NBER WORKING PAPERS SERIES

INTERNATIONAL FISCAL POLICY COORDINATION AND COMPETITION: AN EXPOSITION

Assaf Razin

Efraim Sadka

Working Paper No. 3779

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 1991

We thank Lans Bovenberg for useful comments on an earlier draft of the paper. This paper is part of NBER's research program in International Studies. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #3779
July 1991

INTERNATIONAL FISCAL POLICY COORDINATION AND COMPETITION: AN EXPOSITION

ABSTRACT

The paper highlights key considerations necessary for the analysis of international tax competition and the desirability of international tax harmonization.

The analysis of a Nash-Cournot international tax competition is carried out for (1) competing countries that cannot exercise significant market power in the world economy when setting tax rates, (2) competing countries that incorporate the indirect effect on world prices into the tax design and (3) competing governments that are unable to commit themselves to a preannounced path of tax for the entire future. The discussion is carried out by using basic principles of international taxation under full integration of goods and capital world markets.

Assaf Razin
Department of Economics
Tel Aviv University
Tel Aviv
69978 Israel
and NBER

Efraim Sadka
Department of Economics
Tel Aviv University
Tel Aviv
69978 Israel

I. Principles of International Taxation

II. Optimal Taxation and Capital Movements

III. Tax Competition and Coordination: International Price Taking Behavior

IV. Extensions: Terms of Trade Manipulation and Discretionary Policy

The paper addresses the issue of international tax competition among sovereign governments, in the presence of fully integrated markets for capital and goods. To present a self contained argument we start by examining the basic principles of international taxation. Concerning capital income (direct) taxation we distinguish between the residence principle and the source principle. According to the first principle households and firms are taxed on their worldwide income, uniformly, regardless of where income originates. This does not exclude taxes collected in the source country, as long as the residence country would credit these taxes. According to the second principle agents are taxed uniformly where income originates, regardless of their residence.

Concerning commodity (indirect) taxation we distinguish between the destination principle and the origin principle. Under the first principle commodities are taxed uniformly regardless of whether they are imported or produced domestically. In contrast, under the second principle the uniform tax is applied to all goods that are produced in a particular country, regardless of their final destination.

International tax arbitrage imposes severe constraints on the ability of an individual fiscal authority to set tax rates on capital income and on commodities. To prevent profitable arbitrage foreign and domestic residents must be indifferent between foreign and domestic assets, on the one hand, and between purchasing any tradable commodity at home or abroad on the other hand. As a result various tax rates adopted by various countries should meet a particular restriction.

To complete the building blocks of the international tax competition model we examine the question of optimal tax strategy for a small open economy, in a second best (tax distorted) world. To do that we apply the Diamond–Mirrlees production efficiency proposition to international taxation.

The analysis of a Nash–Cournot international tax competition is carried out for

three cases:

(1) When each one of the competing countries cannot exercise significant market power in setting its tax rates;

(2) When the design of fiscal policy by each one of the competig countries incorporates the indirect effect on world prices, and

(3) When governments are unable to commit themselves to preannounced paths of taxes for the entire future.

In each one of these cases the paper examines the desirability of international tax harmonization in which tax rates are set cooperatively.

I. PRINCIPLES OF INTERNATIONAL TAXATION

The various structures of the national tax systems have important implications for the direction and the magnitude of international flows of goods and capital and, consequently, for the world–wide efficiency of resource allocation in the integrated world economy. Although there is probably no country which adheres strictly to a pure principle of international taxation, it seems nevertheless that two polar principles with a wide application can be detected, both in the area of direct taxation and in the area of indirect taxation.

1. Capital Income (Direct) Taxation

Two polar principles of international income taxation are the residence (of taxpayer) principle and the source (of income) principle. According to the residence principle, residents are taxed on their world–wide income uniformly, regardless of the source of income (domestic or foreign).[1] Thus, nonresidents are not taxed on incomes

[1]A tax credit is usually given against taxes paid abroad on foreign–source income, so as to achieve an equal effective tax rate on income from all sources. See Frenkel, Razin and

originating in the country. According to the source principle, all incomes originating in the country are taxed uniformly, regardless of the place of residence of the recipients of these incomes. Thus, residents of the country are not taxed on their foreign–source income and nonresidents are taxed equally as residents on incomes originating in the country.

International capital market integration which enables a resident in one country to invest in other countries brings up the issue of international tax arbitrage. Such arbitrage has important implications for the viability of equilibrium in the capital markets.

