwise the agents could adjust their methods of tax evasion to avoid the audits. Based on this agents might form an expectation about the probability that they will be audited in the same way across occupations and income categories.

The tax scheme consists of a tax key, τ, an audit probability, π, a fine rate, f. When agents evade taxes they report a lower income $\widetilde{y} < y$, where $e = y - \widetilde{y} > 0$ is the amount of income hidden from the tax authority. In case of an audit the tax agency finds out the true income y with certainty and collects both the missing tax and a fine proportional to the amount of denied income, hence the total amount collected is: $(\tau + f)e$. In this model the government can choose $\tau \in [0, 1]$ and $f \geq \underline{f}$ where $\underline{f}$ is an exogenous lower bound to the penalty. The government runs a balanced budget and all taxes and fines collected are used to provide the public good g that cannot be targeted to any specific group.

As mentioned before π is the audit probability which is considered as exogenous. There are two reasons to take π as given and f as a choice variable: first of all increasing π, the probability of an audit potentially involves hiring auditors and developing the related infrastructure, which is costly and time-consuming, whereas changing f, the fine rate for detected evasion is costless. Second, it is without loss of generality since in the case of risk neutral individuals increasing f is ex-ante equivalent to increasing π.

When an individual is caught evading his or her taxes, there is an additional fixed cost besides the fine levied on him/her by the tax agency. This cost can be regarded either as a non-monetary cost or as a monetary cost or a combination of the two. If an individual is caught evading taxes, which is learned by his family, friends, colleagues and neighbors this might cause him to feel ashamed of himself for breaking the law, it might inflict a moral cost on him, as well as it might carry some stigma effect with it. Also if the auditing process finds that there is something wrong with the tax return forms, then the verdict itself, the determination of the fine, the collection of it doesn't happen instantaneously, but it takes some time, the individual has to go to court, to the tax agency and has to hire a lawyer, which also bears some costs with it. In this sense there is an additional monetary cost of tax evasion, but this is not collected by the tax agency, and hence doesn't go towards the financing of the public good. In any case, we can capture all of these costs in the monetary equivalent of $F > 0$ fixed cost.

2.3 Tax Evasion Decision

Each individual has the same quasi-linear preference over private consumption c and publicly provided non-targeted goods g, which is given by:

$$U = c + H(g) \tag{1}$$

where $H(\cdot)$ is a concave, increasing function. The utility is linear in c, which implies that the agents are risk-neutral in the consumption of the private good. This might be a surprising assumption, but it is generally used in the literature of public good provision financed by taxes, and it greatly simplifies that calculations as well. The public good is financed by a linear income tax with tax rate $\tau \in [0, 1]$.

Saving is not possible in this economy, hence agents consume all their after tax income. The utility of an agent from group N with income y is hence:

$$W^N = (1 - \tau)y + H(g) \tag{2}$$

Given a tax scheme individuals who can evade taxes choose reported income (or equivalently the amount evaded) to maximize expected utility:

$$W^E \equiv \max_{e \geq 0} E(U) = \max_{e \geq 0} \pi[(1-\tau)y - fe - dF] + (1-\pi)[(1-\tau)y + \tau e] + H(g) \tag{3}$$

where d is a dummy variable which takes the value 1 if $e > 0$ and is equal to 0 if $e = 0$. With probability π the agent is audited and in this case he has to pay the entire tax plus a fine linear in the amount evaded, fe, while he also suffers a utility loss of F if $e > 0$. With probability $1 - \pi$ he is not audited, and in this case, he saves τe on taxes. In any case, he enjoys the public good that is provided $H(g)$. When maximizing his utility the agent does not take into account his effect on the provision of public good, g, since every agent is infinitesimal. W^E denotes the maximized expected utility of an agent from group E.

Since agents are risk neutral they will either evade all their taxes or report their entire income truthfully depending on whether the tax-gamble is more than fair or not. Formally the first order condition yields the following result:

$$e = \begin{cases} y & \text{iff} \quad f < \frac{1-\pi}{\pi}\tau - \frac{F}{y} \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

Equation (4) clearly shows that given a tax rate τ and a fine rate f there exists an income level $y_{\tau,f} = \frac{F}{\frac{1-\pi}{\pi}-f}$ such that all individuals from group E with income $y \leq y_{\tau,f}$ will report their income truthfully, while individuals with income $y > y_{\tau,f}$ will hide their entire income from the tax authorities. Technically, an agent with income exactly equal to the threshold level would be indifferent between hiding the income or reporting it truthfully, since in expected terms the income in the two cases are equal. However, we will assume a weak type of risk aversion: when the expected utility is the same, agents prefer the less risky option. Hence agents with income $y = \frac{F}{\frac{1-\pi}{\pi}-f}$ will report their entire income truthfully.

Given this optimal behaviour by the agents, the government's budget constraint implies that the level of public good g provided will depend on τ, π and f the following way:

$$g = \int_{i \in N} \tau y_i f_N(y_i) di + \int_{i \in E \wedge y_i \leq y_\tau} \tau y_i f_E(y_i) di + \int_{i \in E \wedge y_i > y_\tau} \pi(\tau + f) y_i f_E(y_i) di \tag{5}$$

2.4 Voting

There are two candidates or parties indexed by $P = A, B$ competing in the election. Both candidates are assumed to be office motivated, i.e. they only care about winning, which entails some ego rent $R > 0$. Candidate P hence chooses his policy platform in order to maximize $p_P \cdot R$, where p_P is the probability of winning the election given the other candidate's policy platform.

The platform that the politicians offer contains the tax rate, the fine for evading taxes and the public good provided, $q_P = (\tau_P, f_P, g_P)$. Both the probability of having an audit π and the fixed cost if caught evading, F are regarded as fixed for now.

The voting model used here is known as the probabilistic voting model. In these models the candidates can differ in the platforms that they offer and in another dimension that is orthogonal to the policy platform that they choose. This other dimension can represent a different policy, or alternatively it can capture some popularity component - in any case it captures effects that are not at the focus of the current analysis. This additional component is modeled as out of reach for the politician, i.e. he cannot influence its outcome directly, which is captured by the fact that it is stochastic. Consequently, in these models when voters cast their vote, they not only care about the utility that is implied by the offered platform, but also about what is happening in this other orthogonal dimension to the two parties. The stochastic nature of this component guarantees the existence of an equilibrium.

The stochastic ideology shock itself consists of two shocks: an aggregate δ and an idiosyncratic σ^I popularity shock. We model the shock as a net shock, i.e. the difference between the shock to the popularity of candidate B and that of candidate A. The aggregate shock affects all the agents in the economy in the same way, i.e. it takes the value δ for every single agent, which comes from a uniform distribution: $\delta \sim U[-\frac{1}{2\psi}, \frac{1}{2\psi}]$. The idiosyncratic shock has an income specific uniform distribution and is individual to every single agent even within that income category: $\sigma^I \sim U[-\frac{1}{2\phi^I}, \frac{1}{2\phi^I}]$. This idiosyncratic shock makes it possible for two agents from the same income group and with the same possibility to evade taxes to vote for different candidates.

