A Three-Stage Sub-Game Perfection Model of Corporate Taxation and Multinational Enterprises

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This paper considers the multinational's transfer pricing behaviour and the governments' tax policy designs under the case in which the subsidiary's manager influences the internal transactions. The model endogenises profit taxation by considering the joint setting of tax rates by the government in each country and the transfer price by the multinationals. The equilibrium tax rates in competitive and co-operative regimes are solved for in a generalised form. It is found that, under profit taxation, the competitive tax rates can be raised so as to increase the joint tax revenue. It is possible that the transfer price under the tax regime exceeds that of the non-tax regime, the extent of which is based on the relative tax rates between the two countries and the nature of the demand and production functions.

1. Introduction

During the past few decades, the force of globalisation has worked its way to convey the potential opportunities and gains from cross-border business patterns and has induced firms towards the drive to expand their scope of operation. The state of local market saturation further contributes to these effects. This trend of dynamism stimulates an evolutionary development of business organisation taxonomy. In the process, a local firm may transform to one operating at a national and international level, and, eventually, through meticulous considerations, becomes a multinational corporation or

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enterprise[1] (henceforth, MNE).

Due to their operations in many countries, MNEs are usually subject to multinational tax jurisdictions. Hence, complications arise as national tax systems are exceedingly complex and differ between countries. Amongst other externalities such as economic and political risks, cultural factors and exchange rate uncertainties, cross-jurisdiction corporate tax rate differentials significantly influence the decisions of the MNEs regarding the location of subsidiaries, financing and the transfer prices[2].

The interaction of MNEs and public authorities across countries has been a continuous phenomenon of interest to academics and practitioners as both business and government simultaneously and unceasingly develop their strategies and policies. MNE's organisational structure perpetually mutates in response to vigorous changes in the world's market. The same holds true for the public sectors in different countries as they incessantly research on the regulatory system that leads to the most desirable public welfare level. Conventionally, conflicts of interest arise from the different roles of business and government. Business aims towards efficient management and profit maximisation, despite tax, and tariff and non-tariff barriers imposed by the authorities. Governments, on the other hand, have political responsibilities to fulfil, namely, income redistribution and welfare maximisation for the citizens. Moreover, whether explicitly revealed or otherwise, national sovereignty may be amongst their major concerns.

The approach of this paper is theoretical and conceptual in a sense that the analysis considers one of the many aspects of the

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[1] The term "enterprise" is employed in conjunction with Hoogvelt et al (1987) and most common economic literature on multinational enterprise and transfer pricing so as to underline the fact that the precise legal form (that is, whether the company is incorporated or not) is non-significant, and to ensure that the definition includes private-owned, state-owned and public companies.

[2] The term "transfer price" is then formally defined in Section 2 of this paper.

MNE's decision-making, that is, the transfer pricing behaviour; and a single aspect of the governments' policy design, that is, the corporation tax policies. In real business operation, however, there are various strategies that MNEs utilise in dealing with governments' regulations and their internal management. Analogously, in practice, governments apply some other policy measures on the MNEs as a supplement to their tax policies. Owing to the fact that any theoretical model must be framed by certain limitations, it is, thus, implausible that all factors constitute the setting.

This paper provides further development to the existing models of multinational enterprise and corporate taxation, through constructing a model which endogenises the profit taxation by considering the joint setting of tax rates by the government in each country and the transfer price by the MNEs. The setting represents the case when a subsidiary's manager appears in the model and influences the MNE's decision making. In short, the model in Section 4 of this paper seeks a three-stage sub-game perfection, in the presence of the MNE's transfer pricing practices and the tax authorities' decisions under the two mentioned settings. The competitive equilibrium is then examined in comparison with the co-operative equilibrium, the case when public authorities involved jointly maximise a common welfare function.

The paper is organised as follows. Major issues concerning corporate taxation are discussed in Section 2. Section 3 briefly reviews the major existing literature. Section 4 portrays the three-stage sub-game perfection model of corporate taxation and MNE's manager. This is followed by Section 5, which concludes the paper.

2. Corporate Taxation

Countries differ not only in terms of their corporate tax systems but also in terms of their corporate tax rates. Hence, it may be worthwhile to consider some facts about the corporate tax rate in a world-wide perspective. The recent survey conducted in 2001
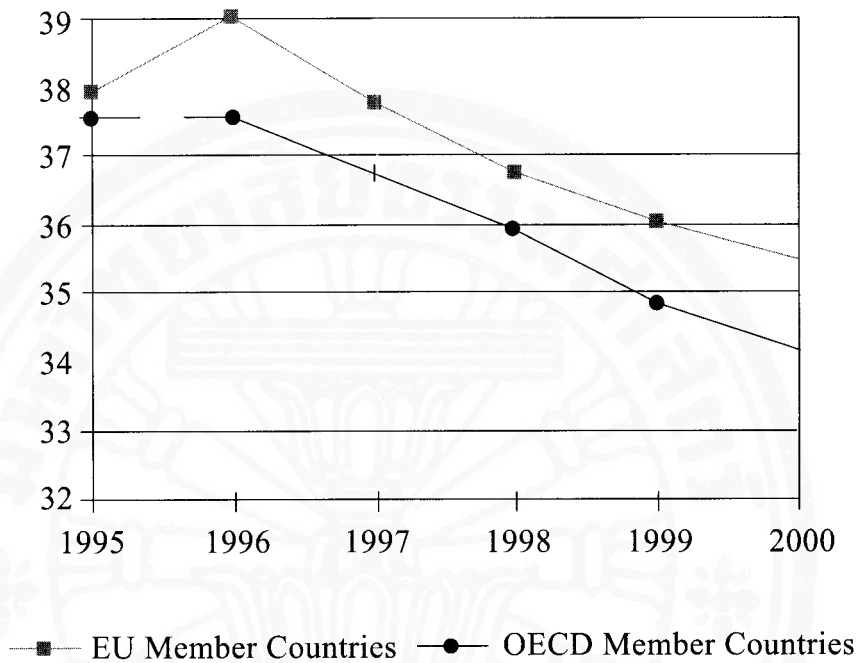
reported in KPMG Corporate Tax Rate Survey- January 2002 notes that countries in less developed regions of the world levy lower tax rates compared to those of the more developed economies and remained so in 2002. However, the difference is narrowing (Figure 1). There is evidence of tax cutting in developed countries as shown in Figure 2. The comparatively less developed nations in the Asia Pacific under survey have an average of 32.1% which represents a slight increase on the 1999 average of 31.7%. As for countries in Latin America, there had been an average increase from 28.5% to 29.3%. Perhaps, if this narrowing trend continues, the corporate tax rates imposed by all countries may be approaching the world-wide competitive rate. Despite the fact that corporate tax rates is only part of the equation, these figures may support the notions of some authors such as Aliber (1985) and Rugman (1981) that transfer pricing behaviour may improve the market and welfare conditions.