To highlight this issue, consider the familiar two–country model ("home" country and "foreign" country) with perfect capital mobility. Denote interest rates in the home country and the foreign country by r and r^*, respectively. In general, the home country may have three different effective tax rates applying to interest income:

τ_{rD} – tax rate levied on residents on domestic source income;

τ_{rA} – effective rate of additional tax levied on residents on foreign–source income (over and above the tax paid in the foreign country);

τ_{rN} – tax rate levied on income of nonresidents.

Correspondingly, the foreign country levies similar taxes, denoted by τ^*_{rD}, τ^*_{rA} and τ^*_{rN}. We assume that these tax rates apply symmetrically to both interest income and interest expenses.

At an equilibrium, the home country residents must be indifferent between investing at home or abroad. This implies that

$$r(1-\tau_{rD}) = r^*(1-\tau^*_{rN}-\tau_{rA}). \tag{I.1}$$

Sadka (1991) for a modern treatise on international taxation.

Similarly, at equilibrium, the residents of the foreign country must be indifferent between investing in their home country (the "foreign country") or abroad (the "home" country), so that

$$(I.2) \qquad r^*(1-\tau^*_{rD}) = r(1-\tau_{rN}-\tau^*_{rA}).$$

Hence, for the interest rates, r and r^* to be positive (in which case we say that the capital market equilibrium is viable), the two equations, (I.1) and (I.2), must be linearly dependent. That is,

$$(I.3) \qquad (1-\tau_{rD})(1-\tau^*_{rD}) = (1-\tau_{rN}-\tau^*_{rA})(1-\tau^*_{rN}-\tau_{rA}).$$

This constraint, which involves tax rates of the two countries, implies that even though the two countries do not explicitly coordinate their tax systems between them, each one nevertheless must take into account the tax system of the other in designing its own tax system.[2]

It is noteworthy that when both countries adopt one of the two aforementioned polar principles of taxation, residence and source, then condition (I.3) is fulfilled. To see this, observe that if both countries adopt the residence principle, then

$$(I.4) \qquad \tau_{rD} = \tau_{rF} + \tau^*_{rN}, \ \tau^*_{rD} = \tau^*_{rA} + \tau_{rN}, \text{ and } \tau_{rN} = 0 = \tau^*_{rN}.$$

---

[2]The issue of tax arbitrage is not unique to open economies. Tax arbitrage emerges also in closed economies if the relative tax treatment of various assets differ across individuals. In the open economy case tax arbitrage becomes more serious if different types of financing are treated differently. This enables individuals and corporations to arbitrage across different statutory tax rates. Another factor that increases the scope of tax arbitrage is the interaction between inflation and exchange rates, on the one hand, and differential tax treatments of inflation and exchange rate gains and losses.

If both countries adopt the source principles, then

$$\tau_{rD} = \tau_{rN},\ \overset{*}{\tau}_{rD} = \overset{*}{\tau}_{rN},\ \text{and}\ \tau_{rA} = \overset{*}{\tau}_{rA} = 0. \tag{I.5}$$

Evidently, the joint constraint (I.3) is fulfilled, if either (I.4) or (I.5) holds. However, if the two countries do not adopt the same polar principle (or do not adopt either one of the two polar principles), then condition (I.3) is not in general met, and a viable equilibrium may not exist.

The structure of taxation has also important implications for the international allocation of investments and savings. If all countries adopt the residence principle (that is, condition (I.4) holds), then it follows from either (I.1) or (I.2), the rate–of–return arbitrage conditions, that $r = \overset{*}{r}$. That is, the gross rate of returns to capital are equated internationally. As the gross return to capital is equal to the marginal product of capital, it follows that the marginal products of capital are equated internationally. Thus, the world's output (in the future) is maximized and world–wide production efficiency prevails.[3] However, if the tax rate on income from capital is not the same in all countries (i.e. $\tau_{rD} \neq \overset{*}{\tau}_{rD}$), then the net returns earned by savers vary across countries (i.e. $r(1 - \tau_{rD}) \neq \overset{*}{r}(1 - \overset{*}{\tau}_{rD})$). As the net return to capital is equated to the consumer's intertemporal marginal rate of substitution, it follows that the intertemporal marginal rates of substitution are not equated internationally. Thus, the world's allocation of savings is inefficient.

Alternatively, if all countries adopt the source principle (that is, condition (I.5) holds), then it follows from either (I.1) or (I.2) that $r(1 - \tau_{rD}) = \overset{*}{r}(1 - \overset{*}{\tau}_{rD})$. Thus, the

[3]Efficiency emerges when corporate and individual taxes are fully integrated and interest income faces the same tax rate as equity income. Evidently, a nonuniform treatment of different components of the capital income tax base would violate efficiency.

intertemporal marginal rates of substitution are equated internationally and the world's allocation of savings is efficient. However, if the tax rate on income from capital is not the same in all countries, then $r \neq r^*$. That is, the marginal product of capital varies across countries and the world–wide allocation of investment is inefficient.