The timing of the elections is as follows: (1) both candidates simultaneously choose their policy platforms p_A, p_B, (2) the popularity shocks are realized (3) elections are held where all agents cast a vote for one of the two candidates, (4) the elected candidate implements his announced platform.

For simplicity and without loss of generality consider the following setup of incomes: there are three income groups in the society, the rich, the middle income and the poor, denoted by $I = R, M, P$ with incomes $y^R > y^M > y^P$. Now $y_i \in \left\{y^R, y^M, y^P\right\}$. Denote by $\alpha^{I,J}$ the fraction of the population who has income y^I and is from group $J \in \{E, N\}$, i.e. the poor who can evade $\{P, E\}$ represent $f_E(y^P) = \alpha^{P,E}$ fraction of the society.

Returning to the probabilistic voting setup, individual i will vote for candidate A instead of candidate B given their respective platforms if:

$$W^{I,J}(q_A) > W^{I,J}(q_B) + \sigma^{i,I} + \delta \tag{6}$$

where $I \in \{R, M, P\}$ identifies the income level, $J \in \{E, N\}$ identifies whether the agent can or cannot evade taxes and i identifies the agent within group $\{I, J\}$. That is an agent will prefer candidate A to candidate B if his utility from the platform offered by candidate A is greater than the utility from the platform of candidate B plus the popularity difference for B. This implies that any individual from group $\{I, J\}$ will vote for candidate A if his/her idiosyncratic shock is low enough. The cutoff sigma identifies the swing-voter, i.e. the agent who is indifferent between voting for A and voting for B:

$$\overline{\sigma}^{I,J} \equiv W^{I,J}(q_A) - W^{I,J}(q_B) - \delta \tag{7}$$

Given the platforms of candidate A and candidate B, the identity of the swing voter is pinned down. Then the vote share of candidate A in group $\{I, J\}$ is just the share of agents with their idiosyncratic shocks below $\overline{\sigma}^{I,J}$. Since there is a continuum of agents in all the groups this is equal to:

$$\rho_A^{I,J} \equiv P(\sigma^{I,J} < \overline{\sigma}^{I,J}) = \phi^I(\sigma^{I,J} + \frac{1}{2\phi^I}) = \frac{1}{2} + \phi^I\sigma^{I,J} = \frac{1}{2} + \phi^I(W^{I,J}(q_A) - W^{I,J}(q_B) - \delta) \tag{8}$$

while his/her vote share in the population is:

$$\rho_A = \sum_J \sum_I \alpha^{I,J}\pi_A^{I,J} = \frac{1}{2} - \delta \sum_J \sum_I \alpha^{I,J}\phi^I + \sum_J \sum_I \alpha^{I,J}\phi^I(W^{I,J}(q_A) - W^{I,J}(q_B)) \tag{9}$$

Both candidate A and candidate B maximize the probability that they win given the other candidate's platform:

$$p_A \equiv P(\rho_A > \frac{1}{2}) = \frac{1}{2} + \frac{\psi}{\phi} \sum_J \sum_I \alpha^{I,J}\phi^I(W^{I,J}(q_A) - W^{I,J}(q_B)) \tag{10}$$

where $\phi = \sum_J \sum_I \alpha^{I,J}\phi^I$.

3 Equilibrium

In equilibrium candidate A chooses q_A to maximize the probability that he wins, p_A, while candidate B chooses q_B to maximize his probability of winning, $1 - p_A$. Equation 10 shows that the two candidates are maximizing symmetric functions, hence, in the unique Nash equilibrium they will offer the same platform. From the definition of p_A it is clear that both politicians choose their policy platform in order to maximize a weighted average of the utility that the agents derive from these policies. This is a common feature of probabilistic voting models: in equilibrium the candidates will maximize a weighted social welfare function, where the weights, $\alpha^{I,J}\phi^I$ incorporate both the group size, $\alpha^{I,J}$ and the responsiveness of the groups to the fiscal policy, ϕ^I.

To analyze the policy platform offered in equilibrium, consider candidate A who is choosing q_A to maximize the probability of winning which is equivalent to maximizing the following:

$$\max_{q_A} \sum_J \sum_I \alpha^{I,J}\phi^I W^{I,J}(q_A) \tag{11}$$

Recall from equation (4) that the utility $W^{I,E}$ will depend on the relationship between f,τ and y^I. Namely if $y^I \geq \frac{F}{\frac{1-\pi}{\pi}\tau - f}$ then all individuals from group $\{I, E\}$ will evade their taxes, and hence $W^{I,E} = (1 - \pi\tau - \pi f)y^I - \pi F + H(g)$. On the other hand if $y^I < \frac{F}{\frac{1-\pi}{\pi}\tau - f}$ then all individuals from group $\{I, E\}$ will report their income truthfully and their utility will be $W(I, E) = (1 - \tau)y^I + H(g)$. This implies that the objective function will be different across the $\{\tau, f\}$ space. The stepwise nature of the objective function is due to optimization of consumers: given a tax rate and a penalty rate only individuals above a certain threshold of income ($y_{\tau,f}$) will choose to evade their taxes. Depending on the place of the policy platfrom in the $\{\tau, f\}$ space, different groups will evade. This implies that there are four different regions, all of which can provide one potential equilibrium platform: everyone evades, the middle income and the rich evade, only the rich evade and nobody evades.

In every region, there is at most one platform that can be offered as a winning policy platform. Consider for example the case where the poor do not evade taxes and the middle income and the rich do. The maximization of the objective function with respect to the public good pins down the level of g. [2] Given this level of public good the only question is how to collect the revenue to finance it. Since this is the case where only the rich and the middle income evade, f has to satisfy the following: $\frac{1-\pi}{\pi}\tau - \frac{F}{y^P} \leq f < \frac{1-\pi}{\pi}\tau - \frac{F}{y^M}$. Moreover, as the objective function is linear in f, the fine will either be the highest possible or the lowest possible, depending on which f maximizes the probability of winning. This in turn depends on which group is stronger: those who are evading taxes or those who are not. This boils down to the following: if $\frac{\sum_{I=R,M} \alpha^{I,E} y^I \phi^I}{\pi \sum_{I=R,M} \alpha^{I,E} y^I} > \frac{\alpha^{P,E} y^P \phi^P + \sum_I \alpha^{I,N} y^I \phi^I}{\alpha^{P,E} y^P + \sum_I \alpha^{I,N} y^I}$, then as low penalty as possible maximizes the probability of winning and vice versa. The condition is quite intuitive: it simply means that by an infinitesimal decrease of the penalty rate the candidate wins more votes than how much he loses by doing this. The candidate gains votes from the evaders who win from a decrease of the penalty rate, while he loses part of his vote share from the non-evaders who have to pay higher taxes in this case. Hence, in this scenario it is optimal to make the penalty rate as low as possible, i.e. setting $f = \frac{1-\pi}{\pi}\tau - \frac{F}{y^P}$. However, when the converse is true, then the platform will never win, since f has to be strictly smaller than $\frac{1-\pi}{\pi}\tau - \frac{F}{y^M}$. Hence when setting the penalty rate as high as possible, the two candidates would overbid each other until reaching the limit, thus pushing the platform over to another region, where only the rich evade. This implies that the rich and the middle income group evading can only be an equilibrium if $\frac{\sum_{I=R,M} \alpha^{I,E} y^I \phi^I}{\pi \sum_{I=R,M} \alpha^{I,E} y^I} > \frac{\alpha^{P,E} y^P \phi^P + \sum_I \alpha^{I,N} y^I \phi^I}{\alpha^{P,E} y^P + \sum_I \alpha^{I,N} y^I}$ holds.

