Non-binding minimum taxes may foster tax competition

Kai A. Konrad*

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Abstract

In a Stackelberg framework of capital income taxation it is shown that imposing a minimum tax rate that is lower than all countries' equilibrium tax rates in the unconstrained non-cooperative equilibrium may reduce equilibrium tax rates in all countries.

Keywords: tax competition, minimum tax, tax coordination, Stackelberg

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*Department of Economics, Free University of Berlin, and Social Science Research Center Berlin (WZB). Correspondence address: Kai A. Konrad, WZB, Reichpietschufer 50, D-10785 Berlin, Germany, e-mail kkonrad@wzb.eu, phone +49 30 25491 402, fax +49 30 25491 400. I thank Marie-Laure Breuillé, Clemens Fuest, Tim Goodspeed, Andreas Haufler, Peter Birch Sørensen, Tanguy van Ypersele and an anonymous reviewer for excellent comments. The usual caveat applies. Financial support by the DFG (SPP 1142) is gratefully acknowledged.

1 Introduction

Europe is currently facing a period of income tax competition. In this context policy makers sometimes articulate concern that a downward adjustment of their own tax rates may initiate further tax rate cuts inside the European union, which suggests that they feel that they are operating in a sequential, leader-follower game.[1] Concerns regarding cross-border shopping have led to an agreement on limiting standard sales tax rates in the European Union to a band between 15 and 25 percent[2], Luxemburg and Cyprus currently being the countries that have a tax rate at the lower limit.[3] Agreements on minimum taxes for capital income at source and corporate income taxation have been proposed by experts (see, e.g., the report by the Ruding Committee, 1992, p. 202), but have not been implemented, not even at a level that is lower than the tax rates chosen by the countries in the non-cooperative equilibrium.[4]

This paper shows: a minimum tax rate that is lower than the lowest tax rate in the unconstrained equilibrium may have strong strategic effects.[5] It may induce all countries to make their tax rates lower than those they choose in the unconstrained equilibrium. Implications of the result are: sales tax rates need not be lower, but could potentially be higher than they are now in the European Union if there were no treaty on a minimum tax rate, and corporate taxes may be higher now than after implementing a minimum tax.

Fuest, Huber and Mintz (2005) survey the literature and discuss minimum taxes on capital income at source. Minimum taxes have also been considered in the context of value added taxes and cross-border shopping (e.g., Kanbur and Keen, 1993, Wang, 1999, Hvidt and Nielsen, 2001). Wang (1999) is closest to the current paper. He considers minimum taxes that are binding in the unconstrained Stackelberg equilibrium in the sense that the minimum tax is strictly higher than the lowest tax rate that emerges in the unconstrained Stackelberg equilibrium. I consider a minimum tax that is strictly lower than all tax rates that emerge in the unconstrained Stackelberg equilibrium. Wang finds that the country with the higher tax rate may adjust its equilibrium tax rate downwards as a result of the

[1]See, e.g., Altshuler and Goodspeed (2002) for empirical evidence suggesting that countries react to tax rate changes in other countries.

[2]See *Council Directive 2006/112/EC.*

[3]European Commission (2008).

[4]Such an agreement on a level lower than actual rates may be seen as a safeguard against future tax competition in a situation with further increased tax base elasticity.

[5]A minimum tax rate that is above the smallest tax rate chosen inside the EU has redistributional effects and thus makes minimum tax arrangements difficult to attain (see, e.g., Peralta and van Ypersele, 2006).

minimum tax. I find that *all* countries may reduce their tax rates as an implication of the introduction of a minimum tax.

2 The Analysis

Consider a reduced form of capital income tax competition at source. Two countries L and F compete by their choices of tax rates t_L and t_F, respectively, with $t_i \in [0,1]$ for $i \in \{L,F\}$, where the tax rates chosen have the standard implications for the equilibrium allocation of capital, tax revenues and the distribution of capital income. Countries' payoffs are functions of both tax rates and defined as $\pi_L(t_L,t_F)$ and $\pi_F(t_L,t_F)$. Let these functions be continuously differentiable and strictly quasi-concave in t_i and t_j, implying that the iso-payoff curves are convex to the origin.[6] Let $\arg\max_{t_i \in [0,1]}\{\pi_i(t_i,t_j)\} \in (0,1)$ be single-valued for all $t_j \in [0,1]$ and increasing in the other country's tax rate. This implies that the reaction correspondences determining i's optimal tax rate choices for a given tax rate of j are single-valued, upward sloping throughout[7] and can be written as functions $t_L(t_F)$ and $t_F(t_L)$ respectively, with $t_i(t_j) \in (0,1)$ for all $t_j \in [0,1]$. The reaction functions and some representatives of the set of iso-payoff functions are depicted in Figure 1. A Nash equilibrium N is characterized by an intersection of the reaction functions as in Figure 1. A final assumption is that this equilibrium is unique. Together with the previous assumptions, this implies that $t_F(t_L)$ intersects $t_L(t_F)$ for tax rates in the interior of $(0,1)\times(0,1)$ and from the upper left at N.

