



Contents lists available at ScienceDirect

European Journal of Political Economy

journal homepage: www.elsevier.com/locate/ejpeThe elite, inequality and the emergence of progressive taxation[☆]Vicente Calabuig^{*}, Gonzalo Olcina

University of Valencia, ERI-CES, Faculty of Economics, Avda dels Tarongers s/n, Valencia, Spain

ARTICLE INFO

Keywords:

Elite domination
Progressive taxation
Inequality
Reciprocity
Cultural dynamics

ABSTRACT

This paper explores theoretically the role of the ruling elites in the rise of progressive taxation in Western countries in the early 20th century. We focus on their interaction with the level of inequality between the elites and other citizens. We analyse a stylized political economy dynamic model where (wealthy) elite make a decision on the taxes to be paid by non-elite (poorer) citizens and by themselves. A fraction of citizens are fiscal-reciprocators: they experience positive (negative) reciprocity under a progressive (regressive) tax system. This proportion of citizens evolves over time according to their relative payoff compared to materialist citizens. We show that the choice of tax structure depends on the value for the elite of the public good generated by tax revenues, the proportion of fiscal-reciprocators and on the level of inequality between elite and citizen incomes. Our results show a dynamic complementarity between the level of reciprocity in society and tax progressivity. Indeed, this complementarity only operates if inequality is sufficiently low. In this case a progressive tax culture will be achieved, otherwise a regressive tax culture will prevail.

1. Introduction

Progressive taxation has been a main determinant of the expanding state capacity of Western countries. Income taxation was established in many countries at the end of the 19th century and in the early 20th century.¹ This supposed a radical shift in the direction of progressivity from a completely regressive fiscal system based on indirect taxation (excise, tariffs, consumption taxes).

Initially, the top marginal income tax rates remained universally very low. However, 1914 was a turning point, when top tax rates began to rise dramatically, increasing significantly after World War II until the 1980s.² Since then, and to date, the world has seen a long-lasting erosion of top rates in tax regimes, as shown in Fig. 1 extracted from Scheve and Stasavage (2016).

Furthermore, inequality has seemingly displayed an opposite pattern.³ There has been a pronounced reduction in inequality, both in income and wealth, since the beginning of the 20th century in Europe, and in the USA soon after. However, inequality in most advanced countries over the last few decades has increased, as Fig. 2 shows.

[☆] We thank Toke Aidt and two anonymous referees for helpful comments. We also thank the valuable comments of Miguel Gonzalez-Maestre and Daniel Tirado. This paper has also benefited from the comments of participants in the AICO Workshop in Valencia (Spain), in the 10th Oligoworkshop in Nicosia (Cyprus), in a seminar in the University of Murcia (Spain), and in the 18th SING in Messina (Italy). We acknowledge financial support from the Ministerio de Ciencia, grant number PID2021-128228NB-I00 and V. Calabuig also the support of the Conselleria d'Innovació, Universitats, Ciència i Societat Digital, Generalitat Valenciana, grant number AICO/2021/257.

^{*} Corresponding author.

E-mail addresses: Vicente.Calabuig@uv.es (V. Calabuig), Gonzalo.Olcina@uv.es (G. Olcina).

¹ See Aidt and Jensen (2009), Beramendi et al. (2019), Seelkopf et al. (2021), Dinzecco (2015), Scheve and Stasavage (2016) among others.

² See, for example, Scheve and Stasavage (2010, 2016).

³ See Atkinson and Piketty (2010), Saez and Zucman (2020), Piketty (2022), among others.

<https://doi.org/10.1016/j.ejpeco.2023.102433>

Received 29 July 2022; Received in revised form 22 June 2023; Accepted 28 June 2023

Available online 5 July 2023

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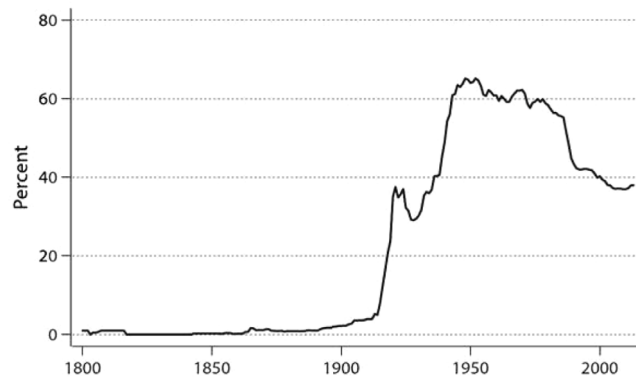


Figure 3.1. Average Top Rates of Income Taxation, 1800-2013. This figure reports the average top marginal income tax rate for the twenty countries in our sample (each country entering the sample in 1800 or first year of independence).

Fig. 1. Average Top Rates of Income Taxation, 1800–2013. From [Scheve and Stasavage \(2016\)](#).

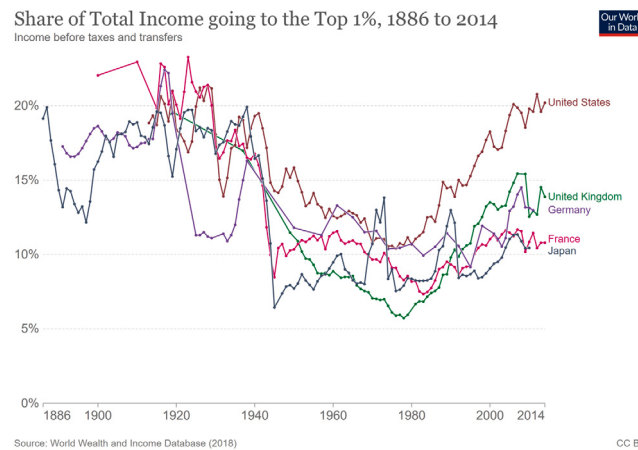


Fig. 2. Share of Total Income going to the Top 1%, 1886–2014. From World Wealth and Income Database (2018).

In fact, there seems to be a negative relationship between inequality and top tax rates. As [Besley \(2015\)](#) states: “all else equal, the raw data suggest that countries with more inequality have lower marginal tax rates”. There also seems to be an opposite movement between the evolution of top tax rates and inequality for some countries, as [Fig. 3](#) shows.

[Blanchet et al. \(2022\)](#), using data on pre- and post-tax income inequality in twenty-six European countries and the US, between 1980 and 2017, show that “higher top marginal tax rates are associated with lower top 1% pre-tax income shares”. There seems to be a relationship between inequality and the tax system beyond its redistributive role.

Many Western economies adopted income taxation under conditions of limited suffrage or without electoral competition.⁴ Therefore, an important question to ask is what makes the elite innovate and adopt progressive taxation. Why do the non-democratic elite tax the wealthy, that is, tax themselves?

Our aim is to explain the emergence of progressive taxation especially pronounced at the beginning of the 20th century, and the role inequality may have played in this process. Are the incentives of the elite towards progressive or regressive taxation influenced by the existing levels of inequality?

One reason why progressive taxation can arise is because it is imposed by the non-elite citizens on the elite. This is what [Acemoglu and Robinson \(2023\)](#) call the conflict between the elite and society. Contrary to the interests of the elite, they may be forced to

⁴ See, for example, [Aidt and Jensen \(2009\)](#).

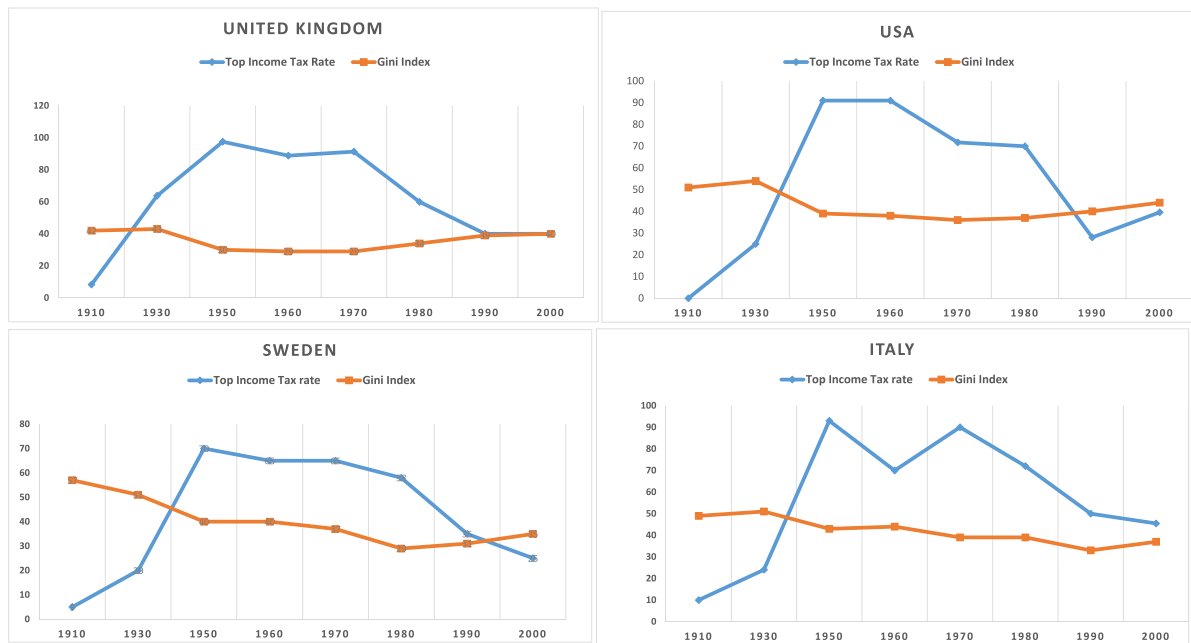


Fig. 3. Top income rates and Gini index.

pay progressive taxes after violent revolutions or threats of revolution or, in a democracy, by a non-elite majority (Acemoglu and Robinson (2013)). But in the late 19th century and the beginning of the 20th century, there was elite political rule almost everywhere. We clearly need to gain a better understanding of the conditions under which the elite would make the decision to pay taxes.

Several reasons have been proposed in the literature as possible explanations for a ruling elite to move to progressive taxation. One possible reason is again external pressure on the ruling elite in the form of spending pressures. There is a broad area of research that stresses that revenue needs arise from military expenditure, inter-state conflict or social conflict (Besley and Persson, 2009, 2011a; Scheve and Stasavage, 2016; Tilly, 1990, among others).