Figure 1: Average corporate tax rates at 1 January 2002
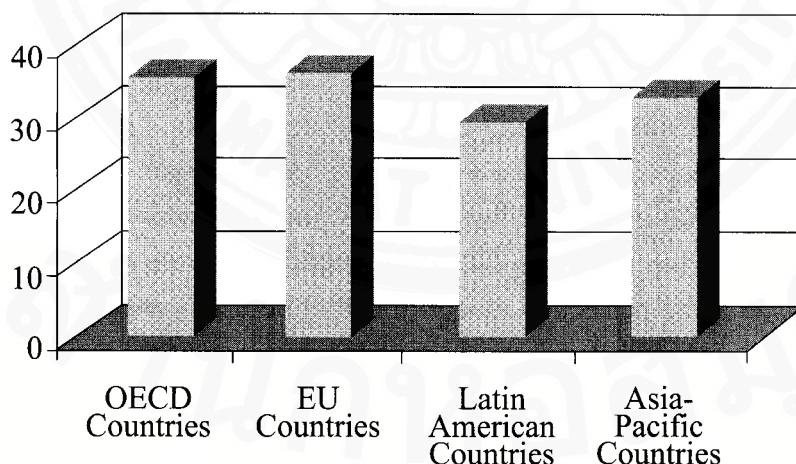
Source: KPMG Corporate Tax Rate Survey- January 2002

Figure 2: OECD and EU average corporate tax rates- 1995-2002

— EU Member Countries —●— OECD Member Countries

Source: KPMG Corporate Tax Rate Survey- January 2002

3. Review of the Literature

The term multinational enterprise has continually been redefined through the changing scopes such as managerial controls and legal pattern of ownership. The term has been used interchangeably with "international corporation" in the 1960s. Despite the firm's interest in international divisions, the latter type tends to remain domestic-oriented in its policy. Hence, the nature of international corporation is usually considered the "ethnocentric" (home country-oriented) stage of the evolution of multinational enterprise.

Since the early 1970's, however, the use of term became more distinct, as international corporations experience a more decentralised

organisational structure. The arrangements of multi-product and multi-divisional structure put forward the need to employ local managers to administer foreign subsidiaries. The increasingly multinational character of the enterprise has led to the evolution from being 'ethnocentric' to 'polycentric' (host country-oriented), and eventually 'geocentric' (world-oriented) as the perceived commercial gains of world-wide operations outweighed the political and social advantages of decentralisation. Hoogvelt et al (1987) refer to the contemporary definition of MNE given by the UN Group of Eminent Persons[3] as:

"Multinational Corporations are enterprises which own or control production and service facilities outside the country in which they are based. Such enterprises are not always incorporated or private; they can also be co-operations or state-owned entities."

The cross-national activities of the MNEs involve internal transfers of goods, which require internal sales of such goods amongst divisions. This necessitates the setting up of intra-firm prices so as to specify the value of the exchanged goods. In fact, the concept of transfer pricing can be traced back to as early as 1883 when Harry Sidgwick (1901) recognised that producers themselves can consume their own outputs (Eccles, 1986, Chapter 2). Originally, known as 'accounting', 'internal' or 'administered' price, the definition of transfer price expands as the structure of firms complicates into separate different divisions (Hoogvelt et al., 1987). Strikingly evidenced in the late 19th and early 20th century, vertical integration and diversification in production and units lead to decentralisation of management structure. As a consequence, the issue of transfer pricing became prominent in the discussion of MNEs (Chandler,

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[3] UNESCOSOC (1978) Transnational Corporations in World Development, a Re-examination, p. 158

1962).

With reference to the UK Inland Revenue's tax agenda in Chapter 8[4], the term can be defined as:

"Transfer pricing is the term used to describe the process whereby prices are set by enterprises which are related to or

"associated with" each other, in respect of dealings between them. Such dealings may include sales or transfers of goods or assets, both tangible and intangible, and the provision of services, including finance. It is important to both taxpayers and tax administrations as it can have a considerable effect on the taxable profits of such associated enterprises. Where the transactions in question are between associated enterprises which are resident in different countries, the transfer prices affect more than one tax jurisdiction. If both jurisdictions do not agree on the appropriate transfer prices and thus the sharing of taxing rights, there is a risk of double taxa-tion or of less than single taxation."

The consequential issue is the debate over the appropriate transfer price reasonably set according to the internal efficiency and whether there is any abuse or manipulation of intra-firm trade within MNE in response to government regulations. From this stand point, Hirshleifer (1956, 1957), whose excerpt is stated in the next paragraph, provides the first formal notions on the transfer pricing problem which has become the benchmark of today's literature.

"The full solution [of transfer price] involves one of the divisions presenting to the other its supply schedule (or demand schedule, as the case may be) as a function of the transfer price. The second division then establishes its output and the transfer price by a

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[4] http://www.inlandrevenue.gov.uk/taxagenda/ecom8.htm. Chapter 8 refers to di-rect taxes and the international rules.

rule which leads to the optimum solution...for the firm as a whole.

Given technological independence and demand independence, if a perfectly competitive market for the intermediate commodity exists, transfer price should be market price. If the market for the intermediate commodity is imperfectly competitive, transfer price should be at the marginal costs of the selling division. The latter is the more general solution...

