SOURCE-BASED AND RESIDENCE-BASED CAPITAL INCOME TAXATION IN OPEN ECONOMIES*

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This paper analyzes the optimal mix of source-based and residence-based capital income taxation in a two-country setting with capital mobility. Tax proceeds are used to finance redistributive transfers. Residence based taxation is not distortionary when not evaded or avoided. With tax evasion or avoidance (avoision), it induces distortionary compliance costs while source based taxation implies inefficient externalities through tax competition. The optimal mix chosen by benevolent national governments competing for mobile capial is shown to depend on the relative importance of compliance costs and of capital-mobility-linked externalities.

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1 INTRODUCTION

Over the last decades, members of the E.U. have experienced increasing capital and labor mobility. This along with the process of economic integration lead to a number of positive effects. However, it has also the consequence of making increasingly difficult redistributive policies at the national level. The basic idea is that mobile factors react to any international differentials in taxation or benefits. National governments cannot abstract from tax competition when designing a tax structure.

In this paper we concentrate on the effect of capital mobility on redistribution that is in part financed by a tax on capital income. In fact, if residence-based capital tax were implementable, it would be non-distortionary and avoid the pitfalls of tax competition. In reality, however, residence-based taxation cannot be enforced on capital invested abroad without incurring compliance costs that can be prohibitive. One has thus to resort to source-based taxation which leads to allocative externalities that are inherent to tax competition. To represent the behavior of taxpayers evading or avoiding residence-based taxes by investing their savings abroad, we use the reduced form of Boadway et al. (1994). These authors use a cost of tax evasion or of income concealment, which simply depends on the amount of income evaded.[1]

We consider in this paper a two-country model with mobile capital and immobile labor. Such a setting fits the European reality; it has been studied by a number of authors who generally consider only one type of capital income tax, most often the source-based one.[2] In our model, we assume that each country consists of two classes: workers and capital owners. Two taxes on capital income, a residence-based one and a source-based one, are introduced to finance transfers towards the workers assumedly earning less than capital owners. Each national government maximizes a utilitarian social welfare function and so doing, it must choose the optimal mix of capital taxes taking into account the compliance costs implied by residence-based taxation and the externalities induced by source-based tax competition.

[1] See Mayshar (1991).

[2] See Wildasin (1988)), Bucovetsky and Wilson (1991)), Wilson (1987), Razin and Sadka (1991), Gabszewicz and van Ypersele (1994) and Lopez et al. (1996). See also the survey by Cremer et al. (1995).

2 THE MODEL

Consider an economy composed of two countries (indexed by $i = A, B$). In country i there are N_i workers each endowed with one unit of labor and M_i capital owners, each endowed with $\overline{K}_i/M_i$ units of capital. Both agents supply their endowments inelastically. We assume that labor is immobile whereas capital is mobile. Capital mobility allows capital endowment to be invested in any country so that if we denote by K_i the capital invested in country i we will typically have $K_i \neq \overline{K}_i$. Throughout this note, we distinguish physical capital K_i used in production in country i and financial capital $\overline{K}_i$ owned by residents of country i that can be either trusted to domestic financial intermediaries and then subject to residence-based taxation or invested abroad and then escaping residence-based taxation.

2.1 Production

Both countries use the same constant returns to scale technology. In any country i capital and labor are used as inputs by perfectly competitive firms to obtain a nontraded commodity according to the aggregate production function

$$Z_i = F(K_i, N_i) = N_i f(k_i) \quad with \quad k_i \equiv \frac{K_i}{N_i} \quad i = A, B \tag{1}$$

This output may be seen as the GDP of country i. Normalizing the price of output to equal one, we have the familiar condition that marginal productivities of factors are equated to their prices in competitive markets :

$$f'(k_i) = r + \tau_i \quad and \quad f(k_i) - k_i f'(k_i) = w_i, \tag{2}$$

where w_i denotes the prevailing wage rate in country i and τ_i is a source-based capital tax. Notice that τ_i inserts a wedge between the cost of capital to domestic firms, $r + \tau_i$, and the domestic return on capital, r. The latter is common to both countries due to the existence of perfect international capital market. Conditions (2) can be used to obtain the demand for capital and the factor-price frontier:

$$k_i = k(r + \tau_i) \quad \text{and} \quad w_i = w(r + \tau_i) \tag{3}$$

with $w_i' = -k_i$ to be employed below.

