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RESEARCH PAPER

Exit and Voice: Yardstick Versus Fiscal Competition Across Governments

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Abstract Government competition is often invoked as one of the main advantage of decentralization. But competition across governments can take two forms, through tax competition (exit) or yardstick competition (voice). We show these two forms may affect political equilibria in opposite directions. Tax competition increases the disciplining effect of elections on politicians, but it reduces the selection effect. Yardstick competition works in just the opposite direction. However, the two forms of competition may be complementary as expected welfare is concerned.

Keywords Tax competition · Yardstick competition · Fiscal federalism · Decentralization · Political equilibria

JEL Classification H11 · H25 · H77

1 Introduction

In a representative democracy, elections represent the fundamental way to discipline politicians. Bad or incompetent governments are thrown out of office and this threat forces them to behave in the interests of voters. Many observers, however, would agree that the electoral mechanism alone may not be powerful enough and that additional disciplining devices on politicians may be helpful. Not surprisingly, the economists'

This paper started as a joint research project with Enrico Minelli at CORE long time ago, but it was almost immediately abandoned. When I decided to resume the project and finish the paper, Enrico Minelli was not longer interested, which is way this work appears under my name only.

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main contribution to this debate has been to advocate more competition across governments. As competition across firms reduces extra profits in the market, so competition across governments would reduce political rents. This general idea has taken two main forms, aptly summarized by Albert Hirschman's famous distinction between "exit" and "voice" (Hirschman 1970). According to the former, people may escape from too greedy a government either by migrating altogether, as in the Tiebout's tradition, or more realistically, by transferring abroad their mobile assets (Brennan and Buchanan 1980). It would be difficult to overestimate the practical influence of this idea. For example, in the debate on the fiscal institutions of the European Union, tax competition among member countries is often defended on the grounds of its disciplining effects on the hefty European governments. But there is also a second version of the same idea. Competition across governments might also improve the information set of voters (Salmon 1987). With competing governments and correlated economic environments, citizens may engage in more relative performance evaluation (also known as "yardstick competition") across politicians, using observations about the results of governments in other regions or other countries to infer something about the quality of their own governments, so reinforcing the disciplining effects of "voice". According to its supporters, both globalization, with its increase in correlation across national economies, and increased media coverage converge in strengthening the practical relevance of this form of disciplining device. Indeed, tax and yardstick competition may also go hand in hand; in the EU, for instance, the increased integration of markets and politics, coupled with the increased mobility of factors, have certainly worked in the direction of deepening both forms of governmental competition.

Tax and yardstick competition have been separately scrutinized at large in the economic literature, both theoretically and empirically (see below). Their link, however, has not been addressed with the same attention. Does tax competition support the informational advantages of yardstick competition? When both forces are at work, which are the predictions in terms of fiscal choices, political equilibria and citizens' welfare? Surprisingly enough, these questions have never been raised in the literature, at least not in formal analyses. The only paper that briefly touches these issues is a work by Besley and Smart (2007).[1] However, they are concerned with the effects of several general fiscal restraints on voter's welfare and as a result, they choose a modelling strategy that does not allow them to focus specifically on the interaction between the two forms of intergovernmental competition.[2] As the topic is relevant, it is instead important to address it explicitly, in a model where both tax and yardstick competition can be introduced and their effects compared.

In the model of this paper, an incumbent politician takes fiscal decisions in a first period, hoping to be re-elected at the end of this period to run for a second term. Voters are "rational ignorant"; they do not know precisely the quality of their incumbent and do not have the same information that politicians have on crucial elements that

[1] See also the textbook treatment by Besley (2006), part 4.

[2] In particular, in their model the amount of resources a "bad" government can expropriate when separating is fixed and does not depend on the forces of tax competition, in contrast with the main trust of the literature generated by the Brennan and Buchanan book. This explains the different results they obtain. See the working paper version of this work for further details.

affect the functioning of the public sector. This informational asymmetry offers "bad" politicians the opportunity, under some conditions, to mimic the good type in the first period and be reelected in the second. In this framework, we first introduce tax competition, which reduces the ability of politicians to tax capital income, and then yardstick competition, assuming the existence of a second economy, correlated to the first, that allows voters to compare the fiscal choices of politicians.

The main results of the paper are as follows. First, we show that the effects of the two forms of intergovernmental competition on political equilibria are generally different. Intuitively, fiscal competition works by reducing the resources a "bad" government can lay his hands on; yardstick competition works by providing the voter with more information to choose between "bad" and "good" governments. As the two mechanisms are different, it is not surprising that they may produce different results. Indeed, if there is a general tendency, this points to a conflict between the two forms of competition. Tax competition, by constraining government's choices on some tax tools, makes the signal (the tax rates) that voters could use to select between bad and good politicians through yardstick competition less informative. In the model, this translates into a larger set of parameters that supports pooling equilibria (between good and bad governments) under tax competition. Second, concerning welfare, yardstick competition is certainly beneficial to voters, as long as it does not change the political equilibrium, while the effects of tax competition are generally ambiguous. But there is however a sense in which the two forms of government competition can be thought of as complementary. Yardstick competition tends to be beneficial to voters when bad politicians "pool" in the first period, as they are more easily found out; tax competition tends to be beneficial to voters when bad politicians "separate" in the first period, as voters are less exploited. Putting both forms of governmental competition together it might well then be that their joint effect on consumer's welfare may turn out to be positive, despite their conflicting effects on political equilibria.

Yardstick competition was introduced in economics by Salmon (1987) and first formalized by Besley and Case (1995), that also offer an empirical application to the USA. A theoretical analysis is in Bordignon et al. (2004) and an empirical application to Italian municipalities is offered by Bordignon et al. (2003). A textbook treatment is in Besley (2006). Kotsogiannins and Schwager (2008) offer a recent theoretical example, by enquiring on the effect of equalization grants on political equilibria. Revelli (2005) offers an interesting recent empirical application to local media markets in the UK. The literature on tax competition is huge. Wilson (2006) offers a recent survey. The question of whether tax competition is beneficial or not, and of its effect on political equilibria, was first raised by Wilson (1989) and Edwards and Keen (1996). A recent interesting theoretical example is Eggert and Sorenson (2008) who argue that tax competition leads to too low tax rates on capital even when politicians only wish to accumulate rents. Empirical studies on tax competition abound. Trannoy et al. (2007) offer a recent example.

The rest of the paper is organized as follows. Section 2 sets up the model. Section 3 derives political equilibria, considering both the case with and without tax competition. Section 4 introduces yardstick competition. Section 5 compares the different mechanisms and derives the basic result of this paper. Section 6 discusses welfare effects. Section 7 concludes.

2 The Model

Consider an economy with a continuos set of identical voters, whose measure is normalized to one. Each consumer derives utility $u(.)$ from a private good c, a (per capita) public good g and leisure $x = (1 - l)$, where l indicates labor supply. We assume the quasi-linear form

$$u = c + H(g) + V(1 - l) \quad (1)$$

so as to eliminate income effects. Both $H(.)$ and $V(.)$ are increasing and strictly concave functions. Each consumer owns one unit of time and one of a private good, which we later identify with "capital".[3] This unit of capital can be invested earning a fix return that we normalized to one. Labor wage is also normalized to one. Governments raise tax revenue by taxing either (or both) capital and labor income. The consumer's budget constraint is:

$$c = (1 - T) + (1 - t)l \quad (2)$$

where T and t indicate, respectively, the tax rate on capital and labor income and $T, t \in [0, 1]$. Governments can use tax revenue to either produce g and/or to accumulate rents. The production function of the public good is stochastic[4]: one unit of revenue produces $\overline{\epsilon}$ units of g when the shock is positive and $\underline{\epsilon}$ units when the shock is negative, with $\overline{\epsilon} > \underline{\epsilon} > 0$.[5] Positive shocks occur with probability $q > 0$. Government's budget constraint is:

$$r = (T + tl) - \frac{g}{\epsilon} \quad (3)$$

where r indicates (per capita) rents and $\epsilon = \left\{\overline{\epsilon}; \underline{\epsilon}\right\}$. Governments come of two types. They are either Welfarist (or "good" governments) or they are Leviathans (or "bad" governments). The former are only interested in maximizing the utility of the consumers; the latter are only interested in maximizing rents.[6] Good governments occur

[3] The assumption of a fix capital endowment is just a simplification; qualitatively, our results below would go through even introducing a consumption-saving choice for the consumer. But notice that this assumption rules out one popular argument in favor of tax competition, the weakening of the time inconsistency problem in capital taxation and its positive effects on saving (see for instance chapter 12 in Persson and Tabellini 2000).