Another situation in which the elite face spending pressures is to raise funds to pay for public goods necessary for the elite to increase the productivity of their investments (infrastructure, security, education, health, etc...). In some studies, this argument would be embedded in a competition between elites (industrial capitalist versus landed elites).⁵ But even so, these spending pressures *per se* cannot explain why the elite tax themselves. Why not simply increase the tax burden on the non-elite?

A factor that crucially affects tax collection is the existing civic culture in society. As mentioned in the previous paragraphs, different historical situations prompt the elite to increase public expenditure, and the necessary funding requires a qualitative increase in tax collection (Besley and Persson, 2011a; Aidt and Jensen, 2009, among others). As emphasized by Besley (2020): "... the power to tax is at the heart of creating an effective state". Coercion has always been a way for the ruling elite to increase effective taxation. But coercion has always had its limits. As several authors have stressed, civic culture (or tax morale) plays a special role in building effective fiscal states (Levi, 1988; Besley, 2020, among others). The recent literature on cultural transmission has convincingly shown how the distribution of population preferences, civic culture, evolves influenced by institutions, shaping the final economic results (see Persson and Tabellini, 2020 for a survey). Civic culture is very different within and across countries (see evidence from the World Values Survey). This may explain the different success between countries in generating different levels of tax compliance. The above considerations likely reflect that civic culture evolves over time affected by the preferences distribution in society and by the existing redistributive institutions.⁶

We want to explore through a theoretical model the precise interplay between spending pressures faced by the elite, the existing levels of civic culture (and the resulting levels of tax compliance) in the non-elite population and, the existing level of inequality in the income distribution between the elite and other citizens. Our objective is to identify how this interaction results in the choice by the ruling elite of a progressive or a regressive tax system. Our model is, therefore, not alternative but rather complementary

⁵ See Beramendi et al. (2019), Mares and Queralt (2015), among others.

⁶ Redistributive institutions are concerned not only with taxes but also redistributive policies on the side of expenditure.

to other existing views of progressive taxation expansion. The forces highlighted in our model may well coexist with “threat of revolution” theories or with “democracy-median voter” theories.

We analyse a stylised political economy dynamic model where an elite group composed of the wealthier citizens makes a decision on the taxes to be paid by non-elite poorer citizens and by themselves. Citizens, meanwhile, make a decision on their tax compliance. In line with [Besley \(2020\)](#), we assume that non-compliance with taxation may be costly if a citizen is caught not paying taxes and, also, that in addition to materialist citizens, there is a proportion of citizens concerned by the progressivity of the tax structure (measured by the difference between the tax paid by the elite and the non-elite). These tax-concerned citizens (or fiscal reciprocators), will reduce their rate of non-compliance the more progressive the fiscal system becomes (positive reciprocity) and will increase their rate of non-compliance the more regressive the fiscal system becomes (negative reciprocity). This reciprocity motive, driven by the perception of the progressivity (fairness) of the tax system, can modify the tax morale in addition to enforcing a decision of non-compliance [Torgler \(2007\)](#), [Luttmer and Singhal \(2014\)](#). This proportion of fiscal-reciprocators, the civic culture, evolves over time according to the relative payoff between fiscal-reciprocators and materialist citizens.

In our study, we start by analysing the elite’s choice in a given period. We show that a high inequality reduces the attractiveness of the public good for the elite (except if the value for the elite of the public good is unusually high, as in wars, revolutions or other existential threats for the elite, in which case for all degrees of inequality the elite always prefer a progressive tax system). However, for a not so large value for the elite of the public good, the level of inequality between the elite and the non-elite plays a key role in the choice of tax system. The main channel for the influence of inequality is through the non-compliance decision. If there is a low level of inequality, whenever the elite implement a progressive tax structure this reduces the non-compliance of fiscal-reciprocators and thus increases the tax revenues. Nevertheless, this latter effect will be smaller the smaller the proportion of fiscal-reciprocators in the population, and the higher the inequality ratio between elite and non-elite. In this latter case, the negative effect on the elite’s utility induced by giving up private consumption by paying taxes will be high (because the elite’s income is relatively high). In other words, a too-rich elite lose interest in the public good and prefer private consumption and therefore not to pay taxes.

The main long-run results we obtain are derived from the dynamic evolution of different tax cultures. A Progressive (Regressive) tax culture is characterized by a high (low) proportion of non-elite fiscal-reciprocators, a low (high) level of inequality, a low (high) non-compliance rate, and high (low) level of public good provision.

Whenever the value of the public good is unusually high for the elite, for instance because of some internal or external existential threat, then society will converge to a progressive tax culture.

However, when the value for the elite of the public good is not so high, our model shows that there is dynamic complementarity between the level of reciprocity in society and tax progressivity. This dynamic complementarity between preference distribution (reciprocity) and institutions (tax system) gives rise to hysteresis: depending on initial conditions, societies can converge to a steady state with regressive taxation and a majority of selfish citizens, or converge to a steady state with progressive taxation and a majority of citizens who are fiscal-reciprocators. However, our model provides an important additional insight; it shows that the level of income inequality crucially determines the culture in which society will end up. Indeed, this complementarity only operates if the inequality ratio is sufficiently low. In this case a progressive tax culture will be achieved, otherwise a regressive tax culture will prevail.

Our paper is related to various strands of literature. It is closely related to the literature on cultural transmission and socialization ([Bisin and Verdier, 2000, 2001](#)) and more specifically, to the work on the endogenous determination of preferences and its interaction with institutions ([Hauk and Saez, 2002](#); [Olcina and Penyarribia, 2004](#); [Besley, 2020](#), among others and, see [Persson and Tabellini, 2020](#) for a review). There is also a strand of literature that analyses the coevolution of culture and institutions (see, for instance, [Tabellini, 2008](#); [Bisin and Verdier, 2021](#)).

In particular, our analysis makes a contribution to the literature on the emergence of progressive taxation and state capacity in a society under elite political domination. [Besley \(2020\)](#) focuses on the role of civic culture (reciprocity) in expanding fiscal capacity in a political model of interaction between the policy-making elite and tax-paying citizens. However, there is no income or wealth inequality in his model. We, instead, provide a causal interpretation of the observed negative correlation between inequality and state capacity through the effect of inequality on progressive taxation under elite political domination.

There is also a strand of literature on the [Meltzer and Richard \(1981\)](#) hypothesis — the idea that democratization will lead to more redistribution. This literature ([Acemoglu and Robinson, 2000](#); [Boix, 2003](#), among others) suggests that progressive taxation is natural in a democracy because low income citizens outnumber the rich, and it shifts the median voter towards low-income agents in society and hence increases the demand for fiscal redistribution. However, the empirical literature is very far from consensus on this hypothesis, suggesting that it is not democratization per se that induce the changes in the tax system. For example, [Aidt et al. \(2022\)](#) do not find causal evidence of a positive link between suffrage reform and redistribution in the UK between 1820 and 1913.⁷ Our model is complementary to this approach. We show that if democracy is captured by the elite or there is direct political domination by the elite, the previous result is reversed; a higher inequality reduces the incentives for the elite to implement a progressive tax system.

The assumption of elite domination in our theoretical analysis is interesting for two reasons: firstly, because it corresponds to the historical circumstances in which the progressive imposition arose, and, secondly, because even in conditions where the elite

⁷ See [Acemoglu et al. \(2015\)](#) for a good summary on this literature.

share power with the non-elite, knowing what the elite's choice would be, without the constraint of democracy, would provide us with information about their fiscal incentives.

From an empirical point of view, there are different results on the emergence of a progressive fiscal system. [Aidt and Jensen \(2009\)](#) find evidence that spending pressure, reduction in tax collection costs and social learning play a significant role in the decision to adopt income taxes. However, [Kammas and Poulima \(2017\)](#) and [Engerman and Sokoloff \(2005\)](#) suggest that inequality in land holding negatively affects the extent of tax progressivity. Likewise, [Adam et al. \(2015\)](#) conclude that the distribution of income appears to be an important determinant of the tax structure. Our model provides a theoretical causal explanation for these empirical relationships.

There is a wide line of research that stresses revenue needs derived from military expenditure, inter-state conflict or social conflict ([Besley and Persson, 2009, 2011a; Tilly, 1990; Scheve and Stasavage, 2016](#), among others). [Scheve and Stasavage \(2016\)](#) obtain that progressive taxation and mass mobilization for war are strongly correlated whereas progressive taxation is not correlated with the extension of suffrage. We also obtain this finding but, additionally, we analyse when progressivity may emerge even in the absence of an existential threat to the elite.

Another branch of the literature highlights the importance of intersectoral competition between the elite in times of industrialization. [Beramendi et al. \(2019\)](#) and [Emmenegger et al. \(2021\)](#) suggest that the industrial elite are interested in providing a high valuation public good beneficial to themselves whenever the increase in industrial output due to the higher public goods provision exceeds their tax costs. [Mares and Queralt \(2015\)](#) point out that in this intra-elites competition, agricultural elites use the choice of a progressive system to reduce the political power of industrial elites. [Bisin and Verdier \(2021\)](#), [Mokyr \(2016\)](#) and [Touré \(2021\)](#) associate the change in the tax system with a process of cultural change within the elite rather than among the citizens. Our model does not address elite competition or heterogeneity of elite preferences but offers an economic reason why and when the elite as a whole would benefit from implementing a progressive tax through its influence in civic culture of non-elite citizens.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 analyses the elite's fiscal policy at each period. Section 4 studies the comparative statics on fiscal progressivity due to changes in the levels of reciprocity and fiscal coercion in society. Section 5 shows the factors that determine the size of state capacity and the level of public good provision. In Section 6, we characterize the preference distribution steady states, or tax cultures, under monotonic payoff-driven dynamics and their determinants, and we provide some comments on how our model could contribute to explaining the fall of progressive taxation in recent decades. Finally, Section 7 presents the conclusions.

