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TAX COMPETITION AND THE NATURE OF CAPITAL

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ABSTRACT

Tax Competition and the Nature of Capital*

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ABSTRACT

The standard race-to-the-bottom result is curious in one respect. If a nation wants to attract foreign capital, providing the optimal level of public amenities (and thus charging the optimal tax rate) would seem optimal. This conjecture fails in the standard tax competition model since foreign capital ignores host nation amenities. While this assumption is reasonable for physical capital, other forms of capital (human capital) tends to move with its owner, so amenities matter. We show that when factors move with their owners, symmetric international tax competition may leads to the socially optimal rate. This result can be thought of as a corollary of the Tiebout efficiency hypothesis.

Keywords: Tax Competition, Tiebout hypothesis

1. INTRODUCTION

At one level, the result that tax competition leads to an under provision of public goods is somewhat curious. If a nation wants to attract foreign capital, providing the optimal level of public amenities (and thus charging the optimal tax rate) would seem to be a good place to start. In the tax competition literature in general, this conjecture is wrong since foreign capital does not benefit from the host nation's amenities; capital is assumed to spend its income in its home nation regardless of where it is employed. This may seem reasonable and relevant when speaking about physical capital – it is quite easy for physical capital owners to be physically separated from their capital. However for many other forms of capital, especially human capital, it is not easy to employ the factor without its owner being present physically. The same can be said for most forms of labour services.

The importance of this point lies in the fact that assuming that capital owners move together with their capital produces a stark result. When factors move with their owners, international tax competition may lead to the socially optimal tax rate. In other words, tax competition may be harmless. In particular, when all factor owners share the same tastes and governments maximise national welfare, the Nash equilibrium tax rate is the first-best rate. This is certainly not a new result to public economics – it is basically a corollary of the famous Tiebout efficiency hypothesis[1] – but it does highlight the sort of assumptions that are necessary to generate harmful tax competition.

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[1] Tiebout (1956) mainly concerns sorting of consumers by their preferences for public goods, but he also asserts that "On the production side it is assumed that communities are forces to keep production costs at a minimum either through the efficiency of city managers *or through competition from other communities*. (p. 422 emphasis added)"

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To illustrate the importance of the nature of capital, fix ideas and introduce notation in a familiar setting, the paper first quickly reviews the standard race-to-the-bottom result. Then we show that when capital is human capital, the tax competition is harmless in the sense that the equilibrium tax rate in a Nash tax game is the same with and without capital mobility. The final section presents our concluding comments.

2. HARMFUL TAX COMPETITION: PHYSICAL CAPITAL

We first briefly review the major contributions to this literature and then – to fix ideas fix ideas and notation – we briefly re-derive the well-known race to the bottom result. This provides a benchmark for the subsequent section that shows the result may be reversed for human capital.

The Standard Tax Competition Literature

The modern literature on tax competition (see Wilson 1999 for a recent survey) focuses on capital that is 'disembodied' in the sense that capital can work in one location while its owner spends its reward in another region; physical capital and knowledge capital are common forms of disembodied capital. The central result here is that international tax competition for a mobile tax base leads to sub-optimally low taxes and under-provision of public goods. This was pointed out in the context of mobile capital by Oates (1972), and formalised by e.g. Gordon (1983), Zodrow and Mieszkowski (1986), Wilson (1986), and Wildasin (1988), with subsequent important contributions from de Crombrugghe and Tulkens (1990), Bucovetsky (1991), Wilson (1991), Wildasin (1991), and Kanbur and Keen (1993). A major proviso to the sub-optimal-taxation result is the so-called Leviathan government hypothesis, which asserts that self-interested policy makers tend to set taxes too high, so the race-to-the-bottom thus may actually yield a second best improvement (see Edwards and Keen 1996).

