Tax compliance and wealth inequality

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Abstract

In this work, we theoretically approach optimal taxing in a public good provision context in a society where wealth is Pareto distributed. Our main result shows that high levels of wealth inequality yield lower levels of tax compliance and, consequently, lower provision of public goods.

Keywords: tax evasion, wealth inequality, public good provision

1. Introduction

Most of the public goods we enjoy have been funded with our taxes. But tax evasion is as old as taxes themselves. If our selfish self finds tax evasion difficultly detectable, it mostly goes unpunished and/or taxes are high, our incentives to tax evade grow. Moreover, there is empirical evidence showing that incentives to tax evade also depend on our level of wealth. For instance, Alstadsæter et al. (2017) show that the richest households in Scandinavia evade about 25% of taxes by concealing assets and investment income abroad. Fixing a tax rate that maximises tax compliance in an unequally distributed population in terms of wealth is, therefore, one of any government's challenges.

Invariably across a cross-section of countries and time periods, a robust stylized fact is that wealth distributions are skewed to the right displaying thick upper tails (Benhabib and Bisin, 2018). The Pareto wealth distribution

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is a power-law distribution function with these characteristics.[1]

As it has been highlighted by different authors (for instance Piketty, 2014), the distribution of wealth depends on tax policy while political economy considerations suggest that the determination of tax policy, in turn, depends on wealth inequality. In this note, we theoretically approach optimal taxing (that is, taxing in the absence of political economy considerations), in a society where wealth is Pareto distributed. Additionally, our model captures the higher opportunities that wealthier have to conceal their financial wealth.[2] This assumption is supported by recent and robust empirical evidence. Alstadsæter et al. (2017) find a sharp gradient of evasion with wealth. We compute the tax that maximises tax compliance and analyse its relationship with the wealth distribution in the society.

Our main result shows that, given a monitoring technology, high levels of inequality yield lower levels of tax compliance, i.e. higher levels of tax evasion and, consequently, lower provision of public goods. Therefore, our theory highlights an additional inefficiency that appears in unequal societies as compared to more egalitarian ones.

Since the seminal paper on tax evasion by Allingham and Sandmo (1972), theoretical tax evasion literature has focused on optimal inheritance taxation (Piketty and Saez, 2013; Heer, 2001), on the use of distortionary taxes (Zodrow and Mieszkowski, 1986; Ballard and Fullerton, 1992), on behavioural aspects explaining tax evasion and tax compliance (See Pickhardt and Prinz, 2014, for a general review) or on the use of randomized controlled trials (See Slemrod, 2019 for a review on methodologies used in the economics of tax compliance). However, this work contributes to the literature in two significant aspects. In first place, we approach total tax compliance rather than individual tax evasion. Secondly, we focus on the relation between wealth distribution and the optimal tax rate that maximises total tax compliance.

[1]The model could be extended to income tax evasion, issue that we leave for further research.

[2]Not all types of wealth are as easy to hide, but most of the wealth of the richest is financial (Alstadsæter et al., 2017). For this reason, we refer to financial wealth.

2. The model

Consider a society formed by a continuum of risk neutral citizens, each one of them with a level of wealth $\omega_i \in [\underline{\omega}, \overline{\omega}]$ from which he/she can contribute g_i to a public good.[3] We assume that $\underline{\omega} = 1$ and that the society's wealth follows a Pareto distribution with a cumulative distribution function $F(\omega) = 1 - \omega^{-\alpha}$ and a probability density function $f(\omega) = \alpha\omega^{-\alpha-1}$, where $\alpha > 1$ is a shape parameter. Specifically, the larger α is, the more egalitarian the society is. Conversely, the lower α is, the more unequal the society is.

The public good is funded with taxes, such that the individual contributes at a tax rate $0 \leq t \leq 1$ over his/her level of wealth. The possible actions that each citizen has are either to contribute to the public good paying his/her taxes $g_i = t\omega_i$ or evading taxes and free riding on the public good $g_i = 0$.

The individual return of the public good depends on the total amount of funds collected through taxes which are multiplied by a factor $\lambda < 1$. This factor is the marginal per capita return (MPCR) of the public good. For simplicity, we assume homogeneity in this parameter, such that everybody values public goods to the same degree. This game gives rise to a cooperation issue where the Nash Equilibrium outcome is inefficient.[4] For this reason, we introduce an external enforcer who is in charge of monitoring and implementing punishment.