2. Model

In each period there is a population of mass 1 divided between a wealthy elite (a small proportion $e < 1$ of the population) and a majority of citizens (a proportion $(1 - e)$ of the population). The income of the elite is w_e and that of the non-elite citizens w , where $w \leq w_e$. Therefore, there is an inequality ratio $\frac{w_e}{w} \geq 1$. There is no democracy (or alternatively, democracy is captured by the wealthy elite) and the elite decide the tax policy.⁸ In each period, the elite have to decide the tax rates to be paid by the population, choosing a tax rate for citizens, t , and another for the elite, t_e . We assume that $\{t, t_e\} \in [0, \bar{t}]$, where $\bar{t}$ is a top tax rate. For simplicity, we assume that $\bar{t} = 1$. Therefore, the fiscal system ranges from progressive taxation ($t_e > t > 0$), to regressive taxation where the elite pays less taxes than citizens ($t_e < t$) including the extreme case in which only citizens pay taxes ($t_e = 0, t > 0$). Thus, the progressivity of the tax system is captured by the difference $(t_e - t)$.

We further assume that all tax revenues levied are devoted to financing a public good, G , that provides a return of $\alpha > 1$ for all members of the population.⁹ In our analysis, this parameter α , the return from the public good, might be different or the same for the elite and citizens. But for our results, the return obtained from the public good for the elite is indeed the relevant factor. For instance, a usual way of approaching a high return α is considering it necessary as the result of either an external threat of war that needs extra resources, or an internal threat of revolution or social unrest that needs to be managed with a high social expenditure (a strong welfare state). But, in general, it could be a return for the elite of any kind of tax-financed expenditure that aminorates social conflict with the non-elite (see [Acemoglu and Robinson, 2023](#)) and also any expenditure that increases productivity and generates positive spillovers that specially favour the elite, such as, the extension of primary education to train a skilled workforce or infrastructure investments (see [Alesina et al., 2019](#)).

The utility function of the elite is given by:

$$\alpha G + w_e(1 - t_e).$$

Citizens must decide, once the elite have chosen the taxes, which share of their income not to declare to the tax authorities (their non-compliance rate), denoted by $n \in [0, 1]$ where n stands for “non-compliance”.

In line with [Besley \(2020\)](#), we assume that non-compliance with taxation may be costly if a citizen is caught and fined for not paying taxes.¹⁰ This is captured by adding a non-compliance material cost, measured in units of private consumption, in a quadratic form:

$$\tau w \frac{n^2}{2} \text{ if } n > 0 \text{ and } 0 \text{ otherwise.}$$

⁸ [Benabou \(2000\)](#) provides evidence and shows that the political system in modern advanced countries is strongly biased towards the wealthy. The decisive political group is located above the median in terms of income and wealth.

⁹ We assume there are no transfers or subsidies in the economy.

¹⁰ Just for simplicity, we assume that the elite, when paying taxes, do not hide any income. This does not significantly affect the results, but it simplifies the analysis.

The parameter τ measures detection effort (coercion) by authorities. These costs are dissipative material costs (supervising or monitoring costs by the government).¹¹

In the population of non-elite citizens there is a proportion μ of “tax concerned” or fiscal-reciprocators that are concerned by fiscal progressivity in addition to the material payoffs and a proportion $(1 - \mu)$ of selfish or materialist citizens just concerned with their material payoffs. We assume that in each period h , $\mu_h \in [\mu, \bar{\mu}]$, where μ is an irreducible fraction of fiscal-reciprocators who cannot be socialized and $1 - \bar{\mu}$ is an irreducible fraction of materialist citizens. The possibility $\mu > 0$ and $\bar{\mu} < 1$ allows for a society to remain partially materialist or fiscal-reciprocal. We will take into account these bounds in Section 6 where we develop our dynamic analysis. However, in the static analysis from Section 3 to Section 5, and for ease of exposition, we drop these bounds on μ . We also focus initially on a single period, dropping any reference to period h .

Therefore, the utility function of a citizen is given by:

$$\alpha G + w[1 - (1 - n)[t - \gamma(t_e - t)] - \tau \frac{n^2}{2}].$$

The parameter γ measures the degree of sensitivity of these citizens to the progressivity of the tax system. Selfish citizens are characterized by $\gamma = 0$, while fiscal-reciprocators are by $\gamma > 0$.

The term $(1 - n)\gamma(t_e - t)$ links tax non-compliance decisions to the progressivity of the tax system for fiscal-reciprocators.¹² If $t_e > t$, a progressive tax system, there is an increase of utility for this type of citizen because it is “as if” non-compliance is based on a lower tax rate. However, there is a loss of utility when this system is regressive i.e. $t_e < t$, because it is “as if” non-compliance is based on a higher tax rate. This captures both an element of positive reciprocity when there is a progressive tax regime and, of negative reciprocity when there is a regressive tax regime.

We make several assumptions throughout the paper. We assume that $\tau > \gamma$, that is, the reciprocity motive is not so strong as to be stronger than coercion. However, in order to simplify the analysis and focus on interesting cases we establish an upper bound in both motives. In particular, in order to focus on interior solutions of non-compliance rates and tax rates we also make the assumption: $\tau < 2$. Finally, we assume that γ is big enough to prompt a different behaviour from different types of non-elite citizens, otherwise behaviour between fiscal-reciprocators and selfish citizens would be indistinguishable. In particular, we assume $\gamma = 1$ to make the model more manageable, without qualitatively changing the results. In short, in the rest of the paper we make the following assumption:

ASSUMPTION: $1 = \gamma < \tau < 2$.

The timing of the game at each period is the following: the elite choose the fiscal system $\{t_e, t\}$, assuming that all fiscal revenues will finance the public good, and then after observing the elite's choice, non-elite citizens choose their non-compliance rate, that determines the level of tax revenues and the size of the public good.

2.1. The non-compliance rate of non-elite citizens

Solving the game by backward induction we first obtain the optimal non-compliance rate for both types of citizens. Let us denote as n_s the non-compliance rate of selfish citizens and as n_f the non-compliance rate of fiscal-reciprocators.

The optimal non-compliance rate for selfish citizens is given by:

$$n_s^* = \frac{t}{\tau},$$

This solution is interior since $\tau > 1$. This non-compliance rate depends positively on the tax rate paid by the non-elite citizens and negatively on the coercion or monitoring parameter τ .

The optimal non-compliance rate for a fiscal-reciprocator is given by:

$$\begin{aligned} n_f^* &= \frac{t - (t_e - t)}{\tau} \text{ if } t - \tau n_f - (t_e - t) = 0, \\ &= 1 \text{ if } t - \tau n_f - (t_e - t) > 0, \\ &= 0 \text{ if } t - \tau n_f - (t_e - t) < 0, \end{aligned}$$

where $(t - \tau n_f - (t_e - t)) = 0$ is the first-order-condition of this utility maximization problem. In the first case, there is an interior solution and in the other two cases a corner solution is obtained.

Note that the optimal non-compliance of a fiscal-reciprocator diminishes with progressivity, and also depends positively on the tax rate paid by non-elite citizens and negatively on the coercion or monitoring parameter τ . Note also that $n_f^* \leq n_s^*$ if $t_e \geq t$ when we compare the interior solutions of both types of citizens. Therefore, non-compliance of a fiscal-reciprocator is higher than non-compliance of a selfish citizen in a regressive tax system whereas it is smaller under a progressive tax system. Obviously, this is a consequence of positive and/or negative reciprocity.

Therefore, the average population non-compliance rate, $n^* = \mu n_f^* + (1 - \mu)n_s^*$, is given by:

$$n^* = (1 - \mu) \frac{t}{\tau}, \text{ for } 0 < t < \frac{t_e}{2},$$

¹¹ We assume that none of the compliance costs are appropriable as public revenues. This assumption simplifies the analysis, and does not significantly affect the results.

¹² Note that, as with the non-compliance costs imposed on citizens, this term of the utility function is also measured in units of private consumption.

$$\begin{aligned} n^* &= \frac{t - \mu(t_e - t)}{\tau}, \text{ for } \frac{t_e}{2} < t < \frac{\tau + t_e}{2}, \\ n^* &= \mu + (1 - \mu)\frac{t}{\tau}, \text{ for } \frac{\tau + t_e}{2} < t. \end{aligned} \quad (1)$$

Next, we characterize the elite's choice of fiscal system $\{t_e, t\}$ anticipating the reaction of non-elite citizens.

3. Optimal policy of the elite

The elite, anticipating the behaviour of citizens, choose the fiscal system $\{t_e, t\}$, maximizing their own utility function (U_e) subject to the budget constraint ($T \equiv G$), that is, all the fiscal revenues T that will finance the spending of public goods, and subject also to the expected average population non-compliance rate n^* . The choice by the elite is represented by the following problem:

$$\begin{aligned} &\max_{(t_e, t)} \alpha G + w_e(1 - t_e) \\ &\text{s.t.} \\ &G \equiv T = ew_e t_e + (1 - e)wt(1 - n^*), \\ &n^* = (1 - \mu)\frac{t}{\tau}, \text{ for } 0 < t < \frac{t_e}{2}, \\ &n^* = \frac{t - \mu(t_e - t)}{\tau}, \text{ for } \frac{t_e}{2} < t < \frac{\tau + t_e}{2}, \\ &n^* = \mu + (1 - \mu)\frac{t}{\tau}, \text{ for } \frac{\tau + t_e}{2} < t. \end{aligned}$$

Equivalently,

$$\begin{aligned} &\max_{(t_e, t)} \alpha(ew_e t_e + (1 - e)wt(1 - n^*)) + w_e(1 - t_e) \\ &\text{subject to} \\ &n^* = (1 - \mu)\frac{t}{\tau}, \text{ for } 0 < t < \frac{t_e}{2}, \\ &n^* = \frac{t - \mu(t_e - t)}{\tau}, \text{ for } \frac{t_e}{2} < t < \frac{\tau + t_e}{2}, \\ &n^* = \mu + (1 - \mu)\frac{t}{\tau}, \text{ for } \frac{\tau + t_e}{2} < t. \end{aligned}$$

To characterize the solution to this problem in a main proposition, let us first prove some lemmata.

Lemma 1. *The elite will always choose in its optimal policy a corner solution in t_e , that is, either $t_e = 1$ or $t_e = 0$.*

Proof. We start by analysing the first order condition (FOC) with respect to t_e ,

$$\frac{\partial(U_e)}{\partial t_e} = (\alpha e - 1)w_e - \alpha(1 - e)wt \frac{\partial n^*}{\partial t_e}.$$

From expression (1) note that $\frac{\partial n^*}{\partial t_e} \leq 0$, that is, the average non-compliance never rises when t_e increases and, in particular, when n^* is interior, $\frac{\partial n^*}{\partial t_e} = -\frac{\mu}{\tau}$.

