Exit and voice. Yardstick versus fiscal competition across governments.

Massimo Bordignon, Catholic University of Milan, Cesifo

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Abstract

Intergovernmental competition 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.

1 Introduction[1]

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' 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

[1] This paper started as a joint research project with Enrico Minelli at CORE in May 2001, 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. The paper benefitted a lot from the very useful comments of two unknown referees and the editor of this Journal. All remaining errors are my responsability only

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 reinforcing 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 reinforcing 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 and political equilibria? And which is their joint effect on 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 recent work by Besley and Smart (2007)[2]. 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[3]. 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 (e.g. an exogenous shock) that 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

[2] See also the textbook treatment by Besley, 2006, part 4.

[3] 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.

period and be reelected in the second. In this framework, we then introduce tax competition, which reduces the ability of politicians to tax capital income, and 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 there is no a-priori reason to believe that the effects of the two forms of intergovernmental competition on political equilibria are the same. 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 select between "bad" and "good" governments. As the two mechanisms are basically different, it is not surprising that they may produce different results. Second, we show if there is a general tendency, this points to a conflict between the two forms of competition. Intuitively, fiscal 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. Third, we show that there is at least one practical important case where the two forms of competition unambiguously conflict. When public expenditure is particularly rigid downwards, because it is formed by public goods that are deemed as important by voters, increasing tax competition unambiguously reduces the informational advantages of yardstick competition. Finally, we show that 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 als. (2004) and an empirical application to Italian municipalities is offered by Bordignon et als. (2003). A textbook treatment is in Besley (2006). Kotsogiannis and Schwager (2008) offer a recent theoretical example, by enquiring on the effect of equalization grants on political equilibria. Revelli (2008) 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 accumulate rents. Empirical studies on tax competition abound. Trannoy et als. (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 large number of identical consumers (voters). 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

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

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"[4]. 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:

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

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: 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 $\overline{\epsilon} > \underline{\epsilon} > 0$. Positive shocks occur with probability $q > 0$. Government's budget constraint is:

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

where r indicates (per capita) rents and $\epsilon = \{\overline{\epsilon}; \underline{\epsilon}\}$. 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[5]. Good

[4] 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).

[5] 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 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 prefer to earn some rents rather than maximize consumers' welfare (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 (2005).

governments occur 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[6]), I assume through the following parametric condition:

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

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

(4) $W(T, t, g) = u(T, t, g)$

and

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

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[7]. 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 as 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 any period. This allows us to fix out-of-equilibrium beliefs in a simple way[8]. 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.

[6] As will be clear from what follows, if A.1 is violated, either no pooling equilibria exist or if they do, they exist only under one form of governmental competition. 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.

[7] 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.

[8] This is the standard assumtpion used in this literature (for exceptions, see Coate and

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 expected to be 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 $\eta(\theta, T, t, g) \geq \theta$[9]. The second period is just as the first, except that there is no stage 0. We solve the game by backward induction.

3.1 Second period

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

$$\max_{l} \; u = (1-T) + (1-t)l + H(g) + V(1-l)$$

taking (T, t, g) as given[10]. The first order condition gives:

(6) $(1-t) - V_x(1-l^*) = 0$

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

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

Morris, 1995 and Bordignon and Minelli, 2001) and it implies that the good government in our model is an "automat" rather than a strategic agent. 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 (formal results available from the author on request). Lockwood (2005), in analyzing a version of Besley and Smart (2007)'s model with strategic good governments, reaches similar conclusions.

[9] Thus, we assume that when indifferent, the citizen votes for the incumbent. As shown in Bordignon and Minelli (2001), this effectively rules out mixed strategy equilibria of the game.

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

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:

(8) $W(T,t,g) = u(T,t,g) = (1-T)+(1-t)L(t)+H(\epsilon(T+tL(t)))+V(1-L(t))$

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

(9) $T : -1 + \epsilon H_g(.) \geq 0, \;\; T \leq 1$

(10) $t : -L(t) + H_g(.)\epsilon(L(t) + tL_t(t)) = -L(t) + H_g(.)\epsilon L(t)(1 - \sigma(t)) \leq 0$, $t \geq 0$.

Note from (9) that if $T^* \leq 1$, $H_g(g^*) = \frac{1}{\epsilon}$; substituting in (10), we get $-L(t)\sigma(t) < 0$, implying $t^* = 0$. A Welfarist would never choose a distorting source of taxation such as the labor tax, if he had at this disposal (enough) of a lump sum tax such as the capital tax. Let us assume this to be the case for both $\overline{\epsilon}$ and $\underline{\epsilon}$[11].

We can then summarize the choices of the welfarist government in a closed economy in the second period as $\mathbf{a}^G(\epsilon) = \{t = 0, T = T^*(\epsilon), g = g^*(\epsilon)\}$ where $g^*(\epsilon) = H_g^{-1}(\frac{1}{\epsilon})$ and $T^*(\epsilon) = g^*(\epsilon)/\epsilon$.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 $\sigma(\widehat{t}) = 1$.[12]

Suppose now we open the economy, allowing for capital to flow abroad. At stage 2, the consumer would now also have the choice of exporting her capital abroad. 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

[11] This assumption is introduced to sharpen results and save algebra. However, none of our results below depends on it. In particular, if $\epsilon H_g(\epsilon) > 1$, both propositions (1) and (2), and eqs. (15) and (16) remain unchanged, with the only caveat that g^* in the formulas should now read $g^* = \epsilon(1 + t(1,\epsilon)L(t(1,\epsilon)))$.

[12] 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 (see note 21), the assumption of an untamed Leviathan is the one which goes mostly *against* the main point we make here.

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 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, $0 \leq \beta < 1$[13]. Notice that if $\beta < T^*(\epsilon)$ for any realization of ϵ, and the incumbent government is a Welfarist, the latter would now need to use the distorting labor tax to finance public expenditure. (10) would then hold as an equality, and the optimal level of public good would be determined by the equation $H_g(g^{c*}) = \frac{1}{\epsilon(1-\sigma(t^{c*}))}$, where $g^{c*} = \epsilon(\beta + t^{c*}L(t^{c*}))$. 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 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 two fiscal variables. If the incumbent government is instead a Leviathan, under tax competition, his preferred choices are $\mathbf{a}^{Bc} = \left\{t = \widehat{t}, T = \beta; g = 0\right\}$.

Notice that in the second period the effect of tax competition on consumer welfare 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 the dead-weight loss of taxation (in addition to tax revenue) and generally enjoys less public good[14]. She is instead better off if the second period incumbent is a Leviathan, as she can now at least save some of her resources from expropriation.

3.2 First period

Having solved the game in the second period, let us then move to the first. By assumption, good 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 if the economy is closed or open. This immediately implies that if the voter observes in the first

[13] 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.

[14] 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.

period fiscal choices that would never be possibly taken by the good government, she can only rationally conclude that these choices come from a Leviathan government (that is, $\eta(\theta, T, t, g) = 0$ for all $(T, t, g) \notin \mathbf{a}^G(\epsilon)$ (or $(T, t, g) \notin \mathbf{a}^{Gc}(\epsilon)$ if the economy is open)). In turn, this also makes the options for the Leviathan in the first period very simple. He might either try to mimic the good government, making choices that this government could also have taken in some cases in the first period and hoping that this will result in a re-election; or he may make some different choices, and in this case he knows that he is going to be defeated at the elections. In the latter case, the best option for him is to immediately choose his preferred strategies and set $\mathbf{a}^B$ (resp. $\mathbf{a}^{Bc}$ if there is tax competition) in the first period too.