Most commonly, divisional autonomy is probably desired not so much to rationalise interdivisional trading so as to create incentives for the separate "profit centres' which will lead to improved internal efficiency within each. Nevertheless, cases may arise in which the former objective is the dominant one, and even where the latter is dominant some of the potential gains may be lost by improper transfer pricing rule or policy..." (Hirshleifer, 1956, p. 183).

As a result of these different views a benchmark for transfer pricing, called the "arm's length standard" transfer price[5] is implemented in most industrialised countries. The description given by the UK Inland revenue is as follows:

"This [the arm's length standard] means that the terms and pricing of such transactions undertaken in the course of conducting business (such as the sale and purchase of goods and services) and in the provision of finance (both borrowing and lending) should be the same if the transactions had been between completely different parties."

This standard, promoted and developed by the Organisation for Economic Co-operation and Development (OECD), is internationally recognised and employed by taxation authorities around the

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[5] To be detailed in Section III of this paper, Hirshleifer (1956) provides the first formal treatment of transfer pricing and arm's-length standard based on economic theory.

world. An example of the standard can be referred to the widely-spoken Section 482 of the US Internal Revenue code which provides guidelines on measurement of the standard arm's length price.

Despite the setting up of the accepted standard transfer price, there are constraints and problems, which can be internal and external, in its implementation. Internal factors relate to organisational and managerial limitations within the enterprise which inhibit the successful execution of transfer pricing techniques in the pursuits of fiscal, financial and strategic objectives. Furthermore, there are difficulties in determining the transfer price of some traded goods such as knowledge, technology and those carried out via e-commerce. This is further exacerbated by natural and government-induced external factors. Due to natural market imperfection, external market efficiency may have never existed. In some circumstances, external sales bureaucracy may make it more cost-efficient to trade internally. Nevertheless, governments tend to impose some other regulations which can create more complexity to transfer pricing problems which, if improperly implemented, may lead to economic inefficiency and welfare diminution.

This gives rise to the core question of whether MNEs mani-pulate transfer pricing so as to accumulate the most profit obtain-able from cross-country tax differentials. Despite the complexity of specifying the arm's-length price in modern transactions[6], contemporary studies in the early stage propose that this arm's-length standard must be conformed to if MNEs do not conduct internal price speculations. In fact a number of studies, to be mentioned in this Section, have shown significant deviations of the internal transfer price from the arm's length standard. This, they suggest, may support the view that the MNEs attempt to avoid tax payments.

The two widely known theoretical models of MNEs' transfer pricing and government regulations are those of Horst (1971) and

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[6] This is expressed in Diewert (1985) whose paper is mentioned later in this Section.

Copithorne (1971). Horst's model, which considers a horizontally integrated intra-firm trade, shows that the MNE chooses the lowest possible transfer price (eg., its marginal cost of production) so as to minimise tariff payments unless the proportional excess of the tax on foreign-oriented profits over home-oriented profits exceeds the tariff rates. It is also noted that the optimal transfer price of intra-firm transactions are valued within certain limits, not based on the open market. Copithorne concludes similarly through the use of a model comprising of a vertically-integrated intra-firm trade within a three-firm MNE. As he expresses, "a multinational corporation lacks strong central decision-making and faces a problem of internal monopoly, which yields an intermediate solution and which is unlikely to be a global profit maximum".

Horst's and Copithorne's models have turned out to become the basic foundation of the sequential findings, such as Lall (1973), Vaitsos (1974), Verlage (1975), Nieckels (1976) and Booth and Jensen (1977), which support the view that MNE manipulate transfer price to minimise taxes payments. Casson (1979) suggests that transfer pricing manoeuvers aiming at diverting tax revenues away from the government cause an over-expansion of foreign investment. Several papers have extended the analyses to consider uncertainty about exchange rates, foreign demand and other cost conditions (Betra and Hadar, 1979; Itagaki,1979, 1981, 1982). Das (1983) employs Horst's model to analyse the effects of demand or cost uncertainty in the foreign market on MNE resource allocation. A generalisation of the behaviour of MNEs in relation to taxation and economic welfare is also provided in Chapter 8 of Cave's (1982) acclaimed textbook, *Multinational Enterprise and Economic Analysis*.

Elitzur and Mintz (1996) employ a downward vertically-integrated MNE model in which the headquarters sells (non-marketed) intermediate goods to a subsidiary in another country. In the model, the government requires the firm to use a 'fictitious price', $\theta = (1 +k)c$, with k denoting the mark-up on costs as compensation for average profit on observed industry-wide profits earned on similar

activities and c represents marginal cost. The simulations also look at the effect of change in parameter variables on the tax rates in home and host countries. The governments of the home and the host countries employ non-cooperative national tax revenue maximisation. It is found that the corporate tax in either country reduces production and tax revenue in both countries. It is then found that in Nash equilibrium, the governments impose negative externalities on one another in the presence of transfer pricing rules. In the case of harmonisation (co-operative regimes), governments would reduce the levels of their tax rates. The results differ from that of Wildasin (1986) and Mieszkowski and Zodrow (1989) in which the Nash equilibrium tax rates are set too low.

4. The Model

The literature review in section III shows a wide range of papers considering the internal functioning of the MNE in the model. Most of the existing literature employing such a framework looks at how the transfer price is affected by uncontrollable factors, either internal or external. These factors are considered exogenous to the firm's processing. Perpending the internal functioning of the firm there are various constraints and problems to which the desired efficiency can be obtained. In using such a framework, the previous papers show the internal workings of the firm that limit how its transfer price can be controlled, and how information and headquarters-subsidiary relationship influence transfer prices, taking taxes as given.

