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Taxation of foreign capital and the optimum tariff *

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Given that the host country has the monopoly power in the exportable market, this paper has been concerned with the optimum tariffs in a specific model where the internationally mobile capital is specific to the import-competing sector. The distinctive feature of this paper is approaching the optimal trade policies as an illustration of the theory of second-best. The second-best tariff rate depends on the given rate of tax on foreign capital yields. When the tax on foreign investment is greater (smaller) than the optimum rate, a tariff greater (smaller) than the traditional formula is required to correct the distortion and restore the equilibrium.

1. Introduction

The main subject of this paper is the determination of optimum tariffs in an economy open to commodity trade and capital movements. This is not a topic that lacks studies. For example, Jones (1967) and Kemp (1966, 1969) are concerned with the optimum tariffs which should be imposed if the optimum tax on capital movements is also being imposed. More recently Dixit (1985) confirms such assertion again that the formula for the standard case in which no capital flows are considered applies to the case of jointly optimum tariffs on goods and factors when there is international capital mobility.

Reality tells us, however, that policy-makers seldom consider the optimal setting of tariffs and foreign capital taxation at a time. It is quite often that tariffs are structured under the constraint of a fixed rate of foreign capital tax (because of bilateral agreement, for instance). The distinctive feature of this present paper is approaching the optimal trade policies as an illustration of the theory of second-best. For a country which possesses monopoly power but taxes or subsidizes foreign capital at an arbitrary rate, what would be the second-best optimal tariff for correcting distortion from an inappropriate tax on foreign capital yields? Since foreign investment tends to be concentrated in specific industries, the specific model analyzed by Jones (1971) and further applied by Brecher and Findlay (1983) has been modified to investigate the second-best optimum tariffs in the presence of foreign capital taxation with the internationally mobile capital specific to the import-competing sector.

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2. Model structure and notation

Consider a moderately-sized 'British' open economy which produces and consumes two goods: an importable (labelled with the subscript M), and an exportable good (labelled with the subscript X). This economy is small in the market for importables in the sense that it is unable to affect the world price of importables, P_M^*, and the foreign rental of capital, R^*. On the other hand, it does possess some degree of monopoly power in the market for exportables whose price, P_X, is endogenously determined. The production of the goods requires labor (L) and capital (K). The domestic labor force moves freely between sectors. However, capital is treated as specific to each sector and imported capital is specific to the import-competing sector. This can be justified from the prevailing economic phenomenon that foreigners tend to invest in protected industries to circumvent trade restrictions.

The model consists of three blocks: the production structure, the consumption structure, and a set of general equilibrium conditions. The production structure is first specified as follows:

$$Q_M = F(L_M, K_M), \tag{1}$$

$$Q_X = G(L_X, \bar{K}_X), \tag{2}$$

$$L_M + L_X = \bar{L}, \tag{3}$$

$$K_M = \bar{K}_d + K_f, \tag{4}$$

$$w = pF_L(L_M, K_M), \tag{5}$$

$$w = G_L(L_X, \bar{K}_X), \tag{6}$$

$$r = pF_K(L_M, K_M), \tag{7}$$

$$(1-\tau)r = p^* r^*. \tag{8}$$

Equations (1) and (2) are production functions for importable and exportable goods, with constant returns to scale. While eq. (3) states that the combined demand for labor (L_M plus L_X) must equal the fixed supply $\bar{L}$ available to the economy, eq. (4) shows that the demand for capital K_M is equal to the sum of the fixed supply of domestically owned capital $\bar{K}_d$ plus the foreign supply K_f. Equations (5)–(7) take from profit maximization in competitive commodity and factor markets, where w and r represent the domestic real wage rate and rental rate, respectively, all measured in terms of exportable goods; p denotes the domestic relative price of importable goods to exportables ($\equiv P_M/P_X$).

Except for the tax, no other restrictions are placed on inflows of foreign capital. Let τ denote the tax rate on foreign investment, and R and R^* denote the nominal domestic and foreign rental rates respectively. Free capital mobility ensures that $(1-\tau)R = R^*$. Dividing through with $P_X P_M^*$, then $(1-\tau)r/P_M^* = r^*/P_X$, where $r \equiv R/P_X$ and $r^* \equiv R^*/P_M^*$. Rearranging the terms, $(1-\tau)r = p^* r^*$ as shown in eq. (8), where $p^*(\equiv P_M^*/P_X)$ is the world relative price of importables. In addition, $P_M^* \equiv P_M/(1+t)$ with t as the tariff rate.