2.2 Workers

All individuals are assumed to have the same well-behaved utility function defined on income. Incomes are however different. For a worker, it is the sum of his wage income and a lump sum transfer, that is

$$y_{wi} = w_i + T_i$$

and his utility function is

$$u_i(y_{wi}) \quad with \quad u_i' > 0, u_i'' \leq 0. \tag{4}$$

2.3 Capital owners

The utility function of capital owners is

$$v(y_{ci}) \quad with \quad v(.) = u(.). \tag{5}$$

The definition of their income, y_{ic}, involves the residence based tax and needs some explanation. In the literature, residence-based capital taxation refers to a tax on residents' capital income regardless of where they have invested their assets. If perfectly enforced, unlike a source-based tax, such a tax is non distortionary with respect to international capital accumulation. In the reality, the tax on foreign income is hardly enforceable. Each capital owner can indeed trust part of his endowment $\overline{k}_i$ to domestic financial intermediaries (or to domestic firms through nominative equity shares), in which case he is subject to the residence-based taxation. Denoting by s_i that part, he obtains $(r - t_i) s_i$ where t_i is the residence-based per unit capital tax. But he can also directly invest $(\overline{k}_i - s_i)$ abroad in which case he evades or avoids the residence-based tax but at an avoision cost $\sigma_i = \sigma(\overline{k}_i - s_i)$.

This function σ_i is assumed to be an increasing $(\sigma_i' > 0)$ and convex $(\sigma_i'' > 0)$ function of the amount of capital invested abroad. It is in fact the reduced form of a more general problem of tax compliance.[3] What is crucial is to realize that σ_i is a real loss for the economy; it encompasses

[3] To explain $\varphi(\overline{k} - s)$, let us cinsider the following simple model: p is the probability of being audited and $\varphi(\overline{k} - s)$ the penalty rate, an increasing function of $(\overline{k} - s)$. Instead of facing the possibility of being audited, the investor can pay some accountants an amount $\sigma(\overline{k} - s)$ that makes his investment detection-proof and yields the same final outcome. In other words, σ is such that

$$(r - t)\overline{k} < (1 - p)[(r - t)s + r(\overline{k} - s)] + p[(r - t)s + (r - t - \varphi)(\overline{k} - s)]$$

$$= (r - t)s + r(\overline{k} - s) - \sigma.$$

One then obtains :

$$\sigma = p(t + \varphi)(\overline{k} - s).$$

the *compliance cost* of the taxpayers when they devote resources to avoision (evasion or avoidance). We can now write the capital owner's income :

$$\begin{aligned} y_{ci} &= (r - t_i) s_i + (\overline{k}_i - s_i) r - \sigma(\overline{k}_i - s_i) \\ &= r\overline{k}_i - t_i s_i - \sigma(\overline{k}_i - s_i) \end{aligned} \tag{6}$$

The capital owner chooses s_i the domestic investment, that maximizes (6). The FOC for an interior solution is :

$$\frac{dy_{ci}}{ds_i} = (r - t_i) - (r - \sigma_i') = 0 \text{ or } t_i = \sigma_i'. \tag{7}$$

It has a simple interpretation : investing abroad stops at the point where the net (of tax or compliance cost) return on capital is the same domestically and abroad.[4]

Optimality condition (7) links the capital income reported for residence-based tax purpose to the per unit tax, t_i (but not on the world return on capital). One indeed obtains :

$$s_i = s(t_i), \tag{8}$$

which is decreasing in t_i thus reflecting the view that increasing evasion is a direct consequence of increasing marginal tax rates.

For example, if we use an exponential compliance cost function such as $\sigma(\overline{k}_i - s_i) = c_i(\overline{k}_i - s_i)^\gamma$ with $\gamma > 1, c_i > 0$, we have $s_i = \overline{k}_i - (t_i/c_i\gamma)^{1/(\gamma-1)}$, which is decreasing in t_i. The parameter c_i measures the cost of compliance. For $c_i = 0, s_i' = -\infty$ and for $c_i \to \infty, s_i' \to \infty$ from below.

[4] To avoid corner solution or at least to assume away an amount of evasion that is either negative or larger than capital endowment, we need $\sigma'(0) = 0$ and $\sigma'(\overline{k}_i) \geqslant t_i$.

2.4 Government

Each national government wishes to undertake some redistribution in favor of its workers assumed to earn less than capitalists. Its tax revenues come from the per-unit tax, τ_i, levied on the capital employed in the domestic country, K_i , and the per-unit tax t_i, levied on the capital reported by its capitalists. These revenues are then transferred to the N_i workers in a lump-sum way. The government budget constraint is simply :

$$\tau_i N_i k\left(r+\tau_i\right)+t_i M_i s\left(t_i\right)=N_i T_i \tag{9}$$

where $N_i k\left(r+\tau_i\right)$ is the domestic demand for capital, and $M_i s\left(t_i\right)$ is the reported savings.

