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Herding, rent-seeking taxpayers, and endemic corruption

Gil S. Epstein[1] and Ira N. Gang[2]

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Abstract: In an environment with extensive corruption where much of the population evades paying their full taxes due, we tackle the question of optimal taxation when constituencies with opposing objectives (the poor and the rich) push tax policy in different directions. We think in terms of a government policy-maker, here called the tax administrator (TA), and rent-seeking lobbying efforts by poor and rich constituencies. We recognize taxpayers' inter-dependency as reflected in increased evasion likelihood when others are thought to be evading. Thus, our modelling incorporates elements from the theory of information cascades (herding) into a standard model of tax evasion. The poor and rich undergo a rent-seeking contest seeking to influence the TA in setting policy so that their constituency is favoured. The TA maximizes an objective function that is a weighted average of expected social welfare, their own interests, and investment in better tax administration.

Key words: tax evasion, corruption, herd behaviour, rent seeking, tax administration, poor

JEL classification: D72, G38, H26, O12

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[1] Bar-Ilan University; CReAM London; GLO Essen; IZA Bonn. [2] Rutgers University; RWI Essen; CReAM London; IOS Regensburg; GLO Essen; IZA Bonn. Corresponding authors: epsteig@mail.biu.ac.il; gang@rutgers.edu

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Information and requests: publications@wider.unu.edu

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Katajanokanlaituri 6 B, 00160 Helsinki, Finland

1 Introduction

With some frequency, countries face a 'culture of evasion' characterized by low tax morale, weak institutions and high inequality, limiting the revenue-raising capability of the state and its role in economic development. Additionally, groups engage in rent-seeking behaviour, competing to influence the tax administrator (TA) who determines the taxes they pay by setting the tax rates, fines, and investment in tools for enforcing the collection of taxes due. This paper tackles the question of optimal taxation/tax administration policy when constituencies with opposing objectives (the poor and the rich) push tax policy in different directions.

Drawing on various elements well-discussed in the literature Epstein and Gang (2019a) model such an economy.[1] Poor and rich taxpayers comprise constituencies with competing economic and political interests, frequently reflected by each desiring different tax rates and enforcement levels. Negotiations, lobbying, and other elements of a political process among competing poor and rich constituencies, and tax administrators contribute to setting and enforcing the tax code. The environment created is one where rules and their enforcement seem fluid and people regularly confront corrupt practices.

In their relatively simple model Epstein and Gang (2019a) obtain striking results, showing how tax collection enforcement echoes the relative lobbying efforts of the poor and rich, which itself hinges on the elasticities of their benefits with respect to changes in the enforcement level and may move in the opposite directions of lobbying efforts, in part reflecting sensitivity to and tolerance of corruption. Reflecting the political culture, the TA's optimal enforcement level favours the preferences of one or the other's (poor or rich) preferences. The paper describes and models how between-group rent-seeking interactions amongst the poor, rich and tax administrators may contribute to irresponsible taxpayer behaviour and weak taxpayer compliance.

While understanding the between-group rent-seeking interactions amongst the TA, the rich and the poor, is critical, it is but one element driving policy and outcomes. Possibly as important are within-group relationships: others in their constituency or interest group may influence an individual's compliance. Within-group taxpayer interdependency can be captured by incorporating elements from the theory of information cascades into the standard treatment of tax evasion. This introduces endemic corruption through the formation of tax-avoiding herds.[2] Sensitivity to

[1] The classic models are established by Allingham and Sandmo (1972) and Yitzhaki (1974). The administrative dimensions of tax revenue collection, enforcement and administration are discussed in Bird (2004), Das-Gupta and Bird (2012), Keen and Slemrod (2017), and Addison et al. (2018). Many people avoid paying taxes, limiting the state's revenue-raising capability and the role it plays in economic development (Andreoni et al. 1998). We examine public policy toward tax enforcement as determined by rent-seeking bureaucrats and politicians and the lobbying efforts of rich and poor constituencies (Myles and Naylor 1996; Schneider and Bose 2017) who take part in a rent-seeking/avoidance contest (Epstein and Nitzan 1999, 2007). Policy-makers maximize an objective function that takes into consideration, in some measure, both social welfare and the policy-maker's own interests (Epstein and Nitzan 2006). This follows from a vast political economy literature on policy formation providing insights on tax policy, corruption, evasion, among many other political processes (Persson and Tabellini 2002: 1549–659; Grossman and Helpman 2001; Epstein and Nitzan 2006). Epstein and Gang (2019b) take up rent seeking in a decentralized economy.

[2] Our theoretical framework uses information cascades (herd effects) to model tax evasion. Information cascades were used by Scharfstein and Stein (1990), Banerjee (1992), and Gul and Lundholm (1995) in investment applications, and by Epstein (2002) to migration.

corruption and related herding behaviour reflect society's 'tax morale' (Alm and Torgler 2006; Luttmer and Singhal 2014).

Epstein and Gang (2010) model taxpayer interdependency reflected in the increased evasion likelihood when others are believed to be evading. This is because potential tax evaders do not have perfect information regarding the best choices or the probability of being caught. Before making their decision, each person looks at the decisions made by previous individuals over time, i.e., they make sequential evasion decisions. This is rational behaviour on the supposition that previous individuals had information the potential evaders do not. In other words, tax evasion follows the herd. Analysing the links among a potential tax evader's decisions, the number of tax evaders and those caught evading in previous periods, the paper shows the general conditions under which expected utility maximizing potential tax evaders decide to emulate other tax evaders.