As a general recapitulation, it is observed that most of the early literature that considers managers shows that MNE does not necessarily intend to employ a transfer price which deviates from the arm's-length standard for the purpose of manipulation and tax avoidance. Instead, deviation may be the result of internal co-ordination. Considering Cave's (1982) approach of headquarters-manager relationship, and in continuation to previous works such as

Donnenfeld and Prusa (1995) and Stoughton and Talmor (1994), the model in this section studies the internal functioning of the firm and the endogeneity of the transfer price and the tax rates. Amongst other possible aspects, this model materialises the role of the subsidiary's manager. The parent-manager relationship is quantified in terms of the MNE's decision on the percentage of the subsidiary's profit that the manager gets and the effort exerted by the manager. Hence, the governments' decisions on tax rate is incorporated in the MNE's parent's decision in determining its transfer price and percentage of profit share that goes to the manager so as to maximise the total profit; and the manager's decision on the level of effort and output to maximise his own utility.

The setting of the model in this paper portrays a scenario of an MNE's parent firm (Firm 1) located in Country A and a subsidiary (Firm 2) located in Country B. The subsidiary's manager plays a crucial role affecting the MNE's internal transactions. This paper's model endogenises profit taxation by considering the joint setting of tax rates by the government in each country and the transfer price by the MNE.[7] The general framework of the model represents a three-stage game, solving for equilibria of the sub-game perfection. In the first stage, the governments choose tax rates. In choosing their tax rates, the major aim of the governments in the two countries is to maximise their tax revenue functions. The profit tax rates are set to be $0 < t_A, t_B < 1$. In the competitive regime, each country's government maximises its own tax revenue function. In the co-operative regime, they jointly maximise tax revenue, which is a combination of the tax revenue functions in the two countries. In the second stage, the MNE chooses its transfer price, θ, and the percentage share of firm 2's profit rationed to the manager, α. Since α is a

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[7] This methodology has also been recommended in the Research Plan for the Economic Policy Research Unit 1998-2003 (Economic Policy Research Unit, 1998, p.3).

percentage, this implies that $0 < \alpha < 1$. The MNE aims at maximising its overall profit function. The profits of all firms in the models are assumed to be non-zero and non-negative. It is assumed, upon certain restrictions which will be clarified along the working of the model, that transfer price exceeds marginal cost by a mark-up value in all the regimes. It is, then, to be determined how different tax regimes would affect this mark-up value. In the third stage, the manager of the downstream firm maximises his utility function, $max_{\{e, x2\}}$ = $\alpha\pi_2$ - $g(e)$, where $g(e)$ is the disutility, by choosing the optimal level of effort, e, and the quantity of the intermediate good required, x_2. Since costs cannot be negative, the level of effort is set to be: $0 < e \leq \theta + \gamma$, where γ is subsidiary's internal cost.

Having portrayed the setting and assumptions of the model, firm 1's profit function is represented by equation (1).

$$\pi_1 = (\theta - c)\, x_2 \tag{1}$$

Firm 2's profit function is expressed in equation (2).

$$\pi_2 = P\left(f_2(x_2)\right) f_2(x_2) - \left[\gamma(e, x_2) + \theta\right] x_2(\theta, \alpha) \tag{2}$$

From equations (1) and (2), the multinational's profit function can be expressed as in (3).

$$\prod = \pi_1 + (1-\alpha)\,\pi_2$$

$$\prod = (\theta - c)\, x_2(\theta, \alpha) + (1-\alpha)\left(P\left(f_2(x_2)\right) f_2(x_2) - \left(\gamma(e, x_2) + \theta\right) x_2(\theta, \alpha)\right) \tag{3}$$

subject to the utility that the manager maximises in equation (4).

$$EU = \alpha\left\{P\left(f_2(x_2)\right) f_2(x_2) - \left(\gamma(e, x_2) + \theta\right) x_2(\theta, \alpha)\right\} - g(e) \tag{4}$$

In equation (4), an increase in effort would increase disutility. On the

other hand, it would reduce the firm's internal cost, γ (e, x_2). The changes in internal cost with respect to e and x_2 are as assumed to satisfy $\partial\gamma/\partial e < 0$ and $\partial\gamma/\partial x_2 < 0$. The manager maximises the utility function with respect to effort and the first order condition is given in (4.1).

$$\frac{\partial EU}{\partial e} = \alpha\left(-\gamma_e x_2\right) - g' = 0 \qquad (4.1)$$

From (4.1), the change in effort, e, with respect to the change in θ and α are as follows: $\partial e/\partial\theta < 0$ and $\partial e/\partial\alpha > 0$. Maximising equation (4) with respect to x_2 leads to the first order condition in (4.2).

$$\frac{\partial EU}{\partial x_2} = \alpha\left[P'f_2'f_2(x_2) + Pf_2' - \gamma_{x2}x_2 - (\gamma + \theta)\right] = 0 \qquad (4.2)$$

From (4.2), the change in x_2 with respect to θ and α are as follows: $\partial x_2/\partial\theta < 0$ and $\partial x_2/\partial\alpha > 0$. From (4.1) and (4.2), the optimal e and x_2 can be solved and explicit solutions can be obtained from specified functional forms. In general, it is not possible to obtain explicit values for e and x_2 in this model. Since costs cannot be negative, the level of effort is set to be: $0 < e \le \theta + \gamma$.

Maximisation of equation (3) with respect to θ, and through simplification using Envelope Theorem, leads to the first order condition in (3.1).

$$\frac{\partial \Pi}{\partial \theta} = x_2 + x_{2\theta}(\theta - c) - (1-\alpha)(\gamma_e e_\theta + 1)x_2 = 0 \qquad (3.1)$$

From (3.1), the solution for θ can be solved in (5).

$$\theta = c + m1 \qquad (5)$$

where $m1$ is the mark-up on cost,

$$m1 = \frac{(1-\alpha)(\gamma_e e_\theta + 1)x_2 - x_2}{x_{2\theta}} > 0.$$

Proof of m1 > 0: From (3.1), $x_{2\theta} (\theta - c) = -x_2 + (1 - \alpha)(\gamma_e e_\theta + 1)x_2$, the LHS is negative under the earlier-stated assumption that $\theta > c$. By identity, it must also be that the RHS < 0. Since $\gamma_e, e_\theta < 0$, it must be that $x_2 > (1 - \alpha)(\gamma_e e_\theta + 1)x_2$, which equivalently is, $1 > (1 - \alpha)(\gamma_e e_\theta + 1)x_2$. Since both the numerator and the denominator of m1 in (5) are negative, m1 > 0.