There is a similar parametric condition for all other regions to contain the winning platform. The equilibrium platforms and the condition of stability are summarized in Appendix A.

Notice that if $\phi^I = \phi$ for every $I \in \{P, M, R\}$ then the above specified existence condition holds with equality as do all the other existence conditions.[3] This implies that if all groups have the same political power, than increasing

[2]In this case, g has to satisfy: $H_g(g) = \frac{1}{\phi} \frac{\pi \sum_{I=R,M} \alpha^{I,E} y^I \phi^I + \alpha^{P,E} y^P \phi^P + \sum_I \alpha^{I,N} y^I \phi^I}{\pi \sum_{I=R,M} \alpha^{I,E} y^I + \alpha^{P,E} y^P + \sum_I \alpha^{I,N} y^I}$.

[3]See Appendix A.

the penalty and decreasing the tax rate or vice versa wins exactly as many votes as it loses. Hence the optimal platform in every sector is identified up to the level of public good, but as to how that is financed - how it is split between taxes and penalties - there aren't any clear predictions. The optimal level of public good in every sector is going to be the same, pinned down by $H_g(g^*) = 1$.[4]

The four possible equilibrium types all imply different levels of taxes, penalties, and public good. These three policies determine the level and direction of redistribution. In the next two sections I will analyze how the policy platform implemented in equilibrium is chosen and the comparative statics of the different types of equilibrium platforms through a simplified case.

3.1 Comparative Statics of an Easier Case

To analyze the different types of equilibria I simplify the algebra by setting the income of the poor to zero: $y^P = 0$. Since the poor do not owe any income tax, they cannot evade their taxes either. This implies that the equilibrium when everyone evades and when only the middle income and the rich evade become indistinguishable. This simplification implies that there will be only three types of equilibria. This loss is worth the simplification it gives in the calculations: since the contribution of the poor to the public good is minor anyway, setting it to zero does not affect my results greatly.

As established in the previous section, the potential equilibrium in every sector of the (τ, f) space is unique and it exists if a politically powerful enough segment of the population support it. The three sectors and the corresponding potential equilibria are: everyone evades (AE), the rich evade (RE) and nobody evades (NE):[5]

1. Everyone evades: In this case the possible evaders pay relatively lower contributions compared to those who do not have this possibility. Hence the redistribution is in general from rich to poor and from non-evaders to evaders. $g_{AE}, \tau_{AE}, f_{AE}$

2. The rich evade: Redistribution is from middle income to rich and poor, and non-evaders to evaders. $g_{NE}, \tau_{RE}, f_{RE}$

3. Nobody evades: Redistribution goes the usual way: from higher income individuals to lower income ones. $g_{NE}, \tau_{NE}, f_{NE}$

[4]This is the "social optimum" defined as the maximizing point of a utilitarian welfare function.

[5]See the conditions for existence of each type of equilibrium, and the characterization of the equilibrium platforms in Appendix B.

The following propositions summarize the main comparative statics: the level and direction of the redistribution that prevails in the different equilibrium types.

Proposition 1. *The level of redistribution, g_{NE} and the tax rate, τ_{NE} is lower in the equilibrium where nobody evades taxes than it is in all other equilibrium types, given that there are other potential equilibrium platforms.*

Proof. See Appendix C. □

Proposition 2. *If there exists a (RE) equilibrium platform and there exists an (AE) equilibrium platform, then the level of redistribution is highest if only the rich evade: $g_{RE} > g_{AE} > g_{NE}$.*

Proof. See Appendix C. □

The results in the propositions above come from the balance of two effects. As we move from sector to sector more and more potential evaders choose not to evade. We can call this the *tax base effect*, which implies that as more and more people start to pay the tax that they owe, the total amount of taxable income increases. For example, when moving from sector (AE) to sector (RE), the tax base changes from $\pi \sum_{R,M} \alpha^{I,E} y^I + \sum_{R,M} \alpha^{I,N} y^I$ to $\pi\alpha^{R,E}y^R + \alpha^{M,E}y^M + \sum_{R,M} \alpha^{I,N} y^I$, implying an increase in the tax base of $(1-\pi)\alpha^{M,E}y^M$. The other mechanism is the *tax price effect* which is driven by the the actual tax incidence. As an individual chooses not to evade any of his taxes, he feels the entire burden of the tax, while when choosing to evade some of his tax, his burden is lower: $\tau > \pi(\tau + f)$. Put in another way, when an individual is not evading taxes, he bares a higher proportion of the public good on himself, he feels the real cost of the public good. While when an individual is evading taxes, then a smaller portion of the public good is financed from his taxes, he is in a way free riding on other people's taxes. This change in how an individual perceives a tax gives him an incentive to vote on a lower tax rate when not evading and hence on a lower public good provision. These two effects offset each other to some extent. Which effect dominates depends on their relative weight, which is governed by the existence conditions. As shown in the Appendix when moving from the (AE) sector to the (RE) sector the *tax base effect* is stronger, while when moving from the (AE) to the (NE) or from the (RE) to the (NE) then the *tax price effect* is stronger.