What the Leviathan actually does depends on the realization of the shock and on δ, the discount rate. By dominance, the Leviathan would never imitate the good type's choices when $\epsilon = \underline{\epsilon}$, because this would just induce either zero or negative rents in the first period, and even under the optimistic beliefs that he would be guaranteed re-election by doing so, the Leviathan would then prefer to separate immediately (as future rents count less then present ones). If $\epsilon = \overline{\epsilon}$, on the other hand, the Leviathan could accumulate positive rents in the first period if he pretended that $\epsilon = \underline{\epsilon}$ and played the corresponding strategies for the good type. By (3), these rents are easily computed to be just a proportion of total revenue in the first period; $(1 - \frac{\underline{\epsilon}}{\overline{\epsilon}})T^*(\underline{\epsilon}) \equiv \phi R(1, \underline{\epsilon})$ in the case without tax competition and $(1 - \frac{\underline{\epsilon}}{\overline{\epsilon}})(\beta + t^{c*}(\underline{\epsilon}, \beta)L(t^{c*}(\underline{\epsilon}, \beta))) \equiv \phi R(\beta, \underline{\epsilon})$ in the case with tax competition, where $\phi \equiv \frac{(\overline{\epsilon} - \underline{\epsilon})}{\overline{\epsilon}}$. The Leviathan would then play this mimicking strategy 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. Letting $p(\mathbf{a}^G(\underline{\epsilon}))$ (resp. $p(\mathbf{a}^{Gc}(\underline{\epsilon}))$ be the expected probability of being re-elected for the Leviathan when he mimics the choices of the good type, the latter condition can be written as

(11) $\phi R(1, \underline{\epsilon}) \ + p(\mathbf{a}^G(\underline{\epsilon}))\delta(1 + \widehat{t}L(\widehat{t})) \geq 1 + \widehat{t}L(\widehat{t})$ in the case without tax competition and

(12) $\phi R(\beta, \underline{\epsilon}) \ + p(\mathbf{a}^{Gc}(\underline{\epsilon}))\delta(\beta + \widehat{t}L(\widehat{t})) \geq \beta + \widehat{t}L(\widehat{t})$ in the case with tax competition[15].

To derive $p(\mathbf{a}^G(\underline{\epsilon}))$ (resp. $p(\mathbf{a}^{Gc}(\underline{\epsilon}))$ we turn to voter's behavior. The rational voter would of course know that Leviathans are playing these strategies. At the equilibrium, upon observing $\mathbf{a}^G(\underline{\epsilon})$ in the case without tax competition or $\mathbf{a}^{Gc}(\underline{\epsilon})$ in the case with tax competition, by Bayes' rule, her ex-post beliefs about the type of government are

(13) $\eta(\theta, \mathbf{a}^G(\underline{\epsilon})) = \eta(\theta, \mathbf{a}^{Gc}(\underline{\epsilon})) = \frac{\theta(1-q)}{\theta(1-q)+(1-\theta)q}$

Solving, we observe that $\eta(.) \geq \theta$ if $\frac{1}{2} \geq q$, which in our case holds true by $A.1$. The conclusions are therefore that $p(\mathbf{a}^G(\underline{\epsilon}))$ (resp. $p(\mathbf{a}^{Gc}(\underline{\epsilon}))$= 1; e.g. at the equilibrium, the Leviathan is surely going to be re-elected if he plays

[15] That is, we are again assuming that when indifferent, the Leviathan prefers to pool.

the mimicking strategy. It then follows from (11) and (12) 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, the Leviathan would play the mimicking strategy in the first period. On the other hand, if 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) the only PBE is a separating equilibrium, where each type plays his favorite strategy in the first period for each realization of the shock. Notice that for $\epsilon = \overline{\epsilon}$ and $\delta \geq \delta^*$ (resp. $\delta \geq \delta^{*c}$ in an open one) the separating equilibrium cannot be a PBE. In fact, at this 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 the Leviathan would then have a profitable deviation that breaks the separating equilibrium. Summing up:

Proposition 1 *" Under A.1, if 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, then the only PBE in pure strategies is a separating equilibrium where each type of government plays his preferred choices in each period. At this equilibrium, the welfarist government is re-elected and the Leviathan government defeated, at the elections. If 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 only PBE in pure strategies is a pooling equilibrium where the Leviathan government plays in the first period the corresponding strategies of the good type of government for $\epsilon = \underline{\epsilon}$. At this pooling equilibrium, both types of government are re-elected."*

Hence, elections are not enough to tame completely Leviathans. Under the conditions stated in Proposition 1, Leviathan governments can still harm voters in the first period and be re-elected in the second. Tax competition clearly *does* make a difference: in general, $\delta^* \neq \delta^{*c}$, meaning that the support for pooling equilibria is generally different in the two cases. But before discussing *how* tax competition affects the electoral game, let us consider first 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.

[16] We briefly discuss partial correlation in section 6. Bordignon, Cerniglia and Revelli (2004) and Besley and Smart (2007) also consider partial correlation.

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 government chosen 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 there is no stage 0 and the 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 previous argument, 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 best choices 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 the Leviathan, it depends again on the discount rate and the behavior of voters.

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 the good type's negative shock strategies when $\epsilon = \overline{\epsilon}$, the posterior beliefs of voters can be derived as follows. If the voter observes anything different from either $(t = 0, T^*(\overline{\epsilon}), g^*(\overline{\epsilon}))$ or $(t = 0, T^*(\underline{\epsilon}), g^*(\underline{\epsilon}))$ 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 $(t = 0, T^*(\overline{\epsilon}), g^*(\overline{\epsilon}))$, 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 $(t = 0, T^*(\underline{\epsilon}), g^*(\underline{\epsilon}))$ in her economy, but $(t = 0, T^*(\overline{\epsilon}), g^*(\overline{\epsilon}))$ 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 $(t = 0, T^*(\underline{\epsilon}), g^*(\underline{\epsilon}))$ in *both* economies, her revised beliefs can be derived by Bayes' rule as follows:

$$(14)\ \eta(\theta, \mathbf{a}^G(\underline{\epsilon}), \mathbf{a}^G(\underline{\epsilon})) = \frac{\theta^2(1-q)}{\theta^2(1-q)+(1-\theta)^2 q}$$

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

[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.

the same argument for the case of tax competition, it is immediately seen that everything would go through except that the condition for pooling would now become $\delta \geq \frac{\delta^{*c}}{(1-\theta)}$. 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 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."*[18]

Combining Propositions 1 and 2, we immediately observe:

Corollary 3 *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.*

The corollary then illustrates the basic effect of yardstick competition; it allows citizens to better select between different types of governments.[19] 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 if he had some chances of re-election; and since the future advantages for citizens are uncertain, it may well be that citizens end up by being worse off as a result of yardstick competition. We will come back to this in section 6.

[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 play the separating strategy in the fist period, his best strategy is also to separate.

[19] Strictly speaking, this is not always the case. Even in the context of our model, for instance, if we had assumed $\theta > q > \frac{1}{2}$, pooling behaviour would have been only possible under yardstick competition. Still, as proposition 2 shows, whenever a pooling equilibria exists without yardstick competition, introducing it has the effect of reducing the support for pooling equilibria. See Bordignon, Cerniglia and Revelli (1994) for a further discussion of these issues.

