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DISCUSSION PAPER NO. 287

On the Relevance of Export Demand Conditions for Capital Income Taxation in Open Economies

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RÉSUMÉ

De l'avis de la plupart des observateurs, bien qu'un pays comme le Canada ne soit qu'un participant de seconde importance dans le marché mondial des capitaux et qu'il puisse emprunter et prêter librement à un taux d'intérêt réel mondial prédéterminé, en l'absence d'un crédit pour impôt acquitté à l'étranger, il encourt des pertes considérables de revenus réels au chapitre de l'imposition de la rémunération du capital, et le fardeau tombe sur des facteurs indigènes dans des domaines où l'offre est relativement inélastique tels que le terrain et le travail. De même, bien que l'offre d'épargne intérieure ne soit pas considérablement modifiée par des changements apportés au pays au taux d'imposition de la rémunération du capital, les mesures pour encourager l'épargne doivent être évaluées selon le taux de rendement après impôts plutôt qu'avant impôts, étant donné que les avantages de l'épargne additionnelle prendront la forme d'un plus bas niveau de propriété étrangère dans l'économie plutôt que d'un PIB ou de revenus réels plus élevés. Enfin, si le crédit pour impôt acquitté à l'étranger permet que tous les impôts payés dans le pays d'accueil soient crédités au titre des impôts dûs dans le pays investisseur et s'il n'est pas possible de reporter les impôts sur les revenus gagnés à l'étranger, il sera alors à déconseiller pour le pays d'accueil d'établir son taux d'imposition de la rémunération du capital à un niveau inférieur à ce qu'il est à l'étranger, mais il ne sera jamais non plus dans l'intérêt du pays d'établir un taux plus élevé.

L'auteur conteste la véracité de chacune de ces affirmations en faisant valoir l'important rôle des conditions de la demande des produits exportés dans la détermination du coût réel du recours à des sources externes pour financer une économie ayant un accès illimité au marché international de capitaux à un taux d'intérêt mondial prédéterminé. Une des conséquences importantes de l'analyse est que si un tel pays s'engage dans un accord de libre-échange avec son principal partenaire commercial (renonçant ainsi à l'utilisation de tarifs douaniers, de subventions ou de taxes à l'exportation, ainsi qu'à diverses barrières non tarifaires), et si le revenu d'investissements étrangers est imposé de la même façon que les revenus intérieurs, l'imposition de la rémunération du capital devient alors un instrument important pour assurer la maximisation du bien-être national. Autre conséquence, le taux d'escompte approprié applicable aux décisions publiques d'investir - y compris les décisions d'autoriser ou non des entreprises privées à entreprendre des projets exigeant une approbation réglementaire - est plus élevé que le taux d'intérêt réel qui doit être payé pour le financement de sources externes.

ABSTRACT

It is generally believed that if a country like Canada is a small participant in the international capital market and able to borrow and lend freely at a predetermined world real interest rate then in the absence of the foreign tax credit it suffers substantial real income losses from capital income taxation and the burden falls on indigenous factors in relatively inelastic supply such as land and labour. As well, while the incentive to save is not affected by the country's rate of tax on capital income, measures to encourage saving must be appraised in terms of the after-tax rather than the pre-tax rate of return since the benefits of additional saving will take the form of a reduced level of foreign ownership of the economy rather than a higher GDP or higher real incomes. Finally, if the foreign tax credit enables all taxes paid to the host government to be credited against taxes owed to the investing country then it will be ill-advised for the host country to set its rate of capital income tax below the rate prevailing abroad, but it will never be in the host country's interest to set a higher rate.

This paper disputes the validity of each of these claims by highlighting the important role of export demand conditions in determining the real cost of external funding to an economy with unrestricted access to the international capital market at a predetermined world real interest rate. One important implication of the analysis is that if such a country embarks upon a free trade arrangement with its major trading partner (thereby ruling out the use of tariffs, export taxes and subsidies, and various other non-tariff barriers), and if national treatment is accorded to foreign investment income then the capital income tax becomes an important instrument for ensuring that national welfare is maximized. A second implication is that the appropriate discount rate for public investment decisions - including decisions whether to authorize private firms to proceed with projects that are subject to regulatory approval -- is greater than the real interest rate that must be paid on external funding.

CONTENTS

1. Introduction

The purpose of this paper is to analyze the effects of capital income tax changes in an open economy. We focus specifically on the consequences for the level of capital formation in the economy, the amount of external funding, and the level of domestic economic welfare. We assume throughout that the economy cannot affect the world real interest rate by its own actions, and that foreigners will supply an unlimited amount of funding at the given world real interest rate (i.e., there is no sovereign risk premium). However, we also assume that the economy faces a less than perfectly elastic foreign demand for its exports, and this has the effect of making the cost of externally funded capital schedule slope upward. The paper derives expressions for the optimal rate of tax on capital income and the proportion of any increase in domestic savings that adds to domestic capital formation for the special case in which the supply of domestic savings is independent of the after-tax rate of return.

We find that if the elasticity of foreign demand for exports is less than one, a reduction in the effective tax on capital income will reduce the amount of external funding, reduce the level of capital formation, and reduce domestic welfare. If the foreign demand for exports is elastic a reduction in the capital income tax will increase foreign funding and total capital formation, but domestic welfare will fall unless the effective rate of tax is at least equal to minus the inverse of the price elasticity of export demand. As well, so long as the export demand elasticity is less than infinite an increase in the supply of domestic savings will result in an increase in domestic capital formation despite the fact that the economy has unrestricted access to external funding at a predetermined world real interest rate.

Even if a significant proportion of any increase in domestic saving spills over into the international capital market to finance investment abroad, the national return to saving will equal the pre-tax marginal product of capital in the economy if the capital income tax is set optimally. The paper therefore serves to emphasize the important role of export demand conditions in addition to conditions in the international capital market for capital income taxation in open economies.

Externally funded capital is frequently supplied through foreign direct investment, and any taxes paid in the host country are typically credited against taxes owed in the investing country. The paper analyzes the case of foreign direct investment capital subject to the foreign tax credit and shows that in the absence of the tax deferral provision it is never optimal for the host country to reduce its tax rate below the rate prevailing abroad; in fact, it may be in the interest of the host country to raise its tax above the rate prevailing abroad depending upon the price elasticity of export demand. If all taxes paid to the host country on foreign direct investment income can be credited against taxes owing in the investing country, but if some interest income on foreign portfolio investment cannot be so credited, then it may be in the interest of the host country to set its rate of tax on capital income below the rate prevailing abroad even without the tax deferral provision.

2. Model Specification

The production function for future domestic output or gross domestic product is assumed to be well behaved in two factors: capital services which are financed either by domestic or foreign savings; and labour services supplied only by domestics. In general, one might expect that the amounts of labour and capital supplied by domestics would be responsive to changes in the after-tax wage and rental rates, but for analytical simplicity we assume that the indigenous supplies of both factors are fixed and we focus on the relationship between the tax structure and the level of foreign funding.[1] Gross domestic product (GDP) is then a monotonic increasing and concave function of the amount of capital financed from abroad, which we denote by b:

$$GDP = F(\bar{K}+b,\bar{L}) = F(b), \text{ where } F'(\cdot) > 0,\ F''(\cdot) < 0 .$$

The economy is assumed to be small in the international capital market, and tax-induced changes in the level of foreign funding are small enough that variations in the sovereign or political risk premium can be avoided. The real interest rate that must be offered to attract foreign funding is therefore predetermined at i^* independent of the level of foreign funding. As well, the economy is a price taker in the market for its imports so that any foreign exchange acquired through borrowing can be used to purchase imported capital goods at given prices. For simplicity, imported capital is treated as a perfect substitute for the capital supplied domestically. If we define units of measurement so that one unit of capital sells for one unit of foreign exchange then the amount of foreign exchange that must be earned to repay a loan of b used to finance the purchase of b units of imported capital is given by $(1+i^*)b$.

A key assumption of this paper is that the exports of the economy are imperfect substitutes for the tradeables of other countries so that the economy as a whole faces a downward sloping world demand for its exports even though each individual firm producing exports is a price taker. Moreover, in order to avoid analytical complications we have assumed that the factor requirements for producing exports are similar to the factor requirements for producing goods for domestic consumption. A more elaborate model would distinguish explicitly between tradeable and nontradeable goods as well as between different categories of tradeables, but there is little to be gained in doing so in the present context. Letting p(x), where $p'(\cdot) < 0$ represent the price of exports in units of foreign exchange and x represent the volume of exports in units of domestic output, the amount of future output that must be exported must satisfy the following balance of payments constraint:

$$p(x)x - (1+i^*)b = 0 \ .$$

Under perfectly competitive conditions individual firms will be price takers so that p will be a parameter to which the firms respond. If the host government taxes all income from capital at rate t and allows no deduction for initial resources invested then future consumption by the private sector can be expressed as:

$$C = (1-t)F(b) - x + a$$

where a represents the level of lump sum transfers which must satisfy the government's budget constraint:[2]

$$tF(b) - a = 0 \ .$$

A competitive equilibrium for the private sector is determined by finding the appropriate amount of foreign funding b to maximize future consumption C given the tax rate t, the level of transfers a, the world real interest rate i*, and given that exports x must satisfy the balance of payments constraint. Formally, the private sector behaves as if it chooses b to solve the following maximization problem:

$$\underset{\{b\}}{\text{maximize:}} \quad C = (1-t)F(b) - \frac{(1+i^*)b}{p} + a \ .$$

The first-order condition for an interior maximum is then given by:

$$(1-t)pF_K(b) - (1+i^*) = 0$$

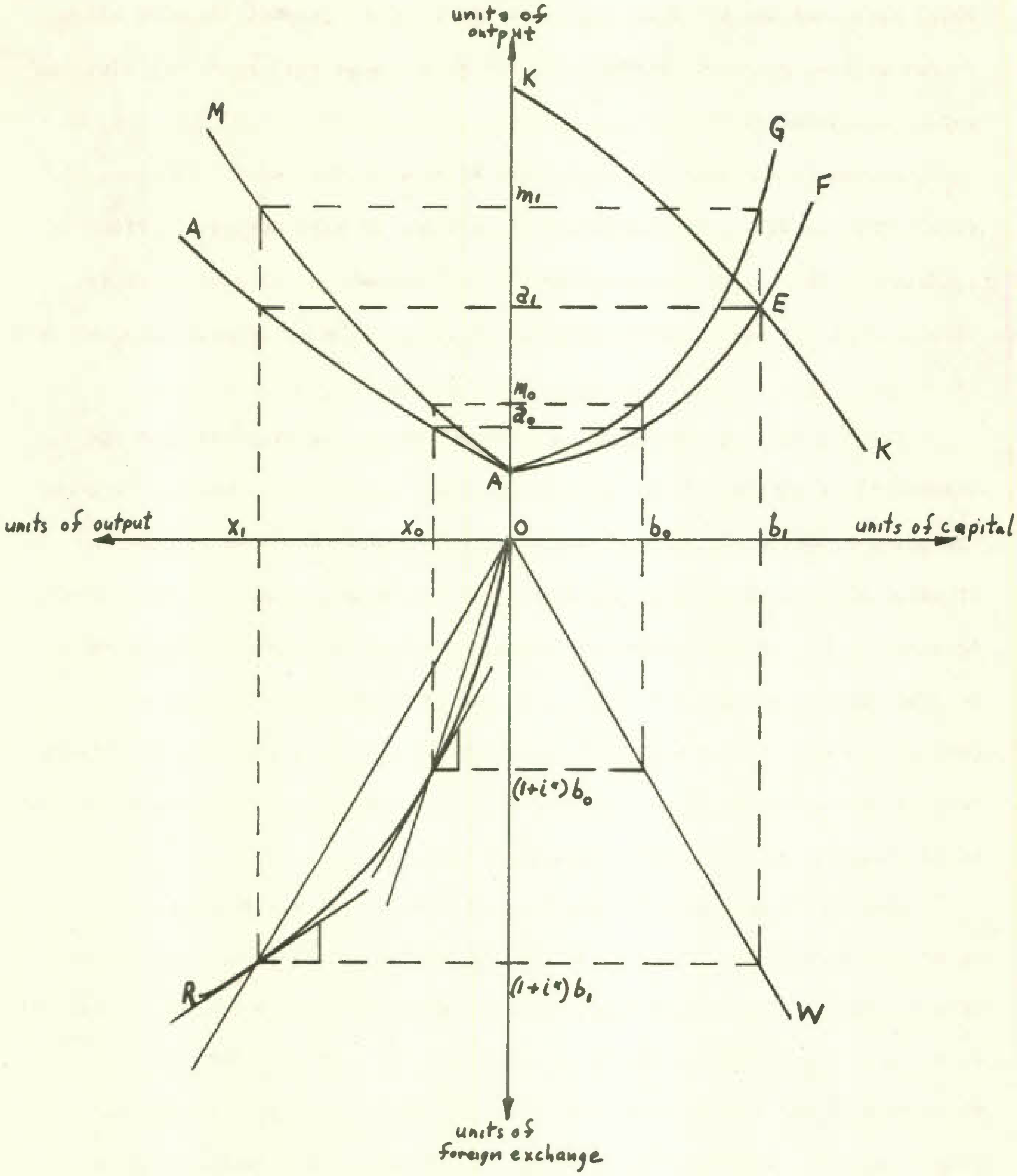
which says that the after-tax value of the marginal product of externally funded capital measured in units of foreign exchange must equal one plus the world real interest rate.