With fixed endowments $\bar{K}_d$, $\bar{K}_X$ and $\bar{L}$ and given p^*, p, t, τ, and r^*, there are eight equations describing equilibrium relations on production side and hence determining eight unknowns: Q_M, Q_X

L_M, L_X, K_M, K_f, w, and r. The supply of importables (Q_M) and of exportables (Q_X), and inflows of foreign capital (K_f) can be derived as follows:

$$Q_M = Q_M(p;\ t,\ \tau), \tag{9}$$

$$Q_X = Q_X(p;\ t,\ \tau), \tag{10}$$

$$K_f = K_f(p;\ t,\ \tau). \tag{11}$$

If we express the above variables in variation rate, then

$$\hat{Q}_M = (1-\omega)\delta\hat{p} - (\theta_{KM}/\theta_{LM})[(1-\omega)\delta + \sigma_M](\hat{\tau} - \hat{t}), \tag{9'}$$

$$\hat{Q}_X = -\omega\delta\hat{p} + (\theta_{KM}/\theta_{LM})\omega\delta(\hat{\tau} - \hat{t}), \tag{10'}$$

$$\hat{K}_f = (1/\alpha)(1-\omega)\delta\hat{p} - (1/\alpha\theta_{LM})[(1-\omega)\delta\theta_{KM} + \sigma_M](\hat{\tau} - \hat{t}), \tag{11'}$$

where $\hat{\tau} = d\tau/(1-\tau)$, $\hat{t} \equiv dt/(1+t)$, $\hat{A} \equiv dA/A$ (with A representing economic variables, such as Q_M, Q_X and K_f etc.), $\omega \equiv wL_M/(Q_X + wL_M)$, and

$\theta_{KM} \equiv rK_M/pQ_M$ = the share of capital in the importable sector,

$\theta_{LM} \equiv wL_M/pQ_M = 1 - \theta_{KM}$ = the share of labor in the importable sector,

$\sigma_M \equiv \left[\left(\frac{F_L}{F_K}\right)\Big/\left(\frac{K_M}{L_M}\right)\right]\Big/\left[\partial\left(\frac{F_L}{F_K}\right)\Big/\partial\left(\frac{K_M}{L_M}\right)\right]$ = the elasticity of substitution of labor for capital in the importable sector,

$\delta \equiv \left(\hat{Q}_M - \hat{Q}_X\right)/\hat{p}$ = the elasticity of substitution of importables for exportables on the supply side,

$\alpha \equiv K_f/K_M$ = the proportion of foreign capital in the importable sector,

$0 < \theta_{KM},\quad \theta_{LM},\ \omega < 1;\quad \sigma_M,\ \delta,\ \alpha > 0.$

As to demand side, the demand for imports (C_M) and exports (C_X) are assumed to be affected by the domestic relative price and real expenditure:

$$C_M = C_M(p,\ e), \tag{12}$$

$$C_X = C_X(p,\ e), \tag{13}$$

where $e = pC_M + C_X$ = the expenditure measured in terms of exportable goods. Similarly, both eqs.

(12) and (13) can also be expressed in variation rate:

$$\hat{C}_M = -(1-\gamma)\epsilon\hat{p} + \eta_M\hat{y}, \tag{12'}$$

$$\hat{C}_X = \gamma\epsilon\hat{p} + \eta_X\hat{y}, \tag{13'}$$

where $\hat{y} \equiv \mathrm{d}y/e$, with $\mathrm{d}y \equiv p\mathrm{d}C_M + \mathrm{d}C_X$, and $\mathrm{d}y$ refers a change in the real income (y) [see Jones (1967, p. 4)], and where

$\gamma \equiv pC_M/e$ = the share of imports consumption in real expenditure,

$\epsilon \equiv \left.\dfrac{\hat{C}_X - \hat{C}_M}{\hat{p}}\right|_{\mathrm{d}y=0}$ = the compensated substitution elasticity of imports consumption for exports,

