WISSENSCHAFTSZENTRUM BERLIN
FÜR SOZIALFORSCHUNG

SOCIAL SCIENCE RESEARCH
CENTER BERLIN

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# Non-Binding Minimum Taxes May Foster Tax Competition

**SP II 2008 – 10**

March 2008

ISSN Nr. 0722 – 6748

**Research Area**
**Markets and Politics**

**Schwerpunkt**
**Märkte und Politik**

**Research Unit**
**Market Processes and Governance**

**Abteilung**
**Marktprozesse und Steuerung**

Zitierweise/Citation:

Kai A. Konrad, **Non-Binding Minimum Taxes May Foster Tax Competition**, Discussion Paper SP II 2008 – 10, Wissenschaftszentrum Berlin, 2008.

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Internet: www.wzb.eu

ABSTRACT

**Non-Binding Minimum Taxes May Foster Tax Competition**

by Kai A. Konrad *

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 non-cooperative equilibrium may reduce equilibrium tax rates in all countries.

*Keywords: Corporate income, capital income, taxation, tax competition, minimum tax, tax coordination, Stackelberg*

*JEL Classification: H87*

ZUSAMMENFASSUNG

**Mindeststeuern können Steuerwettbewerb verstärken**

Diese Arbeit untersucht Steuerwettbewerb als Stackelberg-Spiel. Als zentrales Ergebnis zeigt sich, dass die Einführung einer unteren Grenze für die Höhe der von Ländern wählbaren Steuersätzen zu einer Senkung der Steuersätze im Gleichgewicht führen kann. Die politisch häufig geforderte Einführung von Mindeststeuersätzen im Bereich der internationalen Kapitalbesteuerung kann also im Vergleich zur angestrebten Wirkung genau die gegenteiligen Effekte haben.

* I thank Marie-Laure Breuillé, Clemens Fuest, Tim Goodspeed, Andreas Haufler, Peter Birch Sørensen and Tanguy van Ypersele for comments. The usual caveat applies.

# 1 Introduction

Europe is currently facing a period of strong corporate income tax competition. Multinationals can, by various means, easily relocate their accounting profits to low-tax countries inside the EU. 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] 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). However, despite the fears that a downward spiral in the effective corporate tax rates in Europe will continue, such a minimum tax rate on corporate income has not been implemented, not even at a level that is lower than the tax rates chosen by the countries in an uncoordinated equilibrium.

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). A minimum tax that is lower than the lowest observed tax rates in the union has not been discussed, perhaps because it is believed that such a constraint would have no effect. However, this intuition is misleading. A minimum tax rate that is lower than the lowest tax rate in the unconstrained equilibrium may have strong strategic effects. I show that it may induce all countries to make their tax rates lower than those they choose in the unconstrained equilibrium.

A comprehensive survey of capital tax competition is that of Fuest, Huber and Mintz (2005) who also discuss the literature on a number of aspects of

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

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 1998, Wang 1999, Hvidt and Nielsen 2001). Wang (1999) is closest to the current paper and it also reveals strategic implications of minimum taxes that emerge in a Stackelberg framework. Apart from addressing commodity taxation and cross-border shopping instead of taxes on capital income at source, a major difference is that 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, while in this paper I consider a minimum tax that is strictly lower than all tax rates that emerge in the unconstrained Stackelberg equilibrium. Wong finds that the country with the higher tax rate may adjust its equilibrium tax rate downwards as a result of the 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. 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 opti-

mal tax rate choices for a given tax rate of $j$ are single-valued, upward sloping throughout[2] 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 $N$.

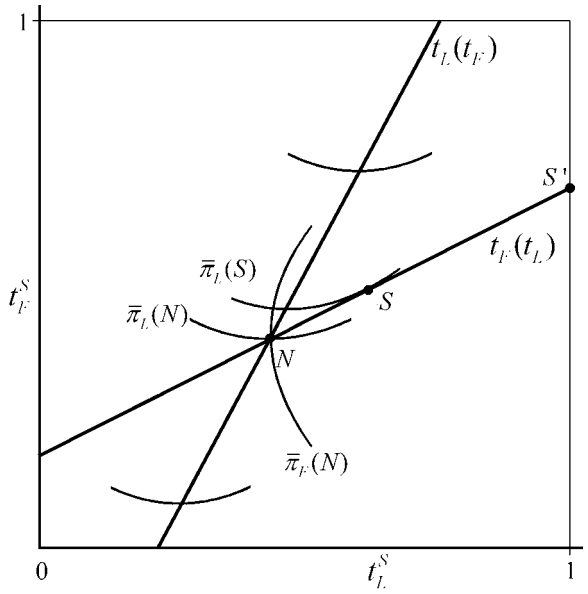


*Figure 1*

Consider now sequential games 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

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

function of $F$. The Stackelberg equilibrium $S$ in Figure 1 is characterized by tax rates

$$t_L^S \equiv \arg \max_{t_L \in [0,1]} \{\pi_L(t_L, t_F(t_L))\}, \text{ and } t_F^S = t_F(t_L^S). \quad (1)$$

In Figure 1 each tax rate combination is mapped into a pair of countries' payoffs, for the whole area of possible tax combinations. The point $S$ is identified as the point for which $L$ attains the highest payoff $\pi_L$ 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 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.