The direction of the redistribution is also different across the sectors. In the (NE) case redistribution goes the conventional way: income is redistributed through the public good from those with higher income to those with lower income. More precisely, if $y^M < \overline{y} \equiv \sum_J \sum_I \alpha^{I,J} y^I$ then redistribution goes from rich to those with middle and low income, whereas if $y^M > \overline{y}$ then redistribution is from rich and middle income to poor. The condition under which only the rich contribute more than average to the public good is equivalent to:

$$\frac{1-\alpha^{M,N}-\alpha^{M,E}}{\alpha^{R,E}+\alpha^{R,N}} < \frac{y^R}{y^M}$$

In the (RE) case the average contribution to the public good is:

$$\begin{aligned} & \tau(\textstyle\sum_{R,M}\alpha^{I,N}y^I+\alpha^{M,E}y^M+\frac{\widehat{\tau}}{\tau}\alpha^{R,E}y^R) \\ where \qquad & \widehat{\tau}=\pi(\tau+f)=\tau-\pi\frac{F}{y^M}<\tau \end{aligned}$$

The rich evaders will pay less than the middle income if: $\frac{y^R}{y^M} < \frac{\tau}{\widehat{\tau}}$, this is more likely to happen, the higher y^M is and the smaller π, F are. The middle income will contribute more than average to the public good if:

$$\frac{1-\alpha^{M,E}-\alpha^{M,N}}{\alpha^{R,N}+\frac{\widehat{\tau}}{\tau}\alpha^{R,E}} > \frac{y^R}{y^M}$$

Which will be more likely to hold if π, F is lower and the smaller is the share of the middle income, and the higher is the share of the rich evaders.

In the (AE) case the average contribution to the public good is:

$$\begin{aligned} & \tau(\textstyle\sum_{R,M}\alpha^{I,N}y^I+\frac{\widehat{\tau}}{\tau}\sum_{R,M}\alpha^{I,E}y^I) \\ where \qquad & \widehat{\tau}=\pi(\tau+\underline{f})<\tau \end{aligned}$$

The rich non-evaders pay the most, and the middle income evaders pay the least apart from the poor, who do not pay any income tax: $\widehat{\tau}y^M < (\tau y^M, \widehat{\tau}y^R) < \tau y^R$. Whether the middle income non-evaders or the rich evaders pay more tax depends on whether the income inequality, $\frac{y^R}{y^P}$ or the tax discrepancy, $\frac{\tau}{\widehat{\tau}}$ is higher. The middle income non-evaders will contribute more than average if:

$$\frac{1-\frac{\widehat{\tau}}{\tau}\alpha^{M,E}-\alpha^{M,N}}{\alpha^{R,N}+\frac{\widehat{\tau}}{\tau}\alpha^{R,E}} > \frac{y^R}{y^M}$$

Which will be more likely to hold if $\tau-\widehat{\tau}$ is higher, equivalently if π and $\underline{f}$ are lower, and the smaller is $\alpha^{M,N}$, and the higher is the share of the rich evaders.

In general without tax evasion if income inequality is high, income is redistributed towards the middle income and the poor. In the presence of tax evasion however, this seems less plausible: if the probability of audit is low, the fraction of rich evaders is high and the income inequality is not that high, then the middle income will contribute more than average to the public good.

The two interesting equilibrium types are the (AE) and the (RE) case.[6] As proposition 2 shows, the public good provision will be higher when only the

[6]The last case with everybody reporting their income truthfully does not seem to occur in reality.

rich evade taxes. As to which equilibrium will feature higher tax rates the model does not have clear predictions: this will greatly depend on the group sizes and the degree of income inequality. In the (AE) equilibrium the redistribution will be more similar to the usual one: from rich to poor and from non-evaders to evaders. The redistribution in (RE) will feature the expropriation of the middle class by the rich and the poor. [7] Since the middle income group will not evade any of their taxes in equilibrium, most of the burden of providing the public good will be on this group, and those who will enjoy this will be the poor and the rich.

3.2 Platform Offered in Equilibrium

To determine which equilibrium will be offered and implemented in equilibrium, we have to consider which platforms exist and if more than one exists, then we have to consider the pairwise race of two different types of potential equilibria.

Empirical evidence suggests that both the (AE) and the (RE) potential equilibrium platforms are likely to exist. The (RE) platform exists if $\phi^R > \phi^M$. The parameter ϕ^I captures the responsiveness of voters in income group I to economic policy. Responsiveness to policy is greater in ideologically more homogenous groups. For this model the implication is that the (RE) equilibrium platform exists if rich voters are more alike ideologically than the middle income group or if they give a higher weight to economic policy. If the opposite is true than the (RE) platform cannot be offered in equilibrium. The (AE) potential equilibrium platform will exist, if $\frac{\sum_{R,M}\alpha^{I,E}y^I\phi^I}{\sum_{R,M}\alpha^{I,E}y^I} > \frac{\sum_{R,M}\alpha^{I,N}y^I\phi^I}{\sum_{R,M}\alpha^{I,N}y^I}$. This condition is equivalent to: $(\frac{\alpha^{R,E}}{\alpha^{M,E}} - \frac{\alpha^{R,N}}{\alpha^{M,N}})(\phi^R - \phi^M) > 0$. If the (RE) equilibrium exists, then the (AE) will exists as well as long as the share of rich in the evader group is larger than their share in the non-evader group. The available evidence suggest that the potential to evade income is decreasing at the low end and increasing in income at the high end of the distribution, i.e. $\frac{\alpha^{M,E}}{\alpha^{M,N}} < \frac{\alpha^{R,E}}{\alpha^{R,N}}$.[8] However, if the (RE) equilibrium does not exist, then this empirical evidence suggests that the (AE) equilibrium will not exist either.

In general the probability that equilibrium A will win against equilibrium B is (recall equation (10)):

[7] The poor in this version of the model can actually be either evading or not evading, since their income is set to zero. It is probably more realistic to assume they have a small positive income, and that they do evade taxes to some extent.

[8] A more general modeling of tax evasion is to model income as composed of a visible and an invisible part. Visible income is reported by a third party, while invisible income is subject to self-reporting. It is a commonly used stylized fact that middle income people have the highest fraction of visible income due to the fact that employment is the most widespread in that category. In the present framework this translates to a low $\frac{\alpha^{M,E}}{\alpha^{M,N}}$ ratio.

$$p_A \equiv P(\rho_A > \frac{1}{2}) = \frac{1}{2} + \frac{\psi}{\phi} \sum_J \sum_I \alpha^{I,J} \phi^I (W^{I,J}(q_A) - W^{I,J}(q_B))$$

Based on the above the most likely scenario is that both the (RE) and the (AE) equilibrium platforms exist.[9] The condition under which the (RE) equilibrium will be implemented is:

$$\sum_J \sum_I \alpha^{I,J} \phi^I (W^{I,J}(q_{RE}) - W^{I,J}(q_{AE})) \geq 0 \tag{12}$$

By plugging in the optimum platforms within sector (RE) and (AE) the above is equivalent to the following:

$$\begin{array}{rl} & H(g_{RE}) - H(g_{AE}) + K > \frac{\tilde{\underline{y}}}{y} H_g^{-1}\left(\widetilde{\frac{\underline{y}_{RE}}{y_{RE}}}\right) - \widetilde{\frac{\underline{y}_{AE}}{y_{AE}}} H_g^{-1}\left(\widetilde{\frac{\underline{y}_{AE}}{\underline{\tilde{y}}_{AE}}}\right) \\ where & K = \pi\left(\frac{1}{\phi}\left(\frac{F}{y^M} + \underline{f}\right) \sum_{R,M} \alpha^{I,E} \phi^I y^I - \frac{F}{y^M} \alpha^{R,E} y^R \frac{\underline{\tilde{y}}}{y}\right) \end{array} \tag{13}$$