The literature on rent-seeker and government interactions provides the context for our analysis (Epstein and Nitzan 2007; Epstein and Gang 2019a). Empirical evidence reveals interdependency among taxpayers, reflected in the increased likelihood of evasion when others are believed to be evading (Geeroms and Wilmots 1985). Dunn (1992) has pointed out that strong empirical evidence reveals, contrary to standard tax evasion theory, that deterrence does not increase tax compliance. Awareness of other individuals has begun to be incorporated into evasion models. Das-Gupta and Gang (2003) examine transactions matching, an enforcement activity which systematically throws up information of use in examining other taxpayers. Bose and Gangopadhyay (2009) introduce a role for intermediaries; Hunt (2004) examines the implications of trust and personal relations.

In this paper we draw on Epstein and Gang (2010) in our modelling intragroup relations within the poor constituency and rich constituency, and Epstein and Gang (2019a) in modelling intergroup relations among the poor, rich and TA, as well as the rent-seeking construct. We highlight government/rent-seeker interactions by modelling the behaviour of the poor and rich as rent-seekers who engage in a contest to influence public policy (as set by the TA) for their own advantage. By its nature, rent seeking is illicit, though not necessarily illegal, as the poor and rich endeavour to sway benefit assignment by the TA, misallocating resources, reducing societal welfare, and possibly lowering collected tax revenue. Moreover, the contest itself uses up resources that could otherwise have been employed to better benefit society.

We ask: What is the appropriate tax policy, i.e., tax setting and the level of effective enforcement, accounting for taxpayer herding behaviour, rent-seeking lobbying by poor and rich taxpayer constituencies, and the adherence or not by the public policy tax administrator to maximizing the social welfare, or otherwise? How does herding on the part of taxpayers affect tax administration, revenue raising, and society's welfare? How does the herd affect rent seeking? What can be done to make tax administration more effective? The TA has to consider these factors when proposing to set taxes and deciding on how much enforcement to do.

The paper proceeds in the next section to set out the 'positive' aspects of our modelling by establishing inter- and intra-group behaviours and the interactions of each of the three actors in our economy—the poor, the rich, and the TA (a proxy for various conceptualizations of the government or policy-maker). It describes how our economy functions in meeting its needs and advancing, though it does not always function well. Section 3 takes up more 'normative' concerns by positing a specific social welfare function useful for highlighting the circumstances under which each of our three agents gain or suffer a loss, as well as for evaluating the welfare of society under these specific circumstances. Section 4 expands the discussion by discussing further aspects of an economy caught in these conditions and concludes.

2 The model

We construct a theoretical model useful in sorting out conceptual issues surrounding taxpayer and TA behaviour, enabling us to understand the implications of policies undertaken by politicians. We start by laying out a model that highlights the structure our thinking, allowing us to then build a more complex story of rent seeking and taxpayer herding. In our rent-seeking model, taxpayer constituencies (poor, rich) engage in a contest hoping to influence the tax administrator (TA) to establish a tax administration and enforcement plan that serves each of their own interests. The high/low divide is one among many ways of characterizing the income distribution. Further simplifying the discussion, we refer to high-income agents as rich, and those with low income as poor. The poor and rich work to convince the TA to establish plans that maximize their own respective expected net benefits. Both act to maximize their expected net benefit by lobbying the government for their respective optimal levels of tax payment enforcement (Das-Gupta 2004; Das-Gupta et al. 2004). While the poor are too poor to pay taxes, they try to influence the TA to make sure the rich are expected to do so.[3] The rich decide how much they will pay, in contrast to what they are expected to pay, taking into account their income, taxes, the probability of being caught, the fines they face if caught, and the cost of influencing the TA. Further, there is taxpayer herding: the rich (being the only agents who have the income level subject to taxation), look at other rich people's changing behaviour in their decision-making about evading taxes.

2.1 The basic model

Consider a country with a large population. Denote by $U_i(w)$ the utility level of individual i with a net income level of w. Each individual must decide whether they will pay or not pay their taxes. We employ the standard Yitzhaki (1974) analysis of the extent of evasion.[4] The utility of individual i, with gross income y, facing a tax rate of t, and who chooses not to evade paying taxes, is given by

$$U_i(w) = U_i\big(y(1-t)\big). \tag{1}$$

The expected utility of an individual who chooses to evade paying taxes is given by

$$E\big(U_i(w)\big) = (1-P)U_i(y) + PU_i\big(y(1-Ft)\big), \tag{2}$$

where P is the probability of detection, i.e., tax evaders are not left alone, but there is less than 100 per cent auditing. The detected evader pays a fine of F for taxes not paid, $F > 1$. The fine is a function of the level of tax meant to be paid and we assume a linear form of a fine: $Fty - ty = (F-1)ty$. Thus the total amount of the fine is yFt.[5]

Each individual has to choose whether to evade or not. An individual will tax evade if $\big(E(U_i(w)) > U_i(w)\big)$. From (1) and (2) we obtain that an individual will tax evade if

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[3] The TA proposes and sets the tax enforcement level E, representing the government in our model. The TA is imperfectly honest, both wanting to receive rents from the efforts of the rich and poor to influence her/his decisions and wanting to act in the best interests of the country by reflecting society's prevalent sentiment with respect to tax avoidance and enforcement (Flatters and MacLeod 1995). Thus, rent-seeking/avoidance is an important part of the corruption story.

[4] Yitzhaki (1974) addresses the question of what extent to evade taxes.

[5] Of course if $Ft > 1$ the taxpayer would need to borrow.

$$P < \frac{U_i(y) - U_i(y(1-t))}{U_i(y) - U_i(y(1-Ft))}. \quad (3)$$

The critical probability of detection falls as the level of risk aversion increases, as we can see from equation (3) following standard risk aversion results.

Consider a simple case where utility is a linear function of an individual's net income: $U_i(w) = w$. Looking at (1) and (2) the individual tax evades if $(1-P)y + Py(1-Ft) > y(1-t)$. If $y(1-Ft) < 0$, $P < 0$ and there is a corner solution. Therefore, the individual evades taxes if and only if $P < 1/F$.