The optimal transfer price in a non-tax regime obtained in (5) is greater than the marginal costs because of the influence of the manager's effort in the downstream firm. That is, if the parent firm had total control over the whole production process, the transfer price would equal marginal cost. Having obtained the optimal transfer price in (5), the MNE's profit function in (3) is, then, maximised with respect to α and the first order condition is given in (3.2).

$$\frac{\partial \Pi}{\partial \alpha} = (\theta - c)x_{2\alpha} - \left[P\left(f_2(x_2) \right) f_2(x_2) - (\gamma + \theta) x_2 \right]$$
$$- (1 - \alpha)\left(\gamma_e e_\alpha x_2 \right) = 0 \qquad (3.2)$$

From (3.2), the solution for α can be solved in (6).

$$\alpha = 1 + \rho 1 \qquad (6)$$

where

$$\rho 1 = \frac{P\left(f_2(x_2) \right) f_2(x_2) - (\gamma + \theta) x_2 - (\theta - c)x_{2\alpha}}{\gamma_e e_\alpha x_2}$$

and $-1 < \rho 1 < 0$ to comply with the prior assumption that $0 < \alpha < 1$.

4.1 Optimisation of Firm

When a tax on profit is introduced, the profit function of each firm becomes those of (7) and (8).

$$\pi_1 = (1- t_A) (\theta - c)x_2 (\theta, \alpha) \tag{7}$$

$$\pi_2 = (1- t_B) \left[P \left(f_2 (x_2) \right) f_2 (x_2) - \left[\gamma (e, x_2) + \theta \right] x_2 (\theta, \alpha) \right] \tag{8}$$

From (7) and (8), the multinational's profit function can be expressed as in (9).

$$\prod = \pi_1 + (1-\alpha)\, \pi_2$$

$$\prod = (1- t_A) (\theta - c)x_2 (\theta, \alpha) + (1- \alpha) (1- t_B) \left(P \left(f_2 (x_2) \right) f_2 (x_2) \right.$$
$$\left. - \left(\gamma (e, x_2) + \theta \right) x_2 (\theta, \alpha) \right) \tag{9}$$

subject to the utility that the manager maximises in (10).

$$EU = \alpha (1- t_B) \left\{ P \left(f_2 (x_2) \right) f_2 (x_2) - \left(\gamma (e, x_2) + \theta \right) x_2 (\theta, \alpha) \right\}$$
$$- g (e) \tag{10}$$

The manager maximises the utility function in (10) with respect to effort and the first order condition is given in (10.1).

$$\frac{\partial EU}{\partial e} = \alpha (1- t_B) (- \gamma_e x_2) - g' = 0 \tag{10.1}$$

From (10.1), the change in effort, e, with respect to the change in θ and α are as follows: $\partial e/\partial \theta < 0$ and $\partial e/\partial \alpha > 0$. Maximising (10) with respect to x_2 leads to the first order condition in (10.2).

$$\frac{\partial EU}{\partial x_2} = \alpha (1- t_B) \left[P' \left(f_2' f_2 (x_2) + Pf_2' - \gamma_e x_2 - (\gamma + \theta) \right] = 0 \tag{10.2}$$

In (10.2), the change in x_2 with respect to θ and α are as follows: $\partial x_2/\partial \theta < 0$ and $\partial x_2/\partial \alpha > 0$. From (10.1) and (10.2), the optimal e and x_2 can be solved and explicit solutions can be obtained from specified functions. In the analysis in this section, all functions are presented in a generalised form.

Maximisation of (9) with respect to θ, and simplification using Envelope Theorem, leads to the first order condition in (9.1).

$$\frac{\partial \Pi}{\partial \theta} = (1- t_A) \left[x_2 + x_{2\theta}(\theta - c)\right] - (1- \alpha)(1- t_B)(\gamma_e e_\theta + 1)x_2 = 0 \quad (9.1)$$

From (9.1), the solution for θ can be solved in (11).

$$\theta = c + m2 \qquad\qquad (11)$$

where the mark-up on cost, $m2$, is

$$m2 = \frac{\dfrac{(1- \alpha)(1- t_B)(\gamma_e e_\theta + 1)x_2}{(1- t_A)} - x_2}{x_{2\theta}}$$

Since it is assumed at the start that $\theta > c$ as in the case of the non-tax regime, it must follow that *(1- a)(1- t_B)($\gamma_e e_\theta$ + 1)x_2 (1- t_A)< x_2.* It is then to analyse the 'additional mark-up' under profit taxation, on the mark-up, $m1$, of the marginal cost of the non-tax transfer price in (2.34). In other word, it would be possible to see the extent of whether the mark-up cost in profit taxation is equal to, greater than or less than that of the non-tax regime. The 'additional mark-up on the mark-up' term under profit taxation shall be denoted by $M2$. That is, in (11), $m2 = M2 + m1$. The consequence is that if $M2 = 0$, then $m2 = m1$, if $M2 > 0$, then $m2 > m1$ and if $M2 < 0$, then $m_2 < m_1$. From (11), the term $M2$ is denoted in (12).

$$M2 = \frac{(1- \alpha)(\gamma_e e_\theta + 1)x_2 \left(\dfrac{(1- t_B)}{(1- t_A)} - 1\right)}{x_{2\theta}} \qquad (12)$$

Considering (12), it can turn out that $M2 = 0$, $M2 > 0$ and $M2 < 0$, depending on the relative values of t_A and t_B. The possibilities can be listed as follows:

    1. If $t_A = t_B$, then $M2 = 0$ and, therefore, $m1 = m2$.

    2. If $t_A < t_B$, then $M2 > 0$ and, therefore, $m1 < m2$.

3. If $t_A > t_B$, then $M2 < 0$ and, therefore, $m1 > m2$.

From (11), the effect on transfer price with respect to the change in the tax rates in country A and country B are shown in (11.1) and (11.2), respectively.