2.5 Capital market

Perfect mobility of capital implies the equalization of the net return on capital across countries. The common rate of return is the solution to the clearing equation in the international capital market :

$$M_i \overline{k}_i+M_{-i} \overline{k}_{-i}=N_i k\left(r+\tau_i\right)+N_{-i} k\left(r+\tau_{-i}\right) \tag{10}$$

This yields $r=r\left(\tau_i, \tau_{-i}\right)$, with :

$$-1<\frac{dr}{d\tau_i}=\frac{-N_i k_i'}{N_i k_i'+N_i k_{-i}'}<0 \tag{11}$$

3 NASH EQUILIBRIUM

In a non-cooperative game setting government i chooses its optimal mix of capital taxes $\{\tau_i, t_i\}$ so as to maximize a utilitarian social welfare function, given the source-based capital tax chosen by the other country, τ_{-i} :

$$\begin{aligned}\max_{\{\tau_i, t_i\}} W_i \;=\; & N_i u\left[w_i\left(r+\tau_i\right)+\tau_i k\left(r+\tau_i\right)+\left(1/N_i\right) t_i M_i s\left(t_i\right)\right]+ \\ & M_i v\left(r \overline{k}_i-t_i s_i\left(t_i\right)-\sigma\left(\overline{k}_i-s\left(t_i\right)\right)\right)\end{aligned} \tag{12}$$

subject to $r=r\left(\tau_i, \tau_{-i}\right)$.

Using (3), (7) and (11), the first order conditions for a maximum of (12) become:

$$t_i=\frac{s_i\left(1-v_i'/u_i'\right)}{-s_i'} \tag{13}$$

and

$$\tau_i=\frac{\left(1-v_i'/u_i'\right) \overline{K}_i-\left(\overline{K}_i-K_i\right)}{-K_{-i}'}. \tag{14}$$

Equation (13) indicates that the tax rate is inversely related to the tax derivative of reported capital and positively to the need of redistribution as expressed by the difference between the two marginal utilities. This difference will be nil with a linear utility and will increase with the degree of concavity of utility functions. When avoision is costly, the tax is high; when the utility function is strongly concave, the tax is also high.

Equation (14) indicates that the source-based tax will depend on three factors : the concern for redistribution $\left(1-v_i'/u_i'\right)$ positively, the level of exported capital $\left(\overline{K}_i-K_i\right)$ negatively, and the tax derivative of capital demand $\left(-\overline{K'}_{-i}\right)$ negatively.

In a symmetric Nash equilibrium, the second term in the numerator of (14) vanishes. Combining (13) and (14), one obtains :

$$\frac{\tau}{t}=\frac{s'}{K'} \frac{\overline{K}}{s} \tag{15}$$

This expression indicates that the optimal mix between τ and t depends on the tax derivative of overall capital demand $\left(K_i'\right)$ and that of reported capital . If, e.g., s_i' is small, that is, avoision costs are high and thus reported capital is hardly affected by residence-based tax, this tax will tend to be relatively high. Another way to write (15) is

$$\frac{\tau/(r+\tau)}{t/(r-t)}=\frac{\varepsilon_s}{\varepsilon_k}$$

where ε_s (alternatively ε_k) is the elasticity of domestic saving (alt. overall capital demand) with respect to the relevant rate of return, $r-t$ (alt. $r+\tau$). This is in line with Ramsey's inverse elasticity formula.

4 A NUMERICAL EXPERIMENT

Our purpose in this section is to analyze by means of numerical illustrations how the two countries interact at the Nash equilibrium. In these examples, countries use the same CRS Cobb-Douglas production function $Z_i = N_i^{\alpha} K_i^{1-\alpha}$ with $\alpha = 3/4$. Initial endowments in capital, $\overline{K}_A$ and $\overline{K}_B$, add up to 200. The number of capitalists who share this endowment stays constant, $M_A = M_B = 5$. We shall consider changes in aversion to inequality in the two countries and see how this affects the non-cooperative equilibrium. Finally we shall allow countries to differ in their compliance costs. We shall assume the functions, $u(y) = v(y)$, to be of the following type :