A competitive equilibrium for the economy is defined by the above first-order condition together with the balance of payments equilibrium condition. This gives two equations in two unknowns x and b to solve as functions of the tax-transfer structure (t,a) and the world real interest rate i^*.

Even though the economy is able to borrow unlimited funds from the international capital market at a predetermined world real interest rate and use these funds to purchase or rent imported capital at given prices, the cost of external funding measured in units of domestic output will be an increasing function of the level of external funding whenever the foreign demand schedule for the country's exports is less than perfectly elastic. A tax-free competitive equilibrium will therefore reflect a greater reliance on external funding than would be optimal from a national point of view. These points can be conveniently illustrated using Figure 1.

The upper right quadrant depicts the marginal social benefit of externally funded capital KK as a function of the amount of capital borrowed from abroad. This schedule represents the economy's excess demand for capital since it is the horizontal difference between the economy's marginal efficiency of capital and the (perfectly inelastic) supply of domestically funded capital. The vertical intercept OK therefore represents one plus the domestic real interest rate that would prevail in the absence of external funding.

Figure 1


units of output
K
M
G
F
m_1
A
a_1
E
m_0
a_0
K
A
units of output
X_1
X_0
O
b_0
b_1
units of capital
$(1+i^*)b_0$
R
$(1+i^*)b_1$
W
units of foreign exchange

The lower right quadrant relates the amount of capital borrowed from abroad in the current period to the amount of foreign exchange that must be repaid in the future period. Since one unit of capital is assumed to cost one unit of foreign exchange then b units of capital borrowed from abroad in the current period requires that $(1+i^*)b$ units of foreign exchange be repaid in the future period. The slope of the OW schedule is one plus the world real interest rate.

The lower left quadrant relates the amount of foreign exchange owed to foreigners to the amount of future domestic output that must be exported to earn it. If the foreign demand schedule for the country's exports is elastic the volume of its exports will be a monotonic increasing and strictly convex function of the amount of foreign exchange owing. We represent this situation in Figure 1 by the curve OR. For an economy facing a predetermined world price for its exports the OR schedule would be a radial from the origin; for an economy facing an inelastic foreign demand for its exports the OR schedule would be a monotonic decreasing function of the amount of foreign exchange owing.

The upper left quadrant graphs the average and marginal cost of exports schedules AA and AM respectively as functions of the volume of exports. The average cost of exports is obtained by dividing each quantity of exports by the amount of foreign exchange that this quantity would earn. Clearly, AA slopes upward because as we move further out along OR the slope of a straight line from the origin to the curve will be increasing as we view it from the vertical axis. The marginal cost of exports is obtained by computing the inverse slope of the OR schedule at any given level of exports. It measures the extra amount of future domestic output that must be exported for each extra unit of foreign exchange borrowed.

To arrive at the average cost of externally funded capital schedule in the upper right quadrant consider an arbitrary amount of capital borrowed from abroad, say b_o. It will require $(1+i^*)b_o$ of foreign exchange to repay the debt in the future period, which will necessitate x_o of future period output being exported. The average cost to the economy of borrowing b_o units of foreign exchange measured in units of future output will then be given by $x_o/(1+i^*)b_o$ which is represented by a_o. The marginal cost to the economy of b_o units of foreign exchange is given by $1/R'(x_o)$ or $1/(p(x_o) + x_o p'(x_o))$ which is denoted by m_o. Therefore the combination (b_o,a_o) lies on the cost of externally funded capital schedule and the combination (b_o,m_o) lies on the marginal cost schedule. Other pairings such as (b_1,a_1) and (b_1,m_1) are obtained by following an identical procedure which traces out the upward sloping average and marginal cost schedules AF and AG respectively for the case of an elastic export demand schedule.

The tax-free competitive equilibrium for such an economy is shown by the intersection of the KK and AF schedules in Figure 1 at point E, where the marginal social benefit of externally funded capital is equal to its average cost. Since the marginal cost of externally funded capital exceeds the average cost the tax-free competitive equilibrium will reflect an excessive reliance on external funding from a national point of view. Some form of government intervention is warranted if national welfare is to be maximized.

3. Effects of a Change in the Capital Income Tax

Consider now the effects of a small change in the rate of capital income tax. Totally differentiating the first-order condition and the balance of payments equilibrium condition with respect to a small change in t we obtain:

$$(1-t)pF_{KK}db + (1-t)p'F_K dx = pF_K dt$$

$$(p+xp')dx - (1+i^*)db \qquad = 0 \ .$$

These two equations can then be solved to give the following comparative statics results:

$$\frac{dx}{dt} = \frac{-(1+i^*)pF_K}{\Delta}$$

$$\frac{db}{dt} = \frac{p^2(1 + \frac{1}{n})F_K}{\Delta}$$

where $n < 0$ represents the price elasticity of world demand for the home country's exports, and where $\Delta = -(1-t)[p'F_K(1+i^*) + p^2F_{KK}(1 + 1/n)]$.

Now it is not immediately apparent whether Δ is positive or negative, but it can readily be shown that stability of equilibrium requires that Δ be positive. To see this, consider how the demand for external funding depends upon the foreign exchange price of exports p. Differentiating the first-order condition for private sector equilibrium with respect to a small change in p and rearranging terms we obtain:

$$(db/dp)_D = -F_K/pF_{KK}$$

which we know is positive given that the production function is well behaved. Therefore, an increase in the foreign exchange price of exports (or, equivalently a reduction in the price of foreign exchange in units of domestic output) will increase the private sector's demand for external funding b.

Next, the supply of external funding must satisfy the balance of payments constraint and we seek the relationship between the price of exports p and the amount of external funding b that maintains balance of payments equilibrium. From the balance of payments constraint we obtain $db/dx = (xp'+p)/(1+i^*)$, where $dx/dp = 1/p'$. Therefore it follows that:

$$(db/dp)_S = (xp'+p)/p'(1+i^*) \ .$$

An increase in the price of exports p (or, equivalently, a reduction in the price of foreign exchange in units of domestic output) will cause a reduction in export sales. If the export demand schedule is price elastic, then foreign exchange earnings will fall and so will the amount of external funding required to maintain balance of payments equilibrium. However, if the export demand schedule is price inelastic, foreign exchange earnings will rise and so will the amount of external funding to maintain the balance of payments. Consequently $(db/dp)_S$ may be positive or negative.

Local stability requires that if the foreign exchange price of exports p deviates slightly above its equilibrium value (or, equivalently, if its inverse, the price of foreign exchange in units of domestic output deviates slightly below its equilibrium value) then excess demand for external funding will develop. Formally, stability requires that:

$$(db/dp)_D - (db/dp)_S = -F_K/pF_{KK} - (xp'+p)/p'(1+i^*) > 0$$

which upon simplification yields the condition:

$$(1+i^*)p'F_K + p^2F_{KK}(1 + 1/n) < 0 \ .$$

This condition is equivalent to the condition that Δ be positive. In terms of Figure 1 stability of equilibrium requires that if AF happens to be negatively sloped it cannot be flatter than KK itself.

We conclude that while $\frac{dx}{dt} < 0$ (i.e., an increase in the capital income tax will always reduce the equilibrium volume of exports), $\frac{db}{dt} \gtrless 0$ as $n+1 \gtrless 0$ (i.e., an increase in the capital income tax may raise or lower the amount of external funding depending upon whether the export demand schedule is inelastic or elastic). In the case shown in Figure 2a the AF schedule is upward sloping reflecting the case where the export demand

Figure 2a

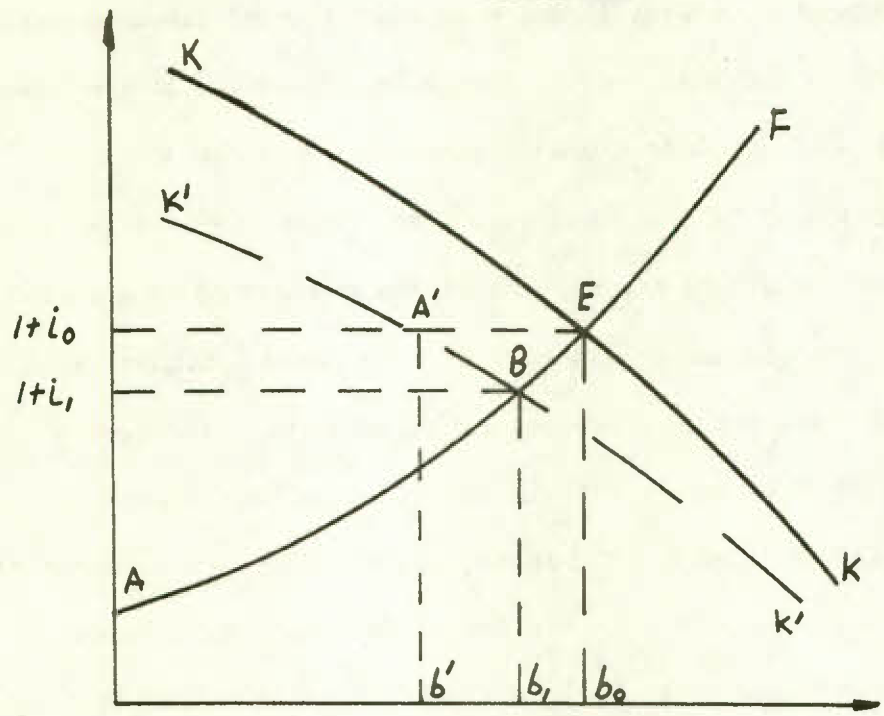
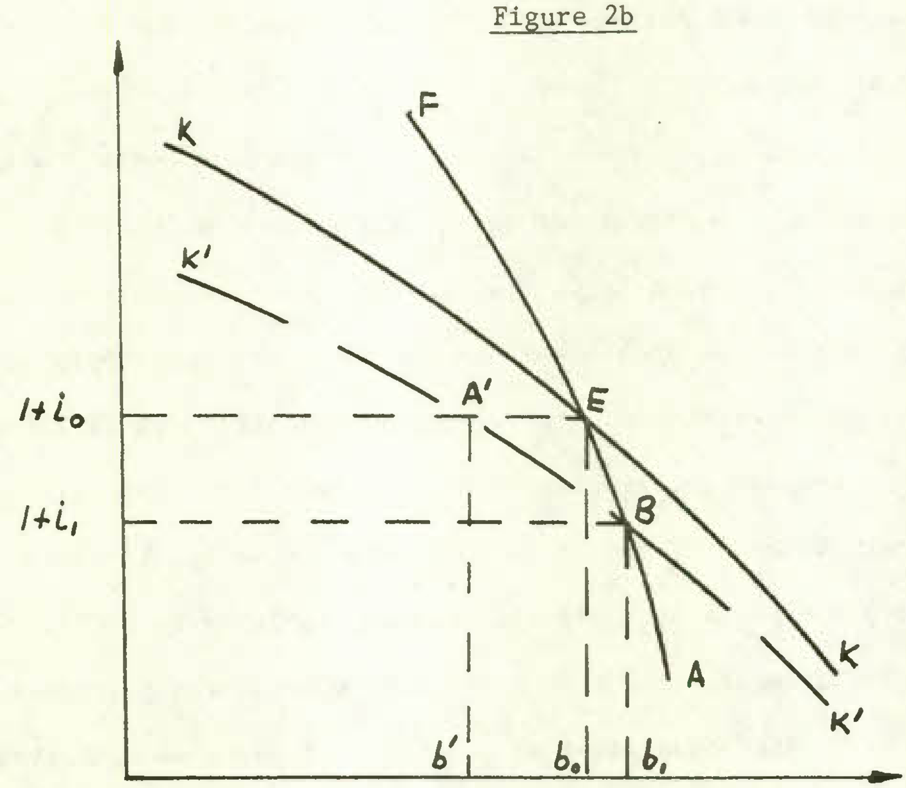


