Institutional Members: CEPR, NBER and Università Bocconi

WORKING PAPER SERIES

How to Maximize Domestic Benefits from Irreversible Foreign Investments

Enrico Pennings

Working Paper n. 205

2001

IGIER – Università Bocconi, Via Salasco 5, 20136 Milano –Italy
http://www.igier.uni-bocconi.it

How to Maximize Domestic Benefits from Irreversible Foreign Investments

Enrico Pennings
IGIER - Bocconi University

ABSTRACT

When a foreign monopolist can either export to a host country or undertake an irreversible foreign direct investment (FDI), it is shown that the host government maximizes net domestic benefits by nearly fully subsidizing the investment cost in combination with taxing away benefits that exceed the gains from exporting. Since a higher tariff increases the firm's propensity to invest and increases tax benefits, maximizing net domestic benefits yields an optimal tariff that is higher than the one derived in previous studies that disregard the dynamics of FDI and the interaction between optimal tax and tariff policy.

Keywords: Foreign Direct Investment, Tax Policy, Tariffs, Irreversibility, Uncertainty.

JEL-Codes: E62, G31, H21.

Correspondence to:
Enrico Pennings, IGIER - Bocconi University, Via Salasco 3/5, 20136 Milano, Italy.
Tel: +39-02-5836 3300
Fax: +39-02-5836 3302
E-Mail: Enrico.Pennings@uni-bocconi.it

Acknowledgement:
This paper has been written as part of a CEPR research network on Foreign Direct Investment and the Multinational Organization, funded by the European Commission under contract number ERBFMRXCT980215. The first version was completed when I was at Universitat Pompeu Fabra.

1. INTRODUCTION

Host governments often lure foreign investors by large investment grants. Backward regions in Europe for example may use the EC's Structural Funds Program to cover up to 62% of the investment cost. Having made the investment the multinational firms are typically exposed to the corporate tax rate that prevails in the host country. The investment subsidy granted to the foreign investor in combination with levying the prevailing tax rate after investment seems a policy that is very ad hoc. This paper studies the host government's optimal policy towards profit tax, subsidy to investment and import tariff when the foreign investor can serve the host country market by undertaking an irreversible foreign direct investment (FDI), or by exporting and waiting with the commitment to FDI. Higher taxes have a negative impact on the foreign investor's propensity to invest, but the effects can be mitigated by a higher subsidy to investment or an increase in the import tariff.

We derive a partial equilibrium model where in a first stage the host government (credibly) announces a particular profit tax, lump-sum tax and import tariff, and in a second stage the firm decides at which market size it will undertake FDI. As long as this market size is not reached, it sticks to exporting, whenever profitable. Given the model structure, market size and profitability are positively related to each other. So, an alternative interpretation would be that the firm invests when the profitability of undertaking the investment reaches a certain trigger value.

With an infinite time horizon for the opportunity of undertaking FDI and uncertainty in the future size of the market, we derive the critical market size for FDI under taxation when the foreign firm and the host government jointly maximize benefits (including profits from investing and consumer surplus). Next, we show that the government can, without cooperating with the foreign firm, fully capture the jointly maximized benefits by nearly fully *subsidizing* the investment cost in combination with taxing away benefits that exceed the gains from exporting. The result gives a rationale for subsidizing foreign investors that goes beyond spillovers from foreign investment. The intuition of the result draws back to Pennings (2000) who shows that a profit tax and a lump-sum tax that generate the same expected revenues have a different effect on the trigger value of investment because of uncertainty sharing with the government even when investors are not risk averse. However, by taking taxation as exogenous and merely showing the existence of a combination of subsidy and tax such that a firm would invest as soon as the return on the investment project is positive, the paper disregards the issue of optimality of a specific tax scheme[1].

Two important aspects of the optimal tax policy need to be highlighted. Without granting a subsidy to investment the optimal trigger value reflects a double markup over the investment cost; the first being the markup over investment cost that is required by the foreign firm and the second representing the host government's markup over the firm's profit (i.e. the optimal profit tax). Furthermore, the optimal combination of tax and subsidy satisfies the condition of time-consistency and no expropriation without an explicit assumption on innate credibility of the host government's policy, since the government has no incentive to change its tax policy after the firm's move to the new location.

Next, the paper extends the optimal tax policy by analyzing the optimal import tariff. In order to isolate the interactive effect of taxes and tariffs on net domestic benefits, we will abstain from any indirect (non-pecuniary) differential effects of taxes and tariffs on the host economy, such as the positive effect of FDI on employment (Brander and Spencer, 1987). Examining the optimal tariff, we find that a higher tariff

[1] Since taxation and subsidies shift rents between the firm and the government, maximization of domestic welfare is not particularly interesting in a national setting.

increases the firm's propensity to invest and thus increases the present value of tax benefits. As a consequence it is shown that maximizing net domestic benefits yields an optimal tariff that is higher than the one derived in previous studies that disregard the dynamics of FDI and the interaction between optimal tax and tariff policy.