$\eta_M \equiv \dfrac{e}{C_M}\dfrac{\partial C_M}{\partial e}$ = the expenditure elasticity of demand for imports,

$\eta_X \equiv \dfrac{e}{C_X}\dfrac{\partial C_X}{\partial e}$ = the expenditure elasticity of demand for exports,

$0 < \gamma < 1; \quad \epsilon,\ \eta_M,\ \eta_X > 0; \quad \gamma\eta_M + (1-\gamma)\eta_X = 1.$

In the following, both eqs. (14) and (15) describe the general equilibrium conditions for the system. Equation (14) specifies $D(p^*)$ as world's demand for home country's exports, which is to be equated to its supply to decide p^*. Equation (15) shows that international payment is in balance at every moment: the sum of imports plus interests payment on foreign capital equals the value of exports. [1]

$$Q_X - C_X = D(p^*), \quad D' > 0, \tag{14}$$

$$Q_X - C_X + p^*\{(C_M - Q_M) + r^*K_f\}. \tag{15}$$

3. The determination of the optimum tariff

Equations (14) and (15) consist of two endogeneous variables (p and y) and two exogeneous variables (t and τ). Totally differentiating eqs. (14) and (15), and substituting from eqs. (9′) to (13′)

[1] In fact, eq. (15) is also an equation showing a budget constraint. The value of consumption must equate the value of production, adjusted for tariff revenues and interest payments on imported capital:

$$pC_M + C_X = pQ_M + Q_X + tp^*(C_M - Q_M) - r(1-\tau)K_f.$$

Substituting eq. (8) into the above result and replacing p with $p^*(1+t)$, eq. (15) can thus be obtained by rearranging the terms.

into the result yields

$$\begin{bmatrix} -\dfrac{Q_X\omega\delta + C_X\gamma\epsilon}{D} - \phi & -\dfrac{C_X\eta_X}{D} \\ \dfrac{p(Q_M - r^*K_M)(1-\omega)\delta + pC_M(1-\gamma)\epsilon}{D(1+t)} + \phi - 1 & -\dfrac{pC_M\eta_M}{D(1+t)} \end{bmatrix} \begin{bmatrix} \hat{p} \\ \hat{y} \end{bmatrix},$$

$$= \begin{bmatrix} -\dfrac{Q_X\omega\delta\theta_{KM}}{D\theta_{LM}}(\hat{\tau} - \hat{t}) - \phi\hat{t} \\ \dfrac{p(Q_M - r^*K_M)\theta_{KM}(1-\omega)\delta + p(\theta_{KM}Q_M - r^*K_M)\sigma_M}{D(1+t)\theta_{LM}}(\hat{\tau} - \hat{t}) + (\phi - 1)\hat{t} \end{bmatrix}, \tag{16}$$

where $\phi \equiv (\mathrm{d}D/\mathrm{d}P^*)(P^*/D) = \hat{D}/\hat{p}^*$, which is the demand elasticity of exportables with respect to the relative price p^* and assumed to be greater than one. [2]

Solving (16) for $\hat{p}$ and $\hat{y}$, we have

$$\hat{p} = (1/\Delta)\{Q_X\omega\delta\theta_{KM}e + C_X\eta_X rK_M[\tau(1+t) - t][\theta_{KM}\delta(1-\omega) + \sigma_M]\}(\hat{\tau} - \hat{t})$$
$$+ (D\theta_{LM}/\Delta)[(\phi e - C_X\eta_X) + t(\phi - 1)C_X\eta_X]\hat{t}, \tag{17}$$

$$\hat{y} = (1/\Delta)\{\{(D\phi + C_X\gamma\epsilon)[(1-\omega)\delta\theta_{KM} + \sigma_M]$$
$$+ Q_X\omega\delta\sigma_M\}rK_M[t - \tau(1+t)] + DQ_X\omega\delta\theta_{KM}[t(\phi - 1) - 1]\}(\hat{\tau} - \hat{t})$$
$$+ (D\theta_{LM}/\Delta)\{(Q_X\omega\delta + C_X\gamma\epsilon)[1 - t(\phi - 1)] + \phi(1-\omega)\delta rK_M[\tau(1+t) - t]\}\hat{t}, \tag{18}$$

where

$$\Delta \equiv \theta_{LM}\{e(Q_X\omega\delta + C_X\gamma\epsilon) + D(\phi e - C_X\eta_X) + tDC_X\eta_X(\phi - 1)$$
$$+ [\tau(1+t) - t]C_X\eta_X\delta(1-\omega)rK_M\}.$$