[4] The assumption that the shock is permanent is for analytic convenience only; nothing essential would change if the shock affected the production function only in the first period.

[5] As an interpretation, one might think of ϵ as a technological shock affecting the productivity of the public sector (i.e. the use of the internet in the administration) but whose precise effects are uncertain and poorly understood by voters. More generally, the shock should be interpreted as a metaphor of any phenomenon that affects the economy but whose effects are better understood by politicians rather than voters. It is this asymmetry that allows politicians to put the blame for their inability to maintain their electoral promises on the fiscal behavior of past politicians (not precisely known to voters) or on external factors (e.g. 9/11, globalization, etc.).

[6] These assumptions are introduced in order to sharpen the results and to connect the present analysis with the literature derived from Brennan and Buchanan (1980) on tax competition that typically assumes

with ex ante probability $\theta > 0$. For technical reasons (in order to guarantee the existence of a pooling equilibrium in pure strategies in all cases considered below,[7]) I assume through the following parametric condition:

$$\theta > \frac{1}{2} > q. \quad (A.1)$$

The respective utility functions of the two types of government is then:

$$W(T, t, g) = u(T, t, g) \tag{4}$$

and

$$L(T, t, g) = r = T + tl - \frac{g}{\epsilon} \tag{5}$$

where, abusing on notation, we use $u(T, t, g)$ to indicate the *indirect utility* of the representative consumer given government fiscal choices.

The economy lasts two periods.[8] In the first, the incumbent politician chooses $\{T, t, g\}$. At the end of this period there is an election and either the incumbent or an opponent candidate is elected. The second period is just like the first, with the only difference being that there are no elections at the end of this period. Each agent in the economy (the consumer, the two types of governments and the opponent) discounts future at the same rate, $0 < \delta < 1$. In order to provide electoral incentives to governments, we assume that the representative citizen does not observe either the realization of the shock or the type of government. However, she knows the stochastic structure of the economy. These assumptions define a dynamic game with incomplete information between the representative voter and the different types of government. The relevant notion of equilibrium for this game is that of perfect Bayesian equilibria (PBE); that is, equilibria where the strategies of each agent (the two types of incumbent government, the representative voter, and the opponent) are optimal given the strategies of any other agent, and where, whenever possible, beliefs are sequentially rational in the sense that they are revised according to Bayes' rule. We solve the game for different hypotheses about intergovernmental competition. For simplicity, in the following, we always assume that Welfarist governments do not play strategically; whatever the realization of the shock, they just do what is better for their citizens in

Footnote 6 continued
Leviathan governments. As will be clear from what follows, the results would not change qualitatively if we instead assumed that bad governments are "dissonant" politicians or incompetent ones who make inefficient choices (e.g. see Besley 2006). For an analysis that focuses explicitly on the different quality of politicians under centralization and decentralization, see Lockwood and Hindricks (2009).

[7] As will be clear from what follows, if (A.1) is violated, either no pooling equilibria exist or if they do, they exist under one form of governmental competition only. We impose (A.1) because we want to compare the effect of the two forms of competition on the trade off between the "disciplining" and the "selection" effect of elections (e.g. Besley and Smart 2007) and this requires that pooling equilibria exist under both forms.

[8] With more periods, the disciplining effects of the electoral systems tend to be reduced, as the future rents from pooling are more heavily discounted. See Besley (2006):149–151 for a formal analysis of this issue. On the more general effects of term limits on political equilibria and welfare effects see Schultz (2008).

any period. This allows us to fix out-of-equilibrium beliefs in a simple way in what follows.[9] We begin by studying political equilibria in a closed economy and in an open economy where capital can also flow abroad. In the next section we introduce yardstick competition.

3 Political Equilibria with and without Tax Competition

In this section, the game unfolds as follows. At stage 0 of the first period, nature moves, by choosing a realization for ϵ and a type for the incumbent government and the opponent; at stage 1, the incumbent moves, by choosing the tax rates on capital and labor and by committing on how to split revenue between rents and public good; at stage 2 consumers make their choices and so tax revenue is also determined. At the end of the first period, the consumer observes the fiscal choices of the incumbent (but not the amount of rents collected) and decides whether to reelect him or elect an opponent. Opponents are also good with probability θ. Let $\eta(\theta, T, t, g)$ be the posterior probability the consumer assigns to the incumbent to be a good government at the end of the first period, as a function of her initial beliefs and the observed first period choices (T, t, g). The consumer votes for the incumbent whenever $\eta(\theta, T, t, g) \geq \theta$.[10] The second period is just as the first, except that there is no stage 0 and no elections at the end of the period. We solve the game by backward induction.

3.1 Second Period

3.1.1 Closed Economy

At stage 2, private sector's choices are as follows. If the economy is closed, capital can only be invested at home, so the only choice the consumer needs to make at this stage concerns her labor supply. The consumer then maximizes

$$\max\ u = (1 - T) + (1 - t)l + H(g) + V(1 - l)l$$

taking (T, t, g) as given.[11] The first order condition gives:

$$(1 - t) - V_x(1 - l^*) = 0 \tag{6}$$

[9] This is the standard assumtpion used in this literature (for exceptions, see Coate and Morris 1995; Bordignon and Minelli 2001). But notice that this assumption is not very restrictive in the present context. It can be proved that the PBE we derive below would always be equilibria even with strategic Welfarist governments, and that they might even be the unique equilibria if one is willing to accept a number of reasonable restrictions on out of equilibrium beliefs. Lockwood (2005), in analyzing a version of Besley and Smart (2007) model with strategic good governments, reaches similar conclusions.

[10] Thus, we assume that when indifferent, the citizen votes for the incumbent. We make below the same assumption for the bad incumbent: he pools when indifferent between pooling and separating. As shown in Bordignon and Minelli (2001), these assumptions effectively rule out mixed strategy equilibria for this game. Hence, we only focus on pure strategy equilibria in what follows.

[11] Tax rates have already been chosen, and the single consumer is too small to affect g in any way.

where thorough the paper subfixes indicate derivatives and asterisks optimal values. Solving, we get :

$$l^* = 1 - V_x^{-1}(1 - t) \equiv L(t) \tag{7}$$

where concavity of $V(.)$ implies $L_t(t) < 0$. For future reference let us indicate with $\sigma(t) \equiv -((L_t(t)t)/L(t))$ the *tax elasticity* of labor supply, and let us also assume $\sigma_t(t) > 0$ so as to guarantee the second order condition for government maximization (see below).

Consider then the choices of the two types of incumbents at stage 1. In the second period, as there is no future ahead, each type of government would simply choose his preferred strategy. Welfarist governments do not receive any utility from rents, so they always set $r = 0$. Leviathan governments do not care for public expenditure, and so they choose $g = 0$. Concerning taxes, if the incumbent government is a Welfarist and the economy is closed, he chooses (T, t) so as to maximize:

$$\begin{aligned} W(T, t, g) &= u(T, t, g) \\ &= (1 - T) + (1 - t)L(t) + H(\epsilon(T + tL(t))) + V(1 - L(t)) \end{aligned} \tag{8}$$

Using (3) and (6), the first order conditions for this problem can be written as:

$$T : -1 + \epsilon H_g(.) \geq 0, \quad T \leq 1 \tag{9}$$

$$\begin{aligned} t &: -L(t) + H_g(.)\epsilon(L(t) + tL_t(t)), \\ &= -L(t) + H_g(.)\epsilon L(t)(1 - \sigma(t)) \leq 0 \; t \geq 0. \end{aligned} \tag{10}$$

As clear from (9) and (10), in a closed economy the capital tax is a lump sum tax, implying that a Welfarist government would never use the distorting labor tax if he had at his disposal enough capital income to finance the desired level of expenditure.[12] To obtain interior solutions, let us then suppose that $H_g(\epsilon) \geq \frac{1}{\epsilon}$ for both $\overline{\epsilon}$ and $\underline{\epsilon}$, implying $t^*(\epsilon) \geq 0$. We can then summarize the choices of the Welfarist government in a closed economy in the second period as $\mathbf{a}^G(\epsilon) = \{t = t^*(\epsilon, 1), T = 1, g = g^*(\epsilon, 1)\}$ where $H_g(g^*) = \frac{1}{\epsilon(1-\sigma(t^*))}$ and $g^* = \epsilon(1 + t^*L(t^*))$. The choices of the Leviathan government are even simpler, as the shock does not affect tax revenue. Whatever the realization of ϵ, the Leviathan would simply maximally tax the consumer. His preferred choices in a closed economy are then $\mathbf{a}^B = \left\{t = \widehat{t}, T = 1; g = 0\right\}$, where $\widehat{t}$ is implicitly defined by the condition $\sigma(\widehat{t}) = 1$.[13]

[12] From (9) if $T^* \leq 1$, $H_g(g^*) = \frac{1}{\epsilon}$; substituting in (10), we get $-L(t)\sigma(t) < 0$, implying $t^* = 0$.