In this section our analysis described individuals' behaviour in the economy. The probability of detection is a given and is constant over time. Next we discuss a simple dynamic sequential model in which the detection probability is unknown. All individuals evaluate this probability, given the different information they may have at the time they make their decisions.

2.2 Rich, poor, and tax-evading herds

We now introduce two types of people: (i) the representative poor person earns Y_P and does not pay taxes—to pay taxes income must be above a certain threshold and the income level of the poor is below this threshold; (ii) the representative rich person earns Y_R and is obligated to pay taxes. We maintain the assumption of the poor not paying and rich paying taxes throughout the remainder of the paper.

The poor are subsidized by the rich who do pay taxes at a rate of t, $0 < t < 1$, as a proportion of their earnings (for now t is exogenous). As long as (3) holds, the rich will evade. However, if (3) does not hold the rich will not evade. In the example presented above where $U(w) = w$, we obtained that if $p < 1/F$, evasion occurs. A rich person who does not evade pays a total tax amount

$$\text{tYR} \quad (4)$$

The probability a rich person will not be caught evading tax is (1-P) and in this case does not pay taxes. The probability a rich person will be caught evading taxes is P and when caught pays the taxes owed and a fine of F on earnings on which taxes should have been paid; thus, the rich evader who is caught pays:

$$\text{P t F YR} \quad (5)$$

Therefore, the difference between (4) and (5) is the poor's loss (it is also the rich's gain) from tax evasion,

$$\text{tYR - P t F YR} = (1 - \text{P F})\ \text{tYR} \quad (6)$$

Equation (6) denotes the stake in the contest between rich and the poor. This is what the rich will save on average by evading and this is what the poor will lose, that is not receive in the form of transfers, public services, etc., as a result of the rich evading. So the higher $P\ t\ F\ Y_R$ the more the poor will obtain.

We assume both the rich and the poor want to influence the TA who decides the level of regulation that determines the probability of being caught evading taxation; here P is not exogenous, it depends on the level of regulation. Each can spend resources trying to influence this level. The poor person invests x resources on influencing the TA in order to obtain transfers, while the rich invests z to decrease their probability of being caught when evading.

Simplifying, we write the probability of being caught, *P*, with a specific function, i.e., assume the probability of being caught equals:

$$P = \frac{x}{x+z}. \tag{7}$$

Thus, the objective of the poor is to maximize:

$$E(U_p) = P\ F\ tY_R - x, \tag{8}$$

while the objective of the rich is to maximize the probability of not being caught (1-*P*) and having to pay tY_R . Thus the rich maximize:

$$E(U_R) = (1 - P)F\ tY_R - z. \tag{9}$$

Calculating equilibrium levels of expenditures *x* and *z*,

$$x^* = z^* = \frac{F\ t\ Y_R}{4}. \tag{10}$$

Thus,

$$P^* = 0.5. \tag{11}$$

It is critical to understand that transfers are progressive, here meaning they are worth more to the poor than to the rich (the marginal utility of income is higher for the poor than the rich).[6] Thus, when the rich transfer a unit of income, upon receipt the poor gain more than a unit's worth of income. The poor gain *c* units, $c > 1$; *c* captures the value of the earnings for the poor. This means that the stakes are not identical. When the rich are caught avoiding taxes they must pay FtY_R. For the poor the stake is $cFtY_R$, that is, *c times* what the rich have to pay if caught evading, where $c > 1$. Thus, the objective of the poor is to maximize:[7]

$$c\ P\ F\ tY_R - x. \tag{12}$$

Equation (12) expresses the poor's perception or utility of the revenue the TA receives from the rich, net of the poor's expenditure to convince the regulator to go after the rich (this is the same as (8) adjusted now by *c*). The objective of the rich is to maximize the probability of not being caught and paying FtY_R. Thus, the rich will maximize (reminder from above, (9)):

$$(1 - P)F\ tY_R - z. \tag{13}$$

Equation (13) tells us what the rich get to keep net of their investment expenditure on trying to convince the regulator not to regulate them.

We calculate equilibrium levels of (lobbying) expenditure, *x* for the poor and *z* for the rich:

$$x^* = \frac{c^2 n}{(1+c)^2} \quad and \quad z^* = \frac{cn}{(1+c)^2}, \tag{14}$$

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[6] We are relaxing the assumption that utility is linear in income. As we have only two groups this allows us to use the same function with a different *c*.

[7] Kahneman and Tversky (2013) discuss the value of receiving not equaling the value of spending.

where $n=F\ tY_R$. Equation (14) differs from (10) by recognizing the progressivity of transfers—that the marginal utility of the income the poor receive is not identical to the marginal utility of the tax paid by the rich.

We now introduce into our analysis a role for perception. Case-based decision theory (Gilboa and Schmeidler 1995) tells us that seeing someone apprehended may have a strong impact on perception. We incorporate this idea here by assuming the poor and rich differ in their beliefs about the probability that tax evasion by the rich will be detected: each believes these probabilities are a bit different than they are in reality (Kahneman and Tversky 2013: 99-127).[8] For the poor, the difference between the actual and their own perceived probability that the TA will detect the rich evading is represented by *a(t)*; for the rich this difference is captured by *b(t)*. The poor and the rich, as well as the TA, know both *a(t)* and *b(t)*, as this is common knowledge. All three agents now see the probability of detecting the rich evading as:[9]

$$P = \frac{x+a(t)}{(x+a(t))+(z+b(t))}. \tag{15}$$

Critically (15) shows that the probability of detection is a function of the perception differences *a* and *b* held respectively by the poor and rich, and that *a* and *b* are both functions of the tax rate.