The variation of t_e has two effects on the utility of the elite. On the one hand, there is a direct effect on the elite's utility, captured in the first term of the derivative, derived from its influence on the elite's private and public good consumption when paying taxes t_e . Obviously, this direct effect is positive if $\alpha > 1/e$, and negative otherwise. In other words, it is positive if the value of the public good is very high.

The second term of the derivative captures an indirect effect, which is always non-negative, resulting from a change in the non-compliance rate, $\frac{\partial n^*}{\partial t_e}$, caused by the change in t_e , that affects the public good provision. An increase in t_e might reduce non-compliance n^* because it increases progressivity, and thus increases $G (\equiv T)$ and the elite's utility. This effect is positive (when $\frac{\partial n^*}{\partial t_e} < 0$) or null (when $\frac{\partial n^*}{\partial t_e} = 0$). Note that this effect does not exist if all citizens are selfish, because their non-compliance rate $n_s^* = \frac{t}{\tau}$ does not depend on the taxes paid by the elite.

Therefore, when $\alpha > 1/e$, the direct effect is positive and since $\frac{\partial n^*}{\partial t_e} \leq 0$, then $\frac{\partial(U_e)}{\partial t_e} \geq 0$, for all t . Thus, if $\alpha > 1/e$, both effects are non-negative, operate in the same direction and there is a corner solution, $t_e = 1, \forall t$.

However, when $\alpha < 1/e$, the direct effect is negative, and the total effect on $\frac{\partial(U_e)}{\partial t_e}$, will depend on the sign of $\frac{\partial n^*}{\partial t_e}$. Thus, the final outcome on U_e depends which effect predominates, but in any case yields a corner solution $t_e = 1$ or $t_e = 0$.

It is easy to compute, from the FOC, that when $\frac{\partial n^*}{\partial t_e}$ is negative there will be a critical value, B , such that,

$$\text{If } t < B, \frac{\partial U_e}{\partial t_e} < 0, \text{ then the corner solution is } t_e = 0,$$

$$\text{if } t \geq B, \frac{\partial U_e}{\partial t_e} > 0, \text{ then the corner solution is } t_e = 1.$$

where $B = \frac{w_e}{w} \frac{(1-ae)\tau}{\alpha(1-e)\mu}$, which is decreasing in α , μ and increasing in τ and in the ratio $\frac{w_e}{w}$.¹³ Note that B can be higher than 1, and in this case the optimal policy of the elite will be to set $t_e = 0$, $\forall t \in (0, 1)$. Note also that this critical value is influenced by the inequality ratio $\frac{w_e}{w}$. ■

In summary, a corner solution is always obtained, that will be either $t_e = 1$ (a tax system where the elite pay high taxes) or $t_e = 0$ (a tax system where the elite do not pay taxes at all). This result simplifies our analysis of the optimal tax rate t set by the elite for the citizens.

In the next lemma we state the possible fiscal equilibria of the game.

Lemma 2. Assuming that $\tau \in (1, 2)$, there are two possible equilibria:

- (a) a Regressive Tax Equilibrium (RTE), ($t_e = 0, t = t_r = \frac{\tau}{2(1+\mu)}$),
- (b) a Progressive Tax Equilibrium (PTE), ($t_e = 1, t = t_p = \frac{\mu+\tau}{2(1+\mu)}$).

Proof. See Appendix for the complete proof. ■

If we look at the FOC with respect to t , we get,

$$\frac{\partial(U_e)}{\partial t} = \alpha(1-e)w[(1-n^*) - t \frac{\partial n^*}{\partial t}].$$

Note that again we find two effects of a change of t on the elite's utility U_e . On the one hand, the first term, captures a direct "tax effect" for a given n^* , which is always positive, because it increases fiscal revenue and public good expenditure. On the other hand, the second term captures an indirect effect, derived from the change in non-compliance n^* caused by the change in the tax paid by citizens, t . The sign of this second effect will depend on the sign of $\frac{\partial n^*}{\partial t}$, which is always positive. An increase in t increases non-compliance n^* and thus decreases G and the elite's utility.

Let us look for an interior solution (both with respect to n^* and t), where $n^* = \frac{t-\mu(t_e-t)}{\tau}$. Note that in this case, $\frac{\partial n^*}{\partial t} = \frac{1+\mu}{\tau} > 0$.

Therefore, analysing the FOC with respect to t , we obtain an interior solution when

$$\frac{\partial U_e}{\partial t} = 0, \text{ then } t = \frac{\mu t_e + \tau}{2(1+\mu)}.$$

But we already know from the previous lemma that the optimal tax policy for the elite is either $t_e = 1$ or $t_e = 0$. Therefore, if $t_e = 1$, in the progressive fiscal system, the tax rate of the citizens, t_p , is given by:

$$t_p = \frac{\mu + \tau}{2(1+\mu)}.$$

If $t_e = 0$, in the regressive fiscal system, the tax rate of the citizens, t_r , is given by:

$$t_r = \frac{\tau}{2(1+\mu)}.$$

Notice that both t_r and t_p are smaller than 1, because $\tau < 2$.

It is also easy to check that these solutions belong to the assumed intervals on t .

$$0 < t_r = \frac{\tau}{2(1+\mu)} < \frac{\tau}{2}$$

and

$$\frac{1}{2} < t_p = \frac{\tau + \mu}{2(1+\mu)} < \frac{\tau + 1}{2}.$$

The Appendix A shows that these feasible interior solutions are in fact the ones that maximize the elite's utility.

Note that with these tax rates, we have the following non-compliance rates in the different equilibria (n_r^* and n_p^* , in the RTE and PTE, respectively).

$$n_r^* = \frac{1}{2} \text{ and } n_p^* = \frac{1}{2} - \frac{\mu}{2\tau}.$$

Note that $n_p^* > 0$ if $\tau > 1$, as we have assumed. Also note that for any $\mu > 0$, $n_r^* > n_p^*$.

In the next proposition we show one of the main results of the paper, characterizing the optimal choice of fiscal policy of the elite in each period.

Proposition 1. Assuming $\tau \in (1, 2)$ and given an inequality ratio $\frac{w_e}{w}$, then (i) if $\alpha \geq 1/e$, the elite will choose the Progressive Tax Equilibrium, $\forall \mu$.

(ii) If $\alpha < 1/e$, there exists a critical value $\mu^*(\alpha, \frac{w_e}{w}, \tau, e)$, which is the implicit solution to $\hat{A}(\mu^*) = \frac{w_e}{w}$, where $\hat{A}(\mu) = \frac{\alpha(1-e)\mu}{4(1-ae)\tau} \frac{(2\tau+\mu)}{(1+\mu)}$, such that,

- (ii1) if $\mu < \mu^*$ the elite choose the Regressive Tax Equilibrium,
- (ii2) if $\mu \geq \mu^*$ the elite choose the Progressive Tax Equilibrium.

¹³ Note that if $t = B$, then $\frac{\partial U_e}{\partial t_e} = 0$, and any t_e is optimal. We exclude this case in order to simplify our presentation.

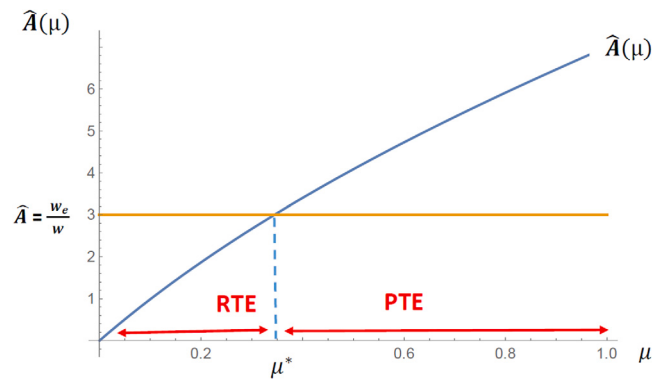


Fig. 4. Inequality and Tax System ($\frac{w_e}{w} = 3, \tau = 1.5, \alpha = 7, e = 0.1$).

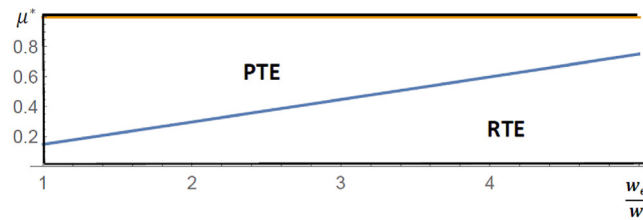


Fig. 5. Basins of Attraction of Progressive and Regressive Tax Equilibrium ($\tau = 1.5, \alpha = 7, e = 0.1$).

Proof. See [Appendix A](#). ■

Note that μ^* is increasing in $\frac{w_e}{w}$ and in τ , and is decreasing in α and e . Note also that μ^* could be greater or equal to 1. In this case, if $\alpha < 1/e$, the elite choose the Regressive Tax Equilibrium for all $\mu \in [0, 1]$.

Proposition 1 shows that, for a given level of inequality, the elite will implement a progressive tax system either if the return obtained by the elite from the public good α is very high ($\alpha \geq 1/e$) or alternatively, even though $\alpha < 1/e$, if the share of reciprocators in the population μ is high enough. In particular, the share of reciprocators has to be sufficiently large $\mu \geq \mu^*$. This critical share of reciprocators μ^* will be higher the higher the inequality ratio $\frac{w_e}{w}$. If any of these conditions does not hold, the elite will implement a regressive tax system, choosing not to pay taxes at all.

Fig. 4 displays function $\hat{A}(\mu)$. The critical value of the inequality ratio $\hat{A}$ is obtained from the comparison between the utility obtained by the elite in the Regressive Tax equilibrium $U_e(RTE)$ and the utility obtained by the elite in the Progressive Tax equilibrium $U_e(PTE)$. It is easy to check that $U_e(RTE) \geq U_e(PTE)$ iff $\frac{w_e}{w} \geq \hat{A}$. Note that the value of the inequality ratio, $\hat{A}$, such that the elite is indifferent between a progressive tax or a regressive tax depends positively on α, μ and e . And negatively on τ , the level of feasible fiscal coercion.¹⁴ Thus, high values of the return of the public good for the elite and a high proportion of fiscal-reciprocators in the population enlarge the range of inequality ratios for which the elite will implement a PTE, while high values of fiscal coercion reduce this range.