Related literature can be split into two areas, one relating to factors affecting the decision between FDI and exporting (agglomeration, tariff jumping, tax policy and the risk of expropriation) and the other to the timing of irreversible investments under uncertainty. With respect to the first stream Buckley and Casson (1981) argue that there is a certain market size for which it is optimal to switch from exporting since exporting has a low fixed cost but high marginal costs whereas FDI entails a high fixed cost but relatively low marginal costs. Apart from agglomeration as a determinant of FDI, tariff jumping appears an important rationale for undertaking local production instead of exporting. The basic idea is that a multinational firm foregoes paying tariffs by local production[2]. The decision between FDI and exporting also hinges on differences in international tax policy. Horst (1971) explored a seminal model on the relationship between tariff and tax policies on the one hand and optimal firm behavior on the other hand, thereby laying the theoretical foundation of tariff jumping[3]. Moreover, it is argued that firms investing abroad run the risk of expropriation. As a consequence, potential investors are reluctant to set up a full-scale foreign plant (Eaton and Gersovitz, 1983).

Recent developments in the literature on irreversible investments under uncertainty, as surveyed by Dixit and Pindyck (1994), enable a sequential analysis of exporting and FDI. The main theoretical idea is that uncertainty creates a value in waiting with investment. Firms only invest when the profits from investing exceed the

---

[2] Evidence of tariff jumping as a determinant of FDI is surveyed by Caves (1982).

[3] A more general model, examining *optimal* tariffs and taxes levied by the host government upon a firm considering to enter has been analyzed by Brander and Spencer (1987). Taking unemployment in the host country into account, they argue that a host country's output tax is lower than its tariff.

cost of investment by the value of waiting to invest[4]. The effect on investment of uncertainty in tax policy has been analyzed in MacKie-Mason (1990), Alvarez et al. (1998), and Hassett and Metcalf (1999). The first paper gives the insight that nonlinear taxes may have surprising effects on investment decisions when output price is uncertain. Main insights of the latter two papers are that higher uncertainty in tax parameters may lead to more rapid investment, contrary to conventional wisdom. The difference between these papers and our approach is that they consider taxes and tax changes as exogenous, whereas we consider endogenous taxation.

The results related to the critical market size for undertaking FDI reinforce the agglomeration and concentration effects on FDI that are found in empirical papers (Head et al., 1995; Brainard, 1997; Devereux and Griffith, 1998). Combining the agglomeration effect with the uncertainty argument, we would predict that uncertainty in market growth might deter firms from investing despite high tariffs or transportation cost and agglomeration effects[5]. Part of uncertainty in market growth will arise from political risk in the host country. By finding a significant negative effect of political risk on the share of sales through affiliates in a host country as percentage of total sales, Brainard (1997) gives some empirical underpinning for the uncertainty hypothesis.

This paper is organized as follows. Section 2 presents the basic model in which (i) the firm maximizes the net present value of benefits from exporting and FDI, given household demand and the host country's tax and tariff policy, and (ii) the government fixes its tax and tariff knowing when it is optimal for the firm to invest. In section 3 we derive the Nash bargaining efficient solution of the lump-sum and profit tax. Section 4

[4] The number of papers confirming the negative impact of uncertainty on investment grows steadily (e.g. Leahy and Whited, 1996; Guiso and Parigi, 1999); particular evidence of its effect on FDI can be found in Pennings and Sleuwaegen (2000) and Miller and Folta (2000).
[5] For example, foreign investments in Russia have been low since the reform to a market economy, though the expected market growth for consumer durables is high (Sinn and Wiechenreider, 1997). The high uncertainty surrounding the growth rate may explain the small stakes of foreign investors in Russia.

derives the main results of the paper, and finally section 5 gives some reflections on the main result and directions for further research.

2. THE MODEL

Under the assumption that (i) the industry in which the firm operates is small compared to the entire economy so that partial equilibrium analysis is appropriate, and (ii) that a representative household maximizes the following separable utility function

$$U = u(x) + m \tag{1}$$

subject to its budget constraints, the inverse demand function of the representative household is

$$u'(x) = q \tag{2}$$

where x is household consumption of the good, q is the consumer price of the good, and m is expenditure on other goods. Let the total number of households in the host country be N.[6] We assume that developments in the market size are uncertain and unpredictable. More specifically, we assume that N follows a geometric Brownian motion, so its stochastic process can be written as

$$dN = \mu N dt + \sigma N dz\,, \tag{3}$$

where z is a Wiener process, and μ and σ denote the drift and standard deviation, respectively. The consumer price of the good can be written as $q = q^E = p^E + \omega$ if the firm exports, and $q = q^F = p^F$ if the firm undertakes FDI, where $\omega > 0$ is the trade cost, and p^E and p^F denote the producer price in the export and FDI regime,

[6] Though different in focus, Haufler and Wooton (1999) use a similar basic model structure in order to investigate the importance of country size in the FDI decision.

respectively. Trade costs consist of transportation costs, $\omega_1 \geq 0$, and a specific tariff[7], $\omega_2 \geq 0$, such that $\omega = \omega_1 + \omega_2$.

