Regional Science and Urban Economics 46 (2014) 18–26

Contents lists available at ScienceDirect

Regional Science and Urban Economics

journal homepage: www.elsevier.com/locate/regec

Endogenizing leadership and tax competition: Externalities and public good provision☆

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ARTICLE INFO

Article history:
Received 18 June 2013
Received in revised form 4 November 2013
Accepted 28 January 2014
Available online 9 February 2014

JEL classification:
H30
H87

Keywords:
Endogenous timing
Tax competition
Externality
Stackelberg

ABSTRACT

This paper analyzes the issue of leadership when two jurisdictions are engaged in tax competition and capital tax revenues are used to finance the provision of local public goods. For that purpose we consider a timing game between the two asymmetric jurisdictions. On the first stage jurisdictions decide to move early or late and on the second stage they choose their tax rates. If jurisdictions differ with respect to population sizes or with respect to preferences for public goods, the Subgame perfect equilibria (SPE) are the two sequential Stackelberg outcomes. If jurisdictions differ with respect to productivities or with respect to capital endowments, the SPE are (i) the two sequential Stackelberg outcomes, (ii) the simultaneous Nash outcome at which both jurisdictions move early or (iii) the single sequential Stackelberg outcome at which the more productive or capital-poorer jurisdiction leads. The differences between the SPE (i)–(iii) are explained with the help of the externalities caused by the jurisdictions' tax rates.

1. Introduction

From the seminal papers of Zodrow and Mieszkowski (1986), Wilson (1986) and Wildasin (1988) it is known that capital tax competition leads to inefficiently low tax rates (also called race to the bottom) and to an underprovision of public goods. Moreover, Bucovetsky and Wilson (1991) studied asymmetric capital tax competition, where jurisdictions differ in population size, and point out that small jurisdictions set lower tax rates than large jurisdictions.[1] The reason for the inefficiency lies in the externalities imposed by the jurisdictions. When setting its tax rate a jurisdiction ignores that its tax rate affects the tax revenues of the other jurisdictions and the interest rate which in turn changes the income of other jurisdictions' residents. Wildasin (1989) and DePeter and Myers (1994) denote the former as fiscal externality and the latter as pecuniary externality.

Recently, parts of these results are challenged by Kempf and Rota-Graziosi (henceforth KR) (2010) who endogenized the timing of decisions by the jurisdictions. Konrad and Keen (2013) point out in their survey on the theoretical analysis of tax competition that "… timing is an essential aspect in strategic games." That is insofar an important issue because it is not clear why jurisdictions should commit to choose tax rates simultaneously. To address that commitment problem Kempf and Rota-Graziosi (2010) follow the literature on duopoly games (i.e. Hamilton and Slutsky, 1990) and analyzed a two stage timing game. At the first stage jurisdictions commit to move early or late and at the second stage they choose their tax rates. This timing game is also called leadership game. Kempf and Rota-Graziosi (2010) show that the Subgame perfect equilibria (SPE) correspond to the two Stackelberg situations and hence there emerges a coordination problem. Using Pareto-dominance and risk-dominance as selection criteria they solve that coordination issue and deduce inter alia the result that the SPE where the less productive jurisdiction leads risk-dominates the other (KR, Proposition (3) (i)).

Quite recently, Ogawa (2013) elaborates that the results of Kempf and Rota-Graziosi (2010) depend on the partial equilibrium nature of their model and on the form of capital ownership, respectively. Kempf and Rota-Graziosi (2010) assume that capital is owned by absentee owners and hence their model is a partial equilibrium.[2] Within a general equilibrium model Ogawa (2013) assumes that capital is owned by the residents of the jurisdictions and shows that the SPE of the timing game is one simultaneous Nash situation. It is worth mentioning that both in KR and Ogawa jurisdictions differ with respect to productivities and tax

☆ Helpful comments from two anonymous referees are gratefully acknowledged. Remaining errors are the author's sole responsibility.

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[1] Pieretti and Zanaj (2011) show that the latter results depend on the costs of capital mobility.

[2] Laussel and Le Breton (1998) point out that this modeling is also compatible with a general equilibrium model if a political economy approach is considered and the welfare function belongs to the median voter. Capital ownerships are distributed over the jurisdiction's residents and it is assumed that the median voter comes away empty-handed with respect to capital ownership. We do not pursue that interpretation in the sequel.

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http://dx.doi.org/10.1016/j.regsciurbeco.2014.01.006

revenues are recycled lump sum to residents. Hence, in both papers there is no underprovision of public goods which is one of the main issues in the tax competition literature (see our remarks in the first paragraph).

The present paper aims to analyze the leadership game when governments compete for capital in order to provide public goods. Before we turn to specific tax competition games with public good provision, we apply results from Hoffmann and Rota-Graziosi (2011) to employ in a general tax competition setting the role of externalities. It turns out that the signs of the externalities determine second-mover incentives and hence the SPE of the timing game. More specifically, if both jurisdictions cause positive externalities in the Nash and Stackelberg games both jurisdictions have second-mover incentives. Since jurisdictions always have a first-mover incentive, the SPE of the timing game are both the sequential Stackelberg equilibria. In contrast, if the externalities inflicted on the jurisdictions are opposite in sign in the Nash game and in the Stackelberg game, both jurisdictions have a second-mover disincentive, and the SPE is the Nash equilibrium at which both countries choose their tax rates early.