As we can see the inequality ratio $\frac{w_e}{w}$ becomes a crucial determinant of the tax system chosen by the elite. Therefore, we can state the following corollary.

Corollary 1. *The set of values of μ for which PTE (RTE) is chosen by the elite decreases (increases) with the inequality ratio $\frac{w_e}{w}$.*

Fig. 5 depicts the pairs $(\mu, \frac{w_e}{w})$ for which the elite choose RTE or PTE (i.e., the basins of attraction of both equilibria). Therefore, if $\frac{w_e}{w}$ increases, μ^* also increases and the range of values of μ for which the elite choose PTE diminishes. The critical value of μ^* depends negatively on coercion τ . In other words, it decreases with τ , reducing the basin of attraction of PTE. Graphically, there will be an upward shift of the function μ^* . Similarly, μ^* depends also negatively on e , the elite's proportion in the population. Lastly, μ^* increases with the return of the public good α . Graphically, there will be a downward shift of the function $\mu^*(\cdot)$ if α increases.

In summary, a key role is played by the return of the public good for the elite. Whenever this α is unusually high, for instance, because of a war or any other existential threat for the elite (like a revolution, a catastrophe, etc...), the elite will choose a progressive tax equilibrium. But even when this α is not so disproportionately high, the elite will be interested in paying taxes, in a progressive tax system, only if a sufficiently high proportion of fiscal-reciprocators is present in the population and inequality is not too high. In this

¹⁴ See [Appendix B](#).

case, although paying taxes t_e reduces the direct utility obtained by the elite from private and public consumption, this negative effect might be compensated by the increase in compliance of reciprocal citizens caused by progressivity, and the subsequent increase in tax revenue and utility derived from public good provision. Nevertheless, this latter effect will be smaller the smaller the proportion of fiscal-reciprocators in the population, and the higher the inequality ratio.

Intuitively, the greater the distance between the elite's income w_e and the non-elite citizens' income w , the smaller will be the positive effect on tax revenue, induced by a decrease in non-compliance, because w is relatively "small", while the negative effect on the elite's utility, caused by giving up private consumption by paying taxes, will be high (because w_e is relatively "high"). In other words, a very rich elite loses interest in the public good and prefers private consumption, for which it does not pay taxes.

4. What drives fiscal progressivity? Reciprocity versus coercion

Given a level of inequality in society, expressed as an inequality ratio $\frac{w_e}{w}$, we analyse the effects of the most important determinants on the elite's choice at each period of a tax system and also their effects on the degree of progressivity/regressivity, measured as the difference $t_e - t$. We have two main parameters, τ and μ , concerning tax compliance, apart from the marginal return of the public good for the elite α . Parameter τ indicates the level of coercion that the government can deploy in collecting taxes (the monitoring of tax evasion and elusion). In particular, it determines the material cost of non-compliance. It depends on the state of monitoring technology and related factors but also, on political decisions. Parameter μ is the proportion in the population of citizens motivated by fiscal reciprocity. Therefore, it constitutes a measure of the level of reciprocity in society (or the existing "tax morale" as it is known in the literature).

First, we analyse the effects of changes in these parameters on the degree of progressivity/regressivity of a fiscal system through their direct effects on the tax rate paid by citizens t and on the indirect effects caused on the non-compliance rates. We then analyse their effects on the elite's decision to establish a progressive or regressive tax system through their effects on the critical level of the inequality ratio $\hat{A}$.

4.1. Effects on the citizen tax rate t and on progressivity

Let us start by looking at the effects on t . It is easy to check that an increase in coercion τ always has a positive effect on the tax set by the elite to be paid by the citizens, both in PTE and RTE fiscal system.¹⁵ Therefore, an increase in τ raises the regressivity both in RTE and in PTE. However, an increase in reciprocity μ will reduce the citizens tax rate both in the PTE system and in the RTE system. Thus, an increase in the reciprocity of society leads to an increase in the progressivity in any tax system chosen by the elite.

Therefore, both forces (coercion and reciprocity) operate in opposite directions with respect to its effects on the increase of the tax t that the elite will optimally implement, and accordingly in terms of the progressivity (the difference $(t_e - t)$) of the tax system.

4.2. Effects on citizen non-compliance n

We now analyse the effects of changes in coercion τ and reciprocity μ on the non-compliance of citizens in the fiscal system, bearing in mind as shown below, that a change in these parameters will only affect the non-compliance rate in a progressive fiscal system, because in the regressive fiscal system these effects will cancel each other out.

There are two effects from a change in τ or μ on non-compliance rates: a direct effect on the non-compliance rates and an indirect effect because of the change in t induced by a change in μ or τ .

In aggregate terms, an increase in coercion τ yields an increase in the non-compliance rate n_p^* in the PTE fiscal system. An increase in τ always decreases the non-compliance rate of selfish citizens in the progressive fiscal system, n_p^s , by the coercion effect. However, this increase in τ results in a dual opposite impact on the non-compliance rate of fiscal-reciprocators in the progressive fiscal system n_p^f . On the one hand, it reduces n_p^f , due to coercion and, on the other hand, increases n_p^f because of a rise in regressivity through the increase of t_p . This latter sub-effect dominates the former and the overall result is a positive effect on n_p^f . Finally, the total effect of an increase in τ is an increase in the average non-compliance n_p^* .¹⁶

An increase in reciprocity μ will cause a reduction in the non-compliance rate in the PTE fiscal system. In this case, the rise in reciprocity causes a decrease in the tax rate t to be paid by the citizens and therefore, an increase in progressivity. All of this reinforces a decrease in the average non-compliance n_p^* .

In summary, reciprocity μ and coercion τ operate in opposite directions with respect to their effect on the average non-compliance in the Progressive Tax Equilibrium (PTE).

However, an increase in τ and μ yields no change in non-compliance in the Regressive Tax Equilibrium (RTE).

Note that $\frac{\partial n_r^*}{\partial \tau} = 0$ because both above mentioned effects (direct and indirect) on n_r^f and n_r^s cancel each other out.¹⁷ Also note that $\frac{\partial n_r^*}{\partial \mu} = 0$. In this case an increase in μ yields, as we already know, a decrease in t_r , but also a reduction in n_r^f and n_r^s and, by a composition effect, n_r^* remains constant.

¹⁵ All the corresponding derivatives in this section can be found in the [Appendix B](#).

¹⁶ [Appendix B](#) shows this effect of the decomposition of n_p^* , between n_p^f and n_p^s .

¹⁷ This is due to the functional form we are using, where the following property holds, $\frac{\partial t_r}{\partial \tau} = \frac{t_r}{\tau}$.

4.3. Effects on the elite's choice of tax system

We consider the case where $\alpha < 1/e$. Let us analyse the effects of changes in coercion τ and reciprocity μ on the critical level of the inequality ratio $\hat{A}$, which determines whether the elite will choose a progressive or a regressive tax system. Note that when the existing inequality ratio $\frac{w_e}{w}$ is higher (lower) than $\hat{A}$ the elite choose RTE (PTE).

We can check that an increase in coercion τ will cause a reduction in $\hat{A}$. In other words, an improvement in monitoring and coercion τ will reduce the incentives of the elite to build a progressive fiscal system for a given ratio $\frac{w_e}{w}$.

As in previous cases, the total effect can be decomposed in several sub-effects. First, we know that the rise in τ will cause an increase both in t_p and t_r , the tax rate paid by citizens in both equilibria. However, it will also cause a reduction in compliance in the progressive tax equilibrium (an increase in n_p^*) that overcomes the positive effect on fiscal revenues of an increased tax rate, leading to a reduction in $\hat{A}$. This overall result, in turn, decreases the attraction of the PTE for the elite, since as $\hat{A}$ diminishes and, for the same inequality ratio $\frac{w_e}{w}$, the elite might switch their preference to a RTE.

However, an increase in reciprocity μ will cause an increase in $\hat{A}$. In this case, the increase in compliance in the progressive tax equilibrium due to this higher proportion of reciprocators in society dominates the negative tax effects. Consequently, there is an increase in the attraction of the PTE for the elite for a given ratio of $\frac{w_e}{w}$, since it increases the possibility of $\frac{w_e}{w}$ being smaller than $\hat{A}$.

Below is a summary of the results obtained in this section:

- An increase in coercion reduces progressivity, tax compliance in the Progressive Tax Equilibrium and the inequality ratio such that the elite are indifferent to choosing between progressive or regressive taxation.
- An increase in reciprocity increases progressivity, tax compliance in the Progressive Tax Equilibrium and the inequality ratio such that the elite are indifferent to choosing between progressive or regressive taxation.

5. State capacity and public good provision

Our model focuses on the interplay between tax progressivity and reciprocity. Given this objective we have assumed for simplicity that all collected tax revenue finances public good provision, leaving aside other public expenditures such as transfers and subsidies.¹⁸ Therefore, the level of public good provision (G) coincides with the level of state capacity, that is, the total revenue obtained from taxation. Let us compute it in both types of equilibria.

The level of public good provision in the Regressive Tax Equilibrium (G_r) is given by:

$$G_r = \frac{(1-e)w\tau}{4(1+\mu)}.$$

Note that G_r increases with the level of coercion τ and the citizens' income w , decreases with the proportion of the elite in society e , and also decreases with the level of reciprocity μ . The higher the proportion of fiscal-reciprocators in the population, the smaller the state capacity. Therefore, negative reciprocity operates in this equilibrium.

The level of public good provision in the Progressive Tax Equilibrium (G_p) is given by:

$$G_p = ew_e + \frac{(1-e)w\tau}{4(1+\mu)} \left(\frac{\tau+\mu}{\tau} \right)^2.$$

Note that G_p increases in all variables w_e , w , τ , μ , w and e . Positive reciprocity operates in this progressive equilibrium: the higher the proportion of fiscal reciprocators in the population the higher the state capacity.

As shown in Section 3, tax rates are higher in a progressive tax equilibrium than in a regressive tax equilibrium, whereas the average level of tax non-compliance is smaller. Consequently, public good provision (and state capacity) is higher in a progressive tax equilibrium.

However, note that in PTE, $n_f^* < n_s^*$, i.e., non-compliance of fiscal-reciprocators is smaller than that of selfish citizens due to the positive reciprocity of the former, while in RTE the opposite happens, $n_f^* > n_s^*$, due to negative reciprocity.