Under the assumption that the production of one unit of the good entails a constant marginal cost of c^E at the home-country plant, maximized pre-tax profits per unit household are $\hat{\pi}^E = (\hat{p}^E - c^E)x(\hat{q}^E)$ if the firm exports. The firm pays a home-country tax rate of $0 \leq \theta_0 \leq 1$ over its profits from exporting. Alternatively, when the firm invests, the costs of setting up a plant in the host country are I. Moreover the firm pays a profit tax of $0 \leq \theta_1 \leq 1$ over its profits and a lump-sum tax (subsidy)[8] of $\theta_2 \geq 0$ ($-I \leq \theta_2 < 0$) which is conditional upon investment. Writing c^F as the constant marginal cost of production abroad, maximized total pre-tax profits per unit household from FDI are $\hat{\pi}^F = (\hat{p}^F - c^F)x(\hat{q}^F)$. As long as the marginal cost of producing abroad is not significantly higher than the marginal cost of production in the home country, we have that $\hat{\pi}^F > \hat{\pi}^E$.

2.1 FIRM'S ACTION

We suppose that the cost of setting up a foreign plant is irreversible, but that the decision to export is reversible. In other words, once a firm decides to close down the production plant, it cannot recover the cost of the plant when it switches back to exporting. Following Dixit and Pindyck (1994), the critical size of the market, N^*, at which it is optimal to undertake the irreversible investment can be written as

$$N^* \frac{\left((1-\theta_1)\hat{\pi}^F - (1-\theta_0)\hat{\pi}^E\right)}{\rho - \mu} = \frac{\beta}{\beta - 1}(I + \theta_2) \tag{4}$$

[7] Ad valorem tariffs could be considered as well, but since the main results are not affected by the specific tariff structure, we restrict space and solely pay attention to specific tariffs.
[8] Since taxes may come in several other forms (e.g. an output tax), the profit tax should be considered as the effective tax rate on profits, net of any taxes or subsidies that are conditional on investment.

for $0 < \theta_1 < \theta_1^U$, with $\theta_1^U = 1 - (1-\theta_0)\pi^E / \pi^F$, where ρ is the appropriate discount rate and $\beta = -\left(\mu - \frac{1}{2}\sigma^2\right)/\sigma^2 + \sqrt{\left(\left(\mu - \frac{1}{2}\sigma^2\right)/\sigma^2\right)^2 + 2\rho/\sigma^2}$. For $\theta_1 = \theta_1^U$ all profits that exceed the benefits from exporting are taxed away by the government. Since uncertainty about the profitability reduces to zero in this case, the firm will set up a foreign plant when the NPV is positive. So when $\theta_1 = \theta_1^U$, the trigger value can be expressed as $N^* = \infty$ for $\theta_2 > -I$ and as $N^* = (\rho - \mu) I / \left(\pi^F - \pi^E\right)$ for $\theta_2 = -I$.

In the absence of taxation by the host country's government, the critical value can be written as

$$N_0^* = \frac{\rho - \mu}{\pi^F - (1-\theta_0)\pi^E} \frac{\beta}{\beta - 1} I, \tag{5}$$

which generalizes the critical market size as derived by Buckley and Casson (1981) for the case of irreversibility and uncertainty. Firms will only prefer FDI to exporting when the profits from FDI are at least as high as the profits from exporting. When there is uncertainty about the size of the market and cost of FDI is irreversible, the firm requires a premium in order to offset the option value of waiting once it decides to invest in addition to the difference between both profits. Let F denote the firm's value of the opportunity to undertake FDI. Then we have

$$F = \left(\frac{(1-\theta_1)\pi^F - (1-\theta_0)\pi^E}{\rho - \mu} N_0^* - (I + \theta_2) \right) E[\exp(-\rho T_0)] \tag{6}$$

where $T_0 = \arg \min_s \{ N(s) = N_0^* \}$ being the time at which it is optimal to switch from exporting to FDI (current time is 0). From the theory of first passage time of Brownian motion (e.g. Harrison, 1990) it is well known that $E[\exp(-\rho T_0)] = \left(N / N_0^*\right)^\beta$. Hence, by inserting equation (5), the option value of FDI in the absence of taxation, F_0, is