The following proposition characterizes the regions of the parameter space where it is more likely that platform (RE) will be implemented in equilibrium.[10]

Proposition 3. *It is more likely that the equilibrium platform from sector (RE) will be implemented than the one from sector (AE) if the exogenous parameters of enforcement: $F, \underline{f}$ or π are higher.*

Proof. See Appendix D. □

The fact that stricter enforcement - i.e. higher minimum penalty, higher fixed costs if caught evading and higher probability of being caught - make equilibrium (RE) more appealing to a majority of the citizens is quite intuitive. These are all changes that make evasion less attractive, and hence have a more detrimental effect on the popularity of the (AE) sector than on the popularity of the (RE) sector.

4 Conclusion

In this paper I have modeled tax evasion as the equilibrium outcome of electoral competition. Politicians offer the possibility to evade taxes to a certain

[9] I will only focus on the decision between these two platforms as the (NE) equilibrium cannot be observed anywhere.

[10] Without specifying the utility function for the public good, $H(g)$ it is impossible to characterize the set of parameters that guarantee that platform (RE) will be implemented. How the relative income, the group size and their political power affect which platform will be implemented is work in progress.

fragment of those who have this possibility. Through tax evasion, the incidence of taxation will be different than otherwise predicted: the burden of financing the public good will be on those who either cannot evade taxes or on those for who tax evasion is not worth it, while the tax evaders will be free-riding to some extent on the public good.

There are two interesting equilibrium types: one where everyone evades taxes, the (AE) equilibrium (henceforth "bad") and one where only the rich evade, the (RE) equilibrium (henceforth "good"). In the "bad equilibrium" a big fraction of the population evades taxes, with low public good provision. In the "good equilibrium" relatively fewer, more wealthy people evading taxes, with higher public good provision.

Future research could explore the implications of such a setup in a dynamic model, where there is more than one election, and in between elections people can change occupations, and hence modify their opportunities to evade taxes. Also, one could argue, that in those countries where tax evasion is a widespread phenomenon, the moral cost or stigma associated with tax evasion is lower (modeled here as a fixed cost F). Hence, once a country gets into a bad equilibrium, the fixed cost F would decline by the next election and the fraction of the population with the opportunity to evade taxes would increase as well (an increase in $\alpha^{I,E}$ as opposed to $\alpha^{I,N}$). The opposite would happen in the case of starting from the "good equilibrium". This suggests that in a dynamic setting these two paths could be self maintaining in the sense, that once in the "bad equilibrium" it only gets worse, with more and more people evading and the economy turning greyer, while starting from the "good equilibrium" the economy gets whiter, although perfect compliance is never achieved.

References

ALLINGHAM, M. G., AND A. SANDMO (1972): "Income Tax Evasion: A Theoretical Analysis," *Journal of Public Economics*, 1(3-4), 323–338.

ANDREONI, J., B. ERARD, AND J. FEINSTEIN (1998): "Tax Compliance," *Journal of Economic Literature*, 36(3-4), 818–860.

BALDRY, J. C. (1986): "Tax evasion is not a gamble," *Economics Letters*, 22, 333–335.

BECKER, W., H.-J. BUECHNER, AND S. SLEEKING (1987): "The Impact of Public Transfer Expenditures on Tax Evasion, an Experimental Approach," *Journal of Public Economics*, 34, 243–252.

COWELL, F. A. (1990): *Cheating the Government*. MIT Press, Cambridge, MA.

COWELL, F. A., AND J. P. F. GORDON (1988): "Unwilligness to Pay, Tax Evasion and public Good provision," *Journal of Public Economics*, 36, 305–321.

ERARD, B., AND J. FEINSTEIN (1994): "The Role of moral Sentiments and Audit Perceptions in Tax Compliance," *Public Finance*, 49, 70–89.

FIORIO, C. V., AND F. D'AMURI (2005): "Workers' tax evasion in Italy," *European Journal of Political Economicy*, Working Paper 104, Universitá Commerciale Luigi Bocconi, Econpubblica, Centre for Research on the Public Sector.

GORDON, J. P. F. (1989): "Individual morality and reputation costs as deterrents to tax evasion," *European Economic Review*, 33, 797–800.

MYLES, G. D., AND R. A. NAYLOR (1996): "A model of tax evasion with group conformity and social customs," *European Journal of Political Economy*, 12, 49–96.

PISSARIDES, C. A., AND G. WEBER (1989): "An Expenditure-Based Estimate of Britain's Black Economy," *Journal of Public Economics*, 39(1), 17–32.

SLEMROD, J. (2007): "Cheating Ourselves: The Economics of Tax Evasion," *Journal of Economic Perspectives*, 21(1), 25–48.

SLEMROD, J., AND S. YITZHAKI (2002): "Tax Avoidance, Evasion and Administration," in *Handbook of Public Economics, Volume 3*, ed. by A. J. Auerbach, and M. S. Feldstein. Amsterdam: Elsevier Science.

A Equilibrium Platforms and Existence Conditions

The objective function has to be maximized in all four sectors. Across the sectors, not just the objective function itself, but the budget constraint of the government is different as well. The maximization of this continuous function, which has a different functional form across the sectors yields at most four local maximum points. The maximization problem is formally defined below. Here $W^{I,E}$ is the maximized utility of an agent facing τ, f, g policy platform. The sets of the budget constraint are defined below.

$$max_{\tau,f,g} \sum_J \sum_I \alpha^{I,J}\phi^I W^{I,J}(\tau,f,g)$$
$$s.t. \quad g = \tau \sum_I \alpha^{I,N} y^I + \tau \sum_{I\in A} \alpha^{I,E} y^I + \pi(\tau+f) \sum_{I\in B} \alpha^{I,E} y^I$$

sector type	A and B	range for f
Everyone evades	$A=\emptyset$ $B=\{P,M,R\}$	$f \in [\underline{f}, \frac{1-\pi}{\pi}\tau - \frac{F}{y^P})$
Middle income and rich evade	$A=P$ $B=\{M,R\}$	$f \in [\frac{1-\pi}{\pi}\tau - \frac{F}{y^P}, \frac{1-\pi}{\pi}\tau - \frac{F}{y^M})$
Rich evade	$A=\{P,M\}$ $B=\{R\}$	$f \in [\frac{1-\pi}{\pi}\tau - \frac{F}{y^M}, \frac{1-\pi}{\pi}\tau - \frac{F}{y^R})$
Nobody evades	$A=\{P,M,R\}$ $B=\emptyset$	$f \geq \frac{1-\pi}{\pi}\tau - \frac{F}{y^R}$