3.1. Joint optimal policies of foreign capital taxation and import tariffs

By changing the conditions of supply, demand and the level of real income, foreign investment can change the gain from trade and then the optimal degree of trade restriction. On the other hand, the trade restriction may change the terms of trade and the profitably of foreign investment and then the optimal taxation of foreign capital. The joint optimization of investment and trade policies sets

[2] The joint optimization of tax and trade policies gives an optimal tax rate on foreign capital as $1/\phi$. If $\phi < 1$, the tax rate is greater than one and capital would not be imported. So it is reasonable to assume ϕ to be greater than one.

both $\hat{y}/\hat{t} = 0$ and $\hat{y}/\hat{\tau} = 0$. Solving for t and τ simultaneously, both rates turn out to be surprisingly simple: [3]

$$t_1^* = 1/(\phi - 1), \tag{19}$$

$$\tau^* = 1/\phi. \tag{20}$$

The neat result as shown in eq. (19) is simply the well-known formula for an optimum tariff in the standard case where no capital movements are considered. This is not surprising at all. As usual, commodities have a wide interpretation, and thus the inflow of capital can be treated as imported intermediate goods. Therefore, the standard formula applies to the case of jointly optimum tariffs on goods and factors when there is international capital mobility, e.g., Jones (1967) and Dixit (1985). Following this line, this optimum tariff rate also applies to the imported capital, i.e., $R = (1 + t_1^*)R^*$ just as $P = (1 + t_1^*)P^*$. Rewritting the relationship between R and R^* as $(1 - \tau^*)R = R^*$, it is easy to prove that $\tau^* = t_1^*/(1 + t_1^*) = 1/\phi$, as indicated in eq. (20). [4]

Since the country considered has monopoly power in the market of exportables, an optimum tariff allows it to exploit monopoly power to raise the real income through a change in the terms of trade. However, the more elastic the foreign demand for exportables is, the less a country can change the terms of trade, and thus, the smaller the optimal tariff is. Two more points are worth noting. First, the optimal tariff varies directly with the optimal rate of tax on foreign capital yields. The larger ϕ is, the smaller will be both t_1^* and τ^*. Second, as $\phi \to \infty$, both t_1^* and τ^* reduce to zero, returning to the conventional assertion that for a small open economy, free trade and free capital mobility are the best policy combination [as in Brecher and Findlay (1983)].

3.2. *Optimal policy in the presence of restricting capital flows*

So far, tax policies forward foreign investment and imports are implicitly assumed to be jointly considered and set by authorities. However, this is not usually the fact of life. In reality, it happens often that tariffs are structured after a tax on foreign capital yields is already given. What would be the setting of the second-best import tariffs given the fixed rate of foreign capital tax? How can we

[3] Both eqs. (19) and (20) are the solutions for the following simultaneous equations:

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} t - \tau(1+t) \\ t(\phi - 1) - 1 \end{bmatrix} = 0,$$

where

$$a_{11} = rK_M\{(D\phi + C_X\gamma\epsilon)[(1-\omega)\delta\theta_{KM} + \sigma_M] + Q_X\omega\delta\sigma_M\},$$

$$a_{12} \equiv DQ_X\omega\delta\theta_{KM},$$

$$a_{21} \equiv rK_M\phi(1-\omega)\delta,$$

$$a_{22} \equiv Q_X\omega\delta + C_X\gamma\epsilon.$$

In addition, it can be shown that the second order condition holds.

[4] If the tariff is not in the optimal level, the tax rate on foreign capital yields is no longer as $1/\phi$. In two papers discussing a quite different subject from this one, Tsaur and Chu (1989, 1990) examine the effect of restricted trade on the inflow of foreign capital and the optimal tax strategy on foreign investment, and find that the second-best tax on foreign capital yields depends on the given rate of tariff. With the tariff rate higher than $1/\phi$, a tax higher than $1/(\phi - 1)$ is required to correct the distortion, and vice versa.

rationalize such policy that a country subsidizes the capital inflows on one hand and levies import tariffs in the other? The second-best problem of the optimum tariffs will be investigated in this section.