The sub-optimal taxation stems from the negative externality that arises when jurisdictions non-cooperatively select tax rates, in part to attract a mobile tax base from another jurisdictions. Perhaps most obvious externality of a tax change on factors that are mobile is the effect on other regions' budgets, what Wildasin (1989) has labelled the "fiscal externality". A second type of externality is that the tax policy in a large region may affect factor returns in another region. This type of "pecuniary externality" has been analysed by Bucovetsky (1991), de Crombrugghe and Tulkens (1990), Wilson (1991) and Wildasin (1988,1991). A result in this setting is that there is a "small country advantage". When a large country lower its tax on capital there is a large increase in the demand for capital and consequently a large fall in the return of capital. A small country, on the contrary, can lower its capital taxes without much negative effect on the after tax return to capital. Finally, some studies have analysed tax competition in a setting where imperfect competition is the driving externality. For example, Janeba (1998) adds tax competition into a strategic trade model. In this setting taxes are competed down to zero.

2.1.1 The Basic Model

Our version of the 'standard tax competition model' (STCM) involves two nations, which we call home and the rest of the world, and two factors of production, which we call

capital K and labour L.[2] Each Walrasian (perfect competition and constant returns) economy produces the same, homogenous private good using these two factors. This good is traded costlessly, so international prices are equalised; factor prices are not equalised since there are more factors than goods. Capital is viewed as physical capital in that it can move internationally without its owner, and indeed, labourers are assumed to be perfectly immobile.

The sole role of government in the model is to set the tax rate, and collect tax revenue that it turns costlessly into a public good. Capital and labour are taxed in the nation in which they are employed (origin principle). For simplicity, the tax rate on labour and capital are identical. Technology for home and rest of world is given by the standard neoclassical production function:

(1) $$Y = F[K, L]; \qquad F_L, F_K, F_{KL} > 0 > F_{KK}, F_{LL}, \quad Y = LF_L + KF_K$$

where subscripts indicate partials, as usual. The restrictions on the partial derivatives impose constant returns and diminishing marginal products.[3] For convenience the good's price is normalised to unity everywhere.

Consumers, who own either labour or capital, have the same preference, which, to be concrete, we assume are given by the simple, explicit function:

(2) $$U = G^\gamma C^{1-\gamma}$$

where G is a public good (this is provided only by government) and C is consumption of the good, and the Cobb-Douglas parameter γ measures the strength of preferences for the public good. Rest-of-world consumers have identical tastes. We assume that U is homogenous of degree one.

2.1.2 Capital Mobility and Taxation

Capital is assumed to be either perfectly mobile, or perfectly immobile. When capital is mobile, the amount of capital working in a nation may differ from the amount of capital owned by a nation, so we need separate notations for these to concepts. We use 'n' and 'n*'to indicate the amount of the mobile factor that is <u>employed</u> in home and in the rest of the world, respectively, while K and K* indicate the amount of capital that each nation <u>owns</u>. The national capital endowments are fixed, so we can without further loss of generality choose units such that the world's fixed capital stock K^w is normalised to unity i.e. n+n*=K^w=1.

The spatial allocation of capital is determined by the equalisation of post-tax rates of return when capital is perfectly mobile. When capital is assumed to be perfectly immobile, the spatial allocation is fixed by endowments. Since factors are paid their marginal products, we can write the location conditions as:

(3)
$$\pi(1-t) = \pi*(1-t*), \qquad \textit{with K mobile}; \quad \pi \equiv F_K[n, L], \colon \pi* = F_K[1-n, L*]$$
$$n = K, \quad n* = K*, \qquad \textit{with K immobile}$$

where 't' and L are home's tax rate and labour force, while t* and L* are the corresponding variables for rest-of-world; π and π^* are the rewards to capital in home and the rest of the world, respectively.