$$\frac{d\theta}{dt_A} = \frac{(1-\alpha)(1-t_B)\left(\gamma_e e_\theta + 1\right) x_2}{x_{2\theta}(1-t_A)^2} < 0 \tag{11.1}$$

and

$$\frac{d\theta}{dt_B} = \frac{-(1-\alpha)\left(\gamma_e e_\theta + 1\right) x_2}{x_{2\theta}} = \frac{-(1-t_A)\, d\theta}{-(1-t_B)\, dt_A} > 0 \tag{11.2}$$

The optimal transfer price under profit taxation obtained in (11) is greater than the marginal costs because of the influence of the manager's effort in the downstream firm. That is, if the parent firm had total control over the whole production process, transfer price would equal marginal cost. Having obtained the optimal transfer price in (11), the MNE's profit function in (9) is, then, maximised with respect to α and the first order condition is given in (9.2).

$$\frac{\partial \Pi}{\partial \alpha} = (1-t_A)\,(\theta - c)\,x_{2\alpha} - (1-t_B)\left[P\left(f_2(x_2)\right)f_2(x_2)\right.$$
$$\left. - (\gamma + \theta)\,x_2\right] - (1-\alpha)(1-t_B)\left(\gamma_e e_\alpha x_2\right) = 0 \tag{9.2}$$

From (9.2), the solution for (can be solved in (13).

$$\alpha = 1 + \rho 2 \tag{13}$$

where

$$\rho 2 = \frac{(1-t_B)\left[P\left(f_2(x_2)\right)f_2(x_2) - (\gamma + \theta)\,x_2\right] - (1-t_A)(\theta - c)x_{2\alpha}}{(1-t_B)\,\gamma_e e_\alpha x_2}$$

and $-1 < \rho2 < 0$ so as to comply with the prior assumption that $0 < \alpha < 1$.

It is then to analyse the 'additional value' on the non-tax share of profit that goes to the manager under profit taxation. From (13), the term $\rho2 = \rho1 + R2$, where $R2$ is the additional value. $R2$ is denoted in (14).

$$R2 = \frac{(\theta - c)x_{2\alpha} \left[1 - \frac{(1 - t_A)}{(1 - t_B)}\right]}{\gamma_e e_\alpha x_2} \tag{14}$$

Considering (14), it can turn out that $R2 = 0$, $R2 > 0$ and $R2 < 0$, depending on the relative values of t_A and t_B. (It is to be recalled that the denominator in (14) is negative since $\gamma_e < 0$ and $e_\alpha > 0$.) The possibilities can be listed as follows:

1. If $t_A = t_B$, then $R2 = 0$ and, therefore, $\rho1 = \rho2$.
2. If $t_A < t_B$, then $R2 > 0$ and, therefore, $\rho1 < \rho2$.[8]
3. If $t_A > t_B$, then $R2 < 0$ and, therefore, $\rho1 > \rho2$.

From (13), the effect on α with respect to the change in tax rates in country A and country B are shown in (13.1) and (13.2), respectively.

$$\frac{\partial \alpha}{\partial t_A} = \frac{(\theta - c)x_{2\alpha}}{(1 - t_B)(\gamma_e e_\theta x_2)} < 0 \tag{13.1}$$

$$\frac{\partial \alpha}{\partial t_B} = \frac{-(1 - t_A)(\theta - c)x_{2\alpha}}{(1 - t_B)^2(\gamma_e e_\alpha x_2)} = \frac{-(1 - t_A)\partial \alpha}{(1 - t_B)\partial t_A} > 0 \tag{13.2}$$

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[8] To avoid confusion, recall the solutions in (6) and (13), when $R2 > 0$, $\rho2$ becomes less negative and, thus, $\rho1 < \rho2$, implying that α under profit taxation is greater than in the non-tax regime. The vice versa explains case 3 which follows.

Having solved for θ and α, and their changes with respect to the changes in t_A and t_B, the relationship between $(\partial x_2/\partial\theta)(\partial\theta/\partial t_A)$ and $(\partial x_2/\partial\alpha)(\partial\alpha/\partial t_A)$ is assumed to satisfy the condition in Assumption 1 such that the overall effect of the increase in the tax rate in country A on the change in x_2 is negative; and, consequently, the resulting change in the internal cost, γ, is positive (referring to equation (4)). This is to ensure that cost is non-negative. From the solutions in (11.2) and (13.2), by multiplying $-(1-t_B)/(1-t_A)$ to both sides of the equation in Assumption 1, Corollary 1 follows.

Assumption 1:

$$(\partial x_2/\partial\theta)(\partial\theta/\partial t_A) < (\partial x_2/\partial\alpha)(\partial\alpha/\partial t_A)$$

Corollary 1:

$$(\partial x_2/\partial\theta)(\partial\theta/\partial t_B) < (\partial x_2/\partial\alpha)(\partial\alpha/\partial t_B)$$

4.2 Government Decisions in Competitive Tax Regime

The tax revenue in the home country A is represented by equation (15).

$$T_A = t_A(\theta - c)x_2(\theta, \alpha) \tag{15}$$

By maximising the tax revenue equation in (15) with respect to t_A, the first order condition is expressed in (15.1).

$$\frac{dT_A}{dt_A} = (\theta - c)\,x_2 + \theta_{tA}\,t_A\,x_2 + t_A\,(\theta - c)\,(x_{2\theta}\,\theta_{tA} + x_{2\alpha}\,\alpha_{tA}) = 0 \tag{15.1}$$

Solving (15.1) gives the optimal tax rate in country A as expressed in (16).

$$t_A = \frac{-(\theta - c)\,x_2}{\theta_{tA}\left[x_2 + (\theta - c)\,x_{2\theta}\right] + (\theta - c)\,x_{2\alpha}\,\alpha_{tA}} > 0 \tag{16}$$

Proof of $t_A > 0$: The numerator in (2.45) is negative taking the prior assumption that $\theta - c > 0$. The denominator is also negative by substituting $x2 = -(\theta - c)x_{2\theta} + (1 - \alpha)(1 - t_B)(\gamma_e e_\theta + 1) x_2/(1 - t_A)$ from (11).