[13] These choices for the Leviathan are of course extreme. One may well image that there are reasons, perhaps constitutional limits on taxation or the simple threat of a revolution, that would forbid even a Leviathan government from completely expropriate his citizens. However, as will be apparent below, the assumption of an untamed Leviathan is the one which goes mostly *against* the main point we make here.

3.1.2 Open Economy

Suppose now we open the economy, allowing capital to flow abroad. At stage 2, the consumer would now also have the choice of exporting her capital. Clearly, her best choice would be to move her endowment of capital so as to equalize the net-of-tax-return from capital across countries; as an effect, if capital is perfectly mobile, any capital tax at home larger than the one applied abroad would drive away all capital from the country. In a (Bertrand) competitive equilibrium across countries, the tax on capital could then only be set equal to zero everywhere. Under less extreme assumptions (various forms of mobility costs), governments would retain some ability to tax capital, but capital taxation in an open economy would drive away part of the capital from the country.

For analytical simplicity, we capture this effect here by just assuming that when the economy is open, the tax base of the capital tax is reduced to some β, $0 \leq \beta < 1$.[14] This entails that capital taxation on the reduced tax base is still not distorting, even in an open economy. The Welfarist government would then still maximally tax capital, $T^* = \beta$, and use the labor tax to finance the residual desired amount of public expenditure. Under tax competition, the optimal choices of the good government in the second period are then $\mathbf{a}^{Gc}(\epsilon) = \{t = t^{c*}(\epsilon, \beta), T = \beta, g = g^{c*}(\epsilon, \beta)\}$, where $H_g(g^{c*}) = \frac{1}{\epsilon(1-\sigma(t^{c*}))}$, $g^{c*} = \epsilon(\beta + t^{c*}L(t^{c*}))$. The subfix "$c$" is a reminder that these are the optimal choices under tax *c*ompetition. We write t^{c*} and g^{c*} as functions of β (in addition to ϵ) to indicate that the force of tax competition (the share of the capital tax base driven away by capital taxation) will generally affect the optimal choices for the remaining fiscal variables. If the incumbent government is instead a Leviathan, under tax competition, his preferred choices are $\mathbf{a}^{Bc} = \left\{t = \widehat{t}, T = \beta; g = 0\right\}$.

We summarize the results of this section by stating:

Lemma 1 *Consider the second period. In a closed economy, if the incumbent is a Welfarist his fiscal choices are* $\mathbf{a}^{G}(\epsilon) = \{t = t^*(\epsilon, 1), T = 1, g = g^*(\epsilon, 1)\}$ *while if the government is a Leviathan his choices are* $\mathbf{a}^{B} = \left\{t = \widehat{t}, T = 1; g = 0\right\}$. *In a open economy, the respective choices of the two governments are* $\mathbf{a}^{Gc}(\epsilon) = \{t = t^{c*}(\epsilon, \beta), T = \beta, g = g^{c*}(\epsilon, \beta)\}$ *and* $\mathbf{a}^{Bc} = \left\{t = \widehat{t}, T = \beta; g = 0\right\}$.

Notice that the effect of tax competition on consumer welfare in the second period strictly depends on the type of government. If the second period incumbent is a Welfarist, tax competition makes the consumer surely worse off, as she now has to pay a higher dead-weight loss from taxation and generally enjoys less public good.[15] She is

[14] Adding a more fully fledged tax competition model would be interesting, but would also greatly complicate the model, and it is not clear if the added complexity would pay off in terms of extra insights. The most interesting effect would come in terms of the support for political equilibria; in an open economy, if a government chose a different tax from that prevailing abroad, capital would flow in or out, and this observation can provide useful information to the voter concerning the quality of her incument.

[15] More precisely, and leaving aside the efficiency effects of capital mobility across countries, consumers as a whole would be better off if capital mobility were prohibited, but each single consumer would be better off if she could escape taxation alone, leaving the other taxpayers to foot the bill. In an atomistic economy, free-riding behavior under capital mobility pushes the economy in a second best equilibrium.

instead better off if the second period incumbent is a Leviathan, as she can now at least save some of her resources from expropriation. We will come back to this in Sect. 6.

3.2 First Period

Having solved the game in the second period, let us then move to the first. By assumption, Welfarist governments do not play strategically and so in the first period they again choose either $\mathbf{a}^G(\epsilon)$ or $\mathbf{a}^{Gc}(\epsilon)$, depending on whether the economy is closed or open. What of interest here is instead the behavior of the bad government. This may "pool" in the first period, choosing actions that the Welfarist could have chosen for some realization of the shock, or may "separate" and plays his preferred strategies in the first period too, choosing either $\mathbf{a}^B(\epsilon)$ in a closed economy or $\mathbf{a}^{Bc}(\epsilon)$ in an open one. Of course, if the Leviathan chooses this second course of actions he knows that he will be defeated at the elections, because the voter will then understand that he is a bad incumbent [the Welfarist would never play $\mathbf{a}^B(\epsilon)$ or $\mathbf{a}^{Bc}(\epsilon)$] and therefore votes for the opponent (who is good with probability θ). On the other hand, if the Leviathan "pools" in the first period, he might have a chance of re-election if the voter confuses him with the Welfarist. As the voter is rational, this of course can only happen if the voter, at the equilibrium where she knows the Leviathan is mimicking the Welfarist, still expects an incumbent playing $\mathbf{a}^G(\epsilon)$ or $\mathbf{a}^{Gc}(\epsilon)$ to be good with a larger probability than the opponent. Finally, for this pooling behavior to form a PBE, it must also be the case that the Leviathan prefers to play this mimicking strategy in the first period and have some chances of re-election, rather than just maximally tax the voter in the first period. Invoking Lemma 1 and (A.1), the following proposition establishes the conditions under which this occurs (a detailed proof is in the Appendix):

Proposition 1 *Let* $\delta^* \equiv (1 - \frac{\phi R(1,\underline{\epsilon})}{1+\widehat{t}L(\widehat{t})})$ *and* $\delta^{*c} \equiv (1 - \frac{\phi R(\beta,\underline{\epsilon})}{\beta+\widehat{t}L(\widehat{t})})$, *where* $\phi \equiv \frac{(\overline{\epsilon}-\underline{\epsilon})}{\overline{\epsilon}}$, $R(s,\underline{\epsilon}) = (s + t^*(\underline{\epsilon}, s)L(t^*(\underline{\epsilon}, s)))$, $s = 1, \beta$. *Then, under* (A.1), *if* (1) *either* (i) $\epsilon = \underline{\epsilon}$; *or* (ii) $\epsilon = \overline{\epsilon}$ *and* $\delta < \delta^*$ *in closed economy or* (iii) $\epsilon = \overline{\epsilon}$ *and* $\delta < \delta^{*c}$ *in an open economy, the unique PBE in pure strategies is a separating equilibrium where in the first period the Welfarist government plays* $\mathbf{a}^G(\epsilon)$ *in a closed economy* [*resp.* $\mathbf{a}^{Gc}(\epsilon)$ *in an open economy*] *and the Leviathan plays* $\mathbf{a}^B$ *in a closed economy* (*resp.* $\mathbf{a}^{Bc}$ *in a open economy*). *At this equilibrium, the Welfarist government is re-elected and the Leviathan government defeated at the elections. If* (2) *either* (i) *the economy is closed,* $\epsilon = \overline{\epsilon}$, *and* $\delta \geq \delta^*$ *or* (ii) *the economy is open,* $\epsilon = \overline{\epsilon}$, *and* $\delta \geq \delta^{*c}$, *then the unique PBE in pure strategies is a pooling equilibrium where in the first period the Welfarist government plays* $\mathbf{a}^G(\overline{\epsilon})$ [*resp.* $\mathbf{a}^{Gc}(\overline{\epsilon})$ *in an open economy*] *and the Leviathan government plays* $\mathbf{a}^G(\underline{\epsilon})$ [*resp.* $\mathbf{a}^{Gc}(\underline{\epsilon})$ *in an open economy*]. *At this equilibrium, both types of government are re-elected.*

Thus, the Leviathan is willing to pool in the first period if and only if the shock is positive and the discount factor is large enough. The reason is simple. Because $\delta < 1$, the Leviathan finds it convenient to pool only if he can accumulate some positive rents in the first period; otherwise, he would be better off by deviating and maximally tax the consumer immediately, rather than waiting until the second period to do the same. However, as the Leviathan is constrained to play either $\mathbf{a}^G(\underline{\epsilon})$ or $\mathbf{a}^G(\overline{\epsilon})$ [resp.