2.1.3   Government's Problem and the Social FOC

The two governments play Nash in tax rates, so taking the rest-of-world tax rate as given, the home government's problem is to choose the tax rate, t, to maximise welfare of the representative consumer subject to (3) and a balanced budget requirement, i.e.:

(4) $\qquad \max_t U[G,C], \text{ where } G = tY, \quad C = (1-t)I$

where Y=F[n,L] is GDP, i.e. the home tax base, and (1-t)I is home after-tax GNP.[4] Also, G is a public good (this is provided only by government), and we have assumed that the cost of G is unity, so home's provision of the public good just equals home's tax revenue.[5] Also, since factors are paid their marginal product, home GNP is:

(5) $\qquad I = F[n,L] - F_K[n,L]n + F_K[n,L]K$

The government's first order condition is:

(6) $\qquad \dfrac{U_G}{U_C} = \dfrac{-dC/dt}{dG/dt} \quad where \quad \dfrac{-dC/dt}{dG/dt} = \dfrac{I}{Y\left(1 + \dfrac{dn/n}{dt} t\eta\right)}; \quad \eta \equiv \dfrac{n\partial F}{Y\partial K}$

Here the left-hand side of the first expression is the marginal rate of substitution between private and public goods, i.e. the social benefit of higher tax revenue. On the right-hand side (RHS) of the second expression, $\eta>0$ is the capital-output elasticity and dn/dt is the responsiveness of capital to northern taxes, taking the southern tax rate as given.[6]

Totally differentiating the location condition, (3), we find:

(7) $\qquad \dfrac{dn/n}{dt} = \dfrac{F_K/n}{(1-t)F_{KK} + (1-t^*)F_{KK}^*} < 0, \quad with\ capital\ mobile,$

$\qquad \dfrac{dn/n}{dt} = 0, \quad with\ capital\ immobile$

Here the F_{KK} terms are negative; these show how fast capital's marginal product declines as capital employment rises.

To solve the game we would specify the rest-of-world first order condition and then use the two conditions to solve for the two tax rates, but we can illustrate the main results without doing so.

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[4] Since some home capital may be working in the rest of the world, it might seem like we should have separate terms for K working in the two nations. However, the location condition (top expression in (3)) ensures that (1-t)F_K=(1-t*)F_K^*, so we can write (1-t)I *as if* all northern capital earned F_K and paid t.

[5] Taxes are collected in the numeraire good Y and thus the assumed production function for G is G=F[K,L] where K and L are hired by the government using the collected Y.

[6] Note that dC/dt=-I+(dI/dn)(dn/dt), but by the envelope theorem dI/dn=0 – basically since there is no distortion between K and L employment, a tax change that induces a small increase in capital employment raises output (GDP) by F_K, but since the extra capital must be paid F_K, there is no change in domestic income (GNP). Note that in many formulations of the STCM only capital is taxed; since the K/L choice is distorted in this case, a tax change that induces extra capital employment does affect national income.

2.2. Symmetric Nation Nash Tax Competition

The left-hand side of the first expression in (6) is the ratio of the marginal social benefit of taxation to the marginal social cost of taxation; the second order conditions of the government's problem ensure that it is downward sloped at the optimum. When capital is immobile, the right-hand side (RHS) of (6) equals unity, so the tax rate is chosen optimally in the sense that the marginal social benefit of taxation, U_G, just equals the marginal social cost, $-U_C$ (note that I=Y when n=K). Thus without capital mobility the social first best is achieved and the equilibrium tax rate is t^S. When capital is mobile the tax rate affects the tax base (i.e. dn/dt<0), so the RHS exceeds unity and this results in a tax rate, t', that is too low. To summarise, we write:

> Result 1 (race to the bottom): The mobility of disembodied capital results in a tax rate that is too low from the social perspective. In this sense, tax competition is harmful.

3. HARMLESS TAX COMPETITION: HUMAN CAPITAL

We now turn to showing that the race-to-the-bottom result is reversed when capital is not disembodied, i.e. when capital and its owner move together as in the case of human capital. To be concrete, we refer to internationally mobile human capital as entrepreneurs.

All assumptions from above are maintained except we now suppose that capital owners must move when capital moves. The preferences of capital owners is identical to that of labourers and the government.

3.1. Nash Competition for Entrepreneurs

The most direct method of establishing that tax competition is harmless when the mobile factor is human capital is to assert that the first-best tax rate is an equilibrium, and then to show that no nation would deviate from this equilibrium.