$$\frac{I}{\beta - 1}\left(\frac{N}{N_o^*}\right)^{\beta}. \qquad (7)$$

2.2 GOVERNMENT'S ACTION

The government's payoff to FDI depends on the firm's timing of investment, which in turn is influenced by the tax parameters set by the government. An optimal tax rule for the host government is a combination of θ_1, θ_2, and ω_2 that maximizes net domestic gain. Expected net domestic gain, G, is the net present value of the sum of expected consumer surplus (CS), expected tax income (W), and expected tariff income (TI). Consumer surplus is attained either in the export regime (CS^E) or in the FDI regime (CS^F). Suppose that the current market size is less than the trigger value ($N < N^*$), and let T denote the first time at which N reaches N^*. Then G is given by

$$G = CS^E(\theta_1, \theta_2, \omega_2) + CS^F(\theta_1, \theta_2, \omega_2) + W(\theta_1, \theta_2) + TI(\theta_1, \theta_2, \omega_2), \qquad (8)$$

where,

$$CS^E = E\int_0^T \{u(\hat{x}^E) - \hat{q}^E \hat{x}^E\} N \exp(-\rho t)dt, \qquad (9)$$

$$CS^F = E\int_T^\infty \{u(\hat{x}^F) - \hat{q}^F \hat{x}^F\} N \exp(-\rho t)dt, \qquad (10)$$

$$W = \left(\theta_1 \frac{\hat{\pi}^F N^*}{\rho - \mu} + \theta_2\right) E[\exp(-\rho T)], \qquad (11)$$

and,

$$TI = E\int_0^T \omega_2 \hat{x}^E N \exp(-\rho t)dt. \qquad (12)$$

Lemma:

$$E\int_0^T N\exp(-\rho t)dt = \frac{N}{\rho-\mu} - \left(\frac{N}{N^*}\right)^\beta \frac{N^*}{\rho-\mu} \text{ and } E\int_T^\infty N\exp(-\rho t)dt = \left(\frac{N}{N^*}\right)^\beta \frac{N^*}{\rho-\mu}.$$

Proof: See, among others, Dixit and Pindyck (1994, pp. 315-316).

By applying the lemma we can write $CS^E = \left\{\frac{N}{\rho-\mu} - \left(\frac{N}{N^*}\right)^\beta \frac{N^*}{\rho-\mu}\right\} cs^E$,

$CS^F = \frac{N^*}{\rho-\mu} cs^F \left(\frac{N}{N^*}\right)^\beta$, $W = \left(\theta_1 \frac{\hat{\pi}^F N^*}{\rho-\mu} + \theta_2\right)\left(\frac{N}{N^*}\right)^\beta$, and

$TI = \left\{\frac{N}{\rho-\mu} - \left(\frac{N}{N^*}\right)^\beta \frac{N^*}{\rho-\mu}\right\} \omega_2 \hat{x}^E$, where $cs^E = u(\hat{x}^E) - \hat{q}^E \hat{x}^E$ and $cs^F = u(\hat{x}^F) - \hat{q}^F \hat{x}^F$. Without taxation by the host government, the net domestic gain, G_0, is

$$\frac{N(cs^E + \omega_2 \hat{x}^E)}{\rho-\mu} + \left(\frac{N}{N_0^*}\right)^\beta \frac{N_0^*(cs^F - cs^E - \omega_2 \hat{x}^E)}{\rho-\mu}. \tag{13}$$

3. EFFICIENT SOLUTION

First, we will consider optimal profit and lump-sum taxed (or subsidies) when the foreign firm has bargaining power and is able to negotiate with the host country's government. Let ψ_1 and ψ_2 be the bargaining power of the firm and the government respectively with $\psi_1 + \psi_2 = 1$. When the firm and the government maximize profits in a Nash-bargaining framework, tax policy appears only relevant for the distribution of profits and does not affect the optimal investment rule. The following proposition summarizes the firm and government payoffs, F_1 and G_1 respectively, and the trigger value of the market size, N_1^*, under Nash bargaining.

Proposition 1: When the firm and the government jointly decide upon when to invest and optimize θ_1 and θ_2 in a Nash-bargaining setting, we have that $N_1^* = \frac{\rho-\mu}{\pi^F - (1-\theta_0)\pi^E + cs^F - cs^E - \omega_2 \hat{x}^E} \frac{\beta}{\beta-1} I$, and $\hat{\theta}_1$ and $\hat{\theta}_2$ are such that $F_1 = \psi_1(F_1 + G_1)$ and $G_1 = \psi_2(F_1 + G_1)$.

Proof: See Appendix.