$\mathbf{a}^{Gc}(\underline{\epsilon})$ or $\mathbf{a}^{Gc}(\overline{\epsilon})$ in an open economy] if he wants to pool, the only way in which he can earn some positive rents in the first period is if the shock has been positive and the Leviathan instead claims to have been negative, as this allows him to over tax the consumer and cash the difference. The rational voter expects this, but given our assumption on the distribution of types and shocks (assumption A.1), upon observing $\mathbf{a}^{G}(\underline{\epsilon})$ [resp. $\mathbf{a}^{Gc}(\underline{\epsilon})$], she still believes that this action is more likely to come from a Welfarist facing a negative shock than from a Leviathan facing a positive shock and trying to fool her. Hence, she re-elects the incumbent. Finally, as pooling in the first period however implies a loss for the bad incumbent, he will be willing to incur this loss only if the future matters enough for him, that is, if the discount factor δ is above a given threshold.

Hence, elections are not enough to tame Leviathans. Under the conditions stated in Proposition 1, Leviathan governments can still harm voters in the first period, by choosing a suboptimal policy given the realization of the shock and therefore accumulating some rents, and nevertheless being re-elected in the second. The proposition also shows that the occurrence of this pooling equilibrium is different in the case with or without tax competition; in general, $\delta^* \neq \delta^{*c}$, meaning that the support for the pooling equilibria is different in the two cases. We will come back to this point in Sect. 5. But before discussing *how* tax competition affects the electoral game, let us first introduce the second form of intergovernmental competition, yardstick competition.

4 Yardstick Competition

To study this case, suppose that we now double the previous economy, forming a second economy exactly identical to the first. For the consumer to be able to learn something about the type of her government by observing the choices made in the other jurisdiction, the two economies must be somehow related; for simplicity, we consider in this section the simplest case of perfect correlation, meaning that the realization of the shock is the same in both economies.[16] We assume instead that the choices by nature of the types of government in the two economies are independently made.

The game evolves as follows. At stage zero of the first period, nature chooses both the realization of the shock (common to the two economies) and the types of government in the two economies. Each government knows the realization of the shock and his type; he does not observe the type of the goverment in the other jurisdiction.[17] At stage 1 of the first period, both governments independently and simultaneously select the tax rates for their economy. Then citizens make their moves and tax revenue and public good supply are realized. Elections simultaneously take place in both economies. The second period is identical to the first, with the only difference that

[16] Qualitatively the results would not change if we assumed instead partial correlation. See Bordignon et al. (2004) and Besley and Smart (2007) for models considering partial correlation.

[17] This is a bit far-fetched; presumably, a politician may know something more about the characteristics of a fellow politician than the common voter. But notice that unless this knowledge is perfect, our main results below would still go through.

there is no stage 0 and there are no elections at the end of this period. The game ends here.

As in the previous section, we suppose that Welfarist governments do not play strategically. By repeating the arguments of the previous section, it is easy to show that in the second period the two types of governments would just choose their preferred strategy, as there are no elections ahead. In the first period, if $\epsilon = \underline{\epsilon}$, the dominant strategies for the two Leviathans in the first period would still be to grab as much as possible immediately and accept defeat at the ensuing elections. But if $\epsilon = \overline{\epsilon}$, Leviathans can still earn positive rents by pretending $\epsilon = \underline{\epsilon}$ and playing the corresponding strategies for the good type. If mimicking is a convenient choice for each Leviathan, it depends again on the discount rate, the behavior of voters and his expectations about the behavior of the other Leviathan.

The posterior beliefs of voters in jurisdiction i, η_i, are now a function of the choices observed in *both* economies: $\eta_i = \eta(\theta, T_i, t_i, g_i, T_j, t_j, g_j)$ $i, j = 1, 2$. Consider first the case without tax competition. At an equilibrium where both Leviathans are known to play $\mathbf{a}^G(\underline{\epsilon})$ when $\epsilon = \overline{\epsilon}$, the posterior beliefs of voters can be derived as follows. If the voter observes anything different from either $\mathbf{a}^G(\overline{\epsilon})$ or $\mathbf{a}^G(\underline{\epsilon})$ in her economy, she knows for sure that her incumbent is a bad type as the good type would never make these moves ($\eta_i = 0$). If she observes $\mathbf{a}^G(\overline{\epsilon})$, she knows for sure that her incumbent is of the good type as the bad type would never make these choices (by dominance), and $\eta_i = 1$. If she observes $\mathbf{a}^G(\underline{\epsilon})$ in her economy, but $\mathbf{a}^G(\overline{\epsilon})$ abroad, she would immediately understand that her incumbent government is a Leviathan who is attempting to fool her ($\eta_i = 0$). If instead she observes $\mathbf{a}^G(\underline{\epsilon})$ in *both* economies, her revised beliefs can be derived by Bayes' rule as follows:

$$\eta\left(\theta, \mathbf{a}^G(\underline{\epsilon}), \mathbf{a}^G(\underline{\epsilon})\right) = \frac{\theta^2 (1-q)}{\theta^2 (1-q) + (1-\theta)^2 q}. \tag{11}$$

It follows that the voter would elect the incumbent if $\theta \geq \frac{1}{2}$, which in our case again holds true by (A.1). Hence, the expected utility of the Leviathan by playing this strategy is $\phi R(1, \underline{\epsilon}) + (1-\theta)\delta(1+\widehat{t}L(\widehat{t}))$; the Leviathan would then play this strategy, if this expected utility is larger than the utility of deviating immediately and collecting maximal rents, that is if $\delta \geq \frac{\delta^*}{(1-\theta)}$. By repeating the same argument for the case of tax competition, it is immediate to see that everything would go through except that the condition for pooling would now become $\delta \geq \frac{\delta^{*c}}{(1-\theta)}$.[18] We can then state:

Proposition 2 *Suppose there are two identical, perfectly correlated economies, with independently chosen types of governments and that* (A.1) *holds. If $\epsilon = \underline{\epsilon}$, then the only PBE is one where both types of governments play their favorite strategy in the first period and the bad type is defeated at the elections. This separating PBE also occurs if $\epsilon = \overline{\epsilon}$, and $\delta < \frac{\delta^*}{(1-\theta)}$ under no tax competition and $\delta < \frac{\delta^{*c}}{(1-\theta)}$ under tax*

[18] But notice that, differently from the previous case, a separating PBE under yardstick competition always exists, even for $\delta \geq \frac{\delta^*}{(1-\theta)}$ [resp. $\delta \geq \frac{\delta^{*c}}{(1-\theta)}$]. Intuitively, if a bad incumbent expects the bad incumbent of the other jurisdiction to always play the separating strategy in the fist period, his best strategy is also to separate for any realization of the shock, because he would in any case be found out with certainty and defeated at the elections.

competition. If $\epsilon = \overline{\epsilon}$, *and* $\delta \geq \frac{\delta^*}{(1-\theta)}$ *under no tax competition and* $\delta \geq \frac{\delta^{*c}}{(1-\theta)}$ *under tax competition, there exists a PBE in pure strategies where the bad type plays the corresponding strategy of the good type for* $\epsilon = \underline{\epsilon}$. *At this pooling equilibrium, the bad type is re-elected if the government in the other jurisdiction also happens to be Leviathan and is defeated otherwise.*

Combining Propositions 1 and 2, we immediately observe:

Corollary 1 *There exists an interval of values for* δ *where pooling equilibria under yardstick behavior do not exist, while they exist in the model without yardstick competition. This interval is given by* $\delta \in \left(\delta^*, \frac{\delta^*}{(1-\theta)}\right)$ *without tax competition and by* $\delta \in \left(\delta^{*c}, \frac{\delta^{*c}}{(1-\theta)}\right)$ *with tax competition.*[19]

The corollary then illustrates the basic effect of yardstick competition in our model; it allows citizens to better select between different types of governments. By knowing that he will be found out with higher probability when cheating, the Leviathan prefers to deviate immediately in a larger number of cases, thus providing citizens with useful information for the ensuing elections. But this information does not come freely. The Leviathan now exploits more fully the citizen in the first period than he would do if he had some chances of re-election; and since the future advantages for citizens are uncertain, they may end up by being worse off as a result of yardstick competition. We will come back to this in Sect. 6.