We now analyse the effects of the parameters, τ and μ , which affect tax compliance, on state capacity and public good provision of an economy.

An increase in coercion τ will cause an increase in the provision of the public good in the PTE system,¹⁹ G_p . Two opposite effects are seen to occur. On the one hand, there is an increase in fiscal revenue obtained in the PTE because of the increase in t_p but, on the other hand, there is a reduction in fiscal revenue due to the increase in the average non-compliance n_p^* . The first effect can be seen to dominate the second one.

Intuitively, as coercion motives are stronger than reciprocity motives, an increase in τ will lead to an increment in the size of public good provision in the PTE.

An increase in reciprocity μ will also cause an increase in the size of G_p . When reciprocity μ increases there is a reduction in t_p but an increase in the rate of compliance $(1 - n_p^*)$, but, in this case, the overall effect on fiscal revenues is positive.

Note that in this situation the elite are interested in a reduction of the tax to be paid by citizens, t_p , because this increases progressivity $(1 - t_p)$ and, reduces average population non-compliance n_p^* and the aggregate effect yields an increment in G_p .

¹⁸ Besley (2020), in contrast, analyses the interplay between expenditure composition (spending on the public good or transfers) and reciprocity.

¹⁹ Note that $\tau > \mu$, because $\tau > 1$.

Regarding the other fiscal regime, RTE, an increase in coercion τ will also cause an increase in the size of the public good, G_r . In this case, there is only a positive effect on the tax revenue because of the increase in t_r caused by the rise of τ , since there is no change in the non-compliance rate.

Nevertheless, an increase in reciprocity μ will produce a reduction in the size of the public good, G_r . When reciprocity μ increases there is a reduction in t_r but there is no change in the rate of compliance $(1 - n_r^*)$, thus there is a reduction in G_r . The final reason that explains this result is negative reciprocity.

In summary, both improved coercion and reciprocity increase state capacity in a Progressive Tax Equilibrium. Nevertheless, in a Regressive Tax Equilibrium only coercion improves state capacity, while greater reciprocity results in lower state capacity.

6. Dynamics of fiscal reciprocity

We now make the preferences distribution in the citizens' population μ endogenous by applying an evolutionary model where the payoff difference between being a fiscal-reciprocator or a selfish citizen affects the evolution of the composition of the population. We assume that in each period h , $\mu_h \in [\mu, \bar{\mu}]$, where μ is an irreducible fraction of fiscal-reciprocators who cannot be socialized and $1 - \bar{\mu}$ is an irreducible fraction of materialist citizens.

The timing of events in the dynamic model is as follows:

First, there is an initial proportion of fiscal-reciprocators in period h , μ_h .

Given this proportion the elite choose the fiscal system (t_e, t) .

Non-elite citizens choose their compliance decision which determines the level of tax revenues and the size of the public good.

The next generation of non-elite citizens is socialized, which determines μ_{h+1} .

Different mechanisms of cultural evolution have been proposed in the literature, but most of them share the following property: preferences that are more successful tend to spread, while those that are not, tend to disappear.²⁰

We assume that μ changes over time according to a simple payoff-monotonic dynamics (Sandholm, 2010). In other words, it will move in the direction of $u_f - u_s$, where u_s , u_f are the utility of the selfish and fiscal-reciprocators, respectively. Therefore, if $u_f - u_s > 0$, μ_h will increase, and, if $u_f - u_s < 0$, μ_h will decrease. The main assumption is that the type of citizen with the highest expected payoff will replicate faster.

More precisely, we assume that μ_h evolves over time as: $\mu_{h+1} = \mu_h + q(\mu_h)(1 - q(\mu_h))Q(D(\mu_h, \tau))$, where $q(\mu_h) \in [0, 1]$ is an arbitrary, continuously increasing function with $q(1) = 1$ and $q(0) = 0$. Furthermore, $Q(\cdot)$ is an arbitrary, continuously increasing function with $Q(0) = 0$, and $D(\mu_h, \tau) = u_f - u_s$ is the relative cultural fitness of fiscal reciprocal versus selfish preferences, captured by the difference in the expected utility of holding them. Note that $D(\cdot)$ depends on μ_h . In this "backward-looking" case, this dynamics turns into a form of replicator dynamics.

6.1. Relative cultural fitness in the Regressive Tax Equilibrium

The expected utility difference between being a fiscal-reciprocator and a selfish citizen in the Regressive Tax Equilibrium can be given by the expression:

$$D_r(\mu, \tau) = u_f^r - u_s^r = w(t_r(n_f^r - n_s^r) - \frac{\tau}{2}((n_f^r)^2 - (n_s^r)^2) - t_r(1 - n_f^r)),$$

where $n_f^r - n_s^r = \frac{1}{2(1+\mu)}$. After substituting and solving, we get that $\forall \mu \in [\mu, \bar{\mu}]$, $u_f^r - u_s^r < 0$. This means that, under a Regressive Tax Equilibrium, for any distribution of preferences in the population, the utility obtained by a selfish individual is higher than the utility obtained by a fiscal-reciprocator. Hence, there will be a reduction in the proportion of fiscal-reciprocators in the following period.

6.2. Relative cultural fitness in the Progressive Tax Equilibrium

The expected utility difference between being a fiscal-reciprocator and a selfish citizen in the Progressive Tax Equilibrium can be given by the expression:

$$D_p(\mu, \tau) = u_f^p - u_s^p = w(t_p(n_f^p - n_s^p) - \frac{\tau}{2}((n_f^p)^2 - (n_s^p)^2) + (1 - t_p)(1 - n_f^p)).$$

After substituting and solving for $u_f^p - u_s^p = 0$, we always have two negative roots given our assumption $1 < \tau < 2$. It can be proved that $u_f^p - u_s^p > 0$, $\forall \mu \in [\mu, \bar{\mu}]$. This means that, under a progressive tax equilibrium, for any distribution of preferences in the population, the utility obtained by a fiscal-reciprocator is higher than the utility obtained by a selfish individual. Hence, there will be an increase in the proportion of fiscal-reciprocators in the following period.

²⁰ There are different approaches in the literature for capturing the ability of a preference trait to spread in the population. In Besley (2017, 2020) and Touré (2021), for example, it depends on the difference in utilities between the two traits. Another possibility, used in the evolutionary literature, is to assume that material rewards rather than utility drive cultural evolution.

Finally, Bisin and Verdier (2001) assume that the difference in socialization efforts of cultural parents with imperfect empathy drives cultural evolution. If, however, cultural parents have perfect empathy, this approach yields results equivalent to assuming that it is the difference in utilities that governs preference dynamics (see Touré, 2021).

6.3. Steady state cultures

Since $u_f - u_s$ is always negative in a RTE and it is always positive in a PTE, any notion of stability implies that only $\mu = \underline{\mu}$ or $\mu = \bar{\mu}$ can be possible long-run outcomes of the preferences distribution μ^{st} .

We denote a Steady State Culture (or a culture) as a stable steady state of the population preferences distribution and the equilibrium played on it. Therefore, a stable steady state where the PTE is played is denoted as a Progressive Tax Culture (PTC) and an analogous definition applies for a Regressive Tax Culture (RTC).

Proposition 2. *Steady state cultures are as follows:*

- (i) If $\alpha \geq 1/e$, then for all μ_o the steady state is PTC with $\mu^{st} = \bar{\mu}$, $t_e = 1$ and $t = \frac{\tau + \bar{\mu}}{2(1 + \bar{\mu})}$.
- (ii) If $\alpha < 1/e$, there exists a critical value $\mu^*(\alpha, e, \tau, \frac{w_e}{w})$, which is the implicit solution to $\hat{A}(\mu^*) = \frac{w_e}{w}$, where $\hat{A}(\mu) = \frac{\alpha(1-e)\mu}{4(1-\alpha e)\tau} \frac{(2\tau + \mu)}{(1 + \mu)}$, such that,
 - (ii1) if $\mu^* \leq \mu_o$, then for all μ_o the steady state is PTC.
 - (ii2) If $\mu^* \geq \bar{\mu}$, then for all μ_o the steady state is RTC with $\mu^{st} = \underline{\mu}$, $t_e = 0$ and $t = \frac{\tau}{2(1 + \underline{\mu})}$.
 - (ii3) If $\mu < \mu^* < \bar{\mu}$ then
 - (ii3a) for $\mu_o < \mu^*$, the steady state is RTC,
 - (ii3b) for $\mu_o \geq \mu^*$, the steady state is PTC.

Proof. The proof of cases (i), (ii1) and (ii2) is straightforward. Let us prove case (ii3).

If the dynamic starts with an initial $\mu_o < \mu^*$, then $\hat{A}(\mu^*) = \frac{w_e}{w} > \hat{A}(\mu_o)$. That is, it starts in the RTE and then $u_f - u_s < 0$ and there will be a reduction in μ . As we know from the previous section, this reduction in turn will cause a reduction in $\hat{A}(\mu_h)$, reinforcing and confirming the RTE system. Eventually, this dynamics will reach a steady state, μ^{st} , in which $\mu^{st} = \underline{\mu}$: a Regressive Tax Culture with $t_e = 0$ and $t = \frac{\tau}{2(1 + \underline{\mu})}$.

If the dynamics starts with an initial $\mu_o \geq \mu^*$, then $\hat{A}(\mu^*) = \frac{w_e}{w} < \hat{A}(\mu_o)$. That is, it starts in the PTE and then $u_f - u_s > 0$ leading to an increase in μ . As we know from the previous section, this increase in turn will cause an increment in $\hat{A}(\mu_h)$, reinforcing and confirming the PTE system. Eventually, this situation will reach a steady state in which $\mu^{st} = \bar{\mu}$: a Progressive Tax Culture with $t_e = 1$ and $t = \frac{\tau + \bar{\mu}}{2(1 + \bar{\mu})}$. ■

This proposition shows again the importance of parameter α , the return of the public good for the elite. Whenever it is unusually high $\alpha \geq 1/e$, the Progressive Tax Culture is a global attractor of the dynamics. From any initial condition, society will end up in a culture with a majority of fiscal-reciprocators, with low levels of tax non-compliance and with a high level of state capacity.