2. Commodity (Indirect) Taxation

Analogously to the residence and source principles of direct taxation, the two polar principles of indirect taxation (particularly, the value added tax – VAT) are the destination principle and the source principle, respectively. According to the destination principle, a good or a service purchased by a resident is taxed uniformly, whether produced domestically or imported. That is, imports are taxed while exports are exempted.[4] Put differently, all goods and services destined for final consumption in the country are taxed, regardless of the source of production. According to the source principle, the tax is levied on all goods and services produced in the country, irrespective of their final destination.

Analogously to international capital mobility which imposes the rate–of–return arbitrage conditions (I.1) and (I.2), trade in goods and services dictates the following price arbitrage conditions:

$$p(1 + \tau_D) = p^*(1 + \tau_X^* + \tau_M) \tag{I.6}$$

and

$$p^*(1 + \tau_D^*) = p(1 + \tau_X + \tau_M^*), \tag{I.7}$$

[4]More precisely, exports are zero–rated rather than just exempted. The destination principle is difficult to apply if consumers are mobile across international borders (through, for example, mailorders). In this case crossborder shopping results in losses of tax revenue to the high–tax country.

where p and p^* are the producer price of a tradeable good in the home and foreign country, respectively. These prices are expressed in terms of a common (to both the home and the foreign countries), untaxed numeraire.[5] The home country may employ three tax rates:

τ_D – tax rate levied on the good if produced domestically and sold domestically;

τ_X – tax rate levied on exports of the good;

τ_M – effective tax rate levied on the imports of the good (in addition to the tax, if any, levied abroad).

Similarly, the foreign country may employ three tax rates: τ_D^*, τ_X^* and τ_M^*. Conditions (I.6) – (I.7) implicitly assume that the good is produced and consumed in positive quantitities in both countries. These conditions yield the following joint constraint which is imposed on both countries:

$$(I.8) \qquad (1 + \tau_D)(1 + \tau_D^*) = (1 + \tau_X^* + \tau_M)(1 + \tau_X + \tau_M^*).$$

As with direct taxes, it is straightforward to verify that either one of the two polar principles, destination and source, when adopted by both countries, meets the joint constraint (I.8). Similarly, when the destination principle is adopted by both countries, world–wide production efficiency prevails (because producer prices are internationally equated), but the international allocation of consumption is generally inefficient (because consumer prices vary across countries).[6] On the other hand, when the source principle is

---

[5]The choice of a common numeraire for both countries implicitly assumes that the numeraire good or factor is internationally mobile.

[6]Evidently, a nonuniform commodity tax structure may allow countries to implicitly violate

adopted by both countries, then the international allocation of consumption is efficient but the allocation of world production is not efficient.

II. OPTIMAL TAXATION AND CAPITAL MOVEMENTS

Apart from its major role in correcting various market failures (due to increasing returns and imperfect competition, external economies or diseconomies, etc.), a government also levies taxes in order to redistribute income and finance the provision of public goods and public inputs. As these taxes are distortionary, the allocation of resources is not Pareto–efficient. Thus, the optimal design of the fiscal policy is typically carried out in a second–best context.

When capital is free to move in or out of the country, and the residence principle is applied in capital income taxation, it follows from the analysis of the preceding section that the marginal product of domestic capital will be equated to the world rate of interest and production efficiency will prevail. An interesting question is whether the fiscal policy should maintain production efficiency (a first–best solution in production), even though the overall allocation of resources in the economy is not pareto–efficient. A fundamental result of the optimal tax theory suggests that, under certain conditions, production efficiency should be still maintained even though the (distortionary) tax structure can achieve only a second–best optimum.[7] Thus, capital should be free to move in and out of the country and residents should be taxed uniformly on their world–wide income (the residence principle).

---

the spirit of the destination principle. They can define commodities in such a way that the high–tax commodities are imported. This practice sneaks in through the back door border taxes such as import or export taxes.

[7]See Peter Diamond and James Mirrlees (1971).

We demonstrate this fundamental result in a stylized two–period model with one composite good, serving both for (private and public) consumption and for investment. In the first period the economy possesses an initial endowment of the composite good. Individuals can decide how much of their initial endowments to consume and how much to save in the first period. Saving is allocated to either domestic investment or foreign investments. In the second period, output (produced by capital and labor), and income from foreign investments, are allocated between private and public consumption. For the sake of simplicity, we assume that government spending takes place in the second period. The government employs taxes on labor, taxes on income from domestic investments, and taxes on income from investments abroad in order to finance optimally, taking into account both efficiency and equity considerations, its public consumption and a uniform lump–sum subsidy for redistribution purposes.