Plugging in the optimal behaviour of the potential evaders and maximizing the objective function we get that the four possible local maxima are:

1. Everyone evades

   - Optimal government expenditure: $H_g(g_{AE}) = \frac{1}{\phi}\frac{\pi\sum_I \alpha^{I,E}y^I\phi^I + \sum_I \alpha^{I,N}y^I\phi^I}{\pi\sum_I \alpha^{I,E}y^I + \sum_I \alpha^{I,N}y^I}$
   - Optimal tax rate: $\tau_{AE} = \frac{g_{AE}}{\pi\sum_I \alpha^{I,E}y^I + \sum_I \alpha^{I,N}y^I}$
   - Optimal fine rate: $f_{AE} = \underline{f}$
   - Condition for existence: $\frac{\sum_I \alpha^{I,E}y^I\phi^I}{\sum_I \alpha^{I,E}y^I} > \frac{\sum_I \alpha^{I,N}y^I\phi^I}{\sum_I \alpha^{I,N}y^I}$

2. Rich, middle income evade

   - Optimal government expenditure: $H_g(g_{RM}) = \frac{1}{\phi}\frac{\pi\sum_{I=R,M} \alpha^{I,E}y^I\phi^I + \alpha^{P,E}y^P\phi^P + \sum_I \alpha^{I,N}y^I\phi^I}{\pi\sum_{I=R,M} \alpha^{I,E}y^I + \alpha^{P,E}y^P + \sum_I \alpha^{I,N}y^I}$
   - Optimal tax rate: $\tau_{RM} = \frac{g_{RM} + \pi\frac{F}{y^P}\sum_{I=R,M}\alpha^{I,E}y^I}{\sum_I \alpha^{I,E}y^I + \sum_I \alpha^{I,N}y^I}$
   - Optimal fine rate: $f_{RM} = \frac{1-\pi}{\pi}\tau_{RM} - \frac{F}{y^P}$
   - Condition for existence: $\frac{\sum_{I=R,M} \alpha^{I,E}y^I\phi^I}{\sum_{I=R,M} \alpha^{I,E}y^I} > \frac{\alpha^{P,E}y^P\phi^P + \sum_I \alpha^{I,N}y^I\phi^I}{\alpha^{P,E}y^P + \sum_I \alpha^{I,N}y^I}$

3. Rich evade

   - Optimal government expenditure: $H_g(g_{RE}) = \frac{1}{\phi}\frac{\pi\alpha^{R,E}y^R\phi^R + \sum_{I=P,M} \alpha^{I,E}y^I\phi^I + \sum_I \alpha^{I,N}y^I\phi^I}{\pi\alpha^{R,E}y^R + \sum_{I=P,M} \alpha^{I,E}y^I + \sum_I \alpha^{I,N}y^I}$

- Optimal tax rate: $\tau_{RE} = \frac{g_{RE}+\pi \frac{F}{y^M}\alpha^{R,E}y^R}{\sum_I \alpha^{I,E}y^I + \sum_I \alpha^{I,N}y^I}$
- Optimal fine rate: $f_{RE} = \frac{1-\pi}{\pi}\tau_{RE} - \frac{F}{y^M}$
- Condition for existence: $\phi^R > \frac{\sum_{I=P,M} \alpha^{I,E}y^I\phi^I + \sum_I \alpha^{I,N}y^I\phi^I}{\sum_{I=P,M} \alpha^{I,E}y^I + \sum_I \alpha^{I,N}y^I}$

4. Nobody evades

- Optimal government expenditure: $H_g(g_{NE}) = \frac{1}{\phi}\frac{\sum_I \alpha^{I,E}y^I\phi^I \sum_I \alpha^{I,N}y^I\phi^I}{\sum_I \alpha^{I,E}y^I + \sum_I \alpha^{I,N}y^I}$
- Optimal tax rate: $\tau_{NE} = \frac{g_{NE}}{\sum_I \alpha^{I,E}y^I + \sum_I \alpha^{I,N}y^I}$
- Optimal fine rate: $f_{NE} \geq \frac{1-\pi}{\pi}\tau_{NE} - \frac{F}{y^R}$

The last point in the first three sectors defines the condition under which there exists a local extreme point in the given sector. Basically if the objective function is increasing in the penalty rate, f, then the maximizing point would be on the border of the two sectors. However, a point is on the border between two sectors, there will be a set of individuals, who will be exactly indifferent between evading taxes and reporting their income truthfully. In this case, I assume that these individuals are better off by reporting their true income even if in expected terms their income is the same in the two cases.[11] This implies that when the objective function is increasing in f, then there does not exist a maximizing point within that sector. The last conditions hence summarize under which condition is the objective function decreasing in f.

B Equilibrium Platforms and Existence Conditions for the Simplified Case

In this case we have exactly the same setup as before, just the income of the poor, y^P is set to zero. This makes two of the sectors indistinguishable, the (AE) and the (RM) sector are computationally equivalent, since the porr do not have any income taxation to evade. This gives us the following set of sectors and maximizing points:

1. Everyone evades

- Optimal government expenditure: $H_g(g_{AE}) = \frac{\widetilde{y_{AE}}}{y_{AE}}$ where the political power and group size weighted average taxed income is $\widetilde{y_{AE}} \equiv \frac{\pi \sum_{R,M} \alpha^{I,E}y^I\phi^I + \sum_{R,M} \alpha^{I,N}y^I\phi^I}{\phi}$ and the tax base (or average taxable income) is: $y_{R,M} \equiv \pi \sum_{AE} \alpha^{I,E}y^I + \sum_{R,M} \alpha^{I,N}y^I$

[11] This is why the range of f sets are open from above.

- Optimal tax rate: $\tau_{AE} = \frac{g_{AE} - \underline{f}\pi \sum_{R,M} \alpha^{I,E} y^I}{y_{AE}}$
- Optimal fine rate: $f_{AE} = \underline{f}$
- Condition for existence: $\frac{\sum_{R,M} \alpha^{I,E} y^I \phi^I}{\sum_{R,M} \alpha^{I,E} y^I} > \frac{\sum_{R,M} \alpha^{I,N} y^I \phi^I}{\sum_{R,M} \alpha^{I,N} y^I}$