We now explain our argument that *a* and *b* are functions of the tax rate *t*. Epstein and Gang (2010) show as more evade the probability of detection changes for the next possible evaders. From this argument of herding in tax evasion we have the idea that the more the rich have to pay in taxes, the greater will be the herd effects on evasion and the rich believe a lower probability of their being caught – as more people evade it is more difficult for the TA to catch any one evader. Thus the rich believe the probability that they will not be caught is higher than it is actually. We also have the herding idea that as the tax rate increases, the poor believe that the probability the evaders will be caught is higher as more are evading.

We implement this argument by assuming the herd effect is captured by the effect of taxes on perceptions in the following manner:[10]

$$\frac{\partial a(t)}{\partial t} > 0, \frac{\partial b(t)}{\partial t} > 0 \ and \ \ \frac{\partial^2 a(t)}{\partial t^2} > 0, \frac{\partial^2 b(t)}{\partial t^2} > 0. \tag{16}$$

Assumptions (16) tell us that as the tax rate increases, more rich taxpayers will follow the herd and evade taxes. And this occurs more as more and more rich taxpayers are evading. So, *a(t)* and *b(t)* capture the herd effect. Thus, the probability of detection (15) is a function of the *herd effect*, which is a function of the tax rate *t*. (16) summarizes our argument on the herd in tax evasion, and we see here that as the tax rate increases the herd grows stronger revealing more herding, though the poor (through *a(t)*) and the rich (through *b(t)*) perceptions of the change may not be identical. And

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[8] In modelling and trying to understand tax compliance behaviour we make the assumption that agents may possess varying perceptions of the probability of tax evasion being detected. This can lead to variation in behavior across groups (Das-Gupta 2004). The idea of perceptual differentials and misperception among taxpayer groups has gained traction, much of it concerning behavior of taxpayers after a random audit, as illustrated by work and discussions on the 'bomb crater effect'. The issue is not settled with the literature suggesting a number of hypotheses and evidence on how these behavioral differences may play out and the alternative mechanisms that may enter into the story. For examples, see Andreoni et al. (1998), Deutsch and Epstein (1998), Maciejovsky et al. (2007), Kasper and Alm (2022a, 2022b).

[9] This form is assumed based on Kahneman and Tversky (2013).

[10] Instead, we could also talk about herds as a change in *a* and *b* and not as a change in *t*!

this affects the perceived probability of detection. The poor and rich hold different beliefs about the probability of detection.

From (12), (13), (14) and (15) we get that the optimal investment of the poor and rich equals:

$$x^{**} = \frac{c^2 n}{(1+c)^2} - a \quad and \quad z^{**} = \frac{cn}{(1+c)^2} - b. \tag{17}$$

Proposition 1: Investment of resources to affect the regulators increases with *c*, $\frac{\partial x^{**}}{\partial c} > 0, \frac{\partial z^{**}}{\partial c} > 0.$

That is, beliefs play a role: the more you think you will gain, the more you invest in getting the TA policy to favour you. It is worth more to the poor so the poor invest more and in equilibrium the rich will invest more as well, as the poor are investing more.

Proposition 2: Herding decreases the investment of resources by poor and rich contestants to influence the TA. That is, $\frac{\partial x^{**}}{\partial a} < 0 \ \frac{\partial z^{**}}{\partial b} < 0.$

The more herding, the less investment in getting the TA policy to favour you. The reason for this is that as the herd effect increases, the groups are more certain of the effect of tax evasion and need to invest less to affect the regulator's decision. For a given z and b the poor are more certain, and for a given x and a the rich are more certain. In equilibrium, there is no change.

Thus from (15) and (17) we obtain that the probability of being caught in equilibrium equals:

$$\mathrm{P} = \frac{c}{1+c}. \tag{18}$$

Total investment in the contest is:

$$x^{**} + z^{**} = \frac{cn}{1+c} - a \ - b \tag{19}$$

The expected payoff in the contest is:

For the poor: $$\frac{cn}{(1+c)^2} + a \tag{20}$$

For the rich: $$\frac{n}{(1+c)^2} + b \tag{21}$$

A measure of welfare is the sum of expected payoffs which equals:

$$\frac{n}{1+c} + \mathrm{a} + \mathrm{b}. \tag{22}$$

From equations (20) and (21),

Proposition 3: The expected payoffs of the groups increase with herding.

The reason for this is that as more evade, it is clearer what will happen and as such will decrease the investment level of the groups.

From equation (22),

Proposition 4: Welfare increases with an increase in herding and decreases as the difference between the income of the poor and rich increases (and increases in *c*).

The tax rate (*t*) is at this stage the only exogenous policy variable we have so far introduced.[11] Though not a policy variable subject to changes by the government or its agent (the TA), *c* is exogenous and captures how much more income is worth to the poor than it is to the rich. Proposition 1 tells us that the greater this relative worth of income to the poor, the greater will be the investments by the poor and rich in lobbying the TA for their preferred tax policy. We also understand that increases in the tax rate increase herding by rich taxpayers, and this increases the poor's perception that tax evasion by the rich will more likely be detected, $a(t) > 0$; for the rich this change is captured by $b(t) > 0$. Proposition 2 then tells us greater herding will also increase investments by the poor and rich in lobbying the TA for their preferred tax policy. Furthermore, in Proposition 3 we see that increased herding also raises each constituency's expected payoff. Proposition 4 simply states when using the sum of the expected payoffs to the poor and rich to capture social welfare, welfare increases with increased herding (*a* and *b* increase as a result of an increase in *t*), and welfare falls the greater the difference in income between the two constituencies, that is when *c* increases.

Propositions 1–4 tell us the basic behaviour of the economy described by our model. We have not yet looked at what happens in our economy when policy is directed at enforcing the tax code. We take this up next.