The precise sequence of actions is as follows:

Contribution Stage - Each player i will individually and simultaneously decide whether to contribute to the public good by paying his/her taxes $g_i = t\omega_i$ or not $g_i = 0$.

Punishment Stage- After contributions are made, the monitor detects free riding with certain probability. If free riding is detected it will automat-

[3]This public good is assumed to be utility enhancing, such that it is included as an external argument in private utility functions (Economides et al., 2011). We leave the possible consideration of a productivity-enhancing public good for future research.

[4]The strategy profile $g_i = 0 \ \forall i$ is the unique Nash Equilibrium. However, the strategy profile $g_i = t\omega_i \ \forall i$ is welfare maximising.

ically be punished with a fine. The expected cost that any free rider faces is $c = \overline{c}(1 - \frac{\omega_i}{\overline{\omega}})$, where parameter $\overline{c}$ captures the existing monitoring and punishment technology. An increase in the probability of detection and/or in the legal fines will imply an increase in $\overline{c}$. The underlying assumption of this function is that the expected cost of being detected and punished decreases with the level of wealth ($\frac{\partial c}{\partial \omega} < 0$). This assumption has a strong empirical support. In particular, Alstadsæter et al., (2017) show that only wealthier individuals can afford mechanisms to conceal wealth.[5] This way, the expected costs they face are lower than those of low-wealth citizens.

The payoff of player i is equal to:

$$\pi_i = \omega_i - g_i + \lambda \int_1^{\overline{\omega}} g(\omega) f(\omega) d\omega - \begin{cases} \overline{c}(1 - \frac{\omega_i}{\overline{\omega}}) & \text{if } g_i = 0 \\ 0 & \text{if } g_i = t\omega_i \end{cases} \tag{1}$$

where $g(\omega)$ is the contribution function, which we derive in the following section.

3. Results

3.1. Tax Collection

In this section, we analyse the incentives to pay taxes and define a contribution function $g(\omega)$. A citizen i will pay taxes by contributing to the public good if the expected returns of doing so are greater that the expected returns of evading taxes.

$$\omega_i - t\omega_i + \lambda \int_1^{\overline{\omega}} g(\omega) f(\omega) d\omega \geq \omega_i + \lambda \int_1^{\overline{\omega}} g(\omega) f(\omega) d\omega - \overline{c}(1 - \frac{\omega_i}{\overline{\omega}}) \tag{2}$$

$$\overline{c}(1 - \frac{\omega_i}{\overline{\omega}}) \geq t\omega_i \tag{3}$$

[5] They show, with a model of supply of tax evasion services that, in equilibrium, only rich individuals can pay for these services.

From this comparison we derive the critical wealth threshold $\hat{\omega}$ that makes this condition hold with equality.

Lemma 1*: The contribution function $g(\omega)$ is as follows:*

$$g(\omega) = \begin{cases} t\omega_i & \text{if } \omega_i \leq \hat{\omega} \\ 0 & \text{if } \omega_i > \hat{\omega} \end{cases} \tag{4}$$

where $\hat{\omega} = \frac{\bar{c}}{t+\bar{c}/\overline{\omega}}$

If individual i has a wealth level such that $\omega_i \leq \hat{\omega}$, he/she will contribute to the public good. Otherwise, if citizen i has a wealth level such that $\omega_i > \hat{\omega}$ he/she will evade taxes. The critical value $\hat{\omega}$ increases with the maximum expected cost of tax evasion $\bar{c}$, with the maximum level of wealth in the society $\overline{\omega}$ and decreases with the tax rate t.

We now quantify the level of tax compliance in the society by computing the total tax collection achieved.[6]

Proposition 1*: Given a wealth distribution $\omega \in [1, \overline{\omega}]$ with a cumulative distribution function $F(\omega) = 1 - \omega^{-\alpha}$, total tax collection will be:*

$$TC = \int_1^{\hat{\omega}} t\omega f(\omega) dw \tag{5}$$

$$TC = \frac{\alpha t}{1-\alpha}\left[\left(\frac{\bar{c}}{t+\bar{c}/\overline{\omega}}\right)^{1-\alpha} - 1\right] \tag{6}$$

See formal proof in the appendix.