For more usual values of the return of the public good for the elite, $\alpha < 1/e$, the inequality ratio becomes the crucial factor in determining the steady state of the dynamics. First, if inequality is very high, namely, $\frac{w_e}{w} > \hat{A}(\bar{\mu})$, then $\mu^* \geq \bar{\mu}$ and the Regressive Tax Culture is a global attractor of the dynamics. From any initial condition, society will end up in a culture with a majority of selfish citizens, with high levels of tax non-compliance and with a low level of state capacity.

Second, if inequality is very low, namely, $\frac{w_e}{w} < \hat{A}(\underline{\mu})$, then $\mu^* < \underline{\mu}$ and the Progressive Tax Culture is a global attractor of the dynamics.

Finally, for levels of inequality between $[\hat{A}(\underline{\mu}), \hat{A}(\bar{\mu})]$ then $\underline{\mu} < \mu^* < \bar{\mu}$ and there is no global attractor of the dynamics. In this case, the steady state depends on the initial condition of society. If the initial condition of the dynamics has a relatively low proportion of fiscal-reciprocators, $\mu_o < \mu^*$, society will end up in a Regressive Tax Culture. However, if the initial condition of the dynamics has a sufficiently high proportion of fiscal-reciprocators, $\mu_o \geq \mu^*$, society will end up in a Progressive Tax Culture. Note again that the critical share of reciprocators μ^* depends crucially on the inequality ratio, in particular, increasing with $\frac{w_e}{w}$.

Fig. 6 depicts the basins of attraction of both cultures (PTC and RTC) in the space $(\mu_o, \frac{w_e}{w})$ of pairs of initial conditions of the dynamics and inequality ratios. This figure illustrates how for low levels of inequality, PTC is the attractor of the dynamics even with low initial levels of reciprocity. But as inequality increases, increasingly higher initial levels of reciprocity are required to reach PTC as the long run outcome. For very high levels of inequality, RTC is the attractor of the dynamics even for initial conditions with a very high proportion of fiscal-reciprocators.

In the Regressive Tax Culture the non-compliance population rate is $n_r^{st} = 1/2$ and the size of public good provision (and therefore, state capacity) is $G_r^{st} = \frac{(1-e)w\tau}{4(1+\underline{\mu})}$, whereas in the Progressive Tax Culture, the non-compliance population rate is $n_r^{st} = 1/2 - \frac{\bar{\mu}}{2\tau}$ and $G_p^{st} = ew_e + \frac{(1-e)w\tau}{4(1+\bar{\mu})} \left(\frac{\tau + \bar{\mu}}{\tau} \right)^2$. The next Corollary compares both cultures.

Corollary 2. *A Progressive (Regressive) Tax Culture has a high (low) proportion of non-elite fiscal-reciprocators, a low (high) tax non-compliance rate, and high (low) level of public good provision.*

It is easy to show that average non-compliance is higher in a regressive tax culture than in a progressive one, that is, $n_r^{st} > n_p^{st}$ and that the tax rate paid by citizens is higher in a regressive tax culture, that is, $t_r > t_p$, when $\tau > \frac{\bar{\mu}(1+\bar{\mu})}{\bar{\mu}-\underline{\mu}} > 1$. Given the results

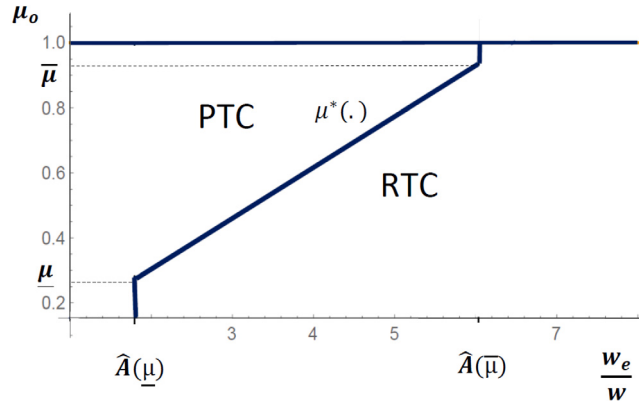


Fig. 6. Basins of Attraction of Progressive and Regressive Culture ($\tau = 1.5, \alpha = 7, e = 0.1$).

obtained in Section 5, namely that G_r is decreasing in μ and G_p is increasing in μ , it follows that $G_p^{st} > G_r^{st}$, that is, state capacity and public good provision is higher in a progressive tax culture.²¹

Previous studies (see Persson and Tabellini, 2020 for a review) in which the population's preference distribution, culture, evolves influenced by institutions, show steady-state complementarity between culture and strong institutions. Similarly, our theoretical model shows that there is complementarity between the level of reciprocity μ and tax progressivity ($t_e - t$). On the one hand, tax progressivity increases with reciprocity because the tax paid by citizens in both a PTC and a RTC is lower when the level of reciprocity in society is higher. On the other hand, reciprocity dynamically increases with tax progressivity, because in a progressive tax equilibrium, cultural fitness favours the spread of fiscal-reciprocal preferences, whereas in a regressive tax equilibrium, cultural fitness favours selfish preferences.

The dynamic complementarity between preference distribution (reciprocity) and institutions (tax system) gives rise to hysteresis: depending on initial conditions, societies can converge to a steady state with regressive taxation, a majority of selfish citizens and a low state capacity or converge to a steady state with progressive taxation, a majority of fiscal-reciprocators and a high state capacity. However, our model provides an important additional insight: it shows that income inequality crucially determines in which culture society will end up in. If the inequality ratio is sufficiently low a progressive tax culture will be achieved, while if it is high, a regressive tax culture will prevail.

6.4. Utility of citizens and the elite between tax cultures

From the utility function of non-elite citizens it follows that both types of citizens are better off in the progressive tax culture than in the regressive one. However, if we compare the utility of the elite in both steady state tax regimes we see that the result depends on the level of inequality in the economy. With this comparison, we identify which tax regime a “farsighted” elite would prefer in the long run. Note that in our model the elite are “shortsighted” in the sense that utility is maximized myopically in each period.

We find that the comparison of the elite's utility in both fiscal regimes depends again on whether the inequality ratio is higher or smaller than a critical value.

$$U_e^{st}(RTE) \geq U_e^{st}(PTE), \text{ if}$$

$$\frac{w_e}{w} \geq \hat{B}(\alpha, e, \tau) = \frac{\alpha(1-e)}{4(1-\alpha e)} \left(\frac{2\bar{\mu}(1+\underline{\mu})\tau + (1+\underline{\mu})\bar{\mu}^2 - \tau^2(\bar{\mu} - \underline{\mu})}{\tau(1+\bar{\mu})(1+\underline{\mu})} \right),$$

where this inequality defines a critical value $\hat{B}$ which depends positively on α and e , and negatively on τ . For instance, an external improvement in coercion technology (an increase in parameter τ) will lead to a decrease in this critical value. Therefore, a society where inequality is such that a “farsighted” elite is initially better off with progressive taxation could change to a situation where it becomes better off with a regressive tax culture.

It can be shown that $\hat{A}(\underline{\mu}) < \hat{B} < \hat{A}(\bar{\mu})$. Thus, if $\frac{w_e}{w} < \hat{B}(\alpha, e, \tau)$ the Progressive Tax Culture is Pareto efficient because the elite and both types of non-elite citizens are better off in this steady state than in the Regressive Tax Culture. Nonetheless, if for instance, $\hat{A}(\underline{\mu}) < \frac{w_e}{w} < \hat{B}$ the economy might end up in an inefficient RTC. This will happen whenever $\mu_o < \mu^*$, that is, the level of reciprocity is low in the initial condition of society, because the elite choose myopically in each period. However, if $\frac{w_e}{w} > \hat{B}(\alpha, e, \tau)$ both tax cultures are Pareto unrankable because the elite obtain higher utility in RTC while citizens obtain higher utility in PTC.

²¹ Empirical evidence on the positive relationship between tax progressivity and tax morale can be found in Frey and Torgler (2007) and Kirchler et al. (2008), among others; on the positive relationship between tax progressivity and tax compliance, see Santoro and Andrighetto (2019), Gangl et al. (2015), among others; on the positive relationship between tax progressivity and state capacity, see Besley and Persson (2011b) and Easterly and Rebelo (1993).

6.5. Some comments on the fall of progressive taxation

Taxation evolved over the 20th century under more democratic regimes, and in recent decades of the 21st century. Top rates increased significantly after World War II until the 1980s. Since then, the world has seen a long-lasting erosion of top rates in tax regimes. The explanation of the evolution of progressive taxation and its erosion in the recent decades requires a model with different degrees of democracy where elite and non-elite interact in the political process. This is a topic for future research. Nevertheless, the insights provided by our theory can complement other explanations of this erosion. What we draw from our model is that knowing what the elite's choice would be, without the constraint of democracy, provides us with information about their incentives for taxation.

We would like to point out that changes in some parameters, such as coercion and the value of the public good for the elite, might help to explain some of the dynamic movements in tax progressivity and inequality which have occurred in recent decades in our societies. For instance, an improvement in coercion technology widens the range of inequality ratios for which the elite choose a regressive tax equilibrium where they do not pay taxes. In recent decades we have witnessed a huge increase in technologies that enable the use of coercive information methods in the taxation of non-elite citizens. This is reflected in the massive use of formal contracts for reporting on tax liabilities to the government (Kleven et al., 2016). Likewise, tax authorities can make use of firms, banks and other entities as a vehicle of tax compliance.²²

Note, also, that a negative shock in the return of the public good for the elite works in exactly the same way. This is likely what has happened in recent decades: some kind of perfect storm against progressive taxation from the point of view of the elite: a substantial improvement in coercion of non-elite citizens, and a sharp fall in the value to the elite of public good provision due to the disappearance of the threat of revolution or internal revolt and of external threats of war. All these factors, combined with the rise in pre-tax inequality since the 1980s in all Western countries,²³ partly explain the extraordinary erosion that has occurred in the progressivity of our tax systems. We reiterate, however, that we do not assume our model to show that progressive taxation erosion happened in the absence of any other forces; we see it as complementary to a fully-fledged model where elite and non-elite interact in the political process.