Figure 2b



schedule is elastic. The imposition of a capital income tax will shift the capital demand schedule downward by the percentage of the tax to, say, K'K', resulting in a new competitive equilibrium at B with a lower level of external funding b_1 and a reduced level of capital formation. However, in the case shown in Figure 2b the AF schedule slopes downward because the price elasticity of export demand is less than one. The imposition of a capital income tax will shift the demand for capital schedule downward to K'K' as before, but in this case the new equilibrium at B reflects a higher level of external funding and therefore an increase in total capital formation.

The reason for the difference between the outcomes in the two cases can be explained in the following way. The imposition of the capital income tax causes a reduction in the private sector's demand for externally funded capital at the unchanged foreign exchange price of domestic output from b_o to, say, b'. This creates excess demand for exports since world demand has not changed but domestic supply has fallen to $(1+i^*)b'/p_o$ which is what is required to satisfy balance of payments equilibrium. The result is an increase in the foreign exchange price of exports (and domestic output) which at least partially restores the demand for externally funded capital. If world demand for the country's exports is elastic then any increase in p will reduce total foreign exchange earnings from exports and cause the supply of external funding consistent with balance of payments equilibrium to fall from its initial value b_o. The new equilibrium level of external funding will therefore lie somewhere between b_o and b' in this case. However, if world demand for the country's exports is inelastic then any increase in p will cause total foreign exchange earnings from exports to rise, thereby increasing the supply of external funding consistent with balance of payments equilibrium above its initial value b_o. Assuming that any increase in p causes a greater increase in the demand for external funding than in the supply necessary to maintain external balance (which is nothing but the condition for stability of equilibrium), the new equilibrium level of external funding must lie above b_o.

Before concluding this section it is of interest to consider the effect of capital income tax changes on the domestic real interest rate. By assumption, the world real interest rate is unaffected by changes in the home country's capital income tax, but this does not imply that the domestic real interest rate remains unaffected even if the international capital market functions perfectly. The domestic real interest rate reflects the marginal rate of substitution between present and future consumption, which according to the first-order conditions is equal to the net of tax marginal product of capital. More precisely, $i = U_1/U_2 - 1 = (1-t)F_K - 1$ from which it follows that:

$$\frac{di}{dt} = (1-t)F_{KK}\frac{db}{dt} - F_K .$$

Substituting for db/dt from earlier work we obtain:

$$\frac{di}{dt} = (1-t)^2 pp'F_K^3/\Delta$$

which says that an increase in the capital income tax will always reduce the domestic real interest rate except in the extreme case where p' = 0.

If the domestic real interest rate falls with an increase in the capital income tax by how much does it fall? In a closed economy the tendency for i to fall will be partially arrested if the supply of domestic savings is responsive to changes in the after-tax rate of return; only if the supply of domestic savings is perfectly inelastic will the real interest rate fall by the full amount of any increase in t. In an open economy with unrestricted access to funding from the international capital market at a predetermined world real interest rate an increase in t can actually cause the domestic real interest rate to fall by more than the increase in t itself. To see this we note that:

$$\frac{di}{dt} - 1 = (1-t)p^2 F_{KK} (1 + \frac{1}{n})/\Delta$$

so that if n > -1 the domestic real interest rate actually falls by more than the increase in t. This result is, of course, implicit in Figure 2b.

If the international capital market functions perfectly how can there be real interest rate differentials across countries? The answer offered here begins with the observation that the real interest rate of any single country is denominated in terms of that country's particular basket of goods. From the standpoint of an individual agent residing in a given country real after-tax rates of return on domestic and foreign assets will be driven to equality in a perfectly functioning international capital market. But if the tradeables produced by each country are less than perfect substitutes for the tradeables of other countries real interest rates will tend to diverge across countries with net debtors having higher real rates than net creditors. The size of such real interest rate differentials will be related to the size of individual countries' net indebtedness positions and they will persist even if there is no risk or uncertainty.

The explanation offered here has nothing whatsoever to do with the existence of country risk that has been cited by others as a reason why the international capital market appears to function imperfectly (see Harberger (1980)). Rather, the reason simply recognizes that net debtor countries must ultimately generate trade balance surpluses and in doing so they will be forced to suffer deleterious real terms of trade effects whenever their exports are imperfect substitutes for other internationally traded goods. These future terms of trade effects get capitalized into current real interest rates making net debtor countries experience higher real interest rates than net creditors. According to this explanation real after-tax rates of return to investors are equalized across countries precisely because real interest rates differ. The existence of these real interest rate differentials is not evidence that the international capital market is functioning poorly, but rather evidence that real terms of trade effects are important in a world where the internationally traded goods of one country are imperfect substitutes for those of others.

4. Second-Best Optimum Tax on Capital Income

The previous section has shown that even though a small open economy may be able to borrow unlimited funds from the international capital market at a predetermined world real interest rate, its cost of external funding will be an increasing function of the level of external funding whenever the foreign demand schedule for its exports is less than perfectly elastic. A natural question to ask at this point is: What is the second-best optimum tax on capital income for the small open economy assuming that it is prevented by GATT rules from imposing tariffs or export taxes, and that discriminatory taxation of capital income earned by foreigners is precluded by international tax treaties?

It should be stressed that since our formal model treats the indigenous supplies of capital and labour as exogenous, we will, in fact, be deriving the first-best optimum tax on capital income. This follows because the imposition of the tax serves to correct a discrepancy between the average cost and the marginal cost of foreign funding without introducing any costly distortions in the domestic economy. In the more complex and realistic case where the supply of domestic savings depends on the after-tax return to savings, the imposition of a capital income tax is a mixed blessing; on the one hand it may serve to correct a divergence between the average and marginal cost of foreign funding, but on the other hand by driving a wedge between the marginal rate of time preference and the marginal product of capital it tends to discourage domestic savings and total capital formation.

The task for the government is to choose an optimum tax rate t to ensure that the private sector maximizes future attainable consumption C. Formally, t must be chosen to maximize $C = (1-t)F(b) - x+a$ subject to the balance of payments constraint $p(x)x - (1+i^*)b = 0$, and subject to the government budget constraint $tF(b) - a = 0$.

Define the Lagrangian function:

$$L(t,a) \equiv (1-t)F(b) - x+a - \lambda(tF(b) - a)$$

where b can be written as a function of x, namely $b(x) = p(x)x/(1+i^*)$ by the balance of payments constraint. Now differentiate $L(\cdot)$ partially with respect to the government's fiscal instruments t and a and set the expressions equal to zero to obtain:

$$\frac{\partial L}{\partial t} = -F + \{(1-t)\frac{F_K(xp'+p)}{1+i^*} - 1\}\frac{dx}{dt} - \lambda\{tF_K(\frac{xp'+p}{1+i^*})\frac{dx}{dt} + F\} = 0$$

$$\frac{\partial L}{\partial a} = 1+\lambda = 0 .$$

Substitute $\lambda = -1$ into the first equilibrium condition and rearrange to obtain:

$$\frac{pF_K}{1+i^*}\{(1+\frac{1}{n})-1\}\frac{dx}{dt}=0 .$$

We know from above that $\frac{dx}{dt} < 0$, so that the optimum capital income tax for the small open economy must be such that:

$$pF_K(1+\frac{1}{n}) = 1+i^* .$$

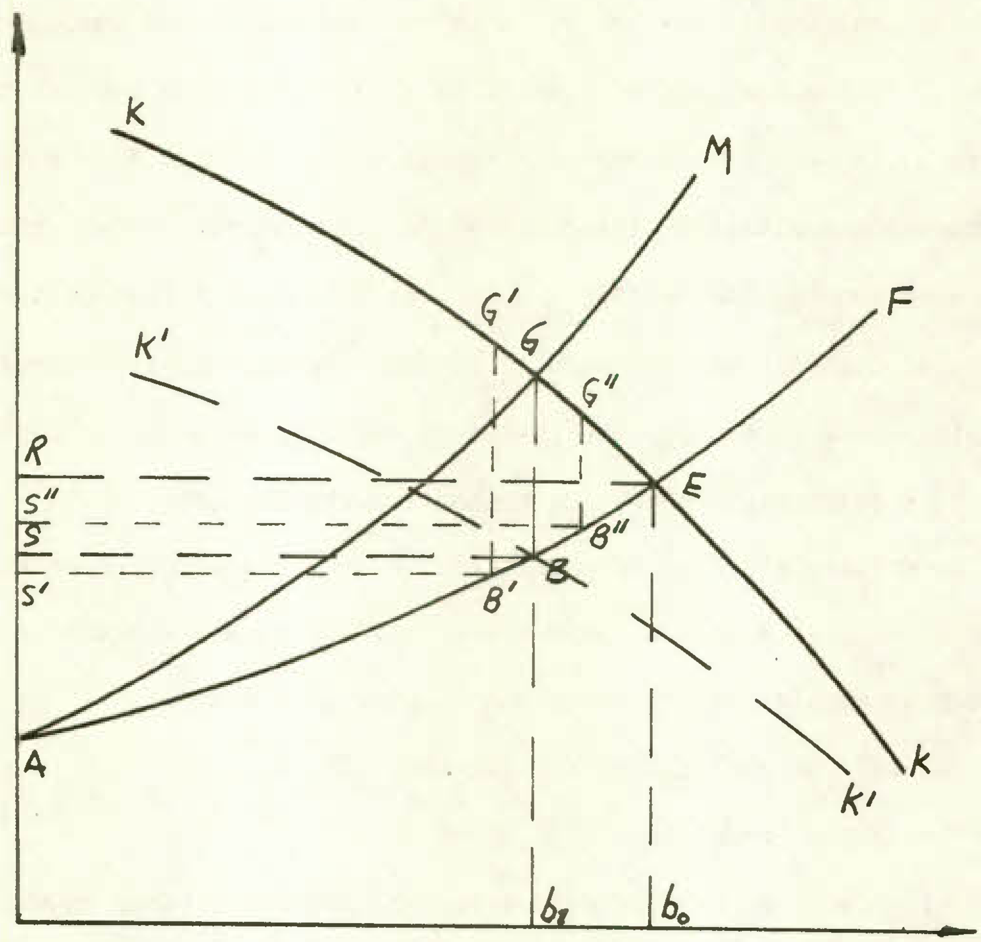
In words, the marginal product of capital in units of foreign exchange must exceed one plus the world real interest rate by a factor related to the price elasticity of demand for exports. Only if n approaches infinity will it be optimal to set the marginal product of capital equal to the world real interest rate, i.e., to reduce the capital income tax to zero.