Suppose there are H households. The utility function of household h is denoted by:

$$(II.1) \qquad u^h(c_{1h}, c_{2h}, L_h, G), \quad h = 1,...,H,$$

where c_{1h}, c_{2h}, and L_h are first–period consumption, second–period consumption and second–period labor supply, respectively, of household h; and G is second–period public consumption.

Denote saving of household h in the form of domestic capital by K_h and saving in the form of foreign capital by B_h. We assume for concreteness, that the patterns of capital flows are such that the country is a capital exporter (i.e. $\sum_h B_h \geq 0$). Thus, the aggregate saving in the form of domestic capital is equal to the stock of capital in the second period. The budget constraints of household h in the first and second period are,

respectively:

(II.2) $$c_{1h} + K_h + B_h = I_h,$$

and

(II.3) $$c_{2h} = K_h[1 + r(1 - \tau_{rD})] + B_h[1 + \bar{r}(1 - \tau_{rA})] + (1-\tau_w)wL_h + S',$$

where

τ_{rD} – tax on capital income from domestic sources;

τ_{rA} – tax on capital income from foreign sources;

τ_w – tax on labor income;

S' – lump–sum subsidy;

r – domestic rate of interest;

$\bar{r}$ – world rate of interest (net of taxes levied abroad);

w – wage rate;

I_h – initial (first–period) endowment.

As was already pointed out in the preceding section, if residents can freely invest abroad, they must, at equilibrium, earn the same net return whether investing at home or abroad. That is,

(II.4) $$r(1 - \tau_{rD}) = \bar{r}(1 - \tau_{rA}).$$

With restrictions on capital flows, the latter equality does not have to hold. In such a case there is an infra–marginal profit on foreign investment, resulting from the net interest differential. One possibility is for this profit to accrue to the investors. Another possibility is for the government to fully tax away this profit. (This is the equivalent

capital–export tax version of the capital–export quota). We adopt the second possibility, namely that the government chooses the level of the tax on income from foreign investments (τ_{rA}) so as to eliminate entirely the infra–marginal profits. This implies that whether or not there are restrictions on foreign investment, the government chooses τ_{rA} so as to maintain the equality (II.4).

Under this tax scheme, the household is indifferent between investing at home (K_h) or abroad (B_h), caring only about the level of total investment ($K_h + B_h$). Therefore, we may consolidate the two periodic budget constraints (II.2) and (II.3) into a single present–value budget constraint:

$$c_{1h} + q_{c2}\, c_{2h} = I_h + q_L L_h + S, \tag{II.5}$$

where $q_{c2} = [1 + (1 - \tau_{rD})r]^{-1}$ is the consumer (after–tax) price of second–period consumption in present value terms; $q_L = (1 - \tau_w)wq_{c2}$ is the consumer price of labor (net wage rate) in present value terms; and $S = q_{c2}S'$ is the present value of the subsidy.

Maximizing the utility function u^h, subject to the budget constraint (II.5), yields the consumption demand functions:

$$c_{ih} = c_{ih}(q_{c2}, q_L, I_h + S, G), \quad i = 1,2; \tag{II.6}$$

the labor supply function:

$$L_h = L_h(q_{c2}, q_L, I_h + S, G); \tag{II.7}$$

and the indirect utility function:

(II.8) $$v^h = v^h(q_{c2}, q_L, I_h + S, G).$$

In the second period, domestic output (Y) is produced by capital and labor, according to a concave, constant–returns–to–scale production function:

(II.9) $$Y = F(K, L)$$

where $K = \sum_h K_h$ is the stock of domestic capital and $L = \sum_h L_h$ is the aggregate supply of labor.

Profit maximization implies that

(II.10) $$r = F_k \text{ and } w = F_L.$$

The resource constraints of this economy require that

(II.11) $$\sum_h I_h = \sum_h c_{1h} + \sum_h B_h + \sum_h K_h,$$

and

(II.12) $$Y + (1 + \bar{r})\sum_h B_h + \sum_h K_h = \sum_h c_{2h} + G.$$

Substituting (II.2), (II.6), (II.7), (II.9) and (II.11) into (II.12) yields the following single equilibrium condition:

$$(II.13)F\{\sum_h I_h - \sum_h c_{1h}(q_{c2},q_L, I_h + S, G) - B, \sum_h L_h(q_{c2},q_L,I_h+S,G)\} + (1+\bar{r})B$$

$$+ \{\sum_h I_h - \sum_h c_{1h}(q_{c2}, q_L, I_h + S, G) - B\}$$

$$- \sum_h c_{2h}(q_{c2}, q_L, I_h + S, G) - G = 0,$$

where $B = \sum_h B_h$ is aggregate capital exports.