Note that $S = (t_L^S, t_F^S)$ is necessarily to the upper right of $N$: the iso-payoff curve $\bar{\pi}_L(N)$ has a slope of zero at the Nash equilibrium $N$, as this point is on $L$'s reaction function $t_L(t_F)$. Accordingly, this iso-payoff curve intersects $t_F(t_L)$ at $N$ from the upper left to the lower right. By continuity and quasi-concavity, this yields a lower payoff than in $N$ for all tax rate combinations along $t_F(t_L)$ on the lower left to $N$, and a whole set of tax rate combinations along $t_F(t_L)$ to the upper right of $N$ need to have higher payoff than $\bar{\pi}_L(N)$ for $L$ by the continuity properties of the payoff function $\pi_L$.

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 (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

$$\hat{t}_i(t_j) = \begin{cases} t_i(t_j) & \text{for} \quad t_i(t_j) > t_F^S - \epsilon \\ t_F^S - \epsilon & \text{for} \quad t_i(t_j) \leq t_F^S - \epsilon \end{cases} \quad \text{for } i, j \in \{L, F\} \text{ and } i \neq j. \qquad (2)$$

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

$$t_L^0 \equiv \arg \max_{t_L \in [t_0, t_L^S]} \{\pi_L(t_L, \hat{t}_F(t_L))\} \text{ and } t_F^0 \equiv \hat{t}_F(t_L^0). \qquad (3)$$

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

Consider now $\epsilon \to 0$. The iso-payoff curve $\bar{\pi}_L$ that passes through $S$ has a strictly positive slope at $S$. For sufficiently small but positive $\epsilon$ 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 (3) is therefore given by

$$\hat{t}_L(t_0) = \max\{t_0, t_L(t_0)\}. \tag{4}$$

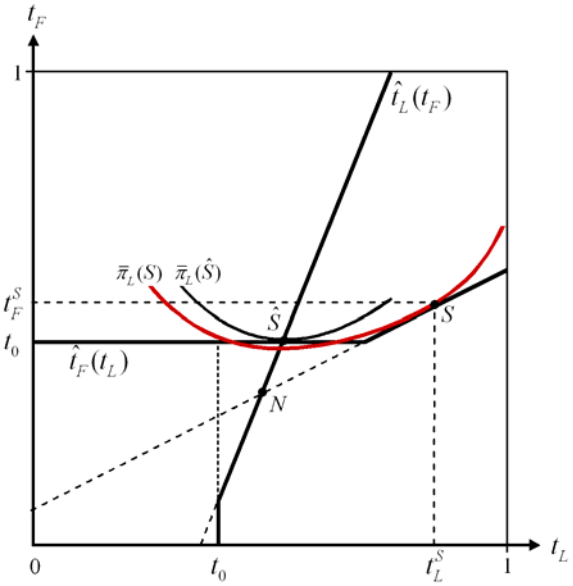


Figure 2a

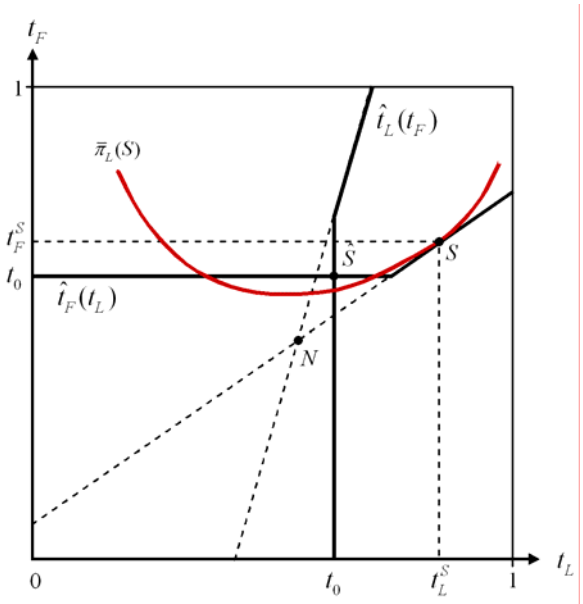


Figure 2b

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. Note also that the leader could gain and the follower would lose from the introduction of such a minimum tax.[3] Intuitively, tax rates are strategic complements. If the Stackelberg leader were to reduce his tax rate compared to $t_L^S$ in the unconstrained Stackelberg equilibrium, the follower would react by a reduction of his tax rate. This reduction is unpleasant for the leader. However, if the minimum tax is only slightly below the tax chosen by the follower in the unconstrained equilibrium and the leader reduces his tax, the follower would like to reduce his tax, but the scope for such a reduction is very limited. The follower cannot reduce his tax to below the minimum tax. Hence, if the leader cuts his own tax rate substantially, he need not fear that there will also be a large unpleasant strategic reaction by the follower, as the follower's scope for a tax cut is limited. The follower's tax rate is lowered only a little bit, down to the minimum tax rate. In the new equilibrium the follower would prefer to have an even smaller tax rate, but is constrained by the minimum tax, whereas the leader chooses the optimal reply to this minimum tax among the feasible replies.

# 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 equilib-

[3] 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 $S$.

rium in which all countries choose a lower tax rate than in the unconstrained equilibrium.

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