Consider now the sequential game in which country L acts as a Stackelberg leader and chooses its tax rate first, and F behaves as a follower. This sequencing of tax rate choices is exogenous here, but could be endogenized along the reasoning in Hamilton and Slutzky (1990). By a choice of t_L the leader L can choose any combination of taxes $(t_L, t_F(t_L))$ along the reaction function of F. In Figure 1 each tax rate combination is mapped into a pair of countries' payoffs, for the whole area of possible tax combinations. At point S the leader L attains the highest payoff π_L from all points $(t_L, t_F(t_L))$ along F's reaction curve. This point is either an interior point such as S, or a corner solution at S'. As $t_F(t_L)$ need not be

[6] Smooth reaction functions can be given a microeconomic underpinning in the context of capital taxation. Reaction functions may, however, become discontinuous if some stock of capital in one or both countries is immobile. In the context of sales tax competition analyzed by Wang (1999), reaction functions are discontinuous if countries are asymmetric.

[7] Upward sloping reaction functions in the context of capital income taxation are also empirically confirmed, e.g., by Altshuler and Goodspeed (2002).

concave, the Stackelberg equilibrium also does not need to be unique. I concentrate on the case of an interior Stackelberg equilibrium such as S, but the argument that is made about the introduction of a minimum tax also applies for a corner equilibrium such as S'. The Stackelberg equilibrium is generically unique in this framework, but the proof of the main result in this paper also works in the case of multiple Stackelberg equilibria.

Figure 1 about here

So far this characterizes the Nash and Stackelberg equilibrium in a reduced form of a standard tax competition framework. Suppose now that L and F, for some reason outside the scope of this analysis, are subject to a minimum tax constraint. Both countries choose their tax rates freely, but cannot choose a tax rate lower than some *minimum tax rate* $t_0 > 0$, i.e., $t_i \in [t_0, 1]$ for both $i \in \{L, F\}$. The two countries choose their tax rates according to the rules of the Stackelberg game that has been outlined above, with the only difference that they choose their taxes from this more constrained interval $[t_0, 1]$. I call the respective game the *constrained Stackelberg game*. The following main result can be stated:

Proposition 1 *Let (t_L^S, t_F^S) be the Stackelberg equilibrium in the unconstrained game, and let $t_L^S \geq t_F^S$. A minimum tax rate $t_0 < t_F^S$ exists such that the Stackelberg equilibrium in the constrained game has lower tax rates for both countries L and F than in the unconstrained game.*

Proof. Let S in Figure 1 characterize the Stackelberg equilibrium in the unconstrained case; in the case of multiple equilibria, consider the equilibrium with the lowest tax rates. Consider a minimum tax rate $t_0 = t_F^S - \epsilon$, for $\epsilon > 0$. This minimum tax rate changes the optimal reply functions of both countries to

$$\hat{t}_i(t_j) = \begin{cases} t_i(t_j) & \text{for} \quad t_i(t_j) > t_F^S - \epsilon \\ t_F^S - \epsilon & \text{for} \quad t_i(t_j) \leq t_F^S - \epsilon \end{cases} \quad \text{for } i, j \in \{L, F\} \text{ and } i \neq j. \tag{1}$$

The choice of $\hat{t}_i(t_j) = t_0$ for $t_i(t_j) < t_0$ follows from the properties of the payoff functions: for a given t_j, payoff of country i increases if it changes its tax rate towards the unconstrained optimum $t_i(t_j)$. Figure 2 depicts the reply functions $\hat{t}_F(t_L)$ and $\hat{t}_L(t_F)$ as the solid lines. These coincide with the reply functions in the unconstrained case for all unconstrained optimal replies that are higher than the minimum tax t_0 and are equal to t_0 for all smaller tax rates $t_i(t_j)$. A Stackelberg equilibrium is characterized by

$$t_L^0 \equiv \arg \max_{t_L \in [t_0, t_L^S]} \{\pi_L(t_L, \hat{t}_F(t_L))\} \text{ and } t_F^0 \equiv \hat{t}_F(t_L^0). \tag{2}$$

The upper limit t_L^S in $t_L \in [t_0, t_L^S]$ can be adopted in (2), because t_L^S is optimal for L among all $t_L \in [t_L^S, 1]$.