The optimal fiscal policy is achieved by maximizing the social welfare function

$$(II.14) \qquad W = W\{v^1(q_{c2}, q_L, I_h + S, G),..., v^H(q_{c2},q_L, I_H + S, G)\},$$

subject to the equilibrium condition (II.13). The control variables are the consumer prices q_{c2} and q_L (which implicitly define the tax rates τ_{rD} and τ_w), public consumption (G), and the aggregate level of capital exports (B). Notice that by referring to B as a control variable we do not mean that the government directly determines the level of capital exports. Rather, the government, through its tax policy, affects total savings $(\sum_h K_h + \sum_h B_h)$ and domestic investments $(\sum_h K_h)$. Capital exports, B, are then determined as a residual (the difference between total savings and domestic investments).

Maximizing (II.14) subject to (II.13) yields (among other conditions) the following first–order condition:

$$(II.15) \qquad r = \bar{r}.$$

The latter condition holds, if the government adopts a policy of letting capital move freely in and out of the country (condition (II.4)) and of employing the residence principle of taxation (i.e. $\tau_{rD} = \tau_{rA}$). In this case, investment is efficiently allocated between home and abroad. The intuition behind the result is that if capital is perfectly mobile, while labor is completely immobile, source–based capital taxes are completely shifted to labor. It is better to tax labor directly than to rely on an indirect labor tax. In other words the small open economy faces a completely elastic schedule of excess supply of capital and applies at the optimum no nonresident taxation.[8]

III. TAX COMPETITION AND TAX COORDINATION: INTERNATIONAL PRICE TAKING BEHAVIOR

If countries integrate their capital markets (e.g. Europe of 1992), then in the absence of full–fledged harmonization of their tax systems, tax competition emerges as a real possibility.

International tax competition, or fiscal policy competition in general, has major effects on the resource allocation between countries and within each country. For example, the world–wide level of savings as well as its cross–country composition may be distorted by such competition. Similarly, the aggregate level of investment and its international allocation is potentially also inefficient. In general, the effects of tax competition on the allocation of resources can be decomposed into two elements. The first consists of indirect manipulation of the international terms of trade by various fiscal measures (other than

[8]If rents cannot be fully taxed or the country manipulates world prices the choice of whether to adopt the source principle or the residence principle (or a mixture of the two principles) would depend on the interest rate elasticities of saving and investment, see Giovannini (1989). See also Gordon (1986) and Musgrave (1987) and Sinn (1990). Dixit (1985) demonstrates a related result by showing that the production efficiency proposition implies no border taxes, such as import or export taxes.

explicit trade barriers such as tariffs and quotas), akin to the familiar "trade wars." The second element, which received less attention, concerns the international and domestic misallocation of resources that is generated by tax competition in a tax distortion–environment, but with international price–taking behavior on the part of the competing governments.

This section focuses on the second element; the next section deals with terms of trade manipulation.

To simplify the exposition, we assume that the world economy consists of two countries, the home country (denoted by a superscript H) and the foreign country (denoted by a superscript F). We maintain the basic model of the preceding section with two periods, one composite good which can serve for private and public consumption and investment, and two factors: an internationally mobile capital, and an internationally immobile labor. To further simplify the notation, we assume that households within each country are identical. This enables us to consider a representative household in each country.

Consider first the home country. The household sector possesses a utility function

$$u^H(c_1^H, c_2^H, L^H, G^H). \tag{III.1}$$

Denoting saving in the form of domestic capital by S^{HH}, and saving exported to country F by S^{HF}, the budget constraint of the household sector in the first period is

$$c_1^H + S^{HH} + S^{HF} = I^H. \tag{III.2}$$

In the second period the budget constraint is:

$$(III.3) \qquad c_2^H = (1-\tau_w^H)\, w^H L^H + S^{HH}[1 + (1-\tau_{rD}^H) r^H]$$

$$+ S^{HF}[1 + (1-\tau_{rA}^H)(1-\tau_{rN}^F) r^F].$$

For ease of notation we specify the tax τ_{rA} in this section as applying to the return from investment abroad, net of the taxes paid abroad (while in section I, τ_{rA} applied to the gross return).[9]