7. Final remarks

In this paper we analyse a stylized political economy model in which the elite make a decision about the taxes to be paid by poorer non-elite citizens and themselves. The citizens make a decision about their tax compliance. The proportion of fiscal-reciprocators, the civic culture, evolves over time as a function of the relative payoff of fiscal-reciprocators and materialist citizens, giving rise to different tax cultures. Our theoretical model explains the precise interaction between the spending pressures faced by the elite, the existing levels of reciprocity (and consequent levels of tax compliance) in the non-elite population and finally, the existing level of inequality in the income distribution between the elite and other citizens, and how this interaction results in the choice by a ruling elite of a progressive or a regressive tax system. Our model is not alternative but rather complementary to other existing views on the progressive taxation evolution.

Progressive (or regressive) taxation affect inequality in an obvious way (through redistribution). However, our theoretical model highlights a reversal causal relationship from inequality towards tax progressivity. According to previous studies Acemoglu and Robinson (2000), Boix (2003), in a democracy, more inequality might imply a poorer median voter and a higher demand for redistribution by means of progressive taxes. However, the empirical evidence shows that among industrial democracies the more unequal ones tend to redistribute less, not more (see Rodriguez, 2004; Pineda and Rodriguez, 2006). Moreover, in real life, the political system is biased towards the wealthy and the elite, and becomes more biased towards them as inequality rises (see Benabou, 2000).

Our model shows that if democracy is captured by the elite or there is direct political domination by the elite, a higher inequality reduces the incentives for the elite to implement a progressive tax system. As far as we know the only paper that presents a similar result is Benabou (2000). In an intergenerational growth model, Benabou finds that the rate of tax progressivity decreases with the political influence of the rich and is U-shaped with respect to inequality.

Institutions, according to Bisin and Verdier (2021), are represented by the relative political power of different groups in society to influence political decisions. In our setting, it will be the relative power of the elite and the non-elite to influence decisions on taxation. We have focused on the incentives of a ruling elite to choose a particular tax system, but a full explanation of the evolution of progressive taxation and its erosion in recent decades requires a model with varying degrees of democracy, where elites and non-elites interact in the political process and where there is co-evolution between culture and institutions. This is a matter for future research.

Declaration of competing interest

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

²² For the wealthy the opposite has happened since the 1980s with the boom of the industry of fiscal evasion services for the rich (see Alstadsaeter et al., 2019).

²³ Pre-distributive (pre-tax) income inequality has increased considerably in Western countries (Blanchet et al., 2022) due to factors that are not included in our model, such as, the loss of bargaining power of trade unions, globalization or skill-biased technological change.

Data availability

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

Appendix A

Proof of Lemma 2.

We now show that the feasible interior solutions obtained in the main text are the ones that globally maximize the utility of the elite.

Let us start with the Regressive equilibrium where $t_e = 0$. The solution obtained in the main text belongs to the interval $t < \frac{\tau}{2}$. For $t > \frac{\tau}{2}$, $n^* = \mu + (1 - \mu)\frac{t}{\tau}$. In this case, the local optimum is a corner solution $t = \frac{\tau}{2}$. It is easy to demonstrate that the utility of the elite is higher in the interior solution obtained in the main text than in this corner solution.

Next, we analyse the Progressive equilibrium where $t_e = 1$. The solution obtained in the main text belongs to the interval $\frac{1}{2} < t < \frac{\tau+1}{2}$. There are two additional intervals in this case: $0 < t < \frac{1}{2}$, where $n^* = (1 - \mu)\frac{t}{\tau}$, and $\frac{\tau+1}{2} < t < \tau$, where $n^* = \mu + (1 - \mu)\frac{t}{\tau}$.

However, note that in both cases, $\frac{\partial n^*}{\partial t_e} = 0$. Then, according to Lemma 1, $t_e = 0$ is optimal for $\alpha < 1/e$, contradicting that we are in the Progressive equilibrium where $t_e = 1$. ■

Proof of Proposition 1.

First, if $\alpha \geq 1/e$, we know that $t_e = 1$, for all t , therefore, the unique equilibrium is $(t_e = 1, t = t_p)$ that we call the Progressive Tax Equilibrium (PTE).

Second, if $\alpha < 1/e$, we know that $t_r < t_p$ for all $\mu \in (0, 1)$.

- If $t_p < B$, then $(t_e = 0, t_r) \forall \mu$ (RTE)

- If $t_r > B$, then $(t_e = 1, t_p) \forall \mu$ (PTE)

- If $t_r < B < t_p$, then both situations (PTE or RTE) are feasible. The elite will choose the one with the highest utility for them. That is, $U_e(RTE) \geq U_e(PTE)$.

$$U_e(RTE) = w_e + \frac{\alpha(1-e)w\tau}{4(1+\mu)}$$

$$U_e(PTE) = \alpha e w_e + \frac{\alpha(1-e)w\tau}{4(1+\mu)} \frac{(\tau + \mu)^2}{\tau^2}$$

$$U_e(RTE) \geq U_e(PTE) \text{ if and only if } \frac{w_e}{w} \geq \hat{A}$$

$$\text{where } \hat{A} = \frac{\alpha(1-e)\mu}{4(1-\alpha e)\tau} \frac{(2\tau + \mu)}{(1 + \mu)}.$$

Defining the critical value μ^* such that $\hat{A}(\mu^*) = \frac{w_e}{w}$, then if $\mu > \mu^*$ elite choose PTE and if $\mu < \mu^*$ elite choose RTE. Note that μ^* can be greater or equal than 1, and in this case the elite choose RTE.

Note also that if $t_p < B$, then $\frac{w_e}{w} > \hat{A}(\mu)$ and then $\mu < \mu^*$, and RTE $\forall \mu$. If $t_r > B$, then $\frac{w_e}{w} < \hat{A}(\mu)$ and then $\mu \geq \mu^*$, and PTE $\forall \mu$.

Note that for $\mu^* < 1$, it is needed that $\hat{A}(\mu = 1) > \frac{w_e}{w}$, that is

$$\frac{\alpha(1-e)}{(1-\alpha e)} > \frac{8\tau}{(2\tau + 1)} \frac{w_e}{w}.$$

Therefore, there will be a critical value for α such that $\mu^* < 1$. This critical value of α is increasing in $\frac{w_e}{w}$ and τ , and decreasing with e . ■

Appendix B

Derivatives of $\hat{A}$

Let us check the effect of changes in several variables on the critical inequality ratio $\hat{A}$, when we assume $\alpha < 1/e$,

$$\frac{\partial \hat{A}}{\partial \alpha} = \frac{(1-e)\mu(\mu + 2\tau)}{4(\alpha e - 1)^2\tau(1 + \mu)} > 0.$$

$$\frac{\partial \hat{A}}{\partial e} = \frac{(\alpha - 1)\alpha\mu(\mu + 2\tau)}{4(\alpha e - 1)^2\tau(1 + \mu)} > 0$$

$$\frac{\partial \hat{A}}{\partial \mu} = \frac{(e - 1)\alpha((2 + \mu) + 2\tau)}{4(\alpha e - 1)(1 + \mu)^2\tau} > 0$$

Therefore, an increase in α , e and μ will increase the likelihood of the progressive tax equilibrium for a given inequality ratio $\frac{w_e}{w}$.

$$\frac{\partial \hat{A}}{\partial \tau} = \frac{(1-e)\alpha\mu^2}{4(\alpha e - 1)(1 + \mu)\tau^2} < 0$$

However, an increase in τ will decrease the likelihood of the progressive tax equilibrium for a given inequality ratio $\frac{w_e}{w}$.

What drives progressivity.

Effect on equilibrium tax rates of changes in coercion and reciprocity

It can be shown that

$$\frac{\partial t_p}{\partial \tau} = \frac{\partial t_r}{\partial \tau} = \frac{1}{2(1+\mu)} > 0.$$

And, given that $\tau > 1$,

$$\begin{aligned} \frac{\partial t_p}{\partial \mu} &= \frac{(1-\tau)}{2(1+\mu)^2} < 0, \\ \frac{\partial t_r}{\partial \mu} &= -\frac{\tau}{2(1+\mu)^2} < 0. \end{aligned}$$

Effect on non-compliance rates of changes in coercion and reciprocity

An increase in τ yields an increase in the non-compliance rate in the PTE fiscal system.

$$\frac{\partial n_p^*}{\partial \tau} = \frac{\mu}{2\tau^2} > 0.$$

The effect on n_p^* is achieved through the composition of different subeffects. An increase in τ always decreases n_p^s , by the effect of coercive motivation. However this increase in τ , creates a dual opposite impact on n_p^f . On the one hand, it reduces n_p^f , due to the coercive motivation and on the other hand, increases n_p^f because of an indirect effect of a rise in regressivity through t_p . The overall result is a positive effect on n_p^f . Finally, the total effect of an increase in τ is an increase in average noncompliance n_p^* . The size of the final positive effect of τ on n_p^* increases with μ . A higher τ yields a higher n_p^* , but this increase in n_p^* will be higher the higher μ .

An increase in μ will cause a reduction in the non-compliance rate in the PTE fiscal system.

$$\frac{\partial n_p^*}{\partial \mu} = -\frac{1}{2\tau} < 0$$

The rise in μ reduces both n_p^f and n_p^s , and this is due to the negative impact on the tax rate t . That is, the rise in reciprocity causes a decrease in the citizens' tax rate and therefore an increase in progressivity. All this reinforces a diminution in noncompliance. The size of the final negative effect of μ on n_p^* diminishes with τ . A higher μ yields a lower n_p^* , but this reduction in n_p^* will be smaller the higher τ .

However, an increase in τ and μ yields no change in non-compliance in the Regressive tax equilibrium (RTE).

$$\frac{\partial n_r^*}{\partial \tau} = \frac{\partial n_r^*}{\partial \mu} = 0$$

First, $\frac{\partial n_r^*}{\partial \tau} = 0$, because the effects (direct and indirect) on n_r^f and n_r^s cancel each other out. This is due to the functional form we are using, where the following property holds, $\frac{\partial t_r}{\partial \tau} = \frac{t_r}{\tau}$.

Nevertheless, in RTE both derivatives, $\frac{\partial n_s}{\partial \mu} < 0$ and $\frac{\partial n_f}{\partial \mu} < 0$, but in aggregate $\frac{\partial n_r^*}{\partial \mu} = 0$, because of a composition effect. This is because $\frac{\partial t_r}{\partial \mu} = \frac{t_r}{1+\mu}$, and then $t_r + (1-\mu)\frac{\partial t_r}{\partial \mu} = 0$, hence $\frac{\partial n_r^*}{\partial \mu} = 0$.

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