3.2. Optimal tax

At this point, we study what would the optimal tax in this context be, understanding as optimal the one that maximises tax compliance. With this

[6]Another approach could be to consider the government's total revenue, which would include tax and fine collection. Here, however, we focus on the tax compliance of the society.

purpose, we study how does the total tax collection depend on the tax rate:

$$\frac{\partial TC}{\partial t} = \frac{\alpha}{1-\alpha}\left[\overline{c}^{1-\alpha}(t+\overline{c}/\overline{\omega})^{\alpha-1} - 1\right] + \frac{\alpha(\alpha-1)}{1-\alpha}\left[\overline{c}^{1-\alpha}(t+\overline{c}/\overline{\omega})^{\alpha-2}\right] \quad (7)$$

The first term of the derivative is a *positive direct effect*. Raising taxes increases tax collection as those who comply with their tax obligations are now paying a greater proportion of their wealth. However, recall that incentives to contribute are decreasing with the tax rate, which implies that if the government increases the tax rate, some citizens are going to start having incentives to evade. This is the *negative indirect tax-evasion effect* captured in the second term of the derivative. The net effect will depend on the weight of these two effects.

The following proposition states that there exists a unique optimal tax t^* that maximizes tax compliance.

Proposition 2*: Given a wealth distribution $\omega \in [1, \overline{\omega}]$ with a cumulative distribution function $F(\omega) = 1 - \omega^{-\alpha}$, there is a unique tax t^* that maximises total tax collection. This optimal tax can either be an interior solution $0 < t^* < 1$ or a corner solution $t^* = 1$.*

See formal proof in the appendix.

The total tax collection has an inverse U-shape that reaches its maximum point at t^*. For low values of t, increasing the tax rate increases total tax collection. Here, the positive direct effect predominates over the negative indirect tax-evasion effect. However, if t is sufficiently high, an increase in the tax rate will make the negative effect counteract the positive effect, such that total contributions fall. At t^*, total tax collection is maximised.

Proposition 3*: The optimal tax t^* and its corresponding tax collection $(TC(t^*))$ are increasing in parameters α, $\overline{\omega}$ and $\overline{c}$.*

See formal proof in the appendix.

4. Discussion

Similarly to results presented in previous literature on tax evasion (Allingham and Sandmo, 1972, for instance), the critical tax t^* and total tax collection are both increasing with the expected costs of tax evading and with the maximum level of wealth. As it might be expected, an increase in the probability of detection or in the legal fine increases tax compliance.

More interestingly, our main result claims that total tax collection and the optimal tax rate are also increasing with the shape parameter α representing the degree of egalitarianism. If the society becomes more egalitarian, that is, an increase in α, the government will also be able to set a higher optimal tax rate that achieves a higher tax collection and, therefore, higher tax compliance. Recall from equation 7, that increasing the tax rate generates a positive direct effect of collecting more and a negative indirect effect of a greater tax evasion. In a more egalitarian society, the positive effect predominates over the negative one for a larger range of tax rate values. This allows setting a higher optimal tax rate in an egalitarian society than in an unequal one. See Figure 1 for a simulation with $\overline{\omega} = 10, \overline{c} = 1$ and different values of α.

Intuitively, as the society grows more egalitarian, a greater proportion of the population is in the bottom segment of the wealth distribution. Now, an increase in the tax rate causes a high direct effect of greater contributions while the indirect tax-evasion effect has a lower impact. For this reason, it takes longer for the negative effect to predominate over the positive one.

Notice that, given that wealthier citizens evade more that poorer ones, egalitarianism in the society would diminish after taxes are paid. This confirms the bidirectional relation between taxation and egalitarianism claimed by Piketty (2014).

Our results illustrate an important cost of non-egalitarian society in terms of wealth. In particular, these societies can set lower optimal taxes and achieve lower levels of tax compliance, which, in turn, implies a lower provision of public goods than more egalitarian societies.