We noted earlier that for any tax rate t the private sector will always behave to satisfy $(1-t)pF_K = 1+i^*$. Therefore, it follows that the optimum tax rate must satisfy the condition $1 + \frac{1}{n} = 1-t$, which implies that $t_{opt} = -\frac{1}{n}$. For example, if n = -2.0 the optimum capital income tax for our model is 50 percent, while if n = -1.5 the optimum tax is 66 2/3 percent, and if n = -3.0 the optimum tax is 33 1/3 percent. If n = -1.0 the supply of externally funded capital is independent of the rate of capital income tax, and any increase in the tax will improve domestic welfare by, in effect, lowering the domestic resource cost of external funding. The full burden of the tax falls on foreigners having to pay a higher price for exports. There is no burden on the domestic citizenry even though the supply of external funding is perfectly elastic at a predetermined world real interest rate. Finally, if n > -1.0 so the export demand schedule is inelastic it will always be in the interest of the host country to raise its capital income tax in our simple model; an optimum for the home country can only occur in the elastic region of its export demand curve.

It must be emphasized that the analytical results obtained here are sensitive to the strong assumption we have made about the zero compensated interest elasticity of supply of domestic savings. Given this assumption the imposition of a capital income tax fails to deter domestic savings and therefore fails to induce a potentially costly domestic distortion. For this reason the capital income tax is precisely equivalent to an export tax, and it is a first-best optimum form of intervention whenever the economy has monopoly power in its export market but is prevented by GATT rules or by a commitment to free trade principles from exploiting this power through commercial policy.

Figure 3 illustrates the optimum tax rate for the case where the country faces an elastic foreign demand for its exports and the compensated interest elasticity of supply of domestic savings is zero. The tax must shift the capital demand schedule K'K' downward sufficiently that it intersects the upward sloping supply of external funding schedule AF at a point B directly below G. The national welfare gain from the capital income tax is then represented by the difference between the quadrilateral REBS giving the reduction in real income transferred to foreigners and the triangle GBE representing the efficiency loss in failing to exploit all domestic investment opportunities that yield a pre-tax rate of return in excess of the cost of external funding. A tax slightly greater than the optimal tax would involve an incremental efficiency loss that exceeds the incremental real income transfer from foreigners resulting from an improvement in the terms of trade. In other words if the capital income tax is set optimally then the area GG'B'B exceeds the area BB'S'S, whereas the area GG"B"B will be smaller than the area BB"S"S.

Figure 3



5. The Benefits of an Increase in Domestic Savings

Recent discussions about tax incidence in open economies have focussed on the extent to which an increase in domestic savings will spill over into the international capital market rather than fund additional domestic investment. It has been argued that if capital markets are perfect and the economy is small then any increase in domestic savings will flow abroad leaving domestic capital formation unchanged. We can shed some light on this issue here by considering whether and to what extent an exogenous increase in the supply of domestic savings used to finance domestic capital formation (K) will displace foreign savings and therefore reduce the amount of capital supplied by foreigners through international borrowing (b).

If we totally differentiate the first-order condition for private sector equilibrium and the balance of payments constraint with respect to a small change in K we obtain the following two equations of change:

$$(1-t)pF_{KK}db + (1-t)p'F_{K}dx = -(1-t)pF_{KK}dK$$

$$(1+i^{*})db - (p+xp')dx = 0 \ .$$

These two equations can then be solved for the induced effects on the level of foreign borrowing and the quantity of exports, which can be written as follows:

$$\frac{db}{dK} = \frac{(1-t)p^{2}(1 + \frac{1}{n})F_{KK}}{\Delta}$$

$$\frac{dx}{dK} = \frac{(1+i^{*})(1-t)pF_{KK}}{\Delta}$$

where $\Delta = -(1-t)[p^{2}F_{KK}(1 + \frac{1}{n}) + (1+i^{*})p'F_{K}] > 0$ as before.

Thus, an increase in the supply of domestic savings (which in our model translates dollar for dollar into an increase in domestic capital) will always reduce the volume of exports, but it may raise, lower, or leave unchanged the amount of external funding. More precisely $\frac{dx}{dK} < 0$, but $\frac{db}{dK} \gtreqless 0$ as $n+1 \gtreqless 0$. In particular, if the price elasticity of world demand for exports is less than one in absolute value then an increase in domestic savings will actually encourage additional foreign funding rather than discourage it. In fact, domestic savings will displace foreign savings dollar for dollar only in the special case where (in addition to being a taker of interest rates in the world capital market) the economy is a price taker in the market for its exports. (Note that as $n \to \infty$ then $p' \to 0$ and $\Delta \to (1-t)p^2 F_{KK}$, so that $\frac{db}{dK} \to -1$.)

Many small open economies tend to be highly specialized in their exports, and while few individual countries actually face inelastic world demands for their exports it seems quite likely that most countries face world demand schedules that are less than perfectly elastic. We can gain further insight into the extent to which an increase in the supply of savings within such an economy results in an increase in total capital formation in that economy by deriving an expression for $\frac{d(b+K)}{dK}$, which takes the form:

$$\frac{d(b+K)}{dK} = \frac{(1-t)p^2(1 + \frac{1}{n})F_{KK} + \Delta}{\Delta} .$$

This expression can be reduced to readily recognizable parameters by noting first that $\sigma = F_K F_L / F_{KL} F$ is the elasticity of substitution between capital and labour in domestic production, second that due to linear homogeneity we have $KF_{KK} + LF_{KL} = 0$, and third that from the first-order condition for private sector equilibrium we have $1+i^* = (1-t)pF_K$. Making all of these substitutions we obtain the following expression:

$$\frac{d(b+K)}{dK} = \frac{\sigma\delta}{\sigma\delta-\beta(1-\delta)(1+n)}$$

where δ represents the share of GDP accruing to capital, and β represents the share of GDP that is exported to finance principal plus interest on external funding.

In Table 1 we present the proportion of incremental domestic savings that contributes to domestic capital formation (rather than spilling over into the international capital market) for various values of n, the price elasticity of world demand for the country's exports. The table is based upon plausible values for σ, δ, and β, namely that $\sigma = .75$, $\delta = .33$ and $\beta = .10$ in one case and $\beta = .20$ in the other. Thus, if $n = -1.0$ and $\beta = .10$ an extra dollar of indigenous savings will increase domestic capital formation by a dollar, whereas if $n = -1.5$ almost 90 percent of the incremental saving stays at home. At the other extreme, when $n = -\infty$ the full amount of additional savings leaks out into the international capital market, while if $n = -10.0$ more than 70 percent leakage occurs. It should be noted that the proportion of additional savings that adds to domestic capital formation increases with higher values of σ and δ, and decreases with higher values of β.

Previous authors (e.g., Feldstein (1983)) have inferred that an economy cannot be small in the international capital market unless any increase in its savings spills over completely into the international capital market leaving its capital formation unchanged. Our analysis shows that an economy can have unrestricted access to external funding at a predetermined world real interest

Table 1

The Proportion of Incremental Domestic Savings that Adds to Domestic Capital Formation and the Ratio of the National Return on Savings to the Pre-Tax Marginal Product of Capital for Alternative Values of n and β*.

	β = .1		β = .2	
n	$\frac{d(b+K)}{dK}$	α	$\frac{d(b+K)}{dK}$	α
-1.0	1.0	1.27	1.0	1.53
-1.5	.88	1.11	.79	1.17
-2.0	.79	1.0	.65	1.0
-3.0	.65	.87	.48	.83
-5.0	.48	.74	.32	.70
-10.0	.29	.63	.17	.60
$-\infty$	0	.50	0	.50

*The tax rate on capital income is assumed to be $t = 0.5$.

rate and still find that a change in its savings rate has a direct impact on its rate of capital formation. Evidence presented by Feldstein that increases in domestic savings are largely allocated to domestic capital formation within individual OECD countries is still consistent with the existence of a perfect international capital market to which each individual OECD country has full and unrestricted access. The apparent fact that an increase in the savings of one OECD country tends to flow largely into capital formation within that country may indicate that each OECD country faces a less than perfectly elastic foreign demand for its exports and must therefore suffer a deterioration in its terms of trade in order to expand its export volume.

Before concluding this section it is useful to ask what is the national return on incremental domestic savings, or in other words by how much will future domestic consumption increase as a result of a small increase in domestic savings? Expressed alternatively, what is the social opportunity cost of a dollar's worth of domestic savings absorbed by public sector deficits? Future domestic consumption is just the total future output less the amount that must be exported to repay principal plus interest on external funding:

$$C = F(K+b) - (1+i^*)b/p(x) .$$

Differentiating this totally with respect to a small change in K and making use of the first-order conditions for private sector equilibrium we obtain:

$$\frac{dC}{dK} = F_K + tF_K \frac{db}{dK} + \frac{1}{n}\frac{dx}{dK} .$$

If we then substitute for $\frac{db}{dK}$ and $\frac{dx}{dK}$ from above and simplify, we obtain:

$$\frac{dC}{dK} = F_K + \frac{(1-t)p^2 F_K F_{KK}}{n\Delta}(1+tn) .$$

Thus, if the government sets the capital income tax optimally so that $t = -1/n$ then the national return on incremental domestic savings will be equal to the pre-tax marginal product of capital in the domestic economy. In general, so long as the home country has imposed its optimal rate of capital income tax then the benefit it derives from incremental domestic savings and the cost it incurs per dollar of savings absorbed in public sector deficits will be the pre-tax rate of return in the economy whether or not all of the savings add to or subtract from incremental domestic investment. However, if $t > -1/n$, then the national return to savings will be less than the pre-tax rate of return in the economy, whereas if $t < -1/n$ the national return to savings actually exceeds the pre-tax rate of return in the economy. Finally, as $n \to \infty$, $\Delta \to -(1-t)p^2 F_{KK}$ and $\frac{dC}{dK} \to (1-t)F_K$, which says that for an economy that is a price taker in its export market as well as an interest rate taker in the world capital market, the national return to savings will be just the after-tax rate of return in the domestic economy which will coincide with the world real interest rate.

The expression for $\frac{dC}{dK}$ can be further simplified as follows:

$$\frac{dC}{dK} = \left(1 - \frac{1+tn}{1+n - (1-t)\dfrac{\sigma\delta}{\beta(1-\delta)}} \right) F_K = \alpha F_K$$

where the expression in round brackets (which we denote by α) represents the ratio of the national return on savings to the pre-tax marginal product of capital in the domestic economy. The second and fourth columns of Table 1 give this ratio for alternative values of n, assuming that $\sigma = .75$, $\delta = .33$, $\beta = .10$ in one case and $\beta = .20$ in the other. The tax rate on capital income is assumed to be 50 percent throughout.

It is apparent from the table that even if the elasticity of foreign demand for exports is -1.5 (i.e., the home country faces a modest, but nonetheless elastic, foreign demand for its exports) the national return on savings is more than 10 percent greater than the pre-tax rate of return when $\beta = .10$, and almost 20 percent greater when $\beta = .20$. The reason for this rather surprising result is that a 50 percent rate of capital income tax is actually below the optimal rate when $n = -1.5$ so that even though only 80 to 90 percent of incremental domestic savings is invested within the economy and 10 to 20 percent flows abroad, the terms of trade improvement results in less final output being exported and more final output being available for domestic consumption. Even if the price elasticity of foreign demand for home exports is as high as -5.0 the national return on savings is 70 to 75 percent of the pre-tax rate of return. This is 20 to 25 percent higher than the after-tax rate of return that has been identified by Feldstein (1983) as the national return on savings for countries that have unrestricted access to external funding at a predetermined world real interest rate. Finally, only in the extreme case of a small open economy able to obtain unlimited funding at the world real interest rate and able to export unlimited amounts of its output at given world prices will the national return on savings be just the after-tax rate of return in the domestic economy.