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 assumptions, yardstick competition works by enforcing 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 4 *Tax and yardstick competition* reinforce *each other if the interval of parameters which support pooling equilibria in the first period further shrinks as an effect of introducing tax competition in the economy; tax and yardstick competition* conflict *in the opposite case.*

Referring back to Propositions 1 and 2, 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^{*}above, it is not a fortiori clear whether tax competition reinforces or conflicts with yardstick competition. To get a better intuition, let us manipulate the formulas to obtain:

$$(15) \qquad \delta^{*c} < (>)\, \delta^{*} \qquad \text{if} \quad \widehat{t}L(\widehat{t}) \;\; < (>) \; \frac{g^{*c}(\beta)-\beta g^{*}(1)}{g^{*}(1)-g^{*c}(\beta)} \equiv m(\beta)$$

(15) 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 work towards *more pooling under tax competition*[21]. That is, as anticipated above, our assumption of an untamed Leviathan is the one that works mostly in favour of greater separation as a result of tax competition. Second, $m(\beta) > 0$. To see this, note the denominator of $m(\beta)$ is certainly positive (as $g^{*}(1) > g^{*c}(\beta)$) and that the numerator of $m(\beta)$ is also positive, as $g^{*c}(\beta) > \underline{\epsilon}\beta$, $g^{*}(1) = \underline{\epsilon}T^{*}$ and $\underline{\epsilon}\beta - \underline{\epsilon}\beta T^{*} \geq 0$ as $T^{*} \leq 1$.

[20] In (15), for simplicity, we dropped the dependence of $g\,(.)$ on ϵ as is known that both levels of public expenditures are evaluated at $\epsilon = \underline{\epsilon}$. The case with no tax competition is captured in (15) 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, (15) would now become:

$$(15') \; \delta^{*c} < (>)\, \delta^{*} \qquad \text{if} \quad t'L(t') - \frac{g'}{\underline{\epsilon}} \;\; < (>) \; \frac{g^{*c}(\beta)-\beta g^{*}(1)}{g^{*}(1)-g^{*c}(\beta)}$$

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

Intuitively, there are two main forces at play in determining if $\widehat{t}L(\widehat{t})$ is larger or smaller than $m(\beta)$. The first hinges on the importance of public expenditure for voters. If voters value g very highly, so much that in spite of having to use the distorting labor tax to finance public expenditure, the good government would still attempt not to reduce too much public good supply, $g^*(1)$ would be not too far from $g^{*c}(\beta)$. Then $m(\beta)$ would become very large, pushing toward more pooling under tax competition. Intuitively, if $g^*(1)$ is not very far from $g^{*c}(\beta)$, 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 that 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.

The second force hinges on $\sigma(t)$ the elasticity of the labor tax base. If σ raises very fast with t, $g^{*c}(\beta)$ will be much smaller than $g^*(1)$, rents when pooling in the first period for the Leviathan will fall a great deal, and $m(\beta)$ will become smaller. This will push toward more separation. But notice that if σ raises very fast with t, $\widehat{t}L(\widehat{t})$ also falls quickly, pushing toward more and not less pooling in the first period.

To see these effects more precisely, let us differentiate (10) (that holds as an equality under tax competition) with respect to β and take a first order approximation. We get[22]:

(16)

$$g^* - g^{*c} \approx \frac{g^{*c}\sigma_t}{\mu L\left(t\right)\left(1-\sigma\right)^2 + g^{*c}\sigma_t}\left(T^* - \beta\right) \equiv s(\mu;\sigma_t)\left(T^* - \beta\right)$$

where $\mu = \left|\frac{H_{gg}g}{H_g}\right| > 0$ is the elasticity of the marginal utility for public expenditure and where all terms in $s(.)$ are evaluated at $\mathbf{a}^{Gc}(\underline{\epsilon})$. The two forces discussed above are clearly represented in this formula. $s(.)$ lies between zero and one. If σ_t is very small and/or μ is very large, $s(.) \longrightarrow 0$ and $g^{*c} \longrightarrow g^*$ implying from (15) that tax competition will certainly induce more pooling behavior. On the other hand, if σ_t is very large and/or μ is very small, $s(.) \longrightarrow 1$, and $m(\beta)$ tend to its minimal value, $\frac{\beta(1-T^*)}{T^*-\beta}$. However, in this case, $\widehat{t}L(\widehat{t})$ also falls, making the total effect generally ambiguous. Getting general results from (15) is difficult. But analytical examples and simulations (see the working paper version of this work, Bordignon (2005) for details) suggest that even with a very elastic labor tax base, it is only for very low values of μ (around 0.1) that we 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 appears 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

[22] To ease notation, we suppose $\underline{\epsilon} = 1$ in (16).

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 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[23]

This conclusion only refers to the type of political equilibria which would occur under either tax or yardstick competition. But the truly interesting question is how the two forms of intergovernmental competition affect voter's welfare and in particular whether they conflict on these grounds too. We begin by noticing that adding either form of intergovernmental competition affects consumer's welfare in two different ways. First, by possibly changing the political equilibria in the first period, switching it from pooling to separating under yardstick competition and from separating to pooling (assuming our previous conclusions to hold) in the case of tax competition. Second, by possibly changing the expected utility of the consumer at *any* given political equilibrium. Bearing this distinction in mind, it is immediate to see that, *at unchanged political equilibrium,* yardstick competition can only be (weakly) beneficial for the voter. In fact, if the original equilibrium was separating and remains separating after the introduction of yardstick competition, nothing changes for the voter. But if the original equilibrium was pooling, and remains pooling after the introduction of yardstick competition, the voter is certainly better off. In fact, when the incumbent is bad in the first period and pools, he 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 (in the context of our assumptions) when there was no yardstick competition[24].

Matters are no so simple for tax competition. In fact, even at unchanged political equilibria, tax competition constraints the fiscal choices that can be made by both bad and good governments in both periods and the net effect on consumer welfare is in general uncertain. So, for example, if the original equilibrium was separating and remains such after the introduction of tax competition, tax competition certainly increases consumer's welfare in the first period if the incumbent is bad (because the consumer is less exploited when the bad type separates), but it reduces it in the second period if a good type is elected (as this has to make larger use of a distorting source of taxation to finance expen-

[23] The present section is based on a more formal analysis that is available from the author on request.

[24] Note that this holds both for a closed and an open economy, that is with or without tax competition.

diture). The opposite holds if the original equilibrium is pooling and remains such after the introduction of tax competition. It can be shown that the crucial variable that determines whether tax competition is harmful or beneficial for the consumer is $\sigma(t^*)$, the value of the labor tax elasticity at the equilibrium with distorting taxation. In particular, if $\sigma(t^*)$ is larger than some threshold $\widehat{\sigma}$, tax competition is certainly harmful for the consumer in both political equilibria. But if $\sigma(t^*) < \widehat{\sigma}$, tax competition increases expected consumer's welfare at the separating equilibrium, and if $\sigma(t^*)$ falls even further, tax competition might turn out to be beneficial even at the pooling equilibrium. The results are intuitive. $\sigma(t^*)$ measures the cost for the consumer to switch to a distorting source of taxation[25]; and if this cost is low, it is worth paying for her, as tax competition reduces by $(1-\beta)$ the loss she suffers when the bad type plays his favorite strategy.

However, the two forms of competition may also change the support for the pooling equilibrium and if the equilibrium in the first period switches as a result of the introduction of either type of competition, the above results could be easily reverted. Introducing simultaneously both forms of intergovernmental competition make the results even messier, as the two forms of competition affect consumer welfare differently in any type of equilibrium, and the equilibrium itself may switch from separating to pooling (if $\frac{\delta^{*c}}{1-\theta} \leq \delta < \delta^*$) or from pooling to separating (if $\delta^* \leq \delta < \frac{\delta^{*c}}{1-\theta}$). General results are clearly very difficult to obtain. Still, there is a general insight that is worth stressing. 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 complements, as their joint inclusion tends to neutralize the effect on political equilibria, while possibly increasing consumer's welfare at each of these equilibria[26].