The tax revenue in country B is expressed in (17).

$$T_B = t_B \left[P\left(f_2(x_2)\right) f_2(x_2) - \left(\gamma(e_{,}, x_2) + \theta\right) x_2(\theta, \alpha) \right] \tag{17}$$

Through maximisation of (17) with respect to tB, and simplification using Envelope Theorem, the first order condition is obtained in (17.1).

$$\frac{dT_B}{dt_B} = Pf_2(x_2) - (\gamma + \theta) x_2 - t_B x_2 \left(\gamma_e (e_\theta \, \theta_{tB} + e_\alpha \alpha_{tB}) x_2 + \theta_{tB} \right)$$
$$= 0 \tag{17.1}$$

Solving for t_B in (17.1), under Assumption 1, leads to the solution in (18).

$$t_B = \frac{P\left(f_2(x_2)\right) f_2(x_2) - (\gamma + \theta) x_2}{x_2 \left[\theta_{tB}(\gamma_e e_\theta + 1) \gamma_e e_\alpha \alpha_{tB} \right]} > 0 \tag{18}$$

Proof of $t_B > 0$: The numerator is positive based on the earlier-stated assumption that profits of all firms are non-zero and non-negative. The denominator is positive by Corollary 1.

4.3 Government Decisions in Co-operative Tax Regime

When Countries A and B agree to operate a co-operative tax regime, the values of t_A and t_B that maximise the sum of the two countries' tax revenue, T_A and T_B, are solved for. Both countries jointly maximise a common tax revenue equation in (19).

$$T = T_A + T_B$$

$$T = t_A(\theta - c) x_2 + t_B \left[P\left(f_2(x_2)\right) f_2(x_2) - \left(\gamma(e, x_2) + \theta\right) x_2(\theta, \alpha) \right] \tag{19}$$

Maximising equation (19) with respect to t_A solves for the first order condition in (19.1).

$$\frac{dT}{dt_A} = \frac{\partial T_A}{\partial t_A} = \frac{\partial T_B}{\partial t_A} = 0$$

where $\partial T_A/\partial t_A$ is solved in (15.1) and,

$$\frac{\partial T_B}{\partial t_A} = t_B x_2 \left[\theta_{tA}(\gamma_e e_\theta + 1) + \gamma_e e_\alpha \alpha_{tA} \right] > 0 \tag{19.1}$$

Proof of $\partial T_B/\partial t_A > 0$: By Assumption 1, the term in the bracket is negative.

As for country B, maximising equation (19) with respect to tB solves for the first order condition in (19.2).

$$\frac{dT}{dt_B} = \frac{\partial T_B}{\partial t_B} = \frac{\partial T_A}{\partial t_B} = 0$$

where $\partial T_B/\partial t_B$ is solved in (17.1), and

$$\frac{\partial T_A}{\partial t_B} = t_A \left(\theta_{tB} \left[x_2 + (\theta - c) x_{2\theta} \right] + (\theta - c) x_{2\alpha} \alpha_{tB} \right) > 0 \tag{19.2}$$

Proof of $\partial T_A/\partial t_B > 0$: From (9.1), x2 + ($\theta$ - c)x$_{2\theta}$ > 0. The remaining variables are positive from the assumptions and solutions in (10.2), (11.2) and (13.2).

From (19.1), it follows that, since $\partial T_B/\partial t_A > 0$, $\partial T_A/\partial t_A < 0$ so that the first order partial derivative of T with respect to t_A, $\partial T/\partial t_A = 0$ for co-operative tax revenue maximisation. Congruently, from (19.2), since $\partial T_A/\partial t_B > 0$, it follows that $\partial T_B/\partial t_B < 0$ so that $\partial T/\partial t_B = 0$. At this point, for further analysis, it is now to solve for the second-order cross partial derivatives. The cross derivatives with respect to t_B and t_A are solved in (19.3) and (19.4), respectively.

$$\frac{\partial^2 T_B}{\partial t_A \partial t_B} = \left[\theta_{tA}(\gamma_e e_\theta + 1) + \gamma_e e_\alpha \alpha_{tA} \right] \left[x_2 + t_B (x_{2\theta} \theta_{tB} \alpha_{tB}) \right] > 0 \tag{19.3}$$

Proof of $\partial^2 T_B/\partial t_A \partial t_B > 0$: The proof follows the consequences of Assumption 1 and Corollary 1.

$$\frac{\partial^2 T_A}{\partial t_B \partial t_A} = \left[\theta_{tB}\left(x_2 + (\theta - c)\, x_{2\theta}\right) + (\theta - c)\, x_{2\alpha}\, \alpha_{tB}\right]$$
$$+ t_A\left[\theta_{tB}\left(x_{2\theta}\,\theta_{tA} + x_{2\alpha}\alpha_{tA}\,x_{2\theta}\right) + \theta_{tA}\,x_{2\alpha}\,\alpha_{tB}\right] > 0 \qquad (19.4)$$

Proof of $\partial^2 T_A/\partial t_B \partial t_A > 0$: By simplifying (19.4) and substituting θt_B and α_{tB} with the solutions in (11.2) and (13.2), the solution in (19.4) becomes:

$$\frac{\partial^2 T_B}{\partial t_B \partial t_A} = \frac{-(1 - t_A)}{(1 - t_B)}\left[x_2\theta_{tA} + (\theta - c + 2t_A)\,(x_{2\theta}\,\theta_{tA} + x_{2\alpha}\alpha_{tA})\right] > 0$$

From (11.1) and Assumption 1, the terms in the bracket are negative.