Figure 4 provides a graphical illustration of the relationship between the national return to savings and the pre-tax marginal product of capital for the case of an elastic export demand schedule in panel a and for the case of an inelastic export demand schedule in panel b. An increase in the supply of domestic savings of ΔS shifts the supply of funds schedule rightward to S'S' causing a reduction in the domestic real interest rate of Δi and a new

Figure 4a

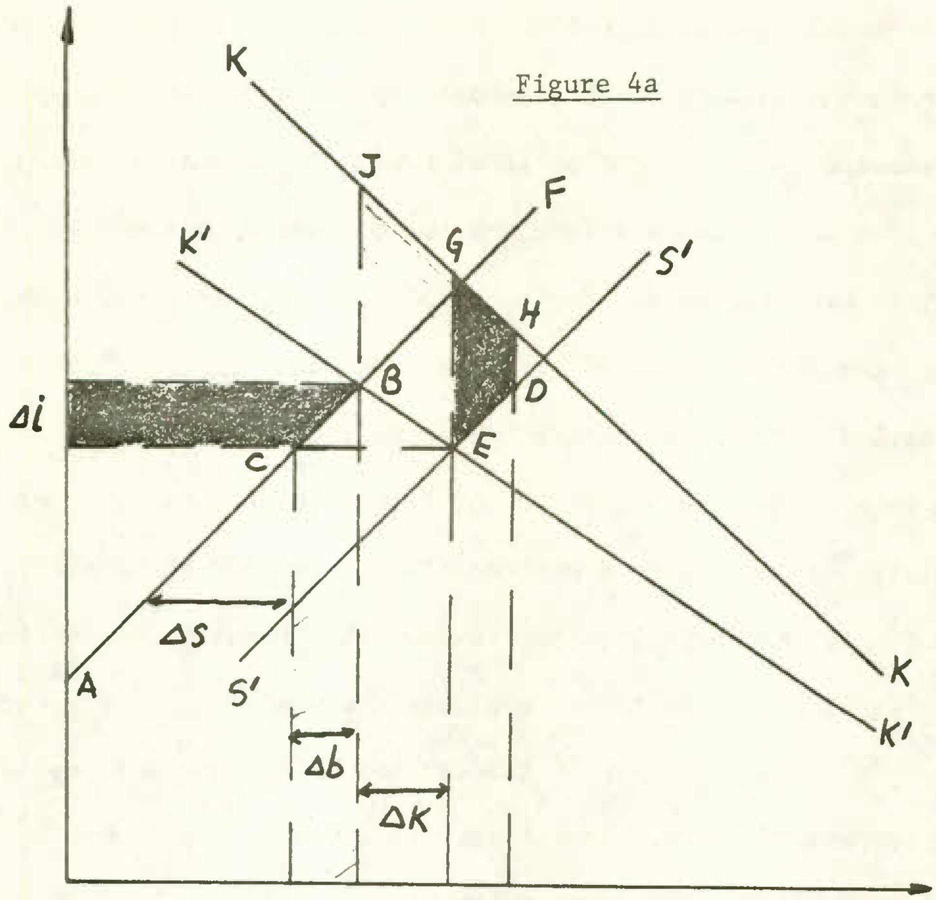
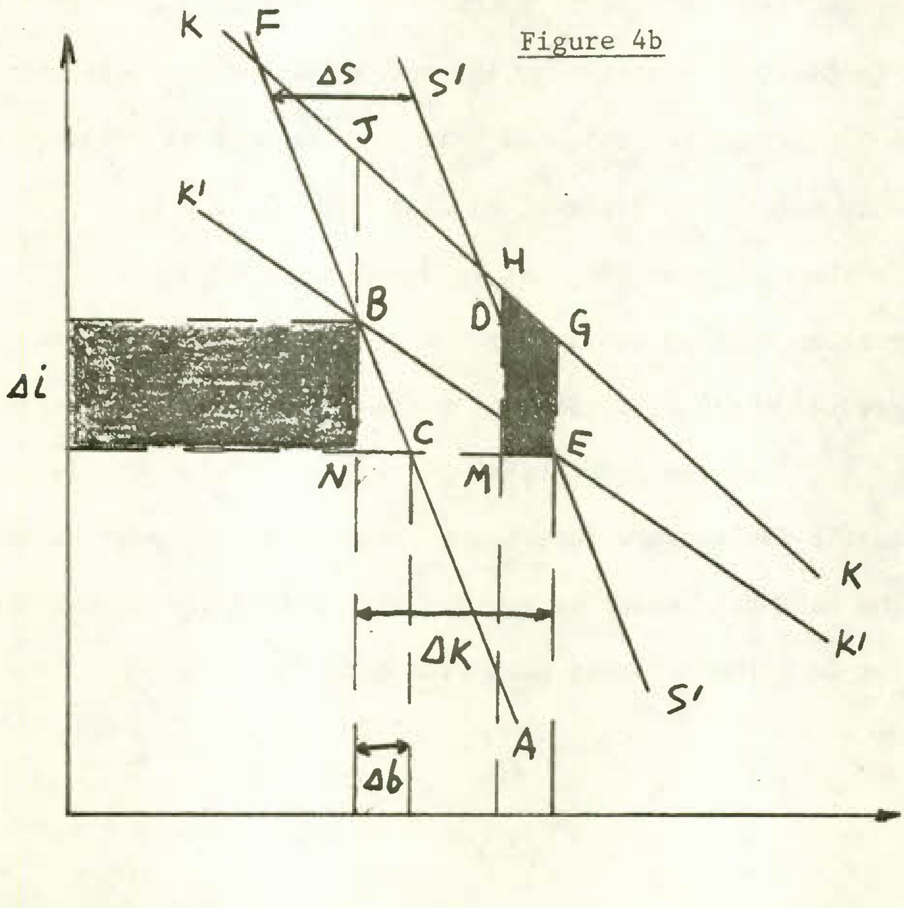


Figure 4b



equilibrium at E. The increase in domestic savings is decomposable into an increase in domestic capital formation of ΔK and either a reduction or an increase in external funding of Δb depending upon whether AF is upward sloping or backward bending. The national return to savings is therefore equal to the area under the KK schedule between J and G plus the reduction in GDP that must be exported to pay for external funding. In panel a the latter corresponds to the shaded areas $BC\Delta i + BC\Delta b$. By construction $BC\Delta b$ is equal to the area beneath S'S' between E and D. Therefore the national return to savings will be greater than, equal to, or less than the pre-tax marginal product of capital depending upon whether $BC\Delta i$ is greater than, equal to, or less than GHDE. If the capital income tax is set optimally then these two areas will be equal since the former reflects the real income transfer to foreigners from a small reduction in the capital income tax and the latter reflects the corresponding real income gain from exploiting domestic investment opportunities yielding more than the opportunity cost of funding. If the capital income tax is set below its optimum value then the former area will exceed the latter and the national return to savings will therefore exceed the pre-tax marginal product of capital.

In panel b the change in GDP that is exported is given by $BC\Delta i - BC\Delta b$. Since by construction $BC\Delta b$ is equal to the area beneath S'S' between D and E, and since the pre-tax marginal product of capital is equal to the area beneath KK between J and H (i.e., the amount that GDP would increase if all of the increase in domestic saving were invested at home with no change in external funding) then the national return to savings will exceed the marginal product of capital by the dark shaded areas $BN\Delta i$ plus HGEM.

6. Foreign Direct Investment

So far we have assumed that all external funding is obtained by borrowing from the international capital market at an exogenously determined world real interest rate. However, the analysis can easily be extended to include foreign direct investment provided that the earnings in the host country are tax exempt in the investing country. But in fact the major source of foreign direct investment for Canada is the U.S. and under the provisions of the foreign tax credit all taxes paid in Canada are credited against taxes owed in the U.S. (see e.g., Breen (1984)). It is therefore important to analyze this situation in further detail.

Suppose that t and t* are the rates of tax on capital income in the host and investing countries respectively, and that foreign direct investment is the only source of external funding. Let z represent the amount of FDI capital which, unlike the capital financed by external borrowing, is assumed to provide a distinctly different flow of services to the production process than the services of capital financed by domestic savings. The gross domestic product of the economy is then given by F(K,z), and the amount available for domestic consumption is F(K,z)-x. Assuming that the host country applies a uniform tax at rate t to all income from capital (i.e., that national treatment is accorded to foreign investors) and that all tax revenue is lump sum redistributed to the host country citizenry, private sector consumption can be expressed as:

$$C = (1-t)[F(K,z) - zF_z] + a$$

where, according to the government's budget constraint:

$$tF(K,z) - a = 0.$$

The supply of capital financed by domestic savings is taken to be exogenous as before. The private sector is therefore passive and foreign direct investment capital is supplied up to the point where the after-tax marginal value product of FDI capital measured at world prices is equal to the after-tax rate of return on similar investments abroad. Under the provisions of the foreign tax credit the relevant tax on capital income from the standpoint of the foreign direct investor will be the higher of the host country and investing country tax rates. In a competitive equilibrium the foreign exchange price of domestic output p will be a parameter to the individual foreign direct investor and the supply of FDI capital must therefore satisfy:

$$(1-t^*)pF_z(K,z) = 1+r^* \quad \text{if } t < t^*$$

or

$$(1-t)pF_z(K,z) = 1+r^* \quad \text{if } t \geq t^*.$$

Here r^* can be thought of as the real after-tax rate of return on comparable investments available to the foreign direct investor in his own country.[3]

Whereas p is a parameter to each individual foreign direct investor, p is endogenously determined within a complete model since we assume that the host country faces a downward sloping demand schedule for its exports. Therefore, to specify a competitive equilibrium one or the other of the above first-order conditions must be combined with the balance of payments constraint which states that the repatriated earnings of FDI capital must equal the foreign exchange value of exports:

$$p(x)x - (1-t)p(x)zF_z(K,z) = 0.$$

Notice that even though the effective tax on foreign direct investment capital may be the investing country tax rate t^*, the tax rate that is relevant for the balance of payments constraint will always be the host country tax rate

t. If $t < t^*$ some of the repatriated earnings of FDI capital will flow to the government of the investing country and the revenue obtained from exports must be high enough to effect this tax revenue transfer.

The problem for the host country government is to choose an optimum tax rate t given that it is constrained to accord national treatment to foreign investors. There are two cases to consider depending upon whether t is set above or below t*. We shall first consider the case where $t < t^*$. Differentiating the appropriate first-order condition and the balance of payments constraint with respect to a small change in t we have:

$$(1-t^*)pF_{zz}dz + (1-t^*)F_z p'dx = 0$$

$$(1-t)[F_z + zF_{zz}]dz - dx = zF_z dt.$$

These two equations can then be solved to yield the following comparative statics results:

$$\frac{dz}{dt} = \frac{(1-t^*)p'F_z^2 z}{\Delta'} > 0$$

$$\frac{dx}{dt} = \frac{(1-t^*)pF_z F_{zz} z}{\Delta} < 0$$

where $\Delta = -(1-t^*)pF_{zz} - (1-t)(1-t^*)p'F_z^2(1 + z\frac{F_{zz}}{F_z}) > 0$ if the competitive equilibrium is stable.

Our results confirm that an increase in the host country's tax rate in the region where $t < t^*$ will increase the amount of FDI capital except when $p' = 0$ in which case there will be no change in z. Moreover, an increase in t in the region where $t < t^*$ will always reduce the amount of exports whether or not $p' = 0$. Therefore, it will never be in the interest of the host country to tax FDI capital at a rate less than the rate prevailing in the investing country.