As a final comment, notice that we have so far treated yardstick and tax competition as separate and independent phenomena. But in fact they are likely to be related. For instance, if we had assumed that our two economies were only partially positively correlated, as in Bordignon et als. (2004), it would have been easy to show, under A.1, that the conditions which support pooling equilibria under yardstick competition become more and more restrictive (e.g. the threshold parameter δ that supports pooling equilibrium increases) as the correlation between the two economies increases (see proposition 3 in Bordignon et als. (2004)). On empirical grounds, one should then expect to see more

[25] Recall from (10) that $H_g(g^{c*}) = \frac{1}{\epsilon(1-\sigma(t^{c*}))}$; hence, the equilibrium value for $\sigma(t^{c*})$ depends on both a demand and a supply factor (e.g. how fast $\sigma(t)$ increases with t).

[26] Indeed, in the knife edge case $\frac{\delta^{*c}}{1-\theta} = \delta^*$, providing that $\sigma(t^*)$ is not too large, their joint effect on consumers' welfare is certainly positive, whatever the political equilibrium in the first period.

politicians being unseated at the elections as a result of increasing correlation among economies. Say, the process of market integration in the EU should also affect the political cycles in the different countries, making it easier for voters to discriminate between good and bad governments. But increasing integration of markets is also likely to increase tax competition (reducing β in our model), making the general effect ambiguous. It would be interesting if future empirical research succeeded in disentangling these two different effects.

7 Concluding remarks

Elections are the main way 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. However, the two forms of competition may be complementary as welfare is concerned; yardstick competition, by reducing the future losses of citizens when the disciplining effect is prevailing; tax competition, by reducing the present losses of citizens when the selection effect dominates. Hence, in expected terms, their joint inclusion in the economy may turn out to be beneficial for citizens.

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8 Technical appendix: not for publication

8.1 Strategic good governments

Consider again the game described in sections 2-3 of the paper. We maintain all assumptions unchanged, but we suppose now that the Welfarist governments also play strategically. We wish to characterize all the PBE of the game in this case, focusing again on pure strategy equilibria. As in the main text, the agents of the game are the two types of incumbent, the voter and the opponent. A strategy for the incumbent government is a function specifying, for each of his possible types, a set of actions $\mathbf{a}(\epsilon) = \{t(\epsilon), T(\epsilon); g(\epsilon)\}$ in each of the two periods and for each of the realizations of ϵ, where $0 \leq t(\epsilon) \leq 1$, $0 \leq T(\epsilon) \leq \beta$, $\beta \leq 1$ and $T(\epsilon) + t(\epsilon)L(t(\epsilon)) \geq \frac{g(\epsilon)}{\epsilon}$. A strategy for the voter is a choice between the incumbent and the challenger at the end of the first period, as a function of the observed level of $\{t, T, g\}$ in the first period. A strategy for the challenger is a choice of $\mathbf{a}(\epsilon)$ in the second period.

Consider the following list of all possible types of pure strategy PBE that can occur in this game. We define as *full pooling equilibrium* a PBE where in the first period the two types of incumbent make the *same* choices for any realization of ϵ, that is where $\mathbf{a}^B(\epsilon) = \mathbf{a}^G(\epsilon) = \mathbf{a}'(\epsilon)$ for $\epsilon = \{\overline{\epsilon}; \underline{\epsilon}\}$. We define as *full separating equilibrium* a PBE where in the first period each type of government plays his short term favorite strategy, that is, where $\mathbf{a}^{G*}(\epsilon) = \{t = t^{c*}(\epsilon, \beta), T = \beta, g = g^{c*}(\epsilon, \beta)\}$ and $\mathbf{a}^{B^*} = \left\{t = \widehat{t}, T = \beta; g = 0\right\}$ in the notation used in the paper. We use the term *pooling equilibrium (* or *partial pooling equilibrium)* to indicate the PBE we have focussed on in the main text, where the bad type plays in the first period the same choice the good type would have played for a *different* realization of the shock; i.e. $\mathbf{a}^B(\epsilon) = \mathbf{a}^G(\epsilon')$ for $\epsilon \neq \epsilon'$, $\epsilon, \epsilon' = \{\overline{\epsilon}; \underline{\epsilon}\}$. Finally, we use the generic term *separating equilibrium* to indicate a PBE where the two types play different strategies in the first period i.e. $\mathbf{a}^B(\epsilon) \neq \mathbf{a}^G(\epsilon')$ and $\mathbf{a}^B(\epsilon) \neq \mathbf{a}^G(\epsilon)$ for $\epsilon \neq \epsilon'$, $\epsilon, \epsilon' = \{\overline{\epsilon}; \underline{\epsilon}\}$, but where these strategies may not coincide with the favorite ones of each type.

We again solve the game by backward induction. In the second period, as there is no future ahead, each incumbent government plays his favorite strategy: $\left\{\mathbf{a}^{G*}(\epsilon), \mathbf{a}^{B^*}\right\}$. Let us then focus on the first period.

We introduce the following notation. Let $\widehat{R} = \widehat{t}L(\widehat{t}) + \beta$ be the maximal rents that the bad type can grab by playing his favorite strategy in each period. Let $\widetilde{R}(\mathbf{a}'(\epsilon^k);\epsilon^j) = T'(\epsilon^k) + t'(\epsilon^k)L(t'(\epsilon^k)) - \frac{g'(\epsilon^k)}{\epsilon^j}$ be the first period rents that the bad type grabs in the first period by mimicking and playing $\mathbf{a}'(\epsilon^k)$ (the good type strategy for shock ϵ^k), when the true realization of the shock is ϵ^j, where $\epsilon^j, \epsilon^k = \{\overline{\epsilon}; \underline{\epsilon}\}$ and ϵ^j may be different from ϵ^k

Consider first the *full pooling equilibrium.* Using the notation above, *necessary* conditions for the existence of this equilibrium are:

(i) $\widetilde{R}(\mathbf{a}'(\epsilon);\epsilon) \geq (1-\delta)\widehat{R}$, $\forall \epsilon$

(ii')$U(\mathbf{a}'(\epsilon)) + \delta U(\mathbf{a}^{G*}(\epsilon)) \geq U(\mathbf{a}^{G*}(\epsilon)) + \delta(\theta U(\mathbf{a}^{G*}(\epsilon)) + (1-\theta)\widetilde{U})$, $\forall \epsilon$

where $\widetilde{U}$ is the utility of the consumer when the bad type plays the fully expropriating strategy. If either (i) or (ii) are violated, one of the two types of incumbent would prefer to deviate and play his favorite strategy, even if he expected that by deviating he would be defeated at the election, while if he played the full pooling strategy he would be re-elected for sure. Letting $\widetilde{U} = 0$ for simplicity, (ii) can be rewritten more simply as

(ii) $U(\mathbf{a}'(\epsilon)) \geq U(\mathbf{a}^{G*}(\epsilon))(1-(1-\theta)\delta)$, $\forall \epsilon$

At the full pooling equilibrium, $\eta(\theta, \mathbf{a}'(\epsilon)) = \theta$; under our assumption on how the citizen votes when indifferent, this means that each type of incumbent is always re-elected by playing the full pooling strategy. In turn, this also means that the necessary conditions (i) and (ii) are also sufficient for the existence of a PBE, provided that out-of-equilibrium beliefs are defined accordingly[27]. For example, if we set $\eta(\theta, \mathbf{a}(\epsilon)) = 0$ for all $\mathbf{a}(\epsilon) \neq \mathbf{a}'(\epsilon)$ and (i) and (ii) are satisfied, the proposed full pooling equilibrium is a PBE of the game.