In a Nash-bargaining framework, both parties maximize the total payoff to investment, i.e. investing as soon as N reaches the investment trigger at which the joint present value of benefits is maximized, and divide the payoff at the moment of investment in accordance with their bargaining power. The outcome under Nash-bargaining reflects the outcome of a social planner. Comparing N_1^* and N_0^* in equation (5), we find that the optimal trigger is the same as the trigger value for a firm that is not subject to pay any tax, except for a 'correction' for the difference between consumer surplus and tariff income. As the difference between cs^F and cs^E increases, the optimal trigger value decreases. Finally, we note that $F_1 + G_1 > F_0 + G_0$.

4. NON-COOPERATIVE SOLUTION

This section analyzes the optimal taxation when both the foreign firm and the host government maximize their own benefits. The host government fixes its profit and lump-sum taxation (subsidy) and the foreign firm decides on when to invest. Firstly we consider the case where the government only maximizes benefits with respect to taxes. Secondly, results are derived for both optimal taxation and optimal subsidy to investment, and thirdly we extend the results by including the analysis of the optimal tariff.

4.1 OPTIMAL TAXATION, NO SUBSIDIES, EXOGENOUS TRADE COSTS.

Taxation clearly gives a trade-off between the height of tax income and the moment at which they are levied. Both $\theta_1 = 0$ and $\theta_1 = \theta_1^U$ yield a zero present value of tax income. Charging a higher tax, thereby making the firm postpone FDI, not only affects expected tax income, it also makes tariff income prolong while reducing consumer surplus through higher prices. Proposition 2 gives the optimal taxation.

Proposition 2: With exogenous trade costs and zero lump-sum taxation/subsidy, optimal profit taxation is $\hat{\theta}_1 = \frac{\theta_1^U}{\beta} - \frac{\beta - 1}{\beta} \frac{cs^F - cs^E - \omega_2 \hat{x}^E}{\hat{\pi}^F}$. In this case the critical market size, N_2^*, equals $\frac{\beta}{\beta - 1} N_1^*$.

Proof: See Appendix.

Proposition 2 shows that taxation leads to a double marginalization, since not only the firm requires a mark-up over the cost of investment, it is also for the government optimal to charge a mark-up (nota bene the same mark-up) over the required tax-free payoff to the firm. Moreover, the trigger value is affected by trade cost. When consumer surplus under FDI is higher than the sum of consumer surplus under exporting and tariff income, the optimal tax provides an incentive for the firm to speed up FDI. It is interesting that the optimal tax rate can become negative when uncertainty and tariffs are sufficiently low. Since the firm's propensity to invest in the foreign country increases with the tariff, the optimal tax rate increases with the tariff.

So, when the government proposes a profit tax to the firm, it can never fully expropriate the benefits from investment. In section 3 we have shown that bargaining with the foreign-based firm leads to sharing of the jointly maximized profits. Thus with solely levying a tax the host government can never pursue a tax-neutral policy *and* fully seize all profits. Next, we show that without bargaining the government can increase tax income by providing a *subsidy*. Even better, since the subsidy neutralizes the tax effect on the investment decision, it can nearly expropriate the full benefits of investment, i.e. the government reaches benefits of $F_1 + G_1$.

4.2 OPTIMAL COMBINATION OF PROFIT TAXATION AND INVESTMENT GRANT, EXOGENOUS TRADE COSTS.

Under both profit taxation and a lump-sum tax/subsidy, proposition 3 states that there exists a tax-neutral[9] combination of profit tax and lump-sum subsidy where the government can fully expropriate all benefits exceeding the gains from exporting.

Proposition 3: When $\hat{\theta}_1 \uparrow \theta_1^U$ and $\hat{\theta}_2 \downarrow -I$, such that $\hat{\theta}_1 \hat{\pi}^F I + \hat{\theta}_2 \left(\hat{\pi}^F - (1-\theta_0)\hat{\pi}^E\right) = 0$ the payoff of the government and the firm approaches $F_1 + G_1$ and 0, respectively.

Proof: See Appendix.

A numerical example helps to illustrate the optimal outcome. Under the base case parameters $cs^F = cs^E + \omega_2 \hat{x}^E$, $(1-\theta_0)\pi^E = 1$, $\pi^F = 2$, $\rho - \mu = 0.1$, $\beta = 2$, $I = 1000$ and $N = 200$ it is easy to calculate that the upperbound of the profit tax, θ_1^U, equals 0.5 and that the investment trigger without government taxation, N_0^*, and the socially optimal investment trigger, N_1^*, both equal 200. Hence, without government taxation the firm's expected payoff to (immediate) investment would be 1000. Table 1A and

[9] By tax-neutrality we mean that the specific choice of the tax parameters yields the same trigger value of investment as the one set by a social planner (see section 3).

table 1B show the critical value at which it is optimal to invest (N_3^*) and the government payoff respectively for different combinations of profit taxation and investment subsidies. It shows that subsidizing the total cost of investment by an amount of 998 and levying a profit tax of 49.9% imply a tax-neutral policy and lead to an expected tax income of 998.