The intuition behind this important result is as follows. If $t < t^*$ then any increase in t will actually encourage additional foreign direct investment in the host country because in the first instance the increase in t means that the foreign direct investor will pay more taxes to the host country government and less to his own government. This means that the quantity of exports needed to finance the initial level of z will fall, and since $p' < 0$ the foreign exchange rate value of each unit of exports will rise. Since the foreign investor is interested in the marginal value product of his capital measured at world prices any increase in p will raise the worth of his investment in the host country and encourage him to invest more.

We now turn to the case where $t \geq t^*$ and ask whether it is ever in the interest of the host country to raise its rate of capital income tax above the rate prevailing abroad. Differentiating the first-order condition appropriate for this case together with the balance of payments constraint with respect to a small change in t we obtain:

$$(1-t)pF_{zz}dz + (1-t)p'F_z dx = pF_z dt$$

$$(1-t)(F_z + zF_{zz})dz - dx = zF_z dt$$

from which the following comparative statics effects emerge:

$$\frac{dz}{dt} = -\frac{pF_z}{\Delta''}\left(1 + \frac{1}{n}\right)$$

$$\frac{dx}{dt} = -\frac{(1-t)pF_z^2}{\Delta''}$$

where $\Delta'' = -(1-t)pF_{zz} - (1-t)^2p'F_z^2 - (1-t)^2p'F_zF_{zz}z > 0$ if the competitive equilibrium is stable.

In this case an increase in t will always reduce the volume of exports but the amount of FDI capital will rise, remain unchanged, or fall depending upon whether $n \gtrless -1$. If $n > -1$ so that $dz/dt > 0$ then it will clearly be in the interest of the host country to raise its rate of capital income tax above t*. This follows because $C = F(K,z) - x$ and we know that $F(\cdot)$ or GDP will increase while x (the volume of exports required to finance the earnings of FDI capital) will fall.

Next, consider the more likely case where $n < -1$, meaning that the host country enjoys some monopoly power in its export market but its export demand schedule is price elastic. At issue is whether or not future output available for domestic consumption will increase when t is raised above t*. Since $C = F(K,z) - x$ then $dC/dt = F_z dz/dt - dx/dt$. If we then substitute for dz/dt and dx/dt we obtain:

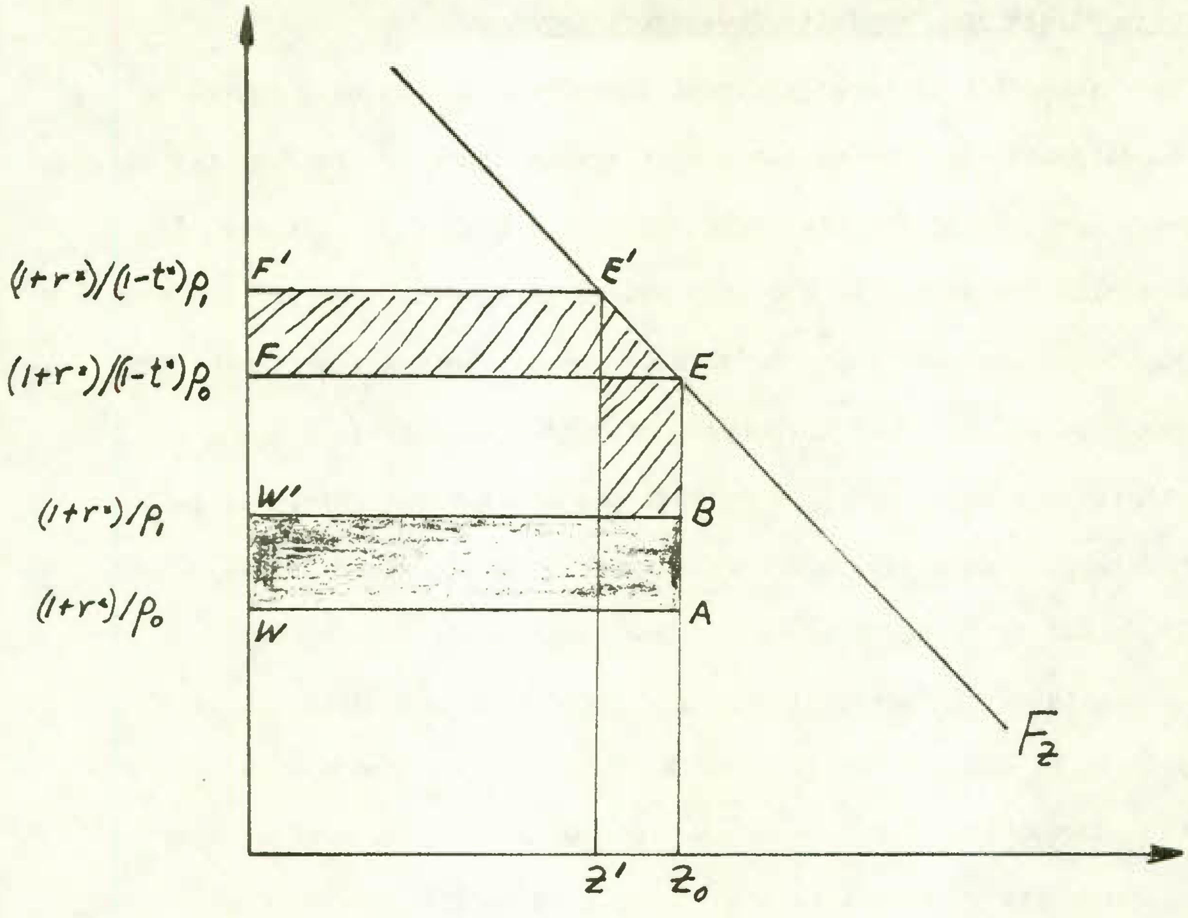
$$\frac{dC}{dt} = \frac{-pF_z^2(1 + \frac{1}{n}) + (1-t)pF_z^2}{\Delta''}$$

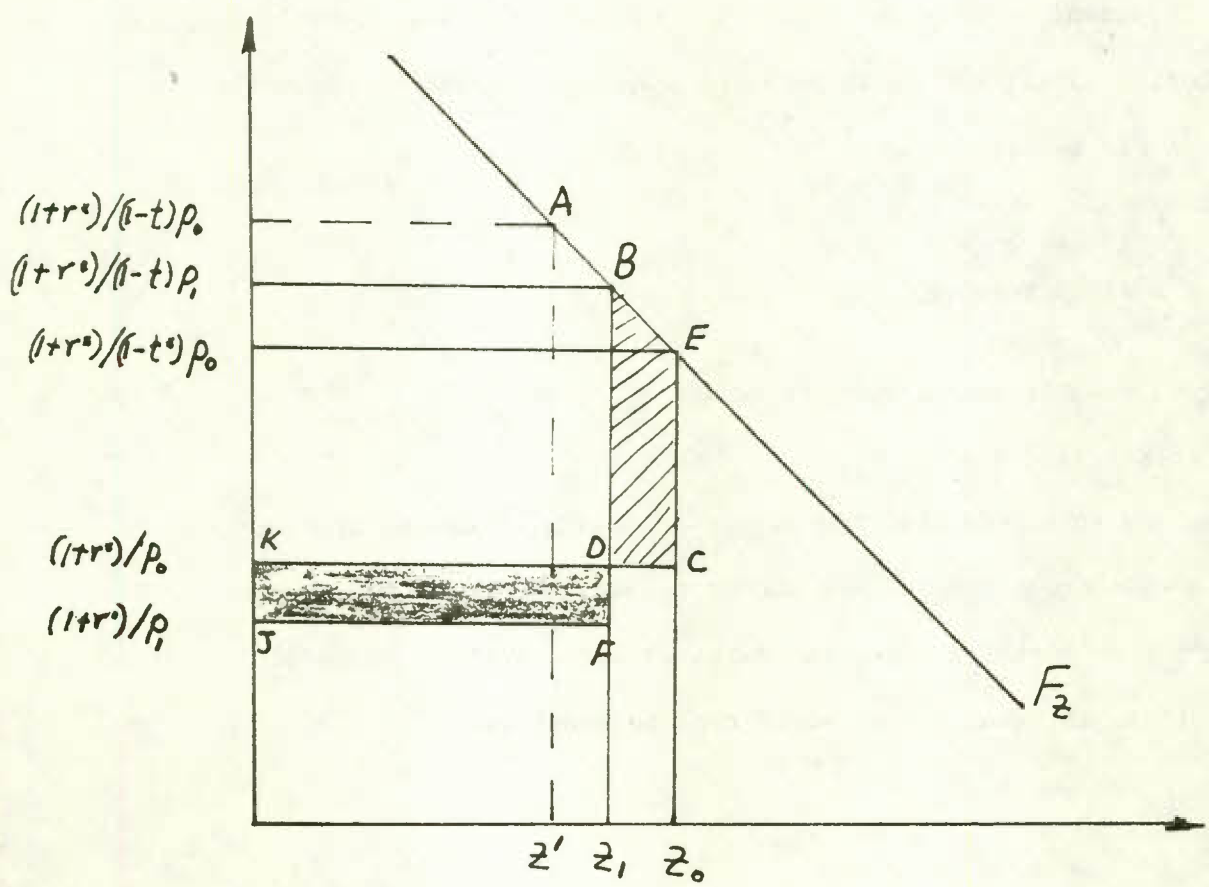
from which it follows that the optimum tax must satisfy $t = -1/n$. Thus, if $n = -1.5$ the optimum tax is 66 2/3 percent, whereas if $n = -2.0$ the optimum tax is 50 percent. It must be emphasized, however, that these rates of tax will be optimal only if the tax rate prevailing in the investing country is less than $-1/n$. For example, if t* = 40 percent then the above calculations would be correct. But suppose that $n = -3.0$ and t* = 40 percent. Then even though the formula gives t = 33 1/3 percent this tax rate would be suboptimal since $t^* > -1/n$. The optimal rate of tax in the host country would instead be 40 percent.

Figure 5 provides a confirmation of the results of this section. In the top panel we consider the consequences of the host country reducing its tax on capital income below the rate prevailing abroad. The initial equilibrium is at E where the marginal product of direct investment capital is equal to $(1+r^*)/(1-t^*)p_o$ and FDI capital is z_o. The area FEAW is tax revenue captured by the host country in setting $t=t^*$. If the capital income tax is reduced and there is no deferral provision the cost of capital to the host country increases by the amount of the tax cut and the level of FDI capital remains unchanged at z_o. For the small open economy the domestic welfare loss is equal to the dark shaded area ABW'W. If the economy has influence over the world price of its exports the cost will be even greater since the transfer of tax revenue to the foreign country will induce a reduction in the foreign exchange price of exports, which will further increase the cost of FDI capital. The new equilibrium will occur at E' with a lower level of FDI capital z' and an additional loss of welfare equal to the light shaded area.

If a reduction in t below t* is welfare reducing for the host country then an increase in t above t* may be welfare improving. The lower panel of Figure 5 illustrates this case. If the economy were small then an increase in t above t* would reduce FDI capital from z_o to z' and result in a new equilibrium at A. However, if the economy has influence over the world price of its exports then the reduced volume of exports needed to finance FDI capital earnings will cause an increase in p and as a result reduce the average and marginal cost of FDI capital to the country. The new equilibrium with an elastic export demand schedule would occur at an intermediate point like B. A domestic welfare gain will occur when t is raised above t* if the area BECD is smaller than the area DFJK.

Figure 5


F'
E'
F
E
W'
B
A
W
F_z
z'
z_0
$(1+r^*)/(1-t^*)p_1$
$(1+r^*)/(1-t^*)p_0$
$(1+r^*)/p_1$
$(1+r^*)/p_0$


$(1+r^*)/(1-t)p_0$
$(1+r^*)/(1-t)p_1$
$(1+r^*)/(1-t^*)p_0$
$(1+r^*)/p_0$
$(1+r^*)/p_1$
A
B
E
K
D
C
J
F
F_z
z'
z_1
z_0

7. Foreign Direct and Portfolio Investment Combined

We have seen that if foreign direct investment is the only source of external funding and the foreign tax credit applies then the foreign tax rate t^* provides a lower bound for the optimum domestic tax rate. However, if foreign portfolio investment is the only source of external funding and the foreign tax credit does not apply to this source of funding then the optimum domestic tax rate is $-1/n$. If both types of funding are available and if $t^* > -1/n$ there is a basic conflict between the optimum tax rules for each type of investment separately, and the question arises whether t should be equal to t^*, equal to $-1/n$, or equal to some combination of the two.