However, one could argue that these out-of-equilibrium beliefs are "unreasonable" as they implicitly assume that the bad agent could play a dominated strategy. Specifically, the rational consumer should realize that $\mathbf{a}^{G*}(\overline{\epsilon})$ is a dominated strategy for the bad type[28] and should therefore assign probability 1 to the incumbent being of the good type upon observing $\mathbf{a}^{G*}(\overline{\epsilon})$; e.g. $\eta(\theta, \mathbf{a}^{G*}(\overline{\epsilon})) = 1$. But this also implies that, when $\epsilon = \overline{\epsilon}$, the good type has a profitable deviation: playing $\mathbf{a}^{G*}(\overline{\epsilon}))$ and be re-elected for sure. This profitable deviation destroys the proposed equilibrium. The conclusion is that under reasonable beliefs the full pooling equilibrium cannot be a PBE of the game.

Consider then the *full separating equilibrium.* At this equilibrium, $\eta(\theta, \mathbf{a}^{G*}(\epsilon)) = 1$ and $\eta(\theta, \mathbf{a}^{B^*}) = 0$. But this immediately implies that for $\delta \geq \delta^* \equiv (1 - \frac{\widetilde{R}(\mathbf{a}^{G*}(\underline{\epsilon});\overline{\boldsymbol{\epsilon}})}{\widehat{R}})$, the full separating equilibrium cannot be a PBE. When $\epsilon = \overline{\epsilon}$ the bad type has a profitable deviation, playing $\mathbf{a}^{G*}(\underline{\epsilon})$ and be re-elected, that destroys the full separating equilibrium. The conclusion therefore is that for $\delta \geq \delta^*$, the full separating equilibrium cannot a PBE of the game.

Consider next the *(partial) pooling equilibrium.* Under the restriction that out of equilibrium beliefs have to be reasonable, in the first period the good type certainly plays $\mathbf{a}^{G*}(\overline{\epsilon})$ when $\epsilon = \overline{\epsilon}$ and plays another choice, say $\mathbf{a}''(\underline{\epsilon})$, when the shock is low. The bad type responds by playing $\mathbf{a}^{B^*}$ when the shock is low and $\mathbf{a}''(\underline{\epsilon})$ when the shock is high. By A.1, the bad type is certainly re-elected when he plays $\mathbf{a}''(\underline{\epsilon})$ in the first period. Necessary conditions for the existence of this equilibrium are:

(iii) $\widetilde{R}(\mathbf{a}''(\underline{\epsilon});\overline{\epsilon}) \geq (1-\delta)\widehat{R}$

(iv)$U(\mathbf{a}''(\underline{\epsilon})) \geq U(\mathbf{a}^{G*}(\underline{\epsilon}))(1-(1-\theta)\delta)$

If (iii) and (iv) are satisfied, by specifying accordingly out of equilibrium beliefs, we can support the partial pooling equilibrium as a PBE of the game; for instance, by setting $\eta(\theta, \mathbf{a}(\epsilon)) = 0$ for all $\mathbf{a}(\epsilon) \neq \left\{\mathbf{a}''(\underline{\epsilon}), \mathbf{a}^{G*}(\overline{\epsilon})\right\}$. Observe

[27] Note that this also requires $\widetilde{R}(\mathbf{a}'(\underline{\epsilon});\underline{\boldsymbol{\epsilon}}) = \widetilde{R}(\mathbf{a}'(\overline{\epsilon});\overline{\boldsymbol{\epsilon}})$ or otherwise the bad type would have a profitable deviation that would break the full pooling equilibrium.

[28] The bad type never gets any rents in the first period by playing this strategy and would therefore be better off by separating immediately

that the set of partial pooling equilibria is certainly not empty; at $\mathbf{a}''(\underline{\epsilon}) = \mathbf{a}^{G*}(\underline{\epsilon})$ and $\delta \geq \delta^*$ (iii) and (iv) are satisfied so that, under the out of equilibrium beliefs specification above, this is certainly a PBE of the game. But there could be other values of $\mathbf{a}''(\underline{\epsilon})$ (more precisely, a continuum of them) which also satisfy (iii) and (iv) and that therefore constitute a PBE.

To make further progress, let $\widehat{\mathbf{a}}(\underline{\epsilon}) = \arg\max \left\{ U(\mathbf{a}; \underline{\boldsymbol{\epsilon}}) \ s.t. \ \widetilde{R}(\mathbf{a};\overline{\epsilon}) = (1-\delta)\widehat{R} \right\}$; that is, $\widehat{\mathbf{a}}(\underline{\epsilon})$ is the best strategy that the good government could play in the first period, when the shock is $\underline{\epsilon}$, still making the bad type indifferent between separating and pooling. Notice that if $U(\widehat{\mathbf{a}}(\underline{\epsilon})) > U(\mathbf{a}''(\underline{\epsilon}))$ there certainly exists a deviating strategy that would make the good government better off in the first period and force the bad type to separate. For instance, at $\mathbf{a} = \widehat{\mathbf{a}}(\underline{\epsilon})$ the good type could infinitesimally reduce $\widehat{t}(\underline{\epsilon})$, letting $\widehat{g}(\underline{\epsilon})$ and $\widehat{T}(\underline{\epsilon})$ unchanged. This would make the consumer (and the good government) surely better off in the first period, while reducing the bad type's first period rents and therefore forcing him to separate. What prevents the good type from playing this deviating strategy is his expectation, under our out of equilibrium beliefs specification above, that by doing so he would be defeated at the elections, and condition (iv) guarantees that the good type is then better off by sticking to the pooling strategy and playing $\mathbf{a}''(\underline{\epsilon})$ instead.

But, in the spirit of the well known Cho and Kreps (1987) "equilibrium dominance" criterion[29] one could argue that these out of equilibrium expectations are "unconvincing". To understand why, notice that the bad type would certainly be worse off with respect to the (partial) pooling equilibrium payoffs if he played the deviating strategy in the first period, while the good type would be better off. Hence, the voter, who expects the two types of incumbent government to play the partial pooling equilibrium strategies, upon observing the deviation described above, should reason that only the good type could play this deviation, and re-elect him. If one accepts this argument, the conclusion is then that the pooling equilibrium can be sustained only if the condition $U(\mathbf{a}''(\underline{\epsilon})) \geq U(\widehat{\mathbf{a}}(\underline{\epsilon}))$ is added to (iii) and (iv). This still leaves us with many possible equilibrium values for $\mathbf{a}''(\underline{\epsilon})$. But note that $\mathbf{a}''(\underline{\epsilon}) = \mathbf{a}^{G*}(\underline{\epsilon})$ always satisfies $U(\mathbf{a}''(\underline{\epsilon})) \geq U(\widehat{\mathbf{a}}(\underline{\epsilon}))$, and for $\delta = \delta^*$, $\mathbf{a}''(\underline{\epsilon}) = \mathbf{a}^{G*}(\underline{\epsilon})$ is the *only* first period equilibrium choice that satisfies this additional condition. Intuitively, $\mathbf{a}^{G*}(\underline{\epsilon})$ is the strategy that maximizes the good type welfare in the first period when $\epsilon = \underline{\epsilon}$, and at the partial pooling equilibrium the good type is always re-elected by playing this strategy. Hence, there is no other strategy that he could play in the first period that is going to make him better off. We conclude that, for "convincing" out of equilibrium beliefs and $\delta \geq \delta^*$, $\mathbf{a}''(\underline{\epsilon}) = \mathbf{a}^{G*}(\underline{\epsilon})$ is the only choice which can be part of the (partial) pooling equilibrium strategies.