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Figure 2a and 2b about here

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Consider now $\epsilon \to 0$. The iso-payoff curve $\overline{\pi}_L$ that passes through S has a strictly positive slope at S. For sufficiently small but positive ϵ this iso-payoff curve intersects $\hat{t}_F(t_L)$ to the left of S, but for a value of $t_L > t_0$. The latter follows from the assumption that $t_L^S \geq t_F^S > t_0$ and $\epsilon \to 0$. The choice t_L^0 in (2) is therefore given by

$$\hat{t}_L(t_0) = \max\{t_0, t_L(t_0)\}. \tag{3}$$

The Figure 2a depicts the case with $\hat{t}_L(t_0) = t_L(t_0)$, Figure 2b depicts the case with $\hat{t}_L(t_0) = t_0$. Now, for $\epsilon \to 0$, it follows that $t_F^0 = t_0 = t_F^S - \epsilon < t_F^S$ and $t_L^0 = \max\{t_0, t_L(t_0)\} < t_L^S$. The latter holds because $t_0 < t_L^S$ and because $t_L(t_0) < t_L^S = t_L(t_F^S)$ by $t_0 < t_F^S$ and by $t_L(t_F)$ being strictly monotonically increasing. ■

Proposition 1 shows that tax coordination that limits the choices of tax rates from below by a minimum tax that is smaller than any of the tax rates that are chosen in the laissez-faire equilibrium can reduce the equilibrium tax rates of all countries to below their unconstrained laissez-faire equilibrium levels. The proof can be re-stated in intuitive terms. Consider the equilibrium S in the absence of a minimum tax in Figure 2a. A minimum tax that is just equal to $t_0 = t_F^S$ will allow the leader to reduce his tax below t_L^S without any reaction by the follower's tax. The tax rates are strategic complements. The follower would like to reduce his tax rate, too, but this is not permitted, as the minimum tax is binding. Hence, a substantial reduction in t_L from t_L^S down to L's optimal point $\hat{S}$ yields a strictly positive increase in L's payoff. This corresponds to the borderline case of Wang's (1999) analysis of minimum taxes $t_0 > t_F^S$, with $t_0 = t_F^S$ as the limiting case in the context of sales tax competition.[8] Note that Proposition 1 considers a minimum tax smaller than $t_0 = t_F^S$. Suppose that the minimum tax t_0 is slightly smaller than t_F^S. In this case, the reduction in t_L starting from t_L^S will first induce a reduction in t_F along $t_F(t_L)$, until the point K is reached in Figure 2. The movement from S to K reduces L's payoff compared to the payoff in S. However, the tax reaction by F comes to a hold once $t_F(t_L) = t_0$. Moreover, the distance

[8] Accordingly, the argument regarding smaller minimum tax rates also locally extends to Wang's (1999) sales tax framework by continuity at $t_0 = t_F^S$.

from S to K and the payoff decrease for L along this distance can be made arbitrarily small by choosing t_0 arbitrarily close to (but smaller than) t_F^S. Once $t_F(t_L) = t_0$ has been reached, for further decreases in t_L the argument just made applies: a further decrease in t_L does not lead to a decrease in t_F, as t_F cannot fall below t_0. The decrease in t_L therefore leads to an increase in L's payoff. This strictly positive increase in payoff outweighs the decrease in payoff from the first few marginal units decrease in t_L from S to K if t_0 is sufficiently close to t_F^S.

Note that a sufficiently small minimum tax leaves the Stackelberg equilibrium S unchanged. However, if the minimum tax $t_0 \leq t_F^S < t_L^S$ changes the equilibrium (from S to $\hat{S}$ as in Figures 2a and 2b), then this change harms the follower and benefits the leader. The follower's payoff at $\hat{S}$ is lower than at the intersection of a vertical line through $\hat{S}$ with $t_F(t_S)$, and his payoff there is lower than at S. Hence, the follower always has a lower payoff in $\hat{S}$ than in S. The leader benefits in $\hat{S}$ compared to S. This follows from a revealed preference argument. The leader could still achieve S by choosing t_L^S. If the leader does not choose t_L^S, this is because the alternative choice provides a higher payoff.

3 Conclusions

The discussion here shows that constraints in the tax rate choice sets of countries that do not prohibit the choice of both countries' equilibrium actions in the unconstrained problem may still strongly affect the equilibrium outcome. A lower bound on tax rates that is lower than the one any of the countries would have chosen in the unconstrained equilibrium can induce an equilibrium in which all countries choose a lower tax rate than in the unconstrained equilibrium.

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