When both types of foreign investment occur simultaneously the gross domestic product of the economy is given by $F(K+b,z)$, and the amount available for domestic consumption is $F(K+b,z) - x$. Assuming that the host country applies a uniform tax at rate t to all income from capital (thereby according national treatment to foreign investors) and assuming that there is lump sum redistribution of all tax revenue to the domestic citizenry, private sector consumption can be written as:

$$C = (1-t)[F(K+b,z) - zF_z] - \frac{(1+i^*)b}{p} + a$$

and the government's budget constraint is:

$$tF(K+b,z) - a = 0.$$

Assuming as before that the supply of capital financed by domestic savings is exogenous, the private sector chooses the level of foreign borrowing b such that the after-tax marginal value product of capital measured at world prices is equal to the world real interest rate:

$$(1-t)pF_K(K+b,z) = 1+i^*.$$

In addition, foreign direct investment capital is supplied up to the point where the after-tax marginal value product of such capital measured at world prices is equal to the after-tax rate of return on similar investments abroad. As before, the equilibrium supply of foreign direct investment capital must satisfy one or the other of:

$$(1-t^*)pF_z(K+b,z) = 1+r^* \quad \text{if } t < t^*$$

or

$$(1-t)pF_z(K+b,z) = 1+r^* \quad \text{if } t \geq t^*.$$

It should be noted that r^* may exceed i^* because of an exogenous risk premium; the foreign direct investor bears the risk of an unforeseen change in the host country's terms of trade, whereas this risk is typically absorbed by domestics in the case of foreign borrowing.

The above two first-order conditions must be supplemented by the balance of payments constraint which states that the foreign exchange value of exports must equal the sum of principal plus interest on foreign borrowing plus the after-tax earnings on foreign direct investment capital:

$$p(x)x - (1+i^*)b - (1-t)p(x)zF_z(K+b,z) = 0$$

where it should be noted that it is the domestic tax rate that enters the balance of payments constraint no matter whether t is greater than, less than or equal to t^*.

Suppose initially that t^* has been set low enough and n is high enough that $t^* < -1/n$. This guarantees that the optimum domestic tax rate will exceed t^* and that t will therefore be the relevant effective tax rate for the foreign direct investor. The problem for the host country is then to find the optimum tax rate t given the constraint that it must accord national treatment to foreign direct investors.

The first step is to determine how b, z, and x are influenced by changes in t. Differentiating the above first-order conditions and the balance of payments constraint totally with respect to a small change in t we obtain the following basic matrix equation:

$$\begin{bmatrix} (1-t)pF_{KK} & 0 & (1-t)p'F_K \\ 0 & (1-t)pF_{zz} & (1-t)p'F_z \\ 1+i^* & \alpha(1+r^*) & -p(1+\frac{1-\theta}{n}) \end{bmatrix} \begin{bmatrix} db/dt \\ dz/dt \\ dx/dt \end{bmatrix} = \begin{bmatrix} pF_K \\ pF_z \\ pzF_z \end{bmatrix}$$

where $\alpha = 1 + zF_{zz}/F_z$ can be thought of as one plus the elasticity of the marginal product of foreign direct investment capital (a number that could be positive or negative), and $\theta = (1-t)zF_z/x$ represents the proportion of export revenue required to finance the earnings of foreign direct investors. For simplicity, we have assumed that $F_{Kz} = 0$, i.e., that foreign direct investment capital and capital financed through domestic savings plus foreign borrowing are neither substitutes nor complements.

Solutions for the effects of capital income tax changes on foreign borrowing, foreign direct investment, and exports are then obtained by solving the above system, which after some manipulation yields:

$$db/dt = -p^3 F_K F_{zz} (1+1/n)/\nabla$$

$$dz/dt = -p^2 F_z F_{KK} (1+1/n)/\nabla$$

$$dx/dt = -(1-t)p^2 (F_{KK} F_z^2 + F_{zz} F_K^2)/\nabla$$

$$\text{where } \nabla = -(1-t)F_{KK}\left[p^2 F_{zz}\left(1 + \frac{1-\theta}{n}\right) + p'F_z\alpha(1+r^*)\right]$$

$$-(1-t)p'F_K F_{zz}(1+i^*) < 0 \; .$$

It is apparent from these expressions that an increase in t will cause both b and z to fall whenever $n < -1$, whereas an increase in t necessarily causes a reduction in x.

To find the optimum tax rate recall that the amount of gross domestic product that is available for domestic consumption is given by $C = F(K+b,z)-x$ and that the optimum value of t ensures that C is maximized. Hence, t must satisfy the condition $dC/dt = F_K db/dt + F_z dz/dt - dx/dt = 0$. When the above expressions are substituted into the expression for dC/dt and dC/dt is set equal to zero we find that $t_{opt} = -1/n$. This result should not be surprising given that we arrived at a similar result earlier in discussing each type of foreign investment separately. We conclude that if the economy has access to foreign portfolio capital at a predetermined world real interest rate i^* and also has access to foreign direct investment capital at a predetermined real after-tax rate of return r^*, and if the foreign tax credit applies to the earnings of foreign direct investment capital but not to foreign portfolio capital, then the optimum rate of tax on capital income is equal to minus the inverse of the price elasticity of export demand whenever $t^* < -1/n$. Thus, even though the host country may be small in the international markets for both direct and portfolio capital it is in its interest to raise its rate of capital income tax above the rate prevailing abroad whenever $t^* < -1/n$.

We now turn to the case where t^* has been set high enough and n is small enough so that $t^* > -1/n$ and consider whether t should be set equal to t^*, equal to $-1/n$, or equal to some combination of the two. To answer this question we assume that t is initially set below t* and consider the effects on b, z, and x of a small change in t in the region where t < t*. The basic matrix equation can be written in the form:

$$\begin{bmatrix} (1-t)pF_{KK} & 0 & (1-t)p'F_K \\ 0 & (1-t^*)pF_{zz} & (1-t^*)p'F_z \\ 1+i^* & \alpha(1-t)pF_z & -p(1+\frac{1-\theta}{n}) \end{bmatrix} \begin{bmatrix} db/dt \\ dz/dt \\ dx/dt \end{bmatrix} = \begin{bmatrix} pF_z \\ 0 \\ pzF_z \end{bmatrix}$$

from which after some simplification we obtain:

$$db/dt = -(1-t^*)p^3F_K[F_{zz}(1+(1+\theta)/n) + (1-t)F_z/nx]/\nabla'$$

$$dz/dt = -(1-t^*)(1-t)p^2p'F_z(zF_zF_{KK}-F_K^2)/\nabla'$$

$$dx/dt = -(1-t^*)(1-t)p^3F_{zz}(zF_zF_{KK}-F_K^2)/\nabla'$$

where $\nabla' < 0$.

It follows from these expressions that an increase in t will cause b to fall whenever $n < -(1+\theta)$, while at the same time z will necessarily rise and x will necessarily fall. Since domestic welfare is given by the amount of GDP available for domestic consumption, namely $C = F(K+b,z)-x$, it is not obvious *a priori* whether an increase in t in the region where t < t* will raise or lower domestic welfare. To assess the effect of an increase in t on domestic welfare we must again derive an expression for dC/dt which now takes the form:

$$dC/dt = \frac{(1-t^*)}{\nabla'} p^3 \{F_K^2 [F_{zz} (1 + \frac{1}{n}) + (1-t) \frac{zF_z F_{zz}}{nx} + \frac{(1-t)F_z^2}{nx}]$$

$$+ (1-t)(zF_z F_{KK} - F_K^2)(\frac{F_K^2}{nx} + F_{zz}).$$

As before, the optimum value for t must satisfy the condition that dC/dt = 0. After further manipulation we arrive at the following expression for the optimum tax rate:

$$t_{opt} = (\gamma + \frac{1}{n})/(\gamma-1)$$

where

$$\gamma = \frac{zF_z}{nx} \left(1 + \frac{F_z^2}{F_K^2} \frac{F_{KK}}{F_{zz}} \right) + \frac{zF_z F_{KK}}{F_K^2} \leq 0 .$$

Suppose that foreign direct investment is negligible or zero. Then z will be close to zero and so will γ. The optimum tax rate will then approximate -1/n no matter how large t* happens to be. On the other hand, suppose that foreign direct investment is nontrivial. Then the domestic tax rate should be set above -1/n and closer to t* in order for the host country government to capture tax revenue being transferred to the investing country government under the foreign tax credit. Finally, notice that as $n \to -\infty$ $t_{opt} \to \gamma/(\gamma-1) > 0$ so that for the small open economy the optimum tax on capital income will not be zero.

To gain further insight into the likely size of γ and t_{opt} it is helpful to consider a specific example. Thus, suppose that the economy's GDP can be written in the additively separable form $F^1(K+b) + F^2(z)$. This specification is consistent with there being no interaction between the supply of one type of capital and the marginal productivity of the other. The economy can then be viewed as consisting of two separate sectors one of which employs domestically funded capital plus capital funded by foreign borrowing and the other which relies exclusively on foreign direct investment capital. In this case γ can be simplified to take the form:

$$\gamma = \frac{zF_z}{nx}\left(1 + \frac{\theta_{L1}}{\theta_{L2}}\,\frac{zF_z}{(K+b)F_K}\,\frac{\sigma_2}{\sigma_1}\right) - \frac{zF_z}{(K+b)F_K}\,\frac{\theta_{L2}}{\sigma_2}$$

Here σ_i i=1,2 represents the elasticity of substitution between capital and labour and θ_{Li} represents the share of labour income in each sector.

For purposes of illustration suppose that $\sigma_1 = \sigma_2 = 1.0$ and $\theta_{L1} = \theta_{L2} = .67$ so that capital's share of GDP is one-third. Suppose as well that the amount of exports required to finance total foreign investment earnings--direct plus portfolio--constitutes one-ninth of GDP. Table 2 then gives the implied values for the optimum capital income tax for various assumptions about the ratio of FDI capital earnings to all other capital earnings, namely $zF_z/(K+b)F_K$ which is denoted by θ in the table. The range chosen for θ is from zero to unity. It is also assumed that the effective capital income tax in the investing country is set at $t^* = 40$ percent.

The first column of the table represents the optimum tax rate in the absence of FDI capital; the entries are equal to minus the inverse of the price elasticity of export demand. To explain the other entries recall that if $t^* = .4$ then t should be set equal to $-1/n$ whenever $n > -2.5$, thereby yielding the first two rows. However, for the remaining rows $n < -2.5$ so that t must lie between .4 and $-1/n$ depending upon the relative importance

Table 2

Implied Estimates of the Optimum Capital Income Tax for Various Values of the Elasticity of Demand for Exports and for Various Ratios of FDI Capital Earnings to all Other Capital Earnings*

n \ θ	0.0	.125	.20	.50	1.0
- 1.5	.67	.67	.67	.67	.67
- 2.0	.50	.50	.50	.50	.50
- 3.0	.33	.40 (.33)	.40 (.33)	.40 (.33)	.40 (.33)
- 5.0	.20	.31 (.25)	.36 (.25)	.40 (.25)	.40 (.25)
- 8.0	.125	.23	.28 (.25)	.40 (.25)	.40 (.25)
-10.0	.10	.20	.25	.39 (.25)	.40 (.25)
-20.0	.05	.14	.18	.33 (.25)	.40 (.25)
- ∞	0	.11	.17	.33 (.25)	.40 (.25)

*Investing country tax rate is assumed to be .40 for the unbracketed entries; if the investing country tax rate is reduced to .25 the bracketed entries denote the appropriate revisions.

of FDI capital. The formula for t_{opt} derived earlier in this section is then used to compute precise values for t with any value in excess of .4 being replaced by .4 itself. For example, if $n = -5.0$ and $\theta = .125$ then the optimum tax is 21 percent, which is higher than the 20 percent rate that would be appropriate in the absence of FDI capital (when $\theta = 0$) but less than the 40 percent rate that would be optimal if θ were equal to .5 or higher.