Consider finally the *separating equilibrium*. At this equilibrium, under our requirement that out of equilibrium beliefs need be reasonable, the good type plays $\mathbf{a}^{G*}(\overline{\epsilon})$ when the shock is high and another choice, say $\mathbf{a}'''(\underline{\epsilon})$, when the

[29] We cannot directly apply the intuitive criterion refinement here because our game is not a standard signalling game, as the citizen does not observe all the actions chosen by the government (e.g. rents in the first period).

shock is low. The bad type always plays $\mathbf{a}^{B^*}$. For this to be an equilibrium, the following conditions need be satisfied

(v) $\widetilde{R}(\mathbf{a}'''(\underline{\epsilon});\overline{\epsilon}) < (1-\delta)\widehat{R}$
(vi)$U(\mathbf{a}'''(\underline{\epsilon})) \geq U(\mathbf{a}^{G*}(\underline{\epsilon}))(1-(1-\theta)\delta)$

to support this as a PBE we need to specify out of equilibrium beliefs accordingly; for instance, by setting $\eta(\theta, \mathbf{a}(\underline{\epsilon})) = 0$ for all $\mathbf{a}(\epsilon) \neq \left\{\mathbf{a}'''(\epsilon), \mathbf{a}^{G*}(\overline{\epsilon})\right\}$. Under these out of equilibrium beliefs, the separating equilibrium is a PBE of the game.

Notice that what prevents the good type, at the separating equilibrium, from playing his maximization choice in the first period is his expectation that $\eta(\theta, \mathbf{a}^{G*}(\underline{\epsilon})) = 0$, that is, his expectation that the voter, by observing the choice that would maximize her utility in the first period when the realization of the shock is $\underline{\epsilon}$, would conclude that the incumbent is a bad type who is trying to fool her. We now inquiry about the "justifiability" of this expectation. McLennan (1985) suggests that "justifiable" out of equilibrium beliefs must be based on the presumption that "deviations from the equilibrium path are more probable if they can be explained in terms of some confusion over which sequential equilibrium is in effect" . Applying this idea here, we notice that under A.1, $\delta \geq \delta^*$ and our previous restrictions on out of equilibrium beliefs, the only pure strategy equilibria in which the voter could observe $\mathbf{a}^{G*}(\underline{\epsilon})$ in the first period are the (partial) pooling equilibria. Hence, observing $\mathbf{a}^{G*}(\underline{\epsilon})$ in the first period should be interpreted by the voter as a signal that the (partial) pooling equilibrium is being played. But then the beliefs of the voter, upon observing $\mathbf{a}^{G*}(\underline{\epsilon})$, should be consistent with the (partial) pooling equilibrium. And under A.1, at the partial pooling equilibrium, the good type is re-elected for sure upon playing $\mathbf{a}^{G*}(\underline{\epsilon})$ in the first period. $\mathbf{a}^{G*}(\underline{\epsilon})$ is then a profitable deviation for the good type that destroys the separating equilibrium.

Summing up, our general conclusion is that under A.1 and the restrictions that out of equilibrium beliefs need to be reasonable, convincing and justifiable, the only pure strategy PBE of the game, when $\delta \geq \delta^*$, is the partial pooling equilibrium. At this equilibrium, the good type plays $\mathbf{a}^{G*}(\epsilon)$, the bad type separates when $\epsilon = \underline{\epsilon}$, and plays $\mathbf{a}^{G*}(\underline{\epsilon})$ when $\overline{\epsilon}$.

8.2 Corner solution for the capital tax

Consider again the FOC for the good government's optimal choices without tax competition:

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

(10) $t : -L(t) + H_g(.)\epsilon(L(t) + tL_t(t)) = -L(t) + H_g(.)\epsilon L(t)(1-\sigma(t)) \leq 0$, $t \geq 0$.

and suppose now that at $T = 1$, $\epsilon H_g(\epsilon T) > 1$, for both realizations of ϵ. Hence, (10) holds as an equality and $t^* > 0$ even without tax competition. Introducing tax competition, $T = \beta < 1$ and (10), at fortiori, holds as an equality, and $t^{*c} > 0$. Let $t^*(1, \epsilon)$ be the optimal tax without tax competition and $t^{*c}(\beta, \epsilon)$ with tax competition. It follows $g^* = \epsilon(1 + t^*(1, \epsilon)L(t^*(1, \epsilon))$ and $g^{*c} = \epsilon(\beta + t^*(\beta, \epsilon)L(t^*(\beta, \epsilon))$. Working through the model, it is clear that propositions 1 and 2 go through unaffected with the only difference that now $R(1, \underline{\epsilon})$ in the definition of δ^* should read $R(1, \underline{\epsilon}) = 1 + t^*(1, \underline{\epsilon})L(t^*(1, \underline{\epsilon})$. Equation (15) also goes through with only difference that now in (15) $g^*(1) = g^* = \underline{\epsilon}(1 + t^*(1, \underline{\epsilon})L(t^*(1, \underline{\epsilon}))$. Using a linear approximation, $g^*(1) \approx g^{*c}(\beta) + (\partial g^{*c}(\beta)/\partial\beta)(1 - \beta)$ with $\partial g^{*c}(\beta)/\partial\beta > 0$ from (10). Hence $g^*(1) > g^{*c}(\beta)$ and the denominator of (15) is positive.Substituting in the numerator of (15), $g^{*c}(\beta) - \beta g^*(1) = (1 - \beta)(g^{*c}(\beta) + \beta\partial g^{*c}(\beta)/\partial\beta) > 0$. Hence $m(\beta) > 0$. Assume now $\underline{\epsilon} = 1$ and notice: $\partial g^{*c}(\beta)/\partial\beta = 1 + L(t(\beta)(1 - \sigma(t(\beta))dt/d\beta$. Differentiating (10), $dt/d\beta = \frac{H_{g_g}(1-\sigma)}{-(H_{g_g}L(1-\sigma)^2 - H_g\sigma_t)}$. Substituting, and using the fact that $H_g(g^{*c}) = (1 - \sigma(t^{*c}))^{-1}$ from (10), $g^*(1) - g^{*c}(\beta) \approx \frac{g^{*c}\sigma_t}{\mu L(t)(1-\sigma)^2 + g^{*c}\sigma_t}(1 - \beta)$ which is equation (16) in the paper.

8.3 Welfare analysis

Let $u(\beta, \epsilon)$ be the maximum utility that a consumer can get when the taxable capital tax base is β and the shock is $\epsilon, 0 < \beta \leq 1, \epsilon = \{\underline{\epsilon}, \overline{\epsilon}\}$; e.g. her utility under the fiscal choices of a Welfarist government. Let $\vartheta u(\beta, \epsilon) = qu(\beta, \overline{\epsilon}) + (1 - q)u(\beta, \underline{\epsilon})$ her expected utility under the Welfarist government, where expectations are taken with respect to the realization of ϵ.Finally, let $\widetilde{u}(\beta)$, $0 < \beta \leq 1$ be consumer's utility under a Leviathan government, when the latter plays the fully exploiting strategy.

