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Even small trade costs restore efficiency in tax competition

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ABSTRACT

We introduce transport cost of trade in products into the classical Zodrow and Mieszkowski (1986) model of capital tax competition. It turns out that even small levels of transport cost lead to a complete breakdown of the seminal result, the underprovision of public goods. Instead, there is a symmetric equilibrium with efficient public goods provision in all jurisdictions.

1. Introduction

More than 25 years ago, the seminal contributions by Zodrow and Mieszkowski (1986) and Wilson (1986) set the starting point for a vast and still growing theoretical literature on capital tax competition.[1] In this line of literature, tax competition is mainly interpreted as tax competition for mobile capital. Accordingly, the models focus almost entirely on factor markets for (mobile) capital and (immobile) labor or land. In the background, a perfectly competitive product market without any friction closes the model.[2] However, one might argue that, whereas perfect mobility of (financial) capital is a plausible assumption, zero cost of trading products between countries is not, except for some special cases.

In this short paper, we introduce transport cost of trade in products into the Zodrow and Mieszkowski (1986) model and derive the tax competition equilibrium.[3] It turns out that the existence of transport cost leads to a complete breakdown of the main result, i.e. the underprovision of public goods. Instead, a symmetric equilibrium emerges in which all countries choose an efficient level of public goods provision. The rationale of this insight is that transport cost in the product sector imply that small differences in prices across countries do not give rise to international arbitrage. Since the balance of payments requires that trade in goods is accompanied by capital flows, imperfect arbitrage on the product market translates into a certain "stickiness" of capital. This allows governments to adjust their capital tax rates until the efficient solution is reached. It is important to note that even small levels of transport costs suffice to switch from inefficiently low levels of public goods provision to efficiency.[4] Hence, our result applies not only to tax competition on the international level, but also to tax competition between sub-national governments, where trade costs are rather low (but not zero).

Our findings certainly do not imply that there is no tax competition in the real world. They do suggest, though, that neglecting trade is not a safe assumption in the classical tax competition model. When even a small transport cost leads to a drastic change in model results, we may conclude that a thoroughly modelled trade

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[1] Literally hundreds of papers have since then explored the robustness of the results to various changes in the modelling approach and a great variety of extensions, many of which are surveyed in Wilson and Wildasin (2004) and Fuest et al. (2005).

[2] Zodrow and Mieszkowski (1986) do not mention the product market explicitly, whereas Wilson (1986) assumes the existence of two private consumption goods, a local one and a national one, the latter of which is costlessly tradable across regions.

[3] We focus on the basic framework introduced by Zodrow and Mieszkowski (1986), but our results concern the Wilson (1986) model as well. See footnote 14 for how our contribution relates to the analysis in Wilson (1987).

[4] Our argument is thus an application of the Diamond (1971) paradox. See Konrad (2010) for another application of this paradox to tax competition. He considers a model with firm mobility, where firms face search costs, which arise because getting information on the true effective corporate tax rate is costly. This leads to a small, though decisive reduction in firm mobility and allows for an efficient tax competition equilibrium.

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side is desirable and may even yield additional (and so far neglected) insights into the welfare properties of tax competition.

The remainder of the paper is organized as follows. Section 2 presents the basic model assumptions. In Section 3 we characterize the market equilibrium for given capital tax rates. Section 4 then turns to the equilibrium of the tax competition game between the countries. Section 5 briefly discusses the results and concludes.

2. Setup

We consider the Zodrow and Mieszkowski (1986) framework in the version presented by Hoyt (1991),[5] and augment it by a transport sector. If transport costs are assumed to be zero, the model boils down to the original one.

There are $n \geqslant 2$ countries. As country indices we use i, $j \in \{1,\ldots,n\}$. Each country hosts a large number of perfectly competitive firms with mass of unity. The representative firm in country i uses k_i units of capital in order to produce a good according to the production function $F(k_i)$, which satisfies $F' > 0 > F''$ and the Inada condition $\lim_{k_i \to 0} F'(k_i) = \infty$.[6] Capital is rented at the world capital market at an interest rate of $r > 0$. Denoting the price of the good produced in country i by p_i and the (source-based) capital tax rate set by country i by $t_i > 0$, the after-tax profits of the firm located in country i are

$$\pi_i = p_i F(k_i) - (r + t_i) k_i. \tag{1}$$

The first-order condition of profit maximization reads

$$p_i F'(k_i) - t_i = r. \tag{2}$$

This condition implies that the after-tax marginal return to capital, $p_i F(k_i) - t_i$, equals the interest rate r and, thus, is equalized across countries.