As before, the rate of return arbitrage in the home country implies that

$$(III.4) \qquad (1-\tau_{rD}^H) r^H = (1-\tau_{rA}^H)(1-\tau_{rN}^F) r^F.$$

Hence, the second–period budget constraint may be rewritten as:

$$(III.5) \qquad c_2^H = (1-\tau_w^H) w^H L^H + S^H[1 + (1-\tau_{rD}^H) r^H],$$

where

$$(III.6) \qquad S^H = S^{HH} + S^{HF}$$

is the aggregate saving of the private sector in country H. Now, the budget constraints for the first and second periods ((III.2) and (III.5)) can be consolidated into a single (present–value) life–time budget constraint:

$$(III.7) \qquad c_1^H + q_{c2}^H c_2^H = I^H + q_L^H L^H,$$

where

---

[9]This is why the net return on one ECU earned abroad is $(1-\tau_{rA})(1-\tau_{rN})$ in this section and $(1-\tau_{rA}-\tau_{rN})$ in section I. This is merely an accounting difference.

(III.7a) $$q^H_{c2} = [1 + (1 - \tau^H_{rD})r^H]^{-1}$$

and

(III.7b) $$q^H_L = (1 - \tau^H_w)w^H[1 + (1 - \tau^H_{rD})r^H]^{-1}$$

are, respectively, the consumer prices of second–period consumption and labor, in present value terms.

Maximization of the utilty function (III.1) subject to the budget constraint (III.7) yields the demand for private consumption in the first period, $c^H_1(q^H_{c2}, q^H_L, I^H, G^H)$, and private consumption in the second period, $c^H_2(q^H_{c2}, q^H_L, I^H, G^H)$, the supply of saving, $S^H(q^H_{c2}, q^H_L, I^H, G^H)$, the supply of labor by the private sector in the second period, $L^H(q^H_{c2}, q^H_L, I^H, G^H)$, and the indirect utility function $v^H(q^H_{c2}, q^H_L, I^H, G^H)$.

Domestic output, Y^H, in the second–period is produced by capital, K^H, and labor, L^H, according to a neo–classical, constant–returns–to–scale production function:

(III.8) $$Y^H = F^H(K^H, L^H).$$

The stock of domestic capital is composed of the saving by domestic residents channelled to domestic uses (S^{HH}), and the saving by the foreign residents channelled to country H (S^{FH}). That is:

(III.9) $$K^H = S^{HH} + S^{FH} = S^H - (S^{HF} - S^{FH}),$$

where use is made of equation (III.6).

As usual, the marginal productivity conditions determine the (pre–tax) interest rate and the wage rate:

(III.10) $$r^H = F_K^H(K^H, L^H)$$

and

(III.11) $$w^H = F_L^H(K^H, L^H).$$

Country F is similar to country H, so that the corresponding equations are like country H equations, except that the superscripts F and H are interchanged. Of particular interest now is the rate–of–return arbitrage condition for residents of country F (the analogue of (III.4)). Assuming interior solutions this becomes:

(III.12) $$(1 - \tau_{rD}^F)r^F = (1 - \tau_{rA}^F)(1 - \tau_{rN}^H)r^H.$$

The second–period resource constraint, faced by country H, is given by:

(III.13) $$G^H + c_2^H(q_{c2}^H, q_L^H, I^H, G^H) = F^H\{K^H, L^H(q_{c2}^H, q_L^H, I^H, G^H)\}$$

$$+ K^H + S^{HF}[1 + (1 - \tau_{rN}^F)r^F] - S^{FH}[1 + (1-\tau_{rN}^H)r^H].$$

The condition states that total private and public consumption in the second–period (i.e., $G^H + c_2^H$) is equal to the sum of: (i) output generated by domestic capital, which is financed by domestic saving (i.e., $I^H - c_1^H = S^H$), minus <u>net</u> capital exports (i.e., gross capital exports, S^{HF}, less gross capital imports, S^{FH}), and labor; (ii) domestic capital (i.e. K^H), and (iii) the income from net capital exports (principal plus interest). Notice that by Walras's Law the government budget constraint in each country is automatically satisfied.

Upon substituting (III.9) into (III.13) and employing the arbitrage condition (III.12), we conclude that country H has a single resource constraint as follows:

$$
\begin{aligned}
(\text{III.14}) \qquad & G^H + c_2^H(q_{c2}^H, q_L^H, I^H, G^H) = F^H\{I^H - c_1^H(q_{c2}^H, q_L^H, I^H, G^H) \\
& -(S^{HF} - S^{FH}), L^H(q_{c2}^H, q_L^H, I^H, G^H)\} \\
& + \{I^H - c_1^H(q_{c2}^H, q_L^H, I^H, G^H)\} \\
& + S^{HF}(1 - \tau_{rN}^F)r^F - S^{FH}(1 - \tau_{rD}^F)r^F/(1 - \tau_{rA}^F).
\end{aligned}
$$

Tax competition works as follows. Each government designs its fiscal policy so as to maximize the welfare of its representative resident. In carrying out the optimization the government must take into account the resource constraints and the arbitrage conditions. It also takes as given all the fiscal instruments employed by other governments. In addition, each government is assumed to behave as a price–taker in the world market. That is, the government assumes that its actions have no effect on international prices (including interest rates). Put differently, at a given rate of interest in the foreign country, r^F, country H assumes that it can export any quantity of capital (S^{HF}) and import any quantity of capital (S^{FH}). A similar behavior is adopted by country F. This leads to a Nash–equilibrium between the two countries.