2.3 Enforcement

Here we enhance our analysis by looking at the TA or politician investing in increased enforcement in order to capture tax evaders. Resources can be invested which affect enforcement and hence the probability of detecting evasion, *P*. Denote this level of enforcement variable by *e*. *e* is a function of the investment level *I,* where $\frac{\partial e}{\partial I} > 0 \; and \; \frac{\partial^2 e}{\partial I^2} > 0$. *I* might reflect, for example, evasion detection technology or training in forensic accounting for the TA. Thus, enforcement *I* might reflect investments increasing TA monitoring effort by which the probability of detection can increase.

Following equation (15) we obtain:

$$P = \frac{x+a(t)+e(I)}{(x+a(t))+e+(z+b(t))}. \qquad (15')$$

z is the investment by the rich to influence the TA in hope of decreasing the probability of being caught. Note that for a given level of *x, a,* and *b*, increasing the investment level (*I*) increases the probability of being caught (the probability of detection) and thus increases investment *z*. However, in equilibrium the results are somewhat different.

[11] Recall, fines (*F*) are a linear function of the level of tax meant to be paid, *(F-1)ty*.

In equilibrium we now obtain:

$$x^{**} = \frac{c^2 n}{(1+c)^2} - a - e \quad and \quad z^{**} = \frac{cn}{(1+c)^2} - b. \tag{17'}$$

Note that enforcement (e) appears on the right-hand side of x^{**}, but not for z^{**}. Thus,

Proposition 5: In equilibrium, as investment in enforcement (e) by the TA increases, investment by the poor (x) trying to influence the TA decreases (investment by the TA supplements investment by the poor) and it does not affect the investment of the rich (z).

Total investment by the poor and rich together in the contest is now:

$$x^{**} + z^{**} = \frac{cn}{1+c} - a - b - e. \tag{19'}$$

The expected payoff in the contest is now:

For the poor: $$\frac{cn}{(1+c)^2} + a + e. \tag{20'}$$

For the rich: $$\frac{n}{(1+c)^2} + b. \tag{21'}$$

Proposition 6: Looking at the total investment by the poor and rich in the contest, in equilibrium, as investment in enforcement (e) by the TA increases, total investment in lobbying by the poor and rich decreases. If the measure of expected welfare does not take into account the TA's investment in enforcement $(\frac{n}{1+c} + \mathrm{a} + \mathrm{b})$, then welfare increases.

If we consider investment by the TA as an expenditure, then:

(i) If $e(I) = I$, total investment in the contest, $x^{**} + z^{**} + I$, does not change, the TA's and the poor's investment are pure substitutes.

(ii) If $e(I) > I$, total investment $x^{**} + z^{**} + I$ increases.

(iii) And if $e(I) < I$, total investment $x^{**} + z^{**} + I$ decreases.

Let us consider the measure of welfare to be the sum of expected payoffs which now equals:

$$\frac{n}{1+c} + \mathrm{a} + \mathrm{b} + \mathrm{e}. \tag{22'}$$

The reason that total welfare increases (similar to Proposition 6) is that e is taken as given and no cost is assigned to it. If we take into consideration the cost of investment in enforcement by the TA then the welfare will be $\frac{n}{1+c} + a + b + e - I$.

Proposition 7: If the cost is $e = I$ then welfare does not change. If the cost is $e > I$ then welfare increase's. If the cost is $e < I$ then welfare decreases.

We continue with the formulation given in equations (15')–(22') for the remainder of the paper.

Rounding out our model, we include the TA making expenditures (investment, *I*) in tax collection enforcement (*e*). These investments increase enforcement of the tax code $\left(\frac{\partial e}{\partial I} > 0\right)$ and affect the probability the TA detects evasion. Note when examining the probability of detection accounting for enforcement, for given levels of *x, a*, and *b*, increasing *I* will increase investment *z* by the rich in lobbying the TA. However, Proposition 5 shows that in equilibrium, when *I* increases and x is allowed to rise, investment in lobbying by the rich, *z*, does not change. Moreover, from Proposition 6, if we use a welfare measure that does not include enforcement, when *I* increases total lobbying by the rich and poor increases, while welfare falls. Once *e(I)* is accounted for as a cost in the measure of welfare, Proposition 7 shows that what happens to welfare depends on the responsiveness of enforcement to investing in enforcement.

3 The political economy of taxation and herding

We now turn to a more explicitly normative treatment of our economy, allowing us to discuss under varying circumstances the TA's consideration of society's aggregate wellbeing as well as the wellbeing of each agent in the economy, including themselves. Here we assume the TA is interested in maximizing a specific objective function which includes social welfare as well as the TA's possible rent collection and investment in enforcing the tax code. The TA can set the tax rate (*t*) and investment in enforcing the tax code (*I*).

3.1 The politically constrained tax administrator

In examining the political economy of tax administration and illicit funds, we look at the politically constrained tax administrator or regulator. Tax level *t* and the fine level *F* are established by the tax administrator (TA), who accounts for the contest between the poor and the rich, its own rent acquisition and its commitment to enhancing the social welfare. These commitments are captured in the TA's specific objective function. Lobbying expenditures made by poor and rich contestants with regard to the proposed taxation and enforcement level lead to TA gains because part or all of their expenditures are a resource transfer to the TA. In the TA's objective function, $G(E(U_P), E(U_R), I, x + z)$, expected net payoffs to the poor and rich are $E(U_P)$ and $E(uU_R)$ as per equations (8) and (9). The contestants' expenditures *(x + z)* either are wasted lobbying resources or represent transfers to the government (of which the TA or regulator is the agent). The TA captures some of these. We further introduce here the utility the TA receives from enforcing the tax code; enforcing the tax code is a function of investment in doing so, as described in the previous section.