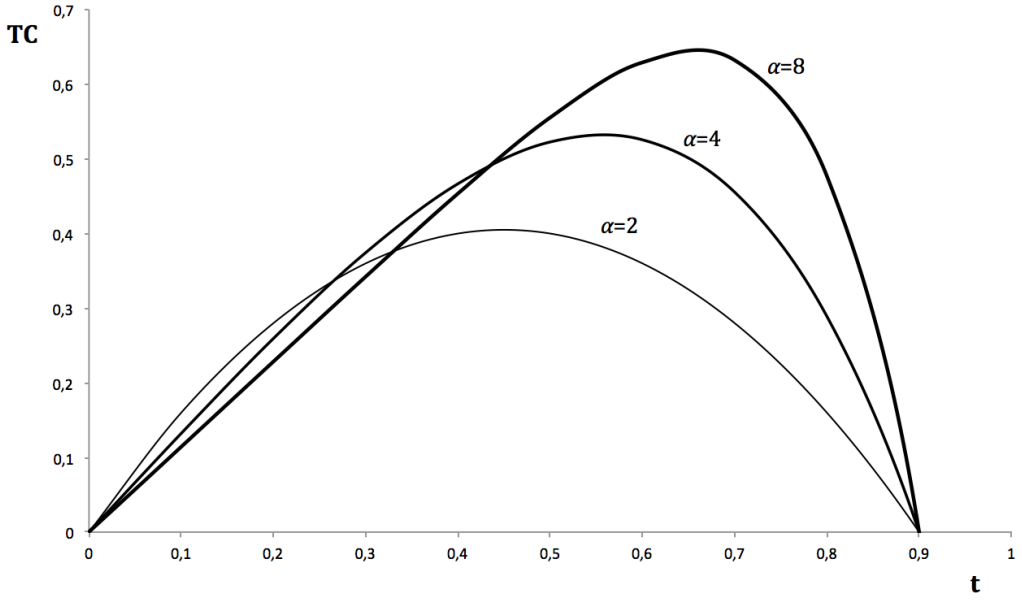

Figure 1: Total contribution for different values of α, $\overline{\omega} = 10, \overline{c} = 1$

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Appendix

Proof of Proposition 1

The total contribution to the public good (TC) is defined as the integral between the minimum wealth $\underline{\omega} = 1$ and the maximum level of wealth willing to contribute $\hat{\omega} = \frac{\overline{c}}{t+\overline{c}/\overline{\omega}}$ of the contributions $t\omega$ times the probability density function $f(\omega) = \alpha\omega^{-\alpha-1}$.

$$TC = \int_1^{\hat{\omega}} t\omega f(\omega)dw = t\int_1^{\hat{\omega}} \omega\alpha\omega^{-\alpha-1}dw = \alpha t\int_1^{\hat{\omega}} \omega^{-\alpha}dw =$$

$$= \alpha t\left[\frac{\omega^{1-\alpha}}{1-\alpha}\right]_1^{\hat{\omega}} = \frac{\alpha t}{1-\alpha}\left[\left(\frac{\overline{c}}{t+\overline{c}/\overline{\omega}}\right)^{1-\alpha} - 1\right].$$

As $\frac{\alpha t}{1-\alpha} < 0$ and $\left[\left(\frac{\overline{c}}{t+\overline{c}/\overline{\omega}}\right)^{1-\alpha} - 1\right] < 0$, $TC > 0$.

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Proof of Proposition 2

We cannot derive an explicit optimal tax from the first order condition obtained from equation 7 ($\frac{\partial TC}{\partial t} = 0$), so we define an implicit function $y = f(\overline{c}, \alpha, t, \overline{\omega})$ with the following properties:

- The function is concave.

$$\frac{\partial^2 y}{\partial t^2} < 0 \qquad \forall t \in [0,1]$$

- The function is increasing in $t = 0$.

$$\left.\frac{\partial y}{\partial t}\right|_{t=0} > 0$$

- At $t = 1$, the function is either decreasing and, in this case, there is an interior solution $0 < t^* < 1$ or is increasing and, therefore, there is a corner solution $t^* = 1$.

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Proof of Proposition 3

Using the Implicit Function Theorem with the function $y = f(\overline{c}, \alpha, t, \overline{\omega})$, we obtain the sign of the following derivatives:

$$\frac{\partial t}{\partial \overline{c}} = -\frac{\partial y/\partial \overline{c}}{\partial y/\partial t} > 0; \qquad \frac{\partial t}{\partial \alpha} = -\frac{\partial y/\partial \alpha}{\partial y/\partial t} > 0; \qquad \frac{\partial t}{\partial \overline{\omega}} = -\frac{\partial y/\partial \overline{\omega}}{\partial y/\partial t} > 0.$$

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