A world market equilibrium exists if world aggregate saving is equal to world aggregate stock of capital, i.e.

$$(\text{III.15}) \qquad S^H + S^F = K^H + K^F.$$

Consider first the optimal policy design in the home country. The government chooses G^H, q^H_{c2}, q^H_L, S^{HF}, S^{FH}, r^H, w^H, τ^H_w, τ^H_{rD}, τ^H_{rA} and τ^H_{rN} so as to maximize the utility function v^H, subject to the resource constraint (III.14), the definitions of q^H_{c2} and q^H_L in (III.7a)–(III.7b), respectively, and the relevant arbitrage condition (III.4). Notice that the other arbitrage condition (III.12) is irrelevant for country H because this condition has no effect on its economy (formally the endogenous variables in (III.12) appear nowhere else in the equations describing the economy of country H). In addition, r^H and w^H are given by the marginal productivity conditions (III.10) and (III.11).

The optimization problem can be simplified a great deal by solving the problem in two stages. First, the government chooses public consumption (G^H), consumer prices of second–period consumption and labor (q^H_{c2} and q^H_L, respectively), capital exports (S^{HF}) and capital imports (S^{FH}), so as to maximize the indirect utilty function (v^H), subject to just one constraint: the resource constraint (III.14). Then, in the second stage, the government sets r^H and w^H from (III.10) and (III.11), respectively; τ^H_{rD} from (III.7a); τ^H_w from (III.7b); τ^H_{tN} from (III.12) and τ^H_{rA} from (III.4).

Carrying out the first stage of the optimization for country H, it follows (from the first–order conditions with respect to capital exports (S^{HF}) and capital imports (S^{FH}) that:

(III.16) $$F^H_K = (1-\tau^F_{rN})r^F$$

and

(III.17) $$F^H_K = (1-\tau^F_{rD})r^F/(1-\tau^F_{rA}),$$

respectively. Evidently, the terms on the right–hand–sides of (III.16) and (III.17) must be equal to each other. In fact, this is an equilibrium condition rather than an optimality

condition. To see this, observe that the term on the right–hand–side of (III.16) is the return to capital exports, while the term on the right–hand–side of (III.17) is the unit cost of capital imports. Since country H takes this return and cost terms as exogenously given, then unless they are equal to each other, unlimited gains can accrue to the country by back–to–back exports and imports of capital. Such unlimited gains are obviously inconsistent with the world market equilibrium.

Similarly, for country F we have:

$$F_K^F = (1 - \tau_{rN}^H) r^H \tag{III.18}$$

and

$$F_K^F = (1 - \tau_{rD}^H) r^H / (1 - \tau_{rA}^H). \tag{III.19}$$

Since by (III.10), $F_K^H = r^H$, it follows from (III.12) and (III.17) that $\tau_{rN}^H = 0$ and, by symmetry, $\tau_{rN}^F = 0$. Also, (III.4) implies that $\tau_{rD}^H = \tau_{rA}^H$. It then follows from either (III.16) or (III.18) that

$$F_K^H = r^H = r^F = F_K^F. \tag{III.20}$$

That is, tax competition leads to an equality between the marginal productivity of capital across countries H and F. This gross rate–of–return equalization implies that the world stock of physical capital is efficiently allocated between country H and country F. It then follows from (III.17) and (III.19) that $\tau_{rD}^H = \tau_{rA}^H$ and $\tau_{rD}^F = \tau_{rA}^F$. Since we have earlier shown that $\tau_{rN}^H = 0 = \tau_{rN}^F$, we conclude that each country taxes its residents on their world–wide income and exempts non–residents from tax. To conclude, the residence

principle of international taxation is adopted by each one of the tax competing countries and the world–wide allocation of investment is efficient.

Now, we address the issue of whether this tax–competition Nash–equilibrium is a second–best optimum (i.e., relative to the available tax policy tools). Or, can there be gains from concerted tax harmonization? Because capital is efficiently allocated between the two countries at this Nash–equilibrium, no further gain from international trade in capital exists. Hence, we conclude that there are no gains from tax harmonization.