5 Yardstick Versus Tax Competition

We are finally ready to make our comparison. We focus on political equilibria in this section and on welfare effects in the following. Unambiguously, in the context of our model, yardstick competition induces more separation in the first period between different types of incumbents. Which are the effects of adding tax competition to this framework? To clarify issues, let us propose the following definition:

Definition 1 Tax and yardstick competition *strengthen* each other if the interval of parameters which support pooling equilibria in the first period further shrinks as a result of introducing tax competition in the economy; tax and yardstick competition *conflict* in the opposite case.

Referring back to Propositions 1 and 1, it is clear that these two cases can be assessed by simply comparing the conditions on the discount rate for supporting pooling equilibria in the two cases, with and without tax competition. That is, tax competition *conflicts* with yardstick competition if $\delta^{*c} < \delta^*$, while tax competition *reinforces* yardstick competition in the opposite case.

By recalling the definitions for δ^{*c} and δ^* in Proposition 1 above, it is not a fortiori clear whether tax competition reinforces or conflicts with yardstick competition. Intuitively, there are two effects to consider. The first concerns the rents that the Leviathan

[19] Strictly speaking, the interval is $\delta \in \left(\delta^*, Max(1; \frac{\delta^*}{(1-\theta)})\right)$ [resp. $\delta \in \left(\delta^{*c}, Max(1; \frac{\delta^{*c}}{(1-\theta)})\right)$ in an open economy]. For $\delta^* + \theta > 1$ (resp. $\delta^{*c} + \theta > 1$) no pooling equilibrium can be supported under Yardstick competition.

can obtain when separating. Tax competition reduces them both in the first and in the second period, but because rents in the first period matter more for the bad government, the separating strategy is now less convenient for him. The second concerns the effect on the rents that the Leviathan can accumulate when pooling. As taxes are now more distortive, the Welfarist government reduces public good supply and tax revenues in the first period, and therefore the rents that the Leviathan can obtain when pooling, as these are just proportional to tax revenue. This makes the Leviathan more willing to separate. The final result then depends on the balance between these two effects.

To get a better understanding of the forces at play, let us manipulate the formulas to obtain:

$$\delta^{*c} < (>)\, \delta^* \quad \text{if } \widehat{t}L(\widehat{t}) \; < (>) \; \frac{g^{*c}(\beta) - \beta g^*(1)}{g^*(1) - g^{*c}(\beta)} \equiv m(\beta). \tag{12}$$

Equation (12) highlights a number of interesting features.[20] First, any exogenous constraint on the maximal tax rate the Leviathan can raise, or on the minimum level of public good he has to offer, resulting in a lower maximum level of rents, would certainly imply *more pooling under tax competition*.[21] This captures the first effect discussed above; any exogenous reduction in the rents the bad government can collect when separating leads him to pool in a larger number of cases in the first period. This also vindicates our previous claim (see note 13) that our assumption of an untamed Leviathan is the one that works mostly in favour of greater separation as a result of tax competition.

The second observation is that $m(\beta) \geq 0$. To see this, note the denominator of $m(\beta)$ is certainly non negative (as $g^*(1) > g^{*c}(\beta)$), and that under our assumptions on $H(.)$ and $V(.)$, the numerator of $m(\beta)$ is also non negative. Indeed, the remark below shows that $g^*(1) - g^{*c}(\beta) \leq (1-\beta)$. It follows $g^{*c}(\beta) - \beta g^*(1) \geq (1-\beta)(g^{*c}(\beta) - \beta) \geq 0$.

Remark 1 Concavity of $H(.)$ and $\sigma_t(.) > 0$ imply $g^*(1) - g^{*c}(\beta) \leq (1 - \beta)$.

Proof Differentiating (10), $dt/d\beta = \frac{H_{gg}(1-\sigma)}{-(H_{gg}L(1-\sigma)^2 - H_g\sigma_t)} \leq 0$, with $dt/d\beta > -1$ and $dt/d\beta = 0$ if and only if $H_{gg} = 0$. Substituting, $\partial g^{*c}(\beta)/\partial\beta = 1 + L(t(\beta))(1 - \sigma(t(\beta))dt/d\beta > 0$, as $L(t(\beta)) < 1$ and $1 > (1-\sigma(t(\beta))) > 0$ by (10). Finally, using the fact that $H_g(g^{*c}) = (1-\sigma(t^{*c}))^{-1}$ from (10) and substituting, $g^*(1) - g^{*c}(\beta) \approx \frac{g^{*c}\sigma_t}{\mu L(t)(1-\sigma)^2 + g^{*c}\sigma_t}(1-\beta)$, where $\mu = \left|\frac{H_{gg}g}{H_g}\right| > 0$ is the elasticity of the marginal utility for public expenditure. $\square$

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[20] In (12), we drop the dependence of $g(.)$ on ϵ as is known that both levels of public expenditures are evaluated at $\epsilon = \underline{\epsilon}$ and to further simplify formulas, we just assume $\underline{\epsilon} = 1$. The case with no tax competition is captured in (12) by writing $\beta = 1$ in $g(.)$.

[21] To see this, suppose that when separating the Leviathan can now only impose a maximum labor tax $t' \leq \widehat{t}$ and needs offer a minimum level of public good $g' \geq 0$. Computing the new values of δ^{*c} and δ^* for this case and solving, Eq. (12) would now become:

$$\delta^{*c} < (>)\, \delta^* \quad \text{if } t'L(t') - \frac{g'}{\underline{\epsilon}} < (>)\, m(\beta) \tag{12$'$}$$

where $t'L(t') - \frac{g'}{\underline{\epsilon}} \leq \widehat{t}L(\widehat{t})$.

The third observation is that rents from pooling in the first period depends essentially on two parametes. The importance of public expenditure for voters, i.e. their willingness to pay for the public good, $\mu = \left|\frac{H_{gg}g}{H_g}\right|$, and the efficiency cost of having to use (in an open economy) more of a distorting tax such as the labor tax to finance public expenditure. As shown in the remark above, when the efficiency cost is low, meaning that σ_t does not raise very fast with t, and/or when μ is large, meaning that the marginal utility for the public good increases quickly when g falls (so that voters are willing to pay a great deal to maintain public expenditure unaltered), $g^*(1)$ would be not too far from $g^{*c}(\beta)$. Then $m(\beta)$ would become large, pushing toward more pooling under tax competition. Intuitively, in this case the rents that the Leviathan government can accumulate when pooling in the first period do not fall very much under tax competition, as they are proportional to revenue and therefore to public expenditure. Hence, since the rents he can grab by separating are instead reduced by $1-\beta$ as an effect of tax competition, the Leviathan is led to pool more in the first period.

In the opposite case, when μ is small and/or σ_t is large, $g^{*c}(\beta)$ will fall a great deal with respect to $g^*(1)$, $m(\beta)$ will become smaller and tax competition may push towards more separation in the first period. Indeed, in the limiting case $\mu = 0$ (e.g. $H_{gg} = 0$), $t(1) = t(\beta) = t'$, $m(\beta) = g^{*c}(\beta) - \beta = t'L(t') < \widehat{t}L(\widehat{t})$ and tax competition unambiguously leads to more separation in the first period. $m(\beta)$ also falls when σ_t becomes larger. But notice that in this case $\widehat{t}L(\widehat{t})$ also falls, making the effect of an increased tax elasticity on the first period equilibrium under tax competition more ambiguous.[22]

Making further progress in the general case is difficult. However, analytical examples and simulations (reported in the Appendix) strongly suggest that in general one should expect $\delta^{*c} < \delta^*$, that is, more pooling under tax competition. The reason is simple. μ is just the inverse of the price elasticity of the public good, and casual observation suggests this elasticity to be pretty small, as public expenditure tends to be very rigid downwards. Hence, one would expect μ to be quite large, but if μ is large, than it surely dominates the effect of a more elastic tax base in (12), considering that a higher σ_t while reducing $g^{*c}(\beta)$ and therefore first period rents from pooling, it also reduces $\widehat{t}L(\widehat{t})$ and therefore first and second period rents from separating. Indeed, the simulations in the Appendix shows that even with an extremely elastic labor tax base, it is only for very low values of μ (around 0.1) that one could get $\delta^{*c} > \delta^*$, that is, more separation under tax competition. If one interprets g as per capita total public expenditure in modern developed countries, including welfare systems, such low levels of μ appear clearly implausible.