$$u(y) = v(y) = \frac{1}{\beta} y^{\beta} \tag{16}$$

with $\beta = 0, 1/2$ or 1. As usual, $(1-\beta)$ can be interpreted as a measure of aversion towards inequality. For $\beta = 0, u(y) = log(y)$ while for $\beta = 1, u(y)$ is linear in y. In the latter case, the country does not care about income distribution, its only concern being to maximize the overall income of its citizens. Finally, we use the tax avoision cost function $\sigma\left(\overline{k}_i - s_i\right) = c_i \left(\overline{k}_i - s_i\right)^2$, which yields $s_i = \overline{k}_i - 0.5 t_i c_i$ implying that $|s_i'|$ decreases with c_i. We consider two values for c_i ($c_i = 1$ *and* 0.01).

Table I

	Value of parameters					*Country A*			*Country B*	
Row	$\overline{K}_A$	β_A	c_A	β_B	c_B	t_A	τ_A	$\overline{K}_A - K_A$	t_B	τ_B
(1)	100	0	1	0	1	0.202	0.001	0	0.202	0.001
(2)	100	0	0.01	0	0.01	0.115	0.076	0	0.115	0.076
(3)	100	0	1	1	1	0.202	0.001	0.127	0	0
(4)	100	0	0.01	1	0.01	0.138	0.066	10.792	0	0.025
(5)	150*	0	0.01	0	0.01	0.158	0.039	97.26	0.058	0.088
(6)	100	0	0.01	0	1	0.138	0.066	10.670	0.159	0.025

$\cdot \overline{K}_B = 50$

Row (1) is taken as the reference case and it corresponds to a symmetrical equilibrium with high costs of compliance. Residence-based taxation is almost only used to insure redistribution. In comparison, compliance costs

in row 2 are lower. Hence, residence-based tax falls and source-base tax rises. In row (3), compliance costs are high and country B is indifferent to income inequality. Country A mainly uses once again residence-based taxation for redistribution purposes and exports some capital in spite of a small wedge in source-based tax rates. With the same asymmetry in preferences but low compliance costs, row (4) shows that country A has to use a lower residence-based tax rate and a higher source-based tax rate than in the previous case; as a consequence, capital import to country B is much higher, and country B is induced to raise its source-based tax (of which a significant part is exported to country A). In row (5), the only source asymmetry is the now different initial endowments in capital with $\overline{K}_A = 150$ and $\overline{K}_B = 50$. Country A relies on residence-based taxation and exports some of its capital endowment to country B. This entices country A to lower its source-based taxation and to rely more on residence-based taxation. Finally, in row (6), the source of asymmetry is compliance cost. Not surprisingly, country A where compliance costs are relatively low has to adopt a lower residence-based tax rate and a higher source-based tax rate than country B.

5 CONCLUSIONS

This note discusses the optimal mix of residence- and source-based capital taxation for redistributive purposes when residence-based taxes lead capital owners to engage into costly avoision activities while source-based taxation causes capital to move abroad. This optimal tax mix is first derived analytically and then illustrated with a numerical example.

The model used is deliberately simple and this calls for a number of qualifications. First, why to restrict tax instruments to these two capital taxes that in reality represent a small fraction of government revenue ? We could indeed have introduced other taxes; as long as those additional instruments carry some distortions, our analysis remains valid. Clearly, if some non distortionary tax - here a tax on labor - were available, one should rely exclusively on it. In a more realistic but more complex model with informational asymmetries about labor abilities and capital ownership, one would not. In such expanded model, distortionary labor income taxation would be levied together with capital taxes of the sort we have analyzed here, but as far as the latter are concerned our qualitative conclusions would carry over.

Second, our note focuses on redistribution. One could have as well used our two taxes to finance a public good rather than redistribution; the problem would then have been a standard Ramsey problem possibly with a single individual. Actually, our tax formula is interpreted in that spirit.

Third, our model is simpler that those used in earlier work by, e.g., Giovannini (1989), Bucovetsky and Wilson (1991)), Huizinga (1995) or Huizinga and Nielsen (1995). Our objective was to exclusively focus on the mix between the two types of capital tax.

Finally, what are the policy implications of our analysis ? The type of measures that can alleviate the two types distortions discussed in this paper are well known. Vis-à-vis the tax competition distortion, one generally thinks of harmonizing and minimum tax strategies; vis-à-vis tax avoision, one often also suggests introducing a minimum withholding tax or increasing coordination in enforcement among tax authorities. Each of these policies carries a cost, more political than financial. The final policy responses will depend on such costs as well as on the extent of the two types of distortions.

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