8.3.1 Tax competition: (1) Separating equilibria

Suppose $\delta < \delta^{*c} < \delta^*$. This means that the original PBE is separating without tax competition and remains such even after introducing tax competition. Using the notation above, the expected utility of the consumer $Eu(\beta, \epsilon)$ in this regime (where expectations are taken with respect to the realization of the type of government) can be written as:

$$(A.1) Eu(\beta, \epsilon) = \theta(\vartheta u(\beta, \epsilon) + \delta\vartheta u(\beta, \epsilon)) + (1-\theta)(\widetilde{u}(\beta) + \delta((1-\theta)\widetilde{u}(\beta) + \theta\vartheta u(\beta, \epsilon))$$

Letting $Eu(1, \epsilon)$ indicate the expected utility of the consumer without tax competition ($\beta = 1$), the effect of the introduction of tax competition on consumer welfare can be evaluated by computing

$$(A.2) Eu(1,\epsilon) - Eu(\beta,\epsilon) = (\vartheta u(1,\epsilon) - \vartheta u(\beta,\epsilon))(\theta(1+(2-\theta)\delta) + (\widetilde{u}(1) - \widetilde{u}(\beta))((1-\theta)(1+\delta(1-\theta))$$

Tax competition is then beneficial for the consumer if:

$$(A.3) \widetilde{u}(\beta) - \widetilde{u}(1) > \frac{\theta(1+(2-\theta)\delta}{(1-\theta)(1+\delta(1-\theta))}(\vartheta u(1,\epsilon) - \vartheta u(\beta,\epsilon))$$

Note that $\widetilde{u}(\beta) - \widetilde{u}(1) = 1-\beta$. Note further that by differentiating (10) wrt β we get:

$$(A.4) \partial u(\beta,\epsilon)/\partial\beta = \frac{\sigma(t^*)}{1-\sigma(t^*)},$$

where t^* is the optimal choice for t given β and the realization of ϵ.

Using a linear approximation,

$$\begin{aligned}(A.5) \vartheta u(1,\epsilon) &\approx \vartheta u(\beta,\epsilon) + (T^* - \beta)(q\partial u(\beta,\bar{\epsilon})/\partial\beta + (1-q)\partial u(\beta,\underline{\epsilon})/\partial\beta) \\ &= \vartheta u(\beta,\epsilon) + (T^* - \beta)(q\frac{\sigma(t^*(\bar{\epsilon}))}{1-\sigma(t^*(\bar{\epsilon}))} + (1-q)\frac{\sigma(t^*(\underline{\epsilon}))}{1-\sigma(t^*(\underline{\epsilon}))})\end{aligned}$$

Substituting for (A.5) in (A.3) and using the fact that $\widetilde{u}(\beta) - \widetilde{u}(1) = 1-\beta$, tax competition is then beneficial if:

$$\begin{aligned}(*)\frac{1-\beta}{T^*-\beta}\frac{(1-\theta)(1+\delta(1-\theta))}{\theta(1+(2-\theta)\delta)} &> \\ q\frac{\sigma(t^*(\bar{\epsilon}))}{1-\sigma(t^*(\bar{\epsilon}))} + (1-q)\frac{\sigma(t^*(\underline{\epsilon}))}{1-\sigma(t^*(\underline{\epsilon}))} &\equiv E(\frac{\sigma(t^*(\epsilon))}{1-\sigma(t^*(\epsilon))})\end{aligned}$$

Now notice that $\frac{1-\beta}{T^*-\beta} \geq 1$, while under the assumption A.1 in the main text, $\frac{(1-\theta)(1+\delta(1-\theta))}{\theta(1+(2-\theta)\delta)} < 1$. $\frac{\sigma(t^*(.))}{1-\sigma(t^*(.))}$ is increasing in $\sigma(t^*(.))$, $\frac{\sigma(t^*(.))}{1-\sigma(t^*(.))} \to \infty$ for $\sigma(t^*) \to 1$ and $\frac{\sigma(t^*(.))}{1-\sigma(t^*(.))} \to 0$ for $\sigma(t^*) \to 0$. Further note from (10) that $t^*(\underline{\epsilon}) \geq (\leq) t^*(\bar{\epsilon})$ as $\mu \geq (\leq) 1$. It follows $\sigma(t^*(\bar{\epsilon})) \leq (\geq) \sigma(t^*(\underline{\epsilon}))$ as $\mu \geq (\leq) 1$. Suppose first $\mu \geq 1$. This implies $\frac{\sigma(t^*(\underline{\epsilon}))}{1-\sigma(t^*(\underline{\epsilon}))} \geq E(\frac{\sigma(t^*(\epsilon))}{1-\sigma(t^*(\epsilon))})$. Next suppose $\mu \leq 1$. This implies $\frac{\sigma(t^*(\bar{\epsilon}))}{1-\sigma(t^*(\bar{\epsilon}))} \geq E(\frac{\sigma(t^*(\epsilon))}{1-\sigma(t^*(\epsilon))})$.

Now let $\widehat{\sigma}$ be such that $\frac{1-\beta}{T^*-\beta}\frac{(1-\theta)(1+\delta(1-\theta))}{\theta(1+(2-\theta)\delta)} = \frac{\widehat{\sigma}}{1-\widehat{\sigma}}$.Hence, if either $\mu \geq 1$ and $\sigma(t^*(\underline{\epsilon})) < \widehat{\sigma}$ or if $\mu \leq 1$ and $\sigma(t^*(\bar{\epsilon})) < \widehat{\sigma}$ tax competition is beneficial for the consumer in the separating regime.

8.3.2 Tax competition: (2) Pooling equilibria

Suppose $\delta^{*c} < \delta^* < \delta$. This means that the political equilibrium is pooling without tax competition and remains pooling after introducing tax competition. The expected welfare of the consumer in this case is:

$$\begin{aligned}(A.6)Eu(\beta,\epsilon) \quad = \quad & \theta(\vartheta u(\beta,\epsilon)+\delta\vartheta u(\beta,\epsilon)) \\ & +(1-\theta)(1-q)(\widetilde{u}(\beta)+\delta((1-\theta)\widetilde{u}(\beta)+\theta u(\beta,\underline{\epsilon})) \\ & +(1-\theta)q(u(\beta,\underline{\epsilon})+\delta\widetilde{u}(\beta))\end{aligned}$$

Using again $Eu(1,\epsilon)$ to indicate the expected utility of the consumer without tax competition:

$$\begin{aligned}(A.7)Eu(1,\epsilon)-Eu(\beta,\epsilon) \quad = \quad & (\vartheta u(1,\epsilon)-\vartheta u(\beta,\epsilon))(\theta(1+\delta)) \\ & +(\widetilde{u}(1)-\widetilde{u}(\beta))(1-\theta)((1-q)(1+\delta(1-\theta))+q\delta) \\ & +(u(1,\underline{\epsilon})-u(\beta,\underline{\epsilon}))((1-\theta)(1-q)\delta\theta+(1-\theta)q)\end{aligned}$$

Tax competition is then beneficial for the consumer if:

$$\begin{aligned} & (A.8)(\vartheta u(1,\epsilon)-\vartheta u(\beta,\epsilon))(\theta(1+\delta)) \\ & +(u(1,\underline{\epsilon})-u(\beta,\underline{\epsilon}))((1-\theta)(1-q)\delta\theta+(1-\theta)q) \qquad (1) \\ < \quad & (\widetilde{u}(\beta)-\widetilde{u}(1))(1-\theta)((1-q)(1+\delta(1-\theta))+q\delta) \qquad (2)\end{aligned}$$

or, using again $\widetilde{u}(\beta)-\widetilde{u}(1)=1-\beta$ and (A.5), if

$$\begin{aligned}(**)\frac{1-\beta}{T^*-\beta} \quad > \quad & E(\frac{\sigma(t^*(\epsilon))}{1-\sigma(t^*(\epsilon))})\frac{\theta(1+\delta)}{(1-\theta)((1-q)(1+\delta(1-\theta))} \\ & +\frac{\sigma(t^*(\underline{\epsilon}))}{1-\sigma(t^*(\underline{\epsilon}))}\frac{(1-q)\delta\theta+q}{(1-q)(1+\delta(1-\theta))}\end{aligned}$$

that is, again, if the value of $\sigma(t^*(\epsilon))$ is sufficiently low (e.g. for $\sigma(t^*(\bar{\epsilon})),\sigma(t^*(\underline{\epsilon}))\rightarrow 0$), tax competition might be beneficial for the consumer even if the political equilibrium is, and remains, pooling after the introduction of tax competition. To compare (*) with (**), let $E(\frac{\sigma(t^*(\epsilon))}{1-\sigma(t^*(\epsilon))})=S$ and let $\frac{\sigma(t^*(\underline{\epsilon}))}{1-\sigma(t^*(\underline{\epsilon}))}=P$. It follows that (*) and (**) can be rewritten as