Our basic conclusion is therefore that there is a tendency for tax competition to lead to more pooling in the first period, so conflicting with yardstick competition. Perhaps, the simplest way to understand our results is the following. As argued by Besley and Smart (2007), elections have both a "disciplining" effect—forcing governments to behave more in the interests of voters—and a "selection" effect –allowing citizens to discriminate between good and bad governments. Tax and yardstick competition affect this trade off in opposite directions. Tax competition, by reducing the resources a bad

[22] Indeed, for $\sigma_t \longrightarrow \infty$, $m(\beta) \rightarrow 0$, but $\widehat{t}L(\widehat{t}) \rightarrow 0$ too.

government can expropriate, generally works in the direction of increasing the disciplining effect. Yardstick competition, by enlarging the information set of voters, works by reinforcing the selection effect. Putting them together, it is then not too surprising that the two forms of government competition may conflict one with the other.

6 Welfare Analysis

This conclusion only refers to the type of political equilibria which would occur under either tax or yardstick competition. But a more interesting question is how the two forms of intergovernmental competition affect voter's welfare and in particular whether they conflict on these grounds too. To discuss this issue, it is useful to write the utility function of the consumer in full, in all the different cases. Consumer's welfare clearly depends on the realization of the shock, if positive or negative, on whether the economy is closed ($T = 1$) or open ($T = \beta$), and on the actions taken by the different types of government in both the first and the second period. Combining all different possibilities, we get, in obvious notation, the following six possible utility levels: $U(1, \epsilon, \mathbf{a}^G(\epsilon))$, $U(\beta, \epsilon, \mathbf{a}^{Gc}(\epsilon))$, $U(1, \overline{\epsilon}, \mathbf{a}^G(\underline{\epsilon}))$, $U(\beta, \overline{\epsilon}, \mathbf{a}^{Gc}(\underline{\epsilon}))$, $U(1, \mathbf{a}^B)$, $U(\beta, \mathbf{a}^{Bc})$, where for example $U(1, \epsilon, \mathbf{a}^G(\epsilon))$ is the utility of the consumer when the economy is closed ($T = 1$) and the utility maximizing choices are taken by the government given the realization of the shock, $\mathbf{a}^G(\epsilon)$, while $U(\beta, \overline{\epsilon}, \mathbf{a}^{Gc}(\underline{\epsilon}))$ is the utility of the consumer when the economy is open ($T = \beta$) and the (Leviathan) government chooses the action $\mathbf{a}^{Gc}(\underline{\epsilon})$ when the shock is $\overline{\epsilon}$, and so on for all other cases. Notice that our previous discussion implies $U(1, \epsilon, \mathbf{a}^G(\epsilon)) > U(\beta, \epsilon, \mathbf{a}^{Gc}(\epsilon))$, $U(\beta, \mathbf{a}^{Bc}) > U(1, \mathbf{a}^B)$, and *a fortiori* $U(s, \overline{\epsilon}, \mathbf{a}^G(\overline{\epsilon})) > U(s, \overline{\epsilon}, \mathbf{a}^G(\underline{\epsilon}))$, $s = 1, \beta$. As the labor tax is more distorting than the capital tax, it also follows that $U(1, \overline{\epsilon}, \mathbf{a}^G(\underline{\epsilon})) > U(\beta, \overline{\epsilon}, \mathbf{a}^{Gc}(\underline{\epsilon}))$.

Using this notation, in the absence of any form of intergovernmental competition and assuming $\delta \geq \delta^*$, so that the pooling equilibrium can be enforced, the expected utility of the consumer can be written as:

$$\begin{aligned} Eu(1,\epsilon) = {} & \theta(1+\delta)\left(qU\left(1,\overline{\epsilon},\mathbf{a}^G(\overline{\epsilon})\right) + (1-q)U\left(1,\underline{\epsilon},\mathbf{a}^G(\underline{\epsilon})\right)\right) \\ & +(1-\theta)\left(q\left(U\left(1,\overline{\epsilon},\mathbf{a}^G(\underline{\epsilon})\right) + \delta U(1,\mathbf{a}^B)\right)\right) \\ & +(1-\theta)(1-q)\left(U(1,\mathbf{a}^B)+\delta\left(\theta U\left(1,\underline{\epsilon},\mathbf{a}^G(\underline{\epsilon})\right)+(1-\theta)U(1,\mathbf{a}^B)\right)\right). \end{aligned} \tag{13}$$

Adding tax competition and assuming $\delta \geq \delta^{*c}$, consumer's expected utility becomes

$$\begin{aligned} Eu(\beta,\epsilon) = {} & \theta(1+\delta)\left(qU\left(\beta,\overline{\epsilon},\mathbf{a}^G(\overline{\epsilon})\right) + (1-q)U\left(\beta,\underline{\epsilon},\mathbf{a}^G(\underline{\epsilon})\right)\right) \\ & +(1-\theta)\left(q\left(U\left(\beta,\overline{\epsilon},\mathbf{a}^G(\underline{\epsilon})\right) + \delta U(\beta,\mathbf{a}^B)\right)\right) \\ & +(1-\theta)(1-q)\left(U(\beta,\mathbf{a}^B)+\delta\left(\theta U\left(\beta,\underline{\epsilon},\mathbf{a}^G(\underline{\epsilon})\right)+(1-\theta)U(\beta,\mathbf{a}^B)\right)\right). \end{aligned} \tag{14}$$

Finally, adding yardstick competition too, and assuming again the discount factor to be large enough to support a pooling equilibria in all possible cases, we get:

$$\begin{aligned} Eu^Y(s,\epsilon) = {} & \theta(1+\delta)\left(qU\left(s,\overline{\epsilon},\mathbf{a}^G(\overline{\epsilon})\right)+(1-q)U\left(s,\underline{\epsilon},\mathbf{a}^G(\underline{\epsilon})\right)\right) \\ & +(1-\theta)\left(q\left(U\left(s,\overline{\epsilon},\mathbf{a}^G(\underline{\epsilon})\right)\right.\right. \\ & \left.\left.+\delta\left((1-\theta)U(s,\mathbf{a}^B)\right)+\theta\left(\theta U(s,\overline{\epsilon},\mathbf{a}^G(\overline{\epsilon}))+(1-\theta)U(s,\mathbf{a}^B)\right)\right)\right. \\ & \left.+(1-\theta)(1-q)\left(U(s,\mathbf{a}^B)+\delta(\theta U(s,\underline{\epsilon},\mathbf{a}^G(\underline{\epsilon}))+(1-\theta)U(s,\mathbf{a}^B))\right)\right); \end{aligned} \tag{15}$$

where $s=1,\beta$. Inspection of Eq. (15) reveals the specific effect of yardstick competition on the expected utility of voter. As can be seen, under yardstick competition, even if the shock is positive and the Leviathan decides to pool in the first period, he is no longer sure to be re-elected. He will be re-elected only if the incumbent in the other jurisdiction also turns out to be bad (that occurs with probability $1-\theta$), otherwise he will lose the elections and the opponent will be elected in his place. In turn, this opponent will be good with probability θ, thus increasing the expected utility of the consumer.