Assume an additive TA objective function,[12]

$$G(E(U_P), E(U_R), x + z) = \propto (E(U_P), + E(U_R) - I) + (1-\propto)(x + z) + (1-\propto)v(I). \quad (23)$$

The TA has mixed commitments, with α capturing the TA's mixed commitments to the public and self. This parameter reflects the prevailing sentiment in the society with respect to tax avoidance and enforcement, echoing poor and rich contestants' expenditure allocations between

[12] Our additive TA objective function is similar to those found in Grossman and Helpman (2001), Persson and Tabellini (2002), Epstein and Nitzan (2006), and Epstein et al. (2011). The TA's objective function is a weighted average of the expected social welfare lobbying efforts, and investment in detection. Policy maximizes an objective function that takes into consideration, in some measure, both social welfare and the policy-maker's own interests (Epstein and Nitzan 2006).

wasteful and non-wasteful resources received by the TA. Here we see the TA's public commitment and narrow self-interest in collecting contestants' expenditures. In (23), $\propto$ is the weight for the public interest (social welfare) and 1-$\propto$ is the weight for the TA's own self-interest.

Given (23), when $\alpha = 1$, the TA is steadfast in its commitment to support the public interest defined by $E(U_P), + E(U_R) - I;$ and sees rent-seeking/avoidance expenditures as entirely wasteful. When $\propto = 0$ the TA is only committed to their own self-interest. Here, when $\propto = 0$, the TA's objective is maximizing poor and rich expenditures on the contest while ignoring the public's welfare. The TA also receives utility from investing in enforcement at a level of *v* with a weight of $(1-\propto)$. The TA cares only about getting contest rent and enforcement, not the public interest!

3.2 The political economy equilibrium

Maximizing the TA's objective function (23), we look at the interior solution to the TA's problem, characterized by the first order condition. To do so, we take into consideration equations (18) through (23) and obtain

$$G(.) = \propto \ (E(U_P) + E(U_R) - I) + (1-\propto)(x + z) + (1-\propto)\ v \tag{24}$$

$$= \propto \left(\frac{n}{1+c} + (\mathrm{a} + \mathrm{b} + \mathrm{e}) - I\right) + (1-\propto)\left(\frac{cn}{1+c} - (\mathrm{a} + \mathrm{b} + \mathrm{e})\right) + (1-\propto)\ v.$$

Remembering that FtY_R = *n* (see equation (14)), (24) becomes:

$$G(.) = \propto \left(\frac{F\ tY_R}{1+c} + \big(\mathrm{a(t)} + \mathrm{b(t)}\big) + e - I\right) + (1-\propto)\left(\frac{cF\ tY_R}{1+c} - \big(\mathrm{a(t)} + \mathrm{b(t)}\big) + e\right) + (1-\propto)v \tag{25}$$

$$= \propto \left(\frac{F\ tY_R}{1+c} - I\right) + (1-\propto)\left(\frac{cF\ tY_R}{1+c}\right) - (1 - 2\ \propto)(\mathrm{a(t)} + \mathrm{b(t)} + e) + (1-\propto)v$$

$$= \frac{F\ tY_R}{1+c}(\propto\ + (1-\propto)c) - \propto I - (1 - 2\ \propto)\ (\mathrm{a(t)} + \mathrm{b(t)} + e) + (1-\propto)v.$$

An objective of the TA is to determine the optimal tax level *t* (f.o.c),

$$\frac{\partial G(.)}{\partial t} = \frac{F\ Y_R}{1+c}\ (\propto + (1-\propto)c) - (1 - 2\ \propto)\left(\left(\frac{\partial \mathrm{a}}{\partial t} + \frac{\partial \mathrm{b}}{\partial t}\right)\right) = 0. \tag{26}$$

Since it holds that $\frac{\partial^2 a(t)}{\partial t^2} > 0, \frac{\partial^2 b(t)}{\partial t^2} > 0,$ second order conditions are satisfied iff $\propto < 0.5$:

$$\frac{\partial^2 G(.)}{\partial t^2} = -(1 - 2\ \propto)\left(\frac{\partial^2 a(t)}{\partial t^2} + \ \frac{\partial^2 b(t)}{\partial t^2}\right) < 0. \tag{27}$$

In the case that $\propto \geq 0.5$ we obtain a corner solution.

Solving the first order condition (26) we obtain:

$$\propto \frac{F\ Y_R}{1+c} + \ (1-\propto)\frac{cF\ Y_R}{1+c} = (1 - 2\ \propto)\left(\frac{\partial \mathrm{a}}{\partial t} + \frac{\partial \mathrm{b}}{\partial t}\right), \tag{28}$$

or,

$$\frac{F\ Y_R}{1+c}\ (\propto + (1-\propto)c) = (1 - 2\ \propto)\left(\frac{\partial \mathrm{a}}{\partial t} + \frac{\partial \mathrm{b}}{\partial t}\right). \tag{29}$$

As c increases, the LHS increases, thus the tax level will need to be higher. Since (16) tells us $\frac{\partial a(t)}{\partial t} > 0, \frac{\partial b(t)}{\partial t} > 0 \; and \; \frac{\partial^2 a(t)}{\partial t^2} > 0, \frac{\partial^2 b(t)}{\partial t^2} > 0$, this requires a higher level of t. Thus, if the tax revenues are worth more to the poor, the TA will increase the tax level. The same is true with regard to fines, F. Summarizing,

Proposition 8: The TA/regulator determines the tax level such that $\frac{F\,Y_R}{1+c}\,(\propto +(1-\propto)c) = (1-2\propto)\left(\frac{\partial \mathrm{a}}{\partial t}+\frac{\partial \mathrm{b}}{\partial t}\right)$. When c and/or F increases, t will be higher (as just discussed).