--------------------------------- Insert table 1A and 1B about here -----------------------------

Note that setting $\hat{\theta}_1 = \theta_1^U$ and $\hat{\theta}_2 = -I$ leads to a suboptimal income, since the firm would invest whenever the NPV is positive. If the firm would undertake the investment as soon as their NPV is zero, the expected tax profit for the government is zero. By not granting the full amount of the investment cost, the firm still has a value in waiting to make the (very small) unsubsidized part of the investment. Of course, a firm will not apply the option rule for investments when it needs to make a net sunk cost investment of one penny. This is probably the argument why the optimal tax rule is not observed in practice. However, the combination of profit taxation and subsidy to inward FDI is prevalent. Proposition 3 explains that this might be consistent with maximizing benefits.

Another reason why the tax system is not observed in practice is that governments generally need to compete in order to attract FDI (e.g. Black and Hoyt, 1989; Haaparanta, 1996). This leads to bargaining power of the firm and the Nash bargaining framework in which any combination of θ_1 and θ_2 such that the payoffs are divided in accordance with their bargaining power may be closer to reality.

A final point to make is that the combination of tax and subsidy is time-consistent. Most studies on FDI and political risk stress the importance of time inconsistency of a tax contract between the host country's government and the multinational firm. Once a firm has committed to an irreversible investment abroad, the government will not hold its initial promise, but fully expropriate the investment after the sunk costs are incurred. The tax system discussed here yields not only optimal decision rules for both the host country's government and the foreign firm, it is also time consistent. The government will never increase taxes because the multinational firm will respond by switching back to exports. Moreover the government will not expropriate the firm's assets since it covered the costs itself by the investment grant and needs the multinational firm to exploit the assets.

4.3 OPTIMAL COMBINATION OF PROFIT TAXATION, INVESTMENT GRANT, AND TARIFF.

Disregarding the tariff jumping argument of FDI, Brander and Spencer (1984) analyzed in a static environment the optimal tariff as a tradeoff between tariff income and consumer surplus. Tariff jumping is an important reason why firms switch from exporting to becoming a multinational enterprise. Therefore the tariff as derived by Brander and Spencer (1984) may not be optimal when firms have the opportunity to avoid the tariff through undertaking FDI. Apart from the dynamic effects of FDI on tariff income and consumer surplus alike, the host country also needs to consider any tax income from inward FDI. The higher the tariff, the sooner the firm will invest, and the higher will be the present value of tax income, ceteris paribus.

In this section, we will look at the tariff income that is optimal from the efficient point of view, which means that we extend the analysis of section 3 for the optimal tariff. The reason is that the results from section 4.2 show that the host government can achieve the total (cooperative) gains from investment by a combination of a lump-sum subsidy and profit tax. When the host government sets the tariff equal to the optimal tariff under Nash bargaining, it maximizes net domestic gain.

It will not come as a surprise that there is no analytical solution to the optimal tariff. From Brander and Spencer we know that maximization of the sum of consumer surplus and tariff income yields the first order condition $BS = 0$, where

$$BS = x^E\left(1 - \frac{\partial q^E}{\partial \omega_2} + \frac{\omega_2}{x^E}\frac{\partial x^E}{\partial \omega_2}\right), \tag{14}$$

which provides no analytic solution for ω_2. Let $\overline{\omega}_2$ denote the tariff such that $BS(\overline{\omega}_2) = 0$. Then we can write the following proposition.

Proposition 4: The optimal tariff $\hat{\omega}_2$ as part of the Nash bargaining solution where the firm and the host government jointly maximize benefits from FDI is higher than the optimal tariff as derived by Brander and Spencer, i.e. $\hat{\omega}_2 > \overline{\omega}_2$.

Proof: See Appendix.

By taking the derivative of W in equation (11) with respect to ω_2 it is easy to prove that tax income increases in the tariff. Proposition 4 tells that taking into account the tax benefits from inward FDI in addition to both consumer surplus and tariff income yields a higher optimal tariff. The intuition behind this goes back to the tariff jumping argument. Higher tariffs provide more income in the export regime while they also work as an incentive to speed up FDI, thereby increasing the present value of tax income.

5. CONCLUDING REMARKS

Considering the implementation of the optimal tax and tariff policy it seems that less developed countries often lack capital to implement a tax rule in which an investment grant is paid prior to the receipt of tax income. Still, paying a part of the sunk cost drastically reduces the investment deterring effect of profit taxation and uncertainty alike, and leads to higher gains for the host country. So, if the host country is credit constrained, there is a profitable role for international organizations to finance and recoup the cost of the investment, while the host country can benefit from potential spillovers.