Next, we investigate specific tax competition models at which governments provide public goods. Jurisdictions are asymmetric with respect to productivities, population sizes, and preferences for public goods or capital endowments. For the sake of specific results we follow Bucovetsky (1991, 2009) and consider linear utility functions and quadratic production functions. If jurisdictions differ with respect to population sizes or preferences for public goods, the externalities turn out to be positive and the SPE of the timing game are the two Stackelberg equilibria. If jurisdictions differ with respect to productivities or capital endowments we get three cases: the SPE of the timing game are (i) the two sequential Stackelberg outcomes, (ii) the simultaneous Nash outcome at which both jurisdictions move early or (iii) the single Stackelberg outcome at which the more productive or capital-poorer jurisdiction leads.

The SPE (iii) is new in the literature and does not emerge in the framework of Kempf and Rota-Graziosi (2010) and Ogawa (2013). The driving force for that SPE is that the externalities are opposite in sign at the Nash equilibrium and at one Stackelberg equilibrium but equal in sign at the other Stackelberg equilibrium. If the jurisdiction that is inflicted by a negative externality, say a, is Stackelberg leader it chooses a lower tax rate relative to the Nash equilibrium. Tax rates are strategic complements and hence the jurisdiction b reacts by also reducing its tax rate relative to the Nash level. Moving from the Nash equilibrium to that Stackelberg equilibrium improves the welfare of the leader a and reduces the welfare of the follower b. Jurisdiction b has a second-mover disincentive. If the jurisdiction b that is inflicted by a positive externality is now Stackelberg leader it chooses a higher tax rate relative to the Nash equilibrium and jurisdiction a reacts by increasing its tax rate relative to the Nash level. Comparing this Stackelberg equilibrium with the Nash equilibrium reveals that at the Stackelberg equilibrium the externalities imposed on both jurisdictions are now positive with the consequence that not only the leader b but also the follower a gains welfare when moving from the Nash equilibrium to the Stackelberg equilibrium at which b leads. Since jurisdiction a has a second-mover incentive and jurisdiction b has a second-mover disincentive, the SPE of the timing game is the sequential outcome at which b leads.

The rest of the paper is organized as follows: Section 2 sets up three tax competition games where we leave the specification of the jurisdictions' welfare function open. Furthermore, Section 2 clarifies the relationship between externalities and first-order and second-order incentives and the relationship between the externalities and the SPE of the timing game. Section 3 introduces a specific tax competition model with linear utility functions, quadratic production functions and public good provision. For different asymmetries we determine the SPE of the leadership game. Section 4 provides some concluding remarks.

2. General tax competition games

In this section we study three tax competition games: a simultaneous Nash game and two sequential Stackelberg games. For that purpose we consider two jurisdictions a and b that are engaged in tax competition. To allow for different settings at the moment we leave the welfare function $W^i(t_i,t_j)$ of jurisdiction $i \in \{a,b\}$, which depends on its own tax rate t_i and on jurisdiction j's $(j \in \{a,b\}), j \neq i)$ tax rate t_j, unspecified. The welfare function is assumed to be continuous in t_a and t_b and the strategy sets are assumed to be compact, i.e. $t_i \in [\underline{t}_i, \overline{t}_i]$, $i = a,b$, where $\underline{t}_i$ and $\overline{t}_i$ is the upper and lower bound of jurisdiction i's tax rate, respectively. Throughout, the rest of the paper we restrict our attention to both interior Nash and Stackelberg equilibria.

2.1. Assumptions

At the simultaneous game the government of jurisdiction i maximizes its welfare $W^i(t_i,t_j)$ with respect to t_i taken as given the tax rate t_j of the other jurisdiction. The first-order conditions $W^i_{t_i}\left(t_i^N, t_j^N\right) = 0$ for $i,j \in \{a,b\}, i \neq j$ implicitly determine the Nash equilibrium tax rates (t_a^N, t_b^N) of the simultaneous game G^N. To have a well-behaved Nash game, we make

Assumption 1. *The welfare function of jurisdiction i*

(i) *is concave in its own tax rate* $\left(W^i_{t_i t_i} < 0\right)$,
(ii) *has a positive second cross-derivative* $\left(W^i_{t_i t_j} > 0\right)$,
(iii) *satisfies* $\left|\frac{W^i_{t_i t_j}}{W^i_{t_i t_i}}\right| < 1$

for $i,j \in \{a,b\}$ *and* $i \neq j$.

Under Assumption 1(i) and (ii) best-response curves are sloping upwards i.e. if jurisdiction j increases its tax rate jurisdiction i reacts by choosing also a higher tax rate. This property is well known as strategic complementarity and often assumed and satisfied, respectively, in tax competition models (see Konrad and Schjelderup, 1999 or Bucovetsky, 2009). Assumption 1(i) ensures that the best response is a function (and not a correspondence) and the strategic complementarity[3] ensures that a Nash equilibrium of the simultaneous game exists (Tangourdeau and Ziad, 2011). Assumption 1(iii) requires that the slope of the best-response curve is smaller than one and is sufficient for the uniqueness of the Nash equilibrium.

Whereas up till now we have portrayed jurisdictions playing Nash against each other in a game characterized by the simultaneous choice of tax rates, we now turn to Stackelberg games which are games of sequential choice of tax rates. In the Stackelberg game G^i jurisdiction i leads and jurisdiction j follows. As follower jurisdiction j chooses its tax rate t_j for given tax rate t_i of jurisdiction i according to the first order condition

$$W^j_{t_j}\left(t_j^F, t_i\right) = 0 \tag{1}$$

for $i,j \in \{a,b\}$ and $i \neq j$. (1) determines the followers best response $t_j^F(t_i)$. The leader maximizes its welfare taking into account the best response of the follower. Then the welfare function of the leader is

[3] The strategic complementarity implies that the Nash game is supermodular.