The solutions in (19.1), (19.2), (19.3) and (19.4) suggest that the competitive tax rates in countries A and B are relatively low and can be raised to the co-operative tax regime level. This is illustrated in Figures 1 and 2 for country A and country B, respectively. In Figure 1, the co-operative tax rate of country A lies between points M and N, which is above the competitive tax rate, located at point M. In Figure 2, the co-operative tax rate of country B lies between points O and P, which is also above the competitive tax rate, located at point O. The first-order partial derivatives of the tax revenue in each country with respect to its own tax rate are negative, $\partial T_A/\partial t_A < 0$, and $\partial T_B/\partial t_B < 0$. This implies that increasing the tax rate from the point of the co-operative tax rate would lower the tax revenue. The solutions in (19.3) and (19.4) state that the cross (or mixed) partial derivatives for both T_A and T_B, which measure the changes of the first-order partial derivatives with respect to the other country's tax rate (t_B and t_A, respectively), are positive. That is, they ensure that the change in the slope of the first-order partial derivative is positive (ie., the slope gets steeper). In Figures 1 and 2, this would mean that, considering the influence of the reaction functions of both countries, the tax rates in the co-operative regime lie between points M and N

for country A and O and P for country B.

**Figure 1: Country A's profit tax rates in competitive
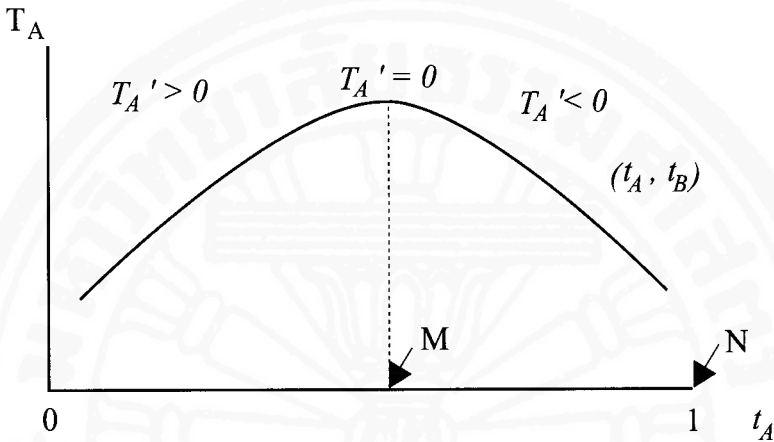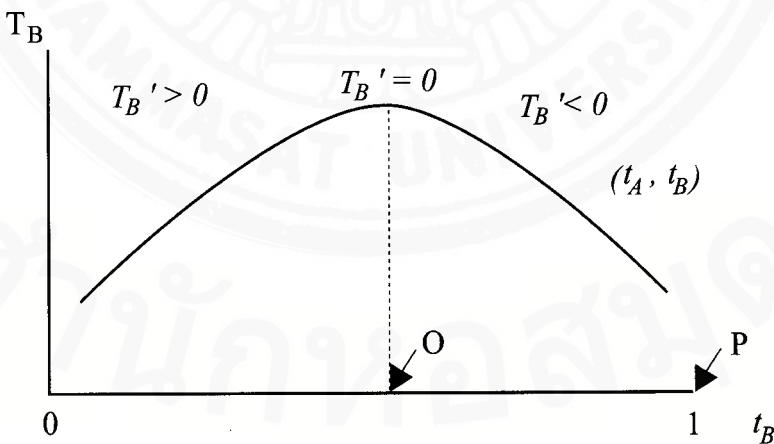and co-operative regimes**

T_A

$T_A' > 0$ $T_A' = 0$ $T_A' < 0$

(t_A, t_B)

M   N

0   1 t_A

**Figure 2: Country B's profit tax rates in competitive
and co-operative regimes**

T_B

$T_B' > 0$ $T_B' = 0$ $T_B' < 0$

(t_A, t_B)

O   P

0   1 t_B

When the two countries jointly optimise a common revenue
function, it is found that the resulting tax rates in both countries are
above the competitive regime level as illustrated in Figures 1 and 2.

These results are congruent with the model in Wildasin (1986), Mieszkowski and Zodrow (1989) and Bloch and Lefbvre (1999). This implies that the equilibrium tax rates are relatively low and can be raised to contribute to higher tax revenue. The effect of the profit tax regime on the transfer price and the manager's share of profit would depend on the solution obtained from the reaction functions of the two countries' tax revenue maximisation. As discussed after having solved for equation (11) and (13), the possible outcomes have been listed. This would depend on the relative tax rates of the two countries and the demand and production functions and the managerial behaviour of the downstream firm. Due to the generality of the analysis, it is only possible to indicate the signs of the variables. However, the results clearly show that the tax rates in the two countries affect the transfer price in the opposite directions. The possible outcomes following equations (11) and (13) show that, taking $\theta - c > 0$ as a priori, the level of the mark-up on cost and the additional value on manager's profit share when profit tax exists can be equal to, greater than or less than levels when there is no tax. It can be observed that, if the two countries impose an identical tax rate (or close to identical tax rate) when they co-operate in setting the tax regime, it would be that $M2 \cong 0$, $m2 \cong m1$ and $R2 \cong 0$, $\rho1 \cong \rho2$. Hence, the transfer price and profit share would just be the amount equal (or close) to those of the non-tax regime.

5. Summary and Conclusions

This paper begins with an overview of MNE, transfer pricing and corporate taxation. It is followed by a review of the literature, which reflects the earlier approach, the extensions of the earlier approach, which looks at the internalisation of the firm, and some of the surveys and empirical findings. Surveys suggest diversified results, showing that tax does have some roles in influencing the outcome.

Section 5, the core of this paper, studies the behaviour of the

MNE and governments, solving for equilibria of the three-stage sub-game. The key concept is to endogenise the firm's transfer price and government tax rates in the decision settings of both parties. The model consists of a two-firm MNE model with the manager, exerting effort and determining the level of output. In return, the manager gets a share of profit. The parent firm determines the transfer price and the percentage of the share of the subsidiary's profit that goes to the manager. Profit taxation is analysed in the model under competitive and co-operative regimes between the governments. The general conclusion drawn is that with profit taxation, competitive tax rates can be raised so as to increase joint tax revenue in both countries.

From the findings, it can somehow reflect and incorporate earlier literature systematically. It is observed that with or without internal consideration of the firm, the transfer price tends to deviate from the firm's efficient transfer price due to its formulation and profit optimisation of transfer price when tax rates are considered. It is by nature that transfer price deviates, not only due to its internal co-ordination, but also as a result of government decisions of whether the competitive or co-operative regime is employed.

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