With respect to the modeling, an obvious extension would be examining imperfect competition. A model of multiple firms operating in oligopoly and trading off exports and FDI would be severely more complicated, but probably would not change the basic results derived in this paper. The main results in this paper stem from the tariff jumping argument and the differential effect of profit taxes and lump-sum taxes on irreversible investments. From Brander and Spencer (1984) we know that only the magnitude of the optimal tariff changes when allowing for more than one firm. Also, from Dixit and Pindyck (1994), in a Stackelberg duopoly the significance of uncertainty on the value of waiting to invest is reduced, but the sunk cost effect remains. We leave an exact formulation of this topic for further research.

REFERENCES

Alvarez, L.H.R., V. Kanniainen and J. Sodersten (1998), Tax Policy Uncertainty and Corporate Investment: A Theory of Tax-Induced Investment Spurts, Journal of Public Economics 69, 17-48.

Black, D.A. and W.E. Hoyt (1989), Bidding for Firms, American Economic Review 79, 1249-1256.

Brainard, S.L. (1997), An Empirical Assessment of the Proximiy/Concentration Tradeoff between Multinational Sales and Trade, American Economic Review 87, 520-544.

Brander, J.A. and B.J. Spencer (1984), Trade Warfare: Tariffs and Cartels, Journal of International Economics 16, 227-242.

Brander, J.A. and B.J. Spencer (1987), Foreign Direct Investment with Unemployment and Endogenous Taxes and Tariffs, Journal of International Economics, 22, 257-279.

Buckley, P.J. and M. Casson (1981), The Optimal Timing of a Foreign Investment, Economic Journal 91, 75-87.

Caves, R.E. (1982), Multinational Enterprise and Economic Analysis, Cambridge University Press, Cambridge.

Devereux, M.P. and R. Griffith (1998), Taxes and the Location of Production: Evidence from a Panel of US Multinationals, Journal of Public Economics 68, 335-367.

Dixit, A. and R. Pindyck (1994), Investment under Uncertainty, Princeton University Press, Princeton, NJ.

Eaton, J. and M. Gersovitz (1983), Country Risk: Economic Aspects, in: Herring, R.J. (Ed.), Managing International Risk, Cambridge University Press, Cambridge, 75-83.

Guiso, L. and G. Parigi (1999), Investment and Demand Uncertainty, Quarterly Journal of Economics 114, 185-227.

Haaparanta, P. (1996), Competition for Foreign Direct Investment, Journal of Public Economics 63, 141-153.

Harrison, J.M. (1990), Brownian Motion and Stochastic Flow Systems, 2nd. ed., Wiley, New York, NY.

Haufler, A. and I. Wooton (1999), Country Size and Tax Competition for Foreign Direct Investment, Journal of Public Economics 71, 121-139.

Hassett, K. and G. Metcalf (1999), Investment with Uncertain Tax Policy: Does Random Tax Policy Discourage Investment?. Economic Journal 109, 372-393.

Head, K., J. Ries, and D. Swenson (1995), Agglomeration Benefits and Location Choice: Evidence from Japanese Manufacturing Investments in the United Sates, Journal of International Economics 38, 223-247.

Leahy, J. and T. Whited (1996), The Effect of Uncertainty on Investment: Some Stylized Facts, Journal of Money, Credit and Banking 28, 64-83.

MacKie-Mason, J.K. (1990), Some Nonlinear Tax Effects on Asset Values and Investment Decisions under Uncertainty, Journal of Public Economics 42, 301-318.

Miller, D. and T.B. Folta (2000), Option Value and Entry Timing, working paper, Krannert School of Management, Purdue University.

Pennings, E. (2000), Taxes and Stimuli of Investment under Uncertainty, European Economic Review 44, 383-391.

Pennings, E. and L. Sleuwaegen (2000), International Relocation: Firm and Industry Determinants, Economics Letters 67, 179-186.

Sinn, H.-W. and A.J. Wiechenreider (1997), Foreign Direct Investment, Political Resentment and the Privatization Process in Eastern Europe, Economic Policy 24, 179-210.

Table 1A: Threshold value of FDI (N*) for different combinations of profit taxation (θ_1) and subsidies to investment (θ_2). Base case parameters: $cs^F = cs^E + \omega_2 \hat{x}^E$, $(1-\theta_0)\pi^E = 1$, $\pi^F = 2$, $\rho - \mu = 0.1$, $\beta = 2$, and $I = 1000$.

θ_1 , θ_2	0	-200	-400	-600	-800	-998
0	200	160	120	80	40	0
0.1	250	200	150	100	50	1
0.2	333	267	200	133	67	1
0.3	500	400	300	200	100	1
0.4	1000	800	600	400	200	2
0.499	100000	80000	60000	40000	20000	200

Table 1B: Expected tax income (W) for different combinations of profit taxation (θ_1) and subsidies to investment (θ_2). Base case parameters: $cs^F = cs^E + \omega_2 \hat{x}^E$, $(1-\theta_0)\pi^E = 1$, $\pi^F = 2$, $\rho - \mu = 0.1$, $\beta = 2$, $I = 1000$, and $N = 200$.