As a final exercise, suppose that the foreign tax rate were suddenly reduced from 40 percent to, say, 25 percent. Many of the entries in the table would be unaffected, and the cases where a revised domestic tax rate is appropriate are represented by the entries in brackets. Since t^* is now equal to .25 the optimum value for t corresponds to $-1/n$ whenever $n > -4.0$, which explains why the entries in the first two rows are unaffected and all entries in the third row are reduced to .33. For $n < -4.0$, $t^* = .25$ sets an upper bound for t so that all entries in rows four to seven that are greater than .25 must be revised downward to .25.

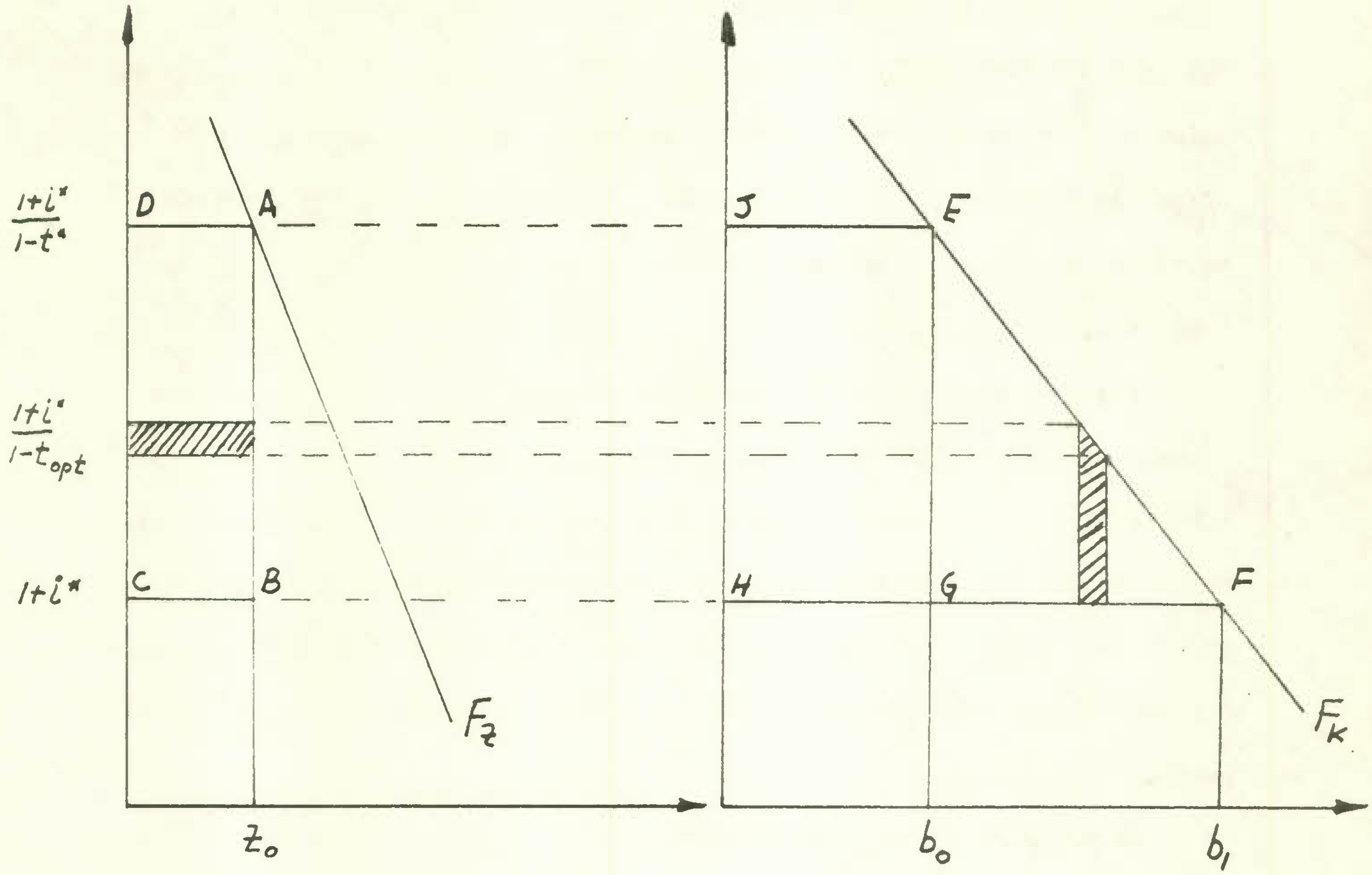
In sum, if the host country must choose a uniform tax on all income from capital that does not discriminate between foreign versus domestic sources, and if the foreign tax credit permits taxes paid to the host country on all foreign direct investment earnings to be credited against taxes owed in the investing country, the optimum tax lies somewhere in between what would be optimal if all foreign investment income were subject to the foreign tax credit provision and what would be optimal if no foreign investment income were eligible. Table 2 indicates very clearly how sensitive the optimal tax rate is to variations in the relative importance of FDI capital.

The ability of the foreign direct investor to defer taxes owed to the investing country through the reinvestment of retained earnings has often been cited as a reason why a reduction in the host country tax rate below the investing country tax rate will be effective in stimulating foreign direct investment in the host country. In this section we have seen that even if the foreign direct investor is unable to defer taxes through reinvestment there may be sound reasons for the host country to set its capital income tax rate below t*. The cost in tax revenue foregone on FDI earnings may be more than offset by gains in the host country as a result of encouraging additional portfolio funding from abroad at a cost below the domestic marginal productivity of capital.

Figure 6 emphasizes this point for the extreme case of a small open economy with no ability to influence the world price for its exports. The initial equilibrium is at z_o and b_o when the host country sets its capital income tax at the rate prevailing in the investing country, namely t*. ABCD in the left panel represents the tax revenue obtained by the host country on FDI capital and EGHJ represents the tax revenue obtained on foreign portfolio capital.

If the host country were to eliminate its capital income tax then ABCD would be transferred to the investing country government and the level of FDI capital would remain unchanged at z_o. Meantime, the amount of foreign portfolio funding would expand to b_1. There would be a net welfare gain to the host country if EFG is larger than ABCD, and this is more likely to occur when the amount of FDI capital is small relative to the amount of portfolio capital and when the slope of the F_K schedule is modest (i.e., F_{KK} is close to zero, or alternatively σ_2 is very large). In general, it will be optimal for the host country to choose a tax rate intermediate between 0 and t* where the marginal transfer of tax revenue on the existing stock of FDI capital is equal to the marginal efficiency gain in encouraging additional foreign portfolio funding.

Figure 6



8. Conclusion

Harberger (1980) used the concept of country risk to explain why much of any increase in a country's saving tends to finance additional investment within that country rather than abroad, and why an investment boom in one country tends to attract relatively more funding from within that country than from the international capital market. Harberger also challenged the profession to find alternative ways of rationalizing why capital does not appear to flow as freely internationally as a perfectly functioning capital market would suggest. This paper provides such an alternative by focussing on the fact that the price elasticities of demand for the exports of individual countries are typically far from infinite and that as a consequence there are inevitable and potentially significant real terms of trade effects involved when capital is transferred internationally. An important implication of this hypothesis is that countries that are net debtors will tend to have high real interest rates, and countries that are net creditors will tend to have low real interest rates, even if real after-tax rates of return to investors are driven to equality across countries in a perfectly functioning international capital market.

A single hypothesis need not explain fully any given phenomenon, of course, and it seems quite likely that both considerations of country risk and terms of trade contribute towards a complete understanding of why the cost of externally funded capital schedule slopes upward for most countries. To the extent that it does the world real interest rate will understate the national return to savings and the true social opportunity cost of capital for any particular country. As well, the effects of incentives to encourage savings cannot be fully decoupled from the effects of incentives to encourage capital formation, and the burden of any increase in capital income taxation will not be borne in full by factors in inelastic supply to that country.

In sum, the major message of this paper is that export demand conditions are crucial in determining both the cost of externally funded capital and the optimal rate of tax on capital income for an open economy. Access to unlimited funding from abroad at a predetermined world real interest rate is not sufficient to ensure that an exogenous increase in a country's supply of saving will spill over fully into the international capital market and leave the level of domestic capital formation unchanged.

In order to illustrate the central point of the paper we derive expressions for the optimal rate of tax on capital income for the economy both in the case where it can obtain unlimited funding from abroad at a predetermined world real interest rate and for the case where external funding is also available from foreign direct investors who demand a given real after-tax rate of return but who are able to credit any taxes paid to the host country government against taxes owed in the investing country. We show that in the presence of the foreign tax credit it is never optimal for the host country to set its rate of capital income tax below that prevailing in the investing country, and that it may be welfare improving for the host country to raise its rate of tax above the rate prevailing abroad depending on the price elasticity of export demand.

The major limitation of the paper is that it ignores the effects of changes in the after-tax rate of return on the supply of domestic savings available to finance domestic capital formation. The more responsive the supply of domestic savings is to changes in the after-tax rate of return the greater will be the domestic welfare cost of any tax-induced divergence between the private and social returns to saving. In this broader context the desirability of any increase in the capital income tax must weigh the benefits of reducing the real cost of external funding against the costs of driving a greater wedge between the private and social returns to saving. These issues are explored in greater detail in a companion paper.

Footnotes

1 Domestics can be viewed as having intertemporal preferences defined over current and future consumption $U(C_o, C)$ and to be maximizing $U(\cdot)$ subject to an initial wealth constraint $C_o + C/(1+i) = V_o$. In order for the supply of initial resources saved, namely $V_o - C_o$, to be independent of the tax policy changes to be analyzed in this paper it must be the case that the intertemporal elasticity of substitution is zero. Theory tells us that the compensated response of saving to change in the after tax rate of return is non-negative, but it is an empirical issue whether it is close to zero (i.e., whether the intertemporal elasticity of substitution is negligible). Harberger (1972) takes the position that the compensated response of saving to change in the after tax rate of return in a closed economy is sufficiently small relative to the response of the demand for capital with respect to the cost of capital that 90 per cent of the resources withdrawn from the capital market to finance a public project will displace private capital formation rather than result in a postponement of current consumption. Conversely, the incidence of a tax on capital income will be almost completely borne by owners of capital and there will be virtually no change in total capital formation. The interest responsiveness of savings as well as the determination of saving are important issues in their own right, but we sidestep them here by assuming that the response of saving to changes in the after tax rate of return is small enough to be ignored.

2 An alternative formulation of the government's budget constraint would be to introduce government expenditure on future output of g and insist that sufficient taxes are imposed to finance the given level of spending: $tF(b) + a = g$. Here a would represent lump sum taxes and the problem would be to determine an optimum combination of t and a to finance a given level of g. The results of this paper indicate that if the economy has market power in its export sector but is precluded from exercising this market power through commercial policy then capital income taxation should be used in conjunction with lump sum taxation to finance any given level of government expenditure.

3 We are assuming that if the host country sets its tax rate below the rate prevailing in the investing country then the difference must be paid to the investing country when the earnings occur rather than when they are repatriated. To ignore the existence of the deferral provision might strike the reader as entirely inappropriate in light of Brean's (1984) revelation that most of the growth in FDI capital occurs through retained earnings rather than through inflows recorded in the balance of payments statistics. Nevertheless, the effects of deferral are difficult to model in a two-period context and in any case it seems important to understand how other factors in addition to deferral influence the choice of an appropriate tax rate on capital income for a host country.

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