In the case that the TA is completely self-interested—does not care about others (the poor and rich) in society, $\propto = 0$ —we obtain:

$$If \;\; \propto = 0, \; we \; get \;\; \frac{F\,Y_R}{1+c}\; c \; = \frac{\partial \mathrm{a}}{\partial t}+\frac{\partial \mathrm{b}}{\partial t}. \tag{30}$$

Let us rewrite (29) as,

$$\frac{F\,Y_R}{1+c}\,\frac{(\propto+(1-\propto)c)}{(1-2\propto)} = \left(\frac{\partial \mathrm{a}}{\partial t}+\frac{\partial \mathrm{b}}{\partial t}\right). \tag{31}$$

In order to compare the solution in (30) to that of (20), let us now compare $\frac{(\propto+(1-\propto)c)}{(1-2\propto)} \; to \; c$:

$$\frac{(\propto+(1-\propto)c)}{(1-2\propto)} \begin{cases} > \\ = \\ < \end{cases} c. \tag{32}$$

This is like comparing $(\propto +(1-\propto)c) \; to \; c\,(1-2\propto)$ which becomes comparing $\propto \;\; to \;\; -c\propto$. In other words, $\frac{(\propto+(1-\propto)c)}{(1-2\propto)} > \; c$. Thus,

Proposition 9: As the TA cares less about the public welfare of others in society (the poor and the rich), the tax level, t, that the TA sets, decreases.

Proposition 8 is derived from equation (25), the TA's objective function, and tells us the tax rate (t) will be set higher when c and/or F increases. Proposition 9 focuses on the TA's setting of the tax rate as $\propto$ falls. $\propto$ captures the importance the TA places on public welfare (the welfare of the poor and rich). As $\propto$ falls, the TA shows more and more self-interest. So, as the TA shows more self-interest, the TA lowers the tax rate. While this seems surprising, remember we have seen that as the rate increases, both the poor and rich spend less on lobbying from which the TA draws rents.

Remember the final formulation of equation (25), that

$$G(.) = \frac{F\,tY_R}{1+c}(\propto \; +(1-\propto)c) - \propto I - (1-2\propto)\,(\mathrm{a(t)} + \mathrm{b(t)} + e) + (1-\propto)v. \tag{25}$$

Now let us consider the determination of a change in the enforcement level by investing in I,

$$\frac{\partial G(.)}{\partial I} = \; -\propto -(1-2\propto)\frac{\partial \mathrm{e}}{\partial I} + (1-\propto)\frac{\partial \mathrm{v}}{\partial I} = 0,$$

$$so \; that \;\; \propto +(1-2\propto)\frac{\partial \mathrm{e}}{\partial I} = (1-\propto)\frac{\partial \mathrm{v}}{\partial I}.$$

Our second order condition tells us: $\frac{\partial^2 G(.)}{\partial I^2} = -(1-2\propto)\frac{\partial^2 \mathrm{e}}{\partial I^2} + (1-\propto)\frac{\partial^2 \mathrm{v}}{\partial I^2} < 0$ iff $\frac{\partial^2 \mathrm{v}}{\partial I^2} < \frac{(1-2\propto)}{(1-\propto)}\frac{\partial^2 \mathrm{e}}{\partial I^2}$. Recalling $\propto < 0.5$, a necessary but not sufficient condition is thus that *t* $\frac{\partial^2 \mathrm{v}}{\partial I^2} < \frac{\partial^2 \mathrm{e}}{\partial I^2}$. This means that the effect on the probability of detection increases faster than the increase in the utility of the TA. We thus have,

Proposition 10: Assuming $\frac{\partial \mathrm{v}}{\partial I} > 0 \ and \ \frac{\partial^2 \mathrm{v}}{\partial I^2} < 0$:

If $\frac{\partial \mathrm{e}}{\partial I} = 1$ then the TA will set *I* such that $\frac{\partial \mathrm{v}}{\partial I} = 1$.

If $\frac{\partial \mathrm{e}}{\partial I} > 1 \ and \ \propto < 0.5$ (as stated above) then the TA will set *I* such that $\frac{\partial \mathrm{v}}{\partial I} > 1$; thus the TA will invest less in enforcement.

If $\frac{\partial \mathrm{e}}{\partial I} < 1 \ and \ \propto < 0.5$ (as stated above) then the TA will set *I* such that $\frac{\partial \mathrm{v}}{\partial I} < 1$; thus the TA will invest more in enforcement.

High tax levels create a situation of high herding, and greater herding decreases investment by the poor and rich trying to affect the tax level set by the TA. Thus, a TA who only cares about their own self will enact lower tax levels than if they cared about others in the society. The reasoning again follows from (16),

$$\frac{\partial a(t)}{\partial t} > 0, \frac{\partial b(t)}{\partial t} > 0 \ and \ \frac{\partial^2 a(t)}{\partial t^2} > 0, \frac{\partial^2 b(t)}{\partial t^2} > 0.$$

If we were to assume decreasing returns then we would only get a solution if the TA cares about public interest more than their own self.

4 Discussion and conclusion

In the above sections of the paper, we studied the explicit interactions among the poor, the rich, and a tax administrator (TA), in order to understand the choice of tax rates and enforcement investment, fines, the consequent social outcome and revenue raising, and the extent of corruption as characterized by tax evasion and lobbying. The poor and the rich represent two constituent (interest) groups who act strategically to drive policy for their own benefit. The income of the poor is so low they do not pay taxes, but do benefit from the taxes others – the rich – pay and hence the poor spend resources to influence the level of taxes the TA chooses. The rich are responsible for paying taxes, but prefer not to. In their tax evasion behaviour, they follow their reference herd, spend resources and enter a contest (as in a lobbying game) with the poor, in order to influence the TA's choices of the level of tax enforcement, taxes and fines. The TA is not a neutral arms-length actor; rather, the TA has both the public and own self-interest in mind when proposing tax policy and administration. The TA chooses a policy in order to maximize a weighted average of the resulting utility levels of two competing groups, as well as the lobbying expenditures of the two contestants (some of which may accrue as rent to the TA), and the costs and benefits from investing in enforcement.