IV. EXTENSIONS: TERMS OF TRADE MANIPULATION AND DISCRETIONARY POLICY

We have so far assumed that the competing countries behave as price–takers in the world markets. This assumption is certainly plausible if there are many competing countries and not one of them is large enough to be able to exercise a nonneglible market power.

Of course, if one of the competing countries is large relative to the world market, then it will not assume a price–taking behavior. In this case, it will design its fiscal policies with a view to their effects on world prices. Put differently, it will attempt to manipulate world prices in its favor. This is akin to the familiar trade war[10] with the resulting inefficiencies in the world–wide allocation of resources. For instance, if we continue to assume a Nash–Cournot type of competition among the various countries (that is, each country takes the fiscal policies of the other countries as exogenously given), then obviously the resulting equilibrium will not be second–best (given the limited set of tax instruments available). The country which has some monopoly power will drive the world

---

[10]For a modern survey see Dixit (1986).

interest rate above its domestic marginal product of capital, if it is a net exporter of capital, thereby preventing an efficient world–wide allocation of investments. If one (or more) of the other countries is also large enough relative to the world economy, then it will try to retaliate with the final outcome impossible to determine a priori. In this case, international fiscal coordination will be a Pareto–improvement.

Another issue is the ability of the governments to commit themselves to pre–announced paths of fiscal policies for the entire future. When they do commit themselves in this way, as we have assumed so far, international tax coordination was either redundant, when the competing countries are price takers, or Pareto–improving when they are able to extract some market power. If, however, governments are not precommitted then it is quite possible that international tax coordination will be harmful. This possibility was first pointed out by Rogoff (1985).[11]

To demonstrate this point in a framework similar to that employed in this paper, we draw on Kehoe (1989). In the absence of pre–commitment, each country will tax capital very heavily, because at each point of time the existing stock of capital is made of <u>past</u> savings and is therefore perfectly inelastic. Hence, at each point of time a tax on the existing capital is a nondistortionary lump–sum tax Kehoe describes a situation in which the decision of the private sector <u>where</u> to channel its savings, home or abroad, is made <u>after</u> taxes are announced (even though the decision <u>how much</u> to save is made before taxes are announced). In this case, in the absence of international tax coordination, each government is deterred from taxing capital too heavily, as it fears that capital will fly to other countries. With tax coordination, this fear no longer exists and the coordinated tax on capital is too heavy. Therefore, international tax coordination is inferior to a full–fledged competition among sovereign tax authorities.

---

[11]See also Canzoneri and Henderson (1988) and Van der Ploeg (1987).

REFERENCES

Canzoneri, Mathew B., and Henderson, Dale W. (1988). "Is Sovereign Policy Making Bad?", in Karl Brunner and Alan Melzer (eds.) Stabilization Policies in Labor Markets, (Carnegie–Rochester Conference Series on Public Policy 28) (Amsterdam: North–Holland), 93–140.

Diamond, Peter A. and Mirrlees James (1971). "Optimal Taxation and Public Production," American Economic Review (March and June), 8–17 and 261–278.

Dixit, Avinash (1985). "Tax Policy in Open Economies," in Alan Auerbach and Martin Feldstein (eds.) Handbook on Public Economics, Chapter 6 (Amsterdam: North Holland), 314–374.

———————— (1985). "Strategic Aspects of Trade Policy," (mimeo, Princeton University).

Frenkel, Jacob, Razin, Assaf and Sadka, Efraim (1991). International Taxation in an Integrated World, (Cambridge: MIT Press).

Giovannini, Alberto (1990). "Reforming Capital Income Taxation in Open Economies: Theoretical Issues," in Horst Siebert (ed.) Reforming Capital Income Taxation, (Tubingen: Mohr).

Gordon, Roger H. (1986). "Taxation of Investment and Savings in a World Economy," American Economic Review 76, 1087–1102.

Kehoe, Patrick J. (1989). "Policy Cooperation Among Benevolent Governments May Be Undesirable," Review of Economic Studies 56 (July), 289–296.

Musgrave, Peggy (1987). "International Tax Competition and Gains from Tax Harmonization," NBER Working Paper No.3152 (October), Cambridge, MA.

Rogoff, Kenneth (1985). "Can International Monetary Policy Cooperation be Counter–Productive"," Journal of International Economics 18 (August), 199–217.

Sinn, Hans–Werner (1990). Tax Harmonization and Tax Competition in Europe," NBER Working Paper No.3263 (February), Cambridge, MA.

Van der Ploeg, Fredrick (1987). "International Policy Coordination in Interdependent Monetary Economies," (mimeo, London School of Economics).