2. Rich evade

- Optimal government expenditure: $H_g(g_{RE}) = \frac{\widetilde{y_{RE}}}{y_{RE}}$ where the political power and group size weighted average taxed income is $\widetilde{y_{RE}} \equiv \frac{\pi\alpha^{R,E} y^R \phi^R + \alpha^{M,E} y^M \phi^M + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\phi}$ and the tax base (or average taxable income) is: $y_{RE} \equiv \pi\alpha^{R,E} y^R + \alpha^{M,E} y^M + \sum_{R,M} \alpha^{I,N} y^I$
- Optimal tax rate: $\tau_{RE} = \frac{g_{RE} + \pi \frac{F}{y^M} \alpha^{R,E} y^R}{y}$ where the tax base (or average income) is $y = \sum_{R,M} \alpha^{I,E} y^I + \sum_{R,M} \alpha^{I,N} y^I$
- Optimal fine rate: $f_{RE} = \frac{1-\pi}{\pi}\tau_{RE} - \frac{F}{y^M}$
- Condition for existence: $\phi^R > \frac{\alpha^{M,E} y^M \phi^M + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\alpha^{M,E} y^M + \sum_{R,M} \alpha^{I,N} y^I}$

3. Nobody evades

- Optimal government expenditure: $H_g(g_{NE}) = \frac{\widetilde{y}}{y}$ where the political power and group size weighted average taxed income is $\widetilde{y} \equiv \frac{\sum_{R,M} \alpha^{I,E} y^I \phi^I + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\phi}$
- Optimal tax rate: $\tau_{NE} = \frac{g_{NE}}{y}$
- Optimal fine rate: $f_{NE} \geq \frac{1-\pi}{\pi}\tau_{NE} - \frac{F}{y^R}$

C Comparative Statics

Proof of proposition 1. We have to show that $g_{NE} < g_K$ and $\tau_{NE} < \tau_K$ for equilibrium platform $K \in \{AE, RE\}$ if equilibrium platform (K) exist. Using that $H(g)$ is concave in g and hence $H_g(g)$ is decreasing in g:

$$
\begin{aligned}
& g_{NE} < g_{AE} \\
\Leftrightarrow \quad & \frac{\widetilde{y}}{y} > \frac{\widetilde{y_{RE}}}{y_{RE}} \\
\Leftrightarrow \quad & H_g(g_{NE}) > H_g(g_{AE}) \\
\Leftrightarrow \quad & \frac{1}{\phi}\frac{\sum_{R,M} \alpha^{I,E} y^I \phi^I + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\sum_{R,M} \alpha^{I,E} y^I + \sum_{R,M} \alpha^{I,N} y^I} > \frac{1}{\phi}\frac{\pi\sum_{R,M} \alpha^{I,E} y^I \phi^I + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\pi\sum_{R,M} \alpha^{I,E} y^I + \sum_{R,M} \alpha^{I,N} y^I} \\
\Leftrightarrow \quad & (1-\pi)(\textstyle\sum_{R,M} \alpha^{I,E} \phi^I y^I) \sum_{R,M} \alpha^{I,N} y^I > (1-\pi)(\sum_{R,M} \alpha^{I,N} \phi^I y^I) \sum_{R,M} \alpha^{I,E} y^I \\
\Leftrightarrow \quad & \frac{\sum_{R,M} \alpha^{I,E} y^I \phi^I}{\sum_{R,M} \alpha^{I,E} y^I} > \frac{\sum_{R,M} \alpha^{I,N} y^I \phi^I}{\sum_{R,M} \alpha^{I,N} y^I}
\end{aligned}
\tag{14}
$$

Where the last line is exactly the condition needed for equilibrium (AE) to exist. The comparison of the tax rates is similarly straightforward, just by looking at their value:

$$
\begin{aligned}
& \tau_{NE} < \tau_{AE} \\
\Leftrightarrow \quad & \frac{g_{NE}}{y} < \frac{g_{AE} - \underline{f}\pi \sum_{R,M} \alpha^{I,E} y^I}{y_{AE}}
\end{aligned}
\tag{15}
$$

Since the denominator on the left hand side is greater than the denominator on the right hand side and the numerator on the lhs is smaller than the numerator on the rhs, the statement is obviously true. Now for the (RE) equilibrium platform:

$$
\begin{aligned}
& g_{NE} < g_{RE} \\
\Leftrightarrow \quad & \frac{\widetilde{y}}{y} > \frac{\widetilde{y_{RE}}}{y_{RE}} \\
\Leftrightarrow \quad & \frac{1}{\phi} \frac{\sum_{R,M} \alpha^{I,E} y^I \phi^I + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\sum_{R,M} \alpha^{I,E} y^I + \sum_{R,M} \alpha^{I,N} y^I} > \frac{1}{\phi} \frac{\pi \alpha^{R,E} y^R \phi^R + \alpha^{M,E} y^M \phi^M + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\pi \alpha^{R,E} y^R + \alpha^{M,E} y^M + \sum_{R,M} \alpha^{I,N} y^I} \\
\Leftrightarrow \quad & \left(\sum_{R,M} \alpha^{I,N} \phi^I y^I + \alpha^{M,E} \phi^M y^M\right) \alpha^{R,E} y^R > \alpha^{R,E} \phi^R y^R \left(\sum_{R,M} \alpha^{I,N} y^I + \alpha^{M,E} y^M\right) \\
\Leftrightarrow \quad & \phi^R > \frac{\alpha^{M,E} y^M \phi^M + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\alpha^{M,E} y^M + \sum_{R,M} \alpha^{I,N} y^I}
\end{aligned}
\tag{16}
$$

Again the last line is the condition that guarantees the existence of a potential equilibrium in the (RE) sector. To show that the tax rate is lower in the case with no evasion than in the case when only the rich evade observe that the numerator is smaller on the lhs than on the rhs, while the denominator is the same.

$$
\begin{aligned}
& \tau_{NE} < \tau_{RE} \\
\Leftrightarrow \quad & \frac{g_{NE}}{y} < \frac{g_{RE} + \pi \frac{F}{y^M} \alpha^{R,E} y^R}{y}
\end{aligned}
\tag{17}
$$

□

Proof of proposition 2. To show that the redistribution is highest if only the rich evade given that the other equilibrium platforms exist we only have to show that $g_{RE} > g_{AE}$ since we showed that g_{NE} is the lowest among the equilibrium platforms that exist.

$$
\begin{aligned}
& g_{AE} < g_{RE} \\
\Leftrightarrow \quad & \frac{\widetilde{y_{AE}}}{y_{AE}} > \frac{\widetilde{y_{RE}}}{y_{RE}} \\
\Leftrightarrow \quad & \frac{1}{\phi} \frac{\pi \sum_{R,M} \alpha^{I,E} y^I \phi^I + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\pi \sum_{R,M} \alpha^{I,E} y^I + \sum_{R,M} \alpha^{I,N} y^I} > \frac{1}{\phi} \frac{\pi \alpha^{R,E} y^R \phi^R + \alpha^{M,E} y^M \phi^M + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\pi \alpha^{R,E} y^R + \alpha^{M,E} y^M + \sum_{R,M} \alpha^{I,N} y^I} \\
\Leftrightarrow \quad & \alpha^{M,E} y^M \left(\sum_{R,M} \alpha^{I,N} \phi^I y^I + \pi \alpha^{R,E} \phi^R y^R\right) > \alpha^{M,E} \phi^M y^M \left(\sum_{R,M} \alpha^{I,N} y^I + \pi \alpha^{R,E} y^R\right) \\
\Leftrightarrow \quad & \frac{\sum_{R,M} \alpha^{I,N} \phi^I y^I + \pi \alpha^{R,E} \phi^R y^R}{\sum_{R,M} \alpha^{I,N} y^I + \pi \alpha^{R,E} y^R} > \phi^M
\end{aligned}
\tag{18}
$$