Inspection of Eqs. (13)–(15) makes it clear that welfare analysis in this context is bound to be very complex. There are two sources of ambiguity. First, adding intergovernmental competition might shift the political equilibrium from one political regime to the other. For instance, while the Eqs. (13)–(15) have been written assuming the discount factor to be always large enough to support pooling equilibria in all possible situations, this might not be the case. For instance, if $\delta^* > \delta > \delta^{*c}$ introducing tax competition would create the opportunity of pooling for the Leviathan in the first period, while this opportunity would not be there in absence of tax competition. Similarly, if $\frac{\delta^{*c}}{1-\theta} > \delta > \delta^{*c}$ adding yardstick competition eliminates all pooling equilibria. And unfortunately, without introducing additional restrictions on the utility function of the consumer, it is not a priori obvious whether the voter is better off in the pooling or in the separating equilibrium. If the bad incumbent separates immediately, the consumer pays a higher cost immediately (she is fully exploited in the first period), but gains an advantage in the second, as now with probability $\theta > \frac{1}{2}$ she elects a good opponent. Depending on if this advantage overcomes the first period cost, the consumer might be better off or worse off in a separating equilibrium with respect to a pooling equilibrium.

The second source of ambiguity derives from the fact that adding intergovernmental competition might change the welfare of the consumer even if the political equilibium does not change. For instance, suppose that the equilibrium may be pooling without tax competition and remains pooling even when tax competition is added to the picture, that is assume $\delta > \delta^* > \delta^{*c}$. Comparing Eqs. (13) with (14), it is immediate to see that adding tax competition when the incumbent turns out to be good surely makes the consumer worse off in both periods and for both realization of the shocks, with an expected loss being given by $\theta(1+\delta)(q(U(1,\overline{\epsilon},\mathbf{a}^G(\overline{\epsilon}))-U(\beta,\overline{\epsilon},\mathbf{a}^{Gc}(\overline{\epsilon}))) + (1-q)(U(1,\underline{\epsilon},\mathbf{a}^G(\underline{\epsilon}))-U(\beta,\underline{\epsilon},\mathbf{a}^{Gc}(\underline{\epsilon})))$. On the other hand, if the incumbent is bad and the shock is positive, that occurs with probability $(1-\theta)q$, the consumer loses $U(1, \overline{\epsilon}, \mathbf{a}^G(\underline{\epsilon})) - U(\beta, \overline{\epsilon}, \mathbf{a}^G(\underline{\epsilon}))$ in the first period but gains $\delta(U(\beta, \mathbf{a}^{Bc}) - U(1, \mathbf{a}^B))$ in the second, while if the incumbent is bad and the shock is negative, that occurs with probability $(1-\theta)(1-q)$ the consumer gains $U(\beta, \mathbf{a}^{Bc}) - U(1, \mathbf{a}^B)$ in the first period and with probability $(1-\theta)$ gains $\delta(U(\beta, \mathbf{a}^{Bc}) - U(1, \mathbf{a}^B))$ also in the second, while he loses $\delta(U(1, \underline{\epsilon}, \mathbf{a}^G(\underline{\epsilon})) - U(\beta, \underline{\epsilon}, \mathbf{a}^G(\underline{\epsilon})))$ with probability θ in the second. Clearly, depending by the size of these welfare gains and losses and on the probability of the different cases to occur, the effect of introducing tax competition on welfare can go in either direction.

Still, in spite of all these ambiguities, there are two observations that are worth making. First, whenever adding yardstick competition does not change the political equilibrium, yardstick competition can only be (weakly) beneficial for the voter. To see this, assume that the original equilibrium to be without tax competition[23] and suppose that $\delta \geq \frac{\delta^*}{1-\theta}$ so that pooling equilibria can be supported even adding yardstick competition. Then, the bad incumbent would choose to pool whenever the shock is positive and separate in the other case. But then yardstick competition can only help the voter. In fact, if the bad incumbent separates in the first period, nothing changes for the voter as she will still vote for the opponent. But, as we discussed above, if the bad incumbent pools in the first period, the voter is certainly better off as the incumbent is now re-elected with probability $1-\theta$ only (e.g. if the other incumbent also turns out to be bad) while he was surely re-elected with no yardstick competition.

The second observation is the following. As shown above, tax competition tends to switch the equilibrium from separating to pooling, and for the same reason, it is potentially more beneficial to voters when bad politicians "separate" in the first period. Yardstick competition tends to switch the equilibrium from pooling to separating, and for the same reason, it is more beneficial to voters when bad politicians "pool" in the first period. From this perspective, the two forms of intergovernmental competition can indeed be thought of as complementary, as their joint inclusion tends to neutralize the effect on political equilibria, while possibly increasing consumer's welfare at each of these equilibria.

7 Concluding Remarks

Elections are the main instrument used in democracies to discipline governments. Economists argue that competition among governments may also play a useful role. But governmental competition can take two forms; either through tax or through yardstick competition. In this paper, we develop a simple model which allows us to study the effects on political equilibria and welfare of both forms of governmental competition. The paper shows that the two forms of competition may, and in general do, conflict as political equilibria are concerned. Tax competition increases the disciplining effect of elections on politicians, but it reduces the selection effect. Yardstick competition works in just the opposite direction. Concerning welfare, results are generally ambiguous. But whenever political equilibria do not change, yardstick com-

[23] The same argument can be make if the original equilibrium was with tax competition.

petition is certainly beneficial for the voter, while tax competition might have either effect. Finally, there is however a sense in which the two forms of competition can be thought of as complementary, as yardstick competition reduces the future losses of citizens when the disciplining effect is prevailing while tax competition reduces the present losses of citizens when the selection effect dominates. Hence, their joint inclusion in the economy might turn out to be beneficial for citizens.

These results have a number of potentially interesting applications. For instance, several countries have witnessed important decentralization phenomena in recent years, and decentralization is often advocate by both researchers and international organizations alike as a way to improve to the efficiency of local governments, by making them more responsible to citizens' interests. Very often, among the arguments used to support decentralization both tax competition (as it reduces tax rates) and yardstick competition (that increases the information set of voters) are mentioned. But then it is useful to know that at least concerning political equilibria, the two forms of governmental competition might have quite opposite effects. Empirical applications of the result of this paper are not straightforward. The paper would suggest that the introduction of tax competition (for instance, by providing local governments with taxing power on a mobile tax base) should have the effect of reducing taxes but also of reducing the turnout of politicians, as even bad or incompetent governments would now prefer to pool more. But decentralization might also improve the ability of citizens to compare the quality of governments and this should induce more separation and therefore more turnout of politicians. It would be interesting if future empirical research succeeded in testing and disentangling these two different effects in specific instances of decentralization.

Appendix

Proof of Proposition 1

As good governments are known not to play strategically, in the first period out of equilibrium beliefs for voters are $\eta(\theta, T, t, g) = 0$ for all $(T, t, g) \notin \mathbf{a}^G(\epsilon)$ in a closed economy [and $\eta(\theta, T, t, g) = 0$ for all $(T, t, g) \notin \mathbf{a}^{Gc}(\epsilon)$ in a open economy]. In turn, this implies that either the Leviathan in the first period chooses $\mathbf{a}^G(\overline{\epsilon})$ or $\mathbf{a}^G(\underline{\epsilon})$ [resp. $\mathbf{a}^{Gc}(\overline{\epsilon})$ or $\mathbf{a}^{Gc}(\underline{\epsilon})$ in an open economy] or he is going to be defeated. In the latter case, the best option for him is to immediately choose $\mathbf{a}^B$ (resp. $\mathbf{a}^{Bc}$ if there is tax competition) in the first period too.

To see when the Leviathan wishes to pool in the first period, consider then the two possible realizations of the shock. Suppose first $\epsilon = \underline{\epsilon}$. In this case, if the Leviathan plays either $\mathbf{a}^G(\overline{\epsilon})$ or $\mathbf{a}^G(\underline{\epsilon})$ [resp. $\mathbf{a}^{Gc}(\overline{\epsilon})$ or $\mathbf{a}^{Gc}(\underline{\epsilon})$] he would collect zero or negative rents in the first period. But then he is better off by separating immediately, as even if he is re-elected, $\delta < 1$ implies that future rents are not enough to compensate the forgone rents in the first period. This proves (i).