Each country is populated by a large number of households which is, again, normalized to unity. The representative household in country i derives utility from private consumption c_i and publicly provided goods g_i according to the utility function $u_i = U(c_i, g_i)$ with $U_c, U_g > 0 > U_{cc}, U_{gg}$. The household is endowed with savings of $\bar{k}$ which are invested at the world capital market. The household's income is given by interest income $r\bar{k}$ and after-tax firm profits π_i. This income is used to purchase c_{ii} units of the consumption good from firms in country i and c_{ij} units of the consumption good from firms in country $j \neq i$. If purchased from firms in country i, the consumption good has a price of p_i. If purchased in country $j \neq i$, i.e. abroad, the price is p_j and a transport cost $\tau \geqslant 0$ per unit of the good applies. The budget constraint of country i's household is

$$r\bar{k} + \pi_i = p_i c_{ii} + \sum_{j \neq i}^{n} (p_j + \tau) c_{ij}. \tag{3}$$

Total consumption of the household in country i equals the sum of consumption from all countries, i.e. $c_i = \sum_{j=1}^{n} c_{ij}$, where the units produced in different countries are perfect substitutes in consumption.

Each government has only one tax instrument, the unit tax on capital. Governments purchase private consumption goods and transform them into the publicly provided good on a one-to-one basis. The government in country i purchases g_{ii} units in its own country and g_{ij} units in country $j \neq i$. Its budget constraint reads

$$t_i k_i = p_i g_{ii} + \sum_{j \neq i}^{n} (p_j + \tau) g_{ij}. \tag{4}$$

Total public consumption in country i amounts to $g_i = \sum_{j=1}^{n} g_{ij}$.

Transport services are provided by a competitive sector which is exempt from corporate taxation and has a linear production function. The only input is capital. Shipping of one unit of the consumption good requires $\theta \geqslant 0$ units of capital including the original case of $\theta = 0$. Profits of the transport sector are given by

$$\pi^{\tau} = (\tau - \theta r) \sum_{i=1}^{n} \sum_{j \neq i}^{n} (c_{ij} + g_{ij}). \tag{5}$$

Perfect competition reduces these profits to zero from which follows

$$\tau = \theta r. \tag{6}$$

Zero profits and tax exemption imply that we neither need an assumption onto whom the transport firms belong nor on, where they are located.[7]

Finally, the equilibrium condition for the world capital market reads

$$\sum_{i=1}^{n} \left(k_i + \theta \sum_{j \neq i}^{n} (c_{ij} + g_{ij}) \right) = n\bar{k}. \tag{7}$$

It equates the world capital demand of the production firms and the transport sector to the world capital supply of the households.

Note that, due to the assumptions of structurally identical countries and homogenous products, trade only arises in our model if there is a positive difference between domestic and import prices. For example, if p_i is larger than $p_j + \tau$, then products are exported from country j to country i. In the symmetric equilibrium, though, no trade occurs at all. But this does not imply that trade is irrelevant. On the contrary, the threat of trade restrains countries in their tax policy as will be demonstrated below.[8]

3. Market equilibrium

In this section we analyze the equilibrium of private markets (capital, transport and product markets), taken as given the capital tax rates of the countries. As a benchmark, we first briefly consider the case without transport cost, in order to replicate the original result, and then turn to the case of positive transport cost.

3.1. Zero transport cost

Assume $\theta = 0$ and, thus, $\tau = 0$. According to the standard arbitrage argument, the price of the consumption good has then to be the same in all countries. Otherwise, all consumers purchase the good solely in the country with the lowest price, implying that demand in all other countries is zero. However, the Inada condition and (2) render supply in all countries positive and, thus, prevent such a market equilibrium. Normalizing the common price to unity we obtain[9]

[5] While Hoyt (1991) considers the general case with an arbitrary number of countries, Zodrow and Mieszkowski (1986) focus on the case of infinitesimally small countries which is obtained as special case of the Hoyt (1991) model if the number of countries converges to infinity.

[6] We can replace the Inada condition by the weaker condition $F(0) = 0$. This would leave our results completely unchanged, but comes at the cost of much more complicated proofs.

[7] Assuming that the transport sector is taxed actually does not change the main insights. However, such an assumption adds a number of complexities arising from the endogeneity of equilibrium transport costs and the necessity of assuming the location and ownership of transport firms.

[8] In fact, the same argument can be applied to the whole class of models following Zodrow and Mieszkowski (1986).

[9] The equilibrium condition for the common product market is $\sum_{i=1}^{n} \sum_{j=1}^{n} (c_{ij} + g_{ij}) = \sum_{i=1}^{n} F(k_i)$. With the help of 1,3 and 4 it is straightforward to show that this condition is always satisfied as identity, which reflects Walras' law in case of zero transport cost. Hence, we can follow Zodrow and Mieszkowski (1986) and ignore this equilibrium condition.