θ_1 , θ_2	0	-200	-400	-600	-800	-998
0	0	-200	-400	-600	-800	-998
0.1	320	200	-100	-400	-700	-997
0.2	480	488	400	-67	-533	-995
0.3	480	550	622	600	-200	-992
0.4	320	388	489	650	800	-982
0.499	4	5	7	10	20	998

APPENDIX

Proof of Proposition 1:

Let $a = \dfrac{\pi^F}{\rho - \mu}$, $b = \dfrac{cs^F - cs^E - \omega_2 \hat{x}^E}{\rho - \mu}$, $c = \dfrac{\pi^E (1 - \theta_0)}{\rho - \mu}$, and $d = \dfrac{(\omega_2 \hat{x}^E + cs^E) N}{\rho - \mu}$.

Hence $F_1 = \{(-a\theta_1 + a - c) N_1^* - (I + \theta_2)\} \left(\dfrac{N}{N_1^*} \right)^{\beta}$, and

$G_1 = \{(a\theta_1 + b) N_1^* + \theta_2\} \left(\dfrac{N}{N_1^*} \right)^{\beta} + d$. From maximizing $F_1^{\psi_1} G_1^{\psi_2}$ with respect to θ_1 and θ_2 we get $\psi_1 G_1 - \psi_2 F_1 = 0$, so $F_1 = \psi_1 (F_1 + G_1)$ and $G_1 = \psi_2 (F_1 + G_1)$. The first order condition with respect to N^* gives $\psi_1 G_1 \dfrac{\partial F_1}{\partial N_1^*} + \psi_2 F_1 \dfrac{\partial G_1}{\partial N_1^*}$. By substituting the result from the first order condition with respect to the tax parameters, we get $\dfrac{\partial (F_1 + G_1)}{\partial N_1^*} = 0$.

Hence $N_1^* = \dfrac{\beta}{\beta - 1} I \dfrac{1}{a + b - c}$, or $N_1^* = \dfrac{\beta}{\beta - 1} \dfrac{\rho - \mu}{\pi^F - (1 - \theta_0)\pi^E + cs^F - cs^E - \omega_2 \hat{x}^E} I$.

Q.E.D.

Proof of Proposition 2:

Let $N^* = \dfrac{\beta}{\beta - 1} \dfrac{I}{(1 - \theta_1) a - c}$, and a, b, and c as before. Then straightforward algebra yields that $\arg\max_{\theta_1} \left\{ (\theta_1 a + b) N^* \left(\dfrac{N}{N^*} \right)^{\beta} \right\} = \dfrac{a - c - (\beta - 1) b}{\beta a}$. Thus $\hat{\theta}_1 = \dfrac{\theta_1^U}{\beta} - \dfrac{\beta - 1}{\beta} \dfrac{cs^F - cs^E - \omega_2 \hat{x}^E}{\pi^F}$. Substituting $\theta_1 = \hat{\theta}_1$ and $\theta_2 = 0$ into (4), and rearranging, gives the desired result for the critical market size.

Q.E.D.

Proof of Proposition 3:

Let N_3^* be the optimal trigger under the combination of profit and lump sum tax. First, total benefits are maximized when $N_3^* = N_1^*$. The equation can be rewritten as $\theta_1 \pi^F I + \theta_2 \left(\pi^F - (1-\theta_0)\pi^E\right) = 0$. $\hat{\theta}_1 \uparrow \theta_1^U$ and $\hat{\theta}_2 \downarrow -I$ fulfill the condition. Second, substituting $\hat{\theta}_1 \uparrow \theta_1^U$ and $\hat{\theta}_2 \downarrow -I$ into equation (8) and (6) yield $G \uparrow (F_1 + G_1)$ and $F \downarrow 0$, respectively.

Q.E.D.

Proof of Proposition 4:

The first order conditions with respect to θ_1, θ_2, and N^* have been analyzed in section 3. The first order condition with respect to ω_2 can be derived as $\frac{\partial (F+G)}{\partial \omega_2} = 0$. The partial derivative equals $\left(\frac{N}{N^*}\right)^{\beta} \frac{N^*}{\rho - \mu} \left\{ -BS - \frac{\partial \pi^E (1-\theta_0)}{\partial \omega_2} \right\} + \frac{N}{\rho - \mu} BS$. From evaluating the first order condition at ϖ_2 and noting firstly that $BS(\varpi_2) = 0$ and secondly that $\frac{\partial \pi^E}{\partial \omega_2} < 0$ for all ω_2, we find that the partial derivative is always positive at ϖ_2. Assuming a unique maximum, we must have that the optimal tariff is higher than ϖ_2.

Q.E.D.