(*) $\frac{1-\beta}{T^*-\beta} > \frac{\theta(1+(2-\theta)\delta')}{(1-\theta)(1+\delta'(1-\theta))}S$ and (**) $\frac{1-\beta}{T^*-\beta} > \frac{\theta(1+\delta'')}{(1-\theta)((1-q)(1+\delta''(1-\theta))}S + \frac{(1-q)\delta''\theta+q}{(1-q)(1+k\delta''(1-\theta))}P$

where $\delta'' > \delta^* > \delta^{*c} > \delta'$. Let $k=\frac{\delta''}{\delta'}>1$. It follows that (**) is more restrictive than (*) if

$$\frac{\theta(1+k\delta')}{(1-\theta)((1-q)(1+k\delta'(1-\theta))}S+\frac{(1-q)k\delta'\theta+q}{(1-q)(1+k\delta'(1-\theta))}P$$
$$> \frac{\theta(1+(2-\theta)\delta')}{(1-\theta)(1+\delta'(1-\theta))}S$$

At $\mu = 1$, $S = P$. Substituting and computing, it can be shown that for k large enough, the RHS of (**) is larger than the RHS of (*), meaning that (**) is indeed more restrictive than (*)[30]. That is, there exists a value of $\sigma(t^*)$ small enough to make tax competition beneficial for the consumer at the separating regime, but still harmful for the consumer at the pooling regime. At fortiori, this holds for $\mu > 1$ too, as $\mu > 1$ implies $P > S$. If $\mu < 1$, $S > P$ and the comparison becomes more uncertain. (**) would be still more restrictive than (*) for k large enough, but the sign could be reversed as P becomes smaller and smaller. In the extreme case $P \to 0$, (*) is more restrictive than (**). But notice from eqs. (15) and (16) that this case is hardly compatible with $\delta^{*c} < \delta^*$.

8.3.3 Tax competition: (3) Switching political equilibria

Suppose $\delta^{*c} < \delta < \delta^*$. This means that introducing tax competition shifts the equilibrium in the first period from separating to pooling. The effect on welfare can again be captured by subtracting $Eu(\beta, \epsilon)$ from $Eu(1, \epsilon)$, where the latter is evaluating at the separate equilibrium and the former at the pooling one:

$$\begin{aligned} & (A.9) Eu(1,\epsilon) - Eu(\beta,\epsilon) \\ = \quad & (\vartheta u(1,\epsilon) - \vartheta u(\beta,\epsilon))\,\theta((1+(2-\theta)\delta) - (\widetilde{u}(\beta) - \widetilde{u}(1))(1-\theta)(1+\delta((1-\theta) \\ & +(1-\theta)q(\widetilde{u}(\beta) + \theta\delta u(\beta,\overline{\epsilon}) - u(\beta,\underline{\epsilon})) \end{aligned}$$

As can be checked, the first two terms on the RHS are identical to (A.2). Hence, the conditions for tax competition to be beneficial for the consumer are more (less) restrictive than (*) depending on if $\widetilde{u}(\beta) + \theta\delta u(\beta,\overline{\epsilon}) > (<) u(\beta,\underline{\epsilon})$.

8.4 Yardstick competition

Case 1. Suppose $\delta < \delta^* < \frac{\delta^*}{1-\theta}$.This means that the equilibrium is separating in the benchmark case and remains separating upon introducing yardstick competition. Clearly nothing changes for the consumer.

Case 2. Suppose $\delta^* < \frac{\delta^*}{1-\theta} < \delta$. This means that the original equilibrium is pooling and remains pooling under yardstick competition. Letting $Eu^Y(1,\epsilon)$ be

[30] For instance, at $\mu = 1$, $k > \frac{1}{\theta\delta'^2}$ is a sufficient condition for the RHS of (**) to be larger than the RHS of (*). But even for $k \to 1$ the RHS of (**) would be larger than the RHS of (*) if $\theta\delta'^2 > (1-q\theta)(1+\delta'(1-\theta))$.

the expected utility with yardstick competition and $Eu(1,\epsilon)$ the one without it, the welfare effect of introducing yardstick competition can be computed as

$$(A.10) Eu^Y(1,\epsilon) - Eu(1,\epsilon) = \delta\theta(u(1,\overline{\epsilon}) - \theta\widetilde{u}(1))) > 0$$

.

Case 3. Suppose $\delta^* < \delta < \frac{\delta^*}{1-\theta}$.This means that the equilibrium switches from pooling to separating:

$$(A.11) Eu^Y(1,\epsilon) - Eu(1,\epsilon) = (1-\theta)q((1-\delta\theta)\widetilde{u}(1) + \theta u(1,\overline{\epsilon}) - u(1,\underline{\epsilon}))$$

The sign is uncertain.

8.5 Tax and yardstick competition

Here there are three cases to consider and eight sub-cases.

(a) $\frac{\delta^{*c}}{1-\theta} < \delta^*$; with (a.1) $\delta < \frac{\delta^{*c}}{1-\theta} < \delta^*$; (a.2) $\frac{\delta^{*c}}{1-\theta} < \delta^* \leq \delta$; (a.3) $\frac{\delta^{*c}}{1-\theta} \leq \delta < \delta^*$; (b) $\delta^* < \frac{\delta^{*c}}{1-\theta}$; with (b.1) $\delta < \delta^* < \frac{\delta^{*c}}{1-\theta}$;(b.2) $\delta^* < \frac{\delta^{*c}}{1-\theta} \leq \delta$;

(b.3) $\delta^* \leq \delta < \frac{\delta^{*c}}{1-\theta}$; (c) $\frac{\delta^{*c}}{1-\theta} = \delta^*$ with (c.1) $\delta < \frac{\delta^{*c}}{1-\theta} = \delta^*$, (c.2) $\frac{\delta^{*c}}{1-\theta} = \delta^* \leq \delta$

.

In cases (a.1), (b.1), (c.1) the original equilibrium was separating and remains such after the introduction of both forms of competition. Yardstick competition has no effect and consumer welfare increases or decreases depending on condition (*).

In cases (a.2), (b.2), (c.2) the original equilibrium was pooling and remains such after the introduction of both forms of tax competition.

The condition for this to be beneficial for the consumer are as in (A.8), with the extra term $\delta\theta(u(\beta,\overline{\epsilon}) - \theta\widetilde{u}(\beta)) > 0$ added at the RHS of (A.8). This captures the beneficial effect of yardstick competition; the mimicking Leviathan is found out with higher probability and this increases the expected welfare of the consumer in this case.

In case (a.3) the equilibrium switches from separating to pooling. The condition for this to be beneficial for the consumer are as in (A.9) with the extra term $\delta\theta(u(\beta,\overline{\epsilon}) - \theta\widetilde{u}(\beta)) > 0$ added at the RHS of (A.9).

In case (b.3) the equilibrium switches from pooling to separating; it is beneficial for the consumer if $Eu^Y(\beta,\epsilon) - Eu(1,\epsilon) > 0$. The sign is uncertain.