We understand taxpayer lobbying as reflecting their constituency's own behaviour vis-à-vis paying taxes. The rich taxpayers in our model decide on whether they will avoid paying taxes and to what degree. Following Epstein and Gang (2010) we use information cascades (herd behaviour) to

capture tax evasion. Potential tax evaders (in this model all those who pay taxes, i.e., the rich) do not have perfect information regarding their best choices or their probability of being caught. Evasion decisions are sequential; each person looks at the decisions made by previous individuals over time, before making their own decision. That is, we look at the connection between the decision an individual makes regarding tax evasion and the number of other individuals in their group already evading, which increases as the tax rate increases. Moreover, taxpayers understand that their risk if they evade reflects how the tax administrator treats their group and this determines the behaviour that the taxpayer references. This is rational behaviour on the supposition that previous individuals had information the potential evaders do not. The outcome is a private decision rule, which may give rise to herd behaviour. Individuals discount private information and decide to tax evade, emulating actions by others in their group. This behaviour is brought to the rent-seeking contest.

The tax administrator is characterized by an objective function that is a weighted average of the expected social welfare and lobbying efforts. The tax administrator (TA) sets the tax rate and fines taking into account the contest between the poor and the rich, the TA's own rent acquiring behaviour, their commitment to performing their duties well and to enhancing social welfare, which includes raising the revenues necessary for the government to function and the economy to advance. Our results depend on the type of political situation that exists in the economy. This is captured by the weight the TA places on each element of the objective function. For example, say $\propto$ is the weight the TA/regulator/politician assigns to social welfare while $(1 - \propto)$ determines the weight the policy-maker assigns to their own self-welfare. The results we obtain are a function of $\propto$ that is going to vary over different countries. If one observes policy-makers who are purely selfish, caring only about themselves, we see one outcome. On the other hand, where policy-makers care about the public interest, we see a different outcome.

In this setting the TA establishes tax policy. We saw that the condition the TA should satisfy when choosing the appropriate tax rate (proposition 8) takes into account the penalty (fine) for evasion if caught, the income of the rich, the marginal utility of income difference between the poor and rich, herding in tax evasion, and the public interest and own private interest. The chosen tax rate will respond to all of these factors. We highlight several. As fines increase, the optimal tax rate will be higher. And we can introduce the role of income distribution as captures in c, a parameter capturing the differential value of the marginal utility of income of the poor vis-à-vis the rich. As c increases, that is if relative marginal income is even more important to poor, the optimal tax rate will again increase.

Tax policy also includes investment in enforcement (I), particularly aimed at improving tax administration. Enforcement investment enters the TA's objective function both as a cost for the constituencies and as a benefit for the TA, increasing their own self-interested well-being. Generally, the optimal level of I for the TA to set depends on the responsiveness of enforcement to increases in I, as clarified in proposition 10 and reflecting that the probability of detection increases faster than the increase in the utility of the TA. High tax levels create a situation of high herding, and greater herding decreases investment by the poor and rich trying to affect the tax level set by the TA. Thus, a TA who only cares about their own self will enact lower tax levels than if they cared about others in the society.

Consequently, in this model we can talk about inequality in terms of the relative importance of marginal income to the poor contrasted with its importance to the rich, that is, c. Tax policy, in terms of the tax rate and enforcement investment is set in this context. Let us now consider the consequences of an increase in this gap between poor and rich marginal incomes, an increase in inequality. Conceptually hold the income of the poor constant, but let the income of the rich

increase. As the difference between the poor and the rich increases, *Yr* increases, optimal *t* chosen by the TA will be higher. This follows directly from our argument for Proposition 5. Assuming the marginal utility of income decreases as income increases, *c* must be increasing. However, compare this to what we learned from propositions 8 and 9 and equation 30. Instead, *c* will be higher as *t* increases. This is from the role played by $\propto$, the weight on social welfare. Proposition 8 is derived from equation (25), the TA's objective function, and tells us the tax rate (*t*) will be set higher when *c* and/or *F* increases. Proposition 9 focuses on the TA's setting of the tax rate as $\propto$ falls. $\propto$ captures the importance the TA places on public welfare (the welfare of the poor and rich). As $\propto$ falls, the TA shows more and more self-interest. So, as the TA shows more self-interest, the TA lowers the tax rate. While this seems surprising, remember we have seen that as the rate increases, both the poor and rich spend less on lobbying from which the TA draws rents. From proposition (9) and equation (30) we learn that as *F* is higher, for a given level of $\propto$, the tax level will be higher. Moreover, from proposition (9) and equation (30) we also learn that as *c* (the weight on the marginal utility of income for the poor) is higher, for a given level of alpha, the tax level will be higher. Given the expected payoff of both groups, the TA maximizes their own expected utility/income). For each given $\propto$, the level of enforcement that the TA proposes will be different. We learn here that lower taxes on the rich does not mean the TA cares more about the public interest. Instead, it may result from the TA caring less about the public welfare of others in society (the poor and the rich).

Ineffective tax administration is a chronic problem in many developing countries and has a direct effect on tax evasion, constrains the state's revenue-raising capability and, hence, the role the state plays in economic development. It can have consequences on some of the 'big ticket' ideas, i.e., what we discussed. As we have set out above, in our modelling and discussion we account for taxpayer behaviour and perception, rent-seeking lobbying by taxpayer constituencies, investment in tax administration, and the adherence or not by the public policy tax administrator to maximizing social welfare.

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