3.1.1 Deviation Argument

We wish to establish that $t=t^*=t^S$ is a Nash equilibrium of the tax game. To do this, we ask whether home could improve its payoff by varying its tax rate slightly when the amount of capital in the home nation, i.e. 'n', can vary in response to tax differentials. Starting off at $t=t^*=t^S$, any deviation will, by definition of the optimal tax rate, decrease utility of capital-owners in the region. This would result in out-migration of entrepreneurs until utility were re-equalised in the two regions. The resulting loss of human capital would lower the utility of the remaining home residents, so this deviation would not raise the payoff of home government. Consequently, the home government would not deviate from $t=t^*=t^S$. By symmetry, the rest of world government would also not find it optimal to deviate and so would not deviate. This establishes that $t=t^*=t^S$ is a Nash equilibrium.

The Nash equilibrium can also be established more mechanically.

3.1.2 Direct Argument

First note that when capital owners move with their capital, GNP and GDP are always identical (i.e. I≡Y). Moreover, C and G are implicit functions of n and t, since:

(8) $\qquad G = tY, \qquad C = (1-t)Y, \qquad Y = F[n, L]$

Finally, since we have normalised preferences to be homogenous of degree one in G and C, the government's objective function can be written as:

(9) $\qquad\qquad\qquad U = f[t]Y, \;\; where \quad f[t] \equiv t^\gamma (1-t)^{1-\gamma}$

and we note that at the first best (i.e. when human capital is immobile):

(10) $\qquad\qquad\qquad \left(f_t[t^S]\right)Y = 0$

so we know that $f_t=0$ at the first best tax rate.

Now allowing human capital to move, we differentiate (9), using (8), to get the government's first order condition. We evaluate it at our hypothesised equilibrium $t=t^*=t^S$:

(11) $\qquad\qquad\qquad \left(f_t[t^S]\right)Y + f[t^S](Y_n n_t) = 0$

where subscripts indicate partial derivatives as usual. Since this is evaluated at the social first-best, i.e. $t=t^*=t^S$, we know from (10) that the first term sum is zero, but the remaining term only equals zero if $n_t=0$. In other words, our hypothesised equilibrium is indeed Nash, only if a marginal change in t, holding t^* constant, will result in no capital movement. We turn now to evaluating this derivative.

The expression that determines the location of entrepreneurs (human capital) differs from the location condition for physical capital since entrepreneurs care about the provision of public goods as well as the tax rate when making their location decisions. In particular, the condition involves an equalisation of utility levels for capital owners, thus:

(12)
$$U[G, C^k] = U[G^*, C^{k*}], \qquad\quad with\ K\ mobile$$
$$n = K, \quad n^* = K^*, \qquad\qquad with\ K\ immobile$$

where the C^k's are the consumption of capital owners. Note that we can write $U[G,C^k]=f[t]Y^\gamma \pi^{1-\gamma}$ since the income of home-based entrepreneurs is π and G=tY; the expression for C^{K*} is isomorphic. To find n_t when capital is mobile, we totally differentiate the top expression in (12) to get:

(13) $\quad Y^\gamma \pi^{1-\gamma}\left(f_t[t^S]\right)dt + f[t^S]\left(\dfrac{\partial(Y^\gamma \pi^{1-\gamma})}{\partial n}\right)dn = f[t^S]\left(\dfrac{\partial(Y^{*\gamma}\ \pi^{*1-\gamma})}{\partial n}\right)dn$

and then collect terms in 'dn' and 'dt'; n_t is the ratio of the coefficients on 'dn' and 'dt', where all the partials are evaluated at our hypothesised equilibrium values for the tax rates.

By the definition of t^S, the first term in (13) is zero. This means that the coefficient on 'dt' is zero, so given that (13) holds, the coefficent on 'dn' must also be zero, i.e. dn/dt must also be zero. This confirms that small changes in the home tax rate, starting from the first-best tax rate, has no marginal effect on the location of capital.