Suppose next that $\epsilon = \overline{\epsilon}$. By the previous argument, the Leviathan would never play $\mathbf{a}^G(\overline{\epsilon})$ [resp. $\mathbf{a}^{Gc}(\overline{\epsilon})$] because this would leave him with zero rents in the first period. However, if he pretended that $\epsilon = \underline{\epsilon}$ and played $\mathbf{a}^G(\underline{\epsilon})$ [resp. $\mathbf{a}^{Gc}(\underline{\epsilon})$] he could earn some first period positive rents. Invoking (3), these rents can be easily computed as $\phi R(1, \underline{\epsilon})$][resp. $\phi R(\beta, \underline{\epsilon})$ in an open economy]. The Leviathan would then play $\mathbf{a}^G(\underline{\epsilon})$ [resp. $\mathbf{a}^{Gc}(\underline{\epsilon})$] if his expected utility of doing so were larger than his utility under his best deviation, which is taking maximal rents in the first period. Computing, this condition in the two cases can be written as:

(a.1) $\phi R(1, \underline{\epsilon}) + p(\mathbf{a}^G(\underline{\epsilon}))\delta(1 + \widehat{t}L(\widehat{t})) \geq 1 + \widehat{t}L(\widehat{t})$ in a closed economy and

(a.2) $\phi R(\beta, \underline{\epsilon}) + p(\mathbf{a}^{Gc}(\underline{\epsilon}))\delta(\beta + \widehat{t}L(\widehat{t})) \geq \beta + \widehat{t}L(\widehat{t})$ in an open economy[24]
where $p(\mathbf{a}^G(\underline{\epsilon}))$ [resp. $p(\mathbf{a}^{Gc}(\underline{\epsilon})$] is the expected probability of being re-elected for the Leviathan when he plays $\mathbf{a}^G(\underline{\epsilon})$ [resp. $p(\mathbf{a}^{Gc}(\underline{\epsilon})$]. To derive $p(\mathbf{a}^G(\underline{\epsilon}))$ (resp. $p(\mathbf{a}^{Gc}(\underline{\epsilon}))$, consider voter's behavior. The rational voter would of course know that Leviathan is playing the mimicking strategy. At the equilibrium, upon observing $\mathbf{a}^G(\underline{\epsilon})$ in the closed economy or $\mathbf{a}^{Gc}(\underline{\epsilon})$ in the open one, by Bayes' rule, her ex-post beliefs about the type of government are

(a.3) $\eta(\theta, \mathbf{a}^G(\underline{\epsilon})) = \eta(\theta, \mathbf{a}^{Gc}(\underline{\epsilon})) = \frac{\theta(1-q)}{\theta(1-q)+(1-\theta)q}$.
Solving, we observe that $\eta(.) \geq \theta$ if $\frac{1}{2} \geq q$, which in our case holds true by (A.1). Hence, $p(\mathbf{a}^G(\underline{\epsilon}))$ [resp. $p(\mathbf{a}^{Gc}(\underline{\epsilon}))] = 1$. It then follows from (a.1) and (a.2) that if $\epsilon = \overline{\epsilon}$ and $\delta \geq \delta^* \equiv (1 - \frac{\phi R(1,\underline{\epsilon})}{1+\widehat{t}L(\widehat{t})})$ in a closed economy or if $\epsilon = \overline{\epsilon}$ and $\delta \geq \delta^{*c} \equiv (1 - \frac{\phi R(\beta,\underline{\epsilon})}{\beta+\widehat{t}L(\widehat{t})})$ in an open one, there exists a pooling PBE, while if $\epsilon = \overline{\epsilon}$ and $\delta < \delta^*$ (resp. $\delta < \delta^{*c}$) the PBE can only be separating. Finally, to prove that these equilibria are also unique, assume at the contrary that for $\epsilon = \overline{\epsilon}$ and $\delta \geq \delta^*$ (resp. $\delta \geq \delta^{*c}$ in an open one) the equilibrium is separating, with each of the type of incumbents playing his preferred startegies. But at a separating equilibrium, voter's ex post beliefs are such that $\eta(\theta, \mathbf{a}^G(\underline{\epsilon})) = 1$ [resp. $\eta(\theta, \mathbf{a}^{Gc}(\underline{\epsilon})) = 1$], meaning that at this equilibrium the Leviathan would have a profitable deviation (mimicking the Welfarist) that would break the equilibrium. Hence, separating cannot be a PBE for this collection of parameters. As easily checked, no profitable deviation instead exists for the separating equilibrium when either $\epsilon = \underline{\epsilon}$, or if $\epsilon = \overline{\epsilon}$ and $\delta < \delta^*$ in a closed economy (resp. if $\epsilon = \overline{\epsilon}$ and $\delta < \delta^{*c}$ in an open one). Hence in this case the only PBE is a separating equilibrium. QED.

Simulations

An Analytical Example

Suppose first that $\underline{\epsilon} = \mu = 1$. Than $g^* = T^* = 1$ and $g^{*c} = (1 - \sigma)$. Suppose further that $\sigma_t = k > 0$ so that $\sigma = kt$. It follows $m(\beta) = \frac{1-kt^*-\beta}{kt^*}$. By the government budget constraint, $t^*L(t^*) = 1 - kt^* - \beta$, so that $m(\beta) = \frac{L(t^*)}{k}$. Consider now the LHS of (12). $\widehat{t}$ is implicitly defined by the condition $1 = \sigma(\widehat{t})$, or $\widehat{t} = \frac{1}{k}$ and $\widehat{t}L(\widehat{t}) = \frac{L(\widehat{t})}{k}$. Substituting in (12), we then get $L(\widehat{t}) < L(t^*)$ as $\widehat{t} > t^*$, implying $\delta^{*c} < \delta^*$.

[24] Assuming that when indifferent, the Leviathan prefers to pool.

Table 1 Computing (15) for different values of $\{\beta, \mu, \widetilde{\sigma}\}$

$\lvert\mu\rvert$	β	$\widetilde{\sigma}$	$\widehat{t}$	g^*	$\widehat{t}L(\widehat{t})$	$m(\beta)$	β	$\widetilde{\sigma}$	$\widehat{t}$	g^*	$\widehat{t}L(\widehat{t})$	$m(\beta)$
2	0.1	0.2	0.83	0.66	0.58	1.68	0.9	0.2	0.83	0.99	0.58	8.87
1	0.1	0.2	0.83	0.63	0.58	1.41	0.9	0.2	0.83	0.98	0.58	4.5
0.5	0.1	0.2	0.83	0.57	0.58	1.1	0.9	0.2	0.83	0.97	0.58	2.3
0.1	0.1	0.2	0.83	0.39	0.58	0.47	0.9	0.2	0.83	0.93	0.58	0.49
2	0.1	2	0.33	0.25	0.15	0.20	0.9	2	0.33	0.95	0.15	0.83
1	0.1	2	0.33	0.24	0.15	0.19	0.9	2	0.33	0.93	0.15	0.45
0.5	0.1	2	0.33	0.23	0.15	0.17	0.9	2	0.33	0.92	0.15	0.24
0.1	0.1	2	0.33	0.17	0.15	0.08	0.9	2	0.33	0.90	0.15	0.05

Values computed for $\underline{\epsilon} = 1$, implying $t(1) = 0$ and $T^* = g^*(1) = 1$

A Second Example with Simulations

Let us suppose the citizen's utility function takes the form $u = c + \frac{1}{1+\mu} g^{1+\mu} - \frac{\widetilde{\sigma}}{1+\widetilde{\sigma}} l^{\frac{1+\widetilde{\sigma}}{\widetilde{\sigma}}}$, with $\mu < 0$ and $\widetilde{\sigma} > 0$. $|\mu|$ is the (constant) elasticity of the marginal utility of the public good, as defined above. Solving, $L(t) = (1-t)^{\widetilde{\sigma}}$, $\sigma = \frac{\widetilde{\sigma} t}{(1-t)}$, so that $\sigma_t = \frac{\widetilde{\sigma}}{(1-t)^2} > 0$ and $\partial \sigma_t / \partial \widetilde{\sigma} > 0$. Furthermore, $\widehat{t} = \frac{1}{1+\widetilde{\sigma}}$, so that $\widehat{t} L(\widehat{t}) = \frac{1}{1+\widetilde{\sigma}} (\frac{\widetilde{\sigma}}{1+\widetilde{\sigma}})^{\widetilde{\sigma}}$. Assuming $\underline{\epsilon} = 1$, it also follows that $g^*(1) = 1$, so that $t(1) = 0$. $g^*(\beta)$ and $t(\beta)$ can be directly computed from (10) as a function of $\{\beta, \mu, \widetilde{\sigma}\}$. I computed (12), by running several simulations (around 500) for different values of $\{\beta, \mu, \sigma\}$ in the range $0.1 \leq \beta \leq 0.9$, $0.1 \leq |\mu| \leq 2$ and $0.1 \leq \widetilde{\sigma} \leq 2$.[25] The table above presents a sample of the results (Table 1).[26]

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[26] The complete set of simulations is available from the author on request.

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