For any given rate of τ, following from eq. (18) with $\hat{\tau}=0$ and then solving for t by setting $\hat{y}/\hat{t}=0$, the optimum rate of tariff is obtained:

$$t_2^* = \frac{D(Q_X\omega\delta + \theta_{LM}C_X\gamma\epsilon) + \tau H}{(\phi-1)D(Q_X\omega\delta + \theta_{LM}C_X\gamma\epsilon) + (1-\tau)H} \gtreqless \frac{1}{\phi-1}, \quad \text{according to } \tau \gtreqless 1/\phi, \tag{21}$$

where

$$H = rK_M\{(D\phi + C_X\gamma\epsilon)[(1-\omega)\delta + \sigma_M] + Q_X\omega\delta\sigma_M\}.$$

The critical rate of τ which judges whether the tariff should be greater or smaller than $1/(\phi-1)$ is exactly the optimum tax on foreign capital yields, $1/\phi$. When the given level of τ is greater than $1/\phi$, the production of importables can be reduced and the production of exportables can be expanded through decrease in foreign capital inflow. This leads to over-exporting of the exportable, given that the host country has the monopoly power in the exportable market. To correct this distortion and restore the optimum, the host country should exploit the monopoly power by reducing its export. This is why, in this case, the host country has to set a tariff higher than $1/(\phi-1)$. This leads to an expansion in importables and a decrease in the production and the export of exportables, and vice versa for the case of $\tau < 1/\phi$. Therefore, depending on whether the tax on foreign investment is greater or lower than $1/\phi$, a tariff higher or lower than $1/(\phi-1)$ follows logically.

Obviously, t_2^* varies directly with τ. Let us examine two special cases: free capital mobility and the small open economies. With free movements of international capital, the tariff rate obtained from eq. (21) with $\tau=0$ is as follows:

$$t_2^* = \frac{D(Q_X\omega\delta + \theta_{LM}C_X\gamma\epsilon)}{(\phi-1)D(Q_X\omega\delta + \theta_{LM}C_X\gamma\epsilon) + H} < \frac{1}{\phi-1}. \tag{22}$$

It is easy to show that $t_2^* > 0$. Thus, imposing tariffs is compatible with free capital mobility in a sense that the combination of such policies is the second-best choice for a country.

To see the case of a small open economy, let $\phi \to \infty$, then τ_2^* is reduced into the following:

$$\lim_{\phi\to\infty} t_2^* = \frac{\tau rK_M[(1-\omega)\delta + \sigma_M]}{(Q_X\omega\delta + \theta_{LM}C_X\gamma\epsilon) + (1-\tau)rK_M[(1-\omega)\delta + \sigma_M]} \gtreqless 0, \tag{23}$$

according to $\tau \gtreqless 0$.

It is clear that for a country that is small in world commodity and capital markets, an important tariff (subsidy) has to be levied to correct the distortion from taxing (subsidizing) foreign capital if the internationally mobile capital is specific to the import-competing sector. With $\tau > 0$, too few production on importables due to less of capital inflows has to be corrected with a tariff to encourage the expansion of importable sector and vice versa for $\tau < 0$. For $\tau = 0$, then $g_2^* = 0$. There would be no case to restrict imports for a small open economy with free capital mobility.

4. Conclusion

Given that the host country has the monopoly power in the exportable market, this paper has been concerned with the optimum tariffs in a specific model where the internationally mobile capital is specific to the import-competing sector. The main findings are (1) When investment and trade policies are treated as mutually dependent decisions, the joint optimization of both policies leads to a traditional formula: the optimum tariff is exactly the reciprocal of foreign demand elasticity of exportables minus one; (2) The second-best tariff rate depends on the given rate of tax on foreign capital yields. When the tax on foreign investment is greater (smaller) than the optimum rate, a tariff greater (smaller) than the traditional formula is required to correct the distortion and restore the equilibrium.

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