Intuition for this seemingly remarkable result is quite straightforward. It relies on the fact that the mobile factor and the government share the same tastes over the tax rate. At the social first-best tax rate, we know that marginal changes in the tax rate have no impact on the value of the objective function; the 'hilltop' is flat. Thus a small change in t, also implies no change in U. With no change in U, we know the U=U* at the initial geographical division of capital, so the small change produces no capital migration. To summarise, we write:

Result 2 (Tiebout efficiency and nature of capital): When the mobile factor owners move with their factor, and these owners have the same tastes as the owners of immobile factors, and governments have Benthamite objectives, Nash tax competition over the mobile factor will result in the first-best tax rate being set. In this sense, tax competition is harmless.

As taxes are used to provide public goods and the mobile factors care about local provision of public goods, the mobile factor acts as if they like taxes – at least up to a point. Since mobile and immobile factors have identical preferences, the tax rate that is most attractive to the mobile factor is also the tax rate most preferred by the immobile factor, so the government's attempt to attract the mobile factor ends up maximising social welfare.

Comments on the Result

This result is certainly not a proof that tax competition is harmless. It is a theoretical landmark, or example, that helps us understand exactly what is driving the standard race-to-the-bottom result. In particular, it tells us is that if tax competition is to be harmful then it is necessary to drive a wedge between the government's preferences over taxes and the mobile factor's preferences over taxes.

4. GENERALITY OF THE HARMLESS TAX COMPETITION RESULT

Here we show that the result does not hold for all preferences when G is taken to be a public good.

When we have general preferences, namely, U=U[G,C] and G is a public good so that each home citizen consumes G=tY, then the government's first order condition is:

(14) $$U_G[tY,(1-t)Y](Y+tY_n n_t)+U_c[tY,(1-t)Y](-Y+(1-t)Y_n n_t)=0$$

instead of (11), and at the first best (no capital mobility case, the tax rate is such that $(U_G-U_C)Y=0$, where the partials are evaluated at G=tY and C=(1-t)Y. As above, the Nash equilibrium t's that satisfy that (14) is the same as the first best only if $n_t=0$. But now, the utility of capital is U[tY,(1-t)π], so total differentiation of the location condition, i.e. the top expression in (12), is:

(15) $$U_G[tY,(1-t)\pi](Ydt+tY_n dn)+U_c[tY,(1-t)\pi](-\pi dt+(1-t)\pi_n dn)=0$$

instead of (13). Now because the partials are evaluated at different points, namely C^k versus C as in (14), dn/dt is not necessarily zero.

However, when preferences are separable between 't' and income, we get the harmless result. The point is easily seen. Separability means that the government's objective function is f[t]Y and capital owners' objectives are f[t]h[π,Y].[7] Since at the first-best 't' we always have $f_t[t^S]=0$, total differentiation of the location conditition will always imply dn/dt=0. To see this, note that the total derivative would be:

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[7] The capital-owners' preferences involve Y since G=tY and π since C=(1-t)π.

(16) $\quad h[Y,\pi]\big(f_t[t^S]\big)dt + f[t^S]\left(\dfrac{\partial h[Y,\pi]}{\partial n}\right)dn = f[t^S]\left(\dfrac{\partial h[Y*,\pi*]}{\partial n}\right)dn$

Because the first term is zero, and the partials of h are not zero, dn must also be zero.

5. CONCLUDING REMARKS

This paper shows that when capital moves with its owner, international tax competition for mobile capital may produce socially optimal taxation. This certainly does not prove that tax competition is harmless; rather it is an example that helps clarify exactly what is driving the standard race-to-the-bottom result. In particular, it tells us is that if tax competition is to be harmful then it is necessary to drive a wedge between the government's preferences over taxes and the mobile factor's preferences over taxes. This wedge always exists when capital earnings are repatriated since capital seeks its highest post-tax reward without concern for amenities. However, when capital-owners move with their capital, they do care about the positive aspects of taxation. If they and the government are in agreement over the pros and cons of taxes, then competition for footloose capital-owners will not necessary lead to inefficient tax cutting. Indeed, there is some presumption that regions would strive to offer the preferred point on the tax/amenities trade-off.

Importantly, this result has implications for empirical work. Our result suggests that researchers should be careful to distinguish between taxes that affect disembodied capital and taxes that affect human capital when testing the implications of the standard tax competition model.

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