The last line is true if equilibrium platform (RE) exist. To see this, consider the condition under which the equilibrium (RE) exists: $\phi^R > \frac{\alpha^{M,E} y^M \phi^M + \sum_{R,M} \alpha^{I,N} y^I \phi^I}{\alpha^{M,E} y^M + \sum_{R,M} \alpha^{I,N} y^I}$. Since the rhs is a weighted average if ϕ^R and ϕ^M, which can only be smaller than ϕ^R if $\phi^M < \phi^R$. However this implies that the weighted average of ϕ^R and ϕ^M is greater than phi^M. [12] Which is exactly the last line above. The order of the tax rates between the (RE) and the (AE) equilibrium platforms is ambiguous:

$$\begin{array}{rc} & \tau_{AE} \geq \tau_{RE} \\ \Leftrightarrow & \frac{g_{AE} - \underline{f}\pi \sum_{R,M} \alpha^{I,E} y^I}{y_{AE}} \geq \frac{g_{RE} + \pi \frac{F}{y^M} \alpha^{R,E} y^R}{y} \\ \Leftrightarrow & \sum_{R,M} \alpha^{I,E} y^I (g_{AE} - \pi g_{RE}) \geq \\ & \geq \sum_{R,M} \alpha^{I,N} y^I (g_{RE} - g_{AE}) + \pi (y_{AE} \frac{F}{y^M} \alpha^{R,E} y^R + y \underline{f} \sum_{R,M} \alpha^{I,E} y^I) \end{array} \tag{19}$$

Looking at the above equation, the following comparative statics results are true, $\tau_{AE} - \tau_{RE}$ is :

- decreasing in π
- decreasing in $g_{RE} - g_{AE}$
- increasing in total evader income $\sum_{R,M} \alpha^{I,E} y^I$
- decreasing in total non-evader income $\sum_{R,M} \alpha^{I,N} y^I$

□

D Equilibrium Determination

Proof of Proposition 3. Recall that platform (RE) and not (AE) will be implemented if and only if:

$$\begin{array}{rc} & H(g_{RE}) - H(g_{AE}) - H_g(g_{NE}) g_{RE} + H_g(g_{AE}) g_{AE} + K > 0 \\ \Leftrightarrow & K > \int_{g_{AE}}^{g_{RE}} (H_g(g_{NE}) - H_g(g)) dg + (H_g(g_{NE}) - H_g(g_{AE})) g_{AE} \\ where & K = \pi (\frac{1}{\phi} (\frac{F}{y^M} + \underline{f}) \sum_{R,M} \alpha^{I,E} \phi^I y^I - \frac{F}{y^M} \alpha^{R,E} y^R \frac{\widetilde{y}}{y}) \\ & K = \pi \alpha^{R,E} \frac{\phi^R}{\phi} (\frac{F}{y^M} \frac{y^R}{y} (1 - \alpha^R y^R) + \underline{f} y^R) + \\ & + \pi \frac{\phi^M}{\phi} (F(\alpha^{M,E} - \alpha^M \alpha^{R,E} \frac{y^R}{y}) + \underline{f} \alpha^{M,E} y^M) \end{array} \tag{20}$$

Moreover, if both platforms exist then $\frac{\widetilde{y_{RE}}}{y_{RE}} < \frac{\widetilde{y_{AE}}}{y_{AE}} < \frac{\widetilde{y}}{y}$, while $g_{RE} > g_{AE} > g_{NE}$. Also, since $H(g)$ is increasing and concave, $H_g(g)$ is a positive decreasing function, while $H_{gg}(g)$ is a negative function.

[12] Unless the weight on ϕ^R is zero, which case I do not consider.

The parameters that affect the expression above are: $\alpha^{I,J}, \phi^I, y^I, \pi, F, \underline{f}$ for $J \in E, N$ and $I \in P, M, R$.

Notice that F and $\underline{f}$ only appear in the term K, and K is increasing in both. Hence, as F and $\underline{f}$ increase, the probability of implementing platform (RE) increases.

To see how the third parameter of enforcement affects the identity of the implemented platform take partial derivative of the first expression above with respect to π:

$$\frac{\frac{\widetilde{y_{RE}}}{y_{RE}} - \frac{\widetilde{y}}{y}}{H_{gg}(g_{RE})} \frac{\partial \frac{\widetilde{y_{RE}}}{y_{RE}}}{\partial \pi} + g_{AE} \frac{\partial \frac{\widetilde{y_{AE}}}{y_{AE}}}{\partial \pi} - g_{RE} \frac{\partial \frac{\widetilde{y}}{y}}{\partial \pi} + \frac{\partial K}{\partial \pi} > 0 \tag{21}$$

Where the partial derivatives are:

$$\begin{aligned} \frac{\partial \frac{\widetilde{y_{RE}}}{y_{RE}}}{\partial \pi} &= \frac{\alpha^{R,E} y^R y^M}{y_{RE}^2} \left(\frac{\phi^R - \phi^M}{\phi}\right)(\alpha^{M,E} + \alpha^{M,N}) > 0 \\ \frac{\partial \frac{\widetilde{y_{AE}}}{y_{AE}}}{\partial \pi} &= \frac{y^R y^M \alpha^{M,N} \alpha^{R,N}}{y_{AE}^2} \left(\frac{\phi^R - \phi^M}{\phi}\right)\left(\frac{\alpha^{R,E}}{\alpha^{R,N}} - \frac{\alpha^{M,E}}{\alpha^{M,N}}\right) > 0 \\ \frac{\partial \frac{\widetilde{y}}{y}}{\partial \pi} &= 0 \\ \frac{\partial K}{\partial \pi} &> 0 \end{aligned} \tag{22}$$

Here $\frac{\frac{\widetilde{y_{RE}}}{y_{RE}} - \frac{\widetilde{y}}{y}}{H_{gg}(g_{RE})} > 0$, since the numerator is negative and the denominator is negative as well. Putting together these partial derivatives, it is clear that the probability that (RE) will be implemented in equilibrium is increasing in π.

Notice that the flatter the function $H_g()$ is at the relevant points, the smaller the r.h. side is, whereas the l.h. side does not depend on the functional form of H_g. This implies that the closer the utility from the public good g is to linear the more likely it is that the (RE) platform is implemented. □