

# DISCUSSION PAPERS IN ECONOMICS

Working Paper No. 99-28

Multinational Firm Decision Making in the Presence of  
Enforceable Transfer Pricing Regulations

Robin Koenigsberg

*Department of Economics, University of Colorado at Boulder  
Boulder, Colorado*

November 1999

Center for Economic Analysis  
Department of Economics



University of Colorado at Boulder  
Boulder, Colorado 80309

© 1999 Robin Koenigsberg

# **Multinational Firm Decision Making in the Presence of Enforceable Transfer Pricing Regulations**

WORKING PAPER 99-28

Robin Koenigsberg  
Department of Economics  
University of Colorado, Boulder  
Boulder, CO 80309-0256  
Office: (303) 492-2517  
E-mail: robin.koenigsberg@colorado.edu

## **Abstract**

This paper considers the factors that influence multinational firm decision making, with respect to its transfer prices and investment decisions, in a regulated environment. For the first time, the investment choice of the firm is endogenized in the presence of transfer pricing regulations, and the real effects on input and output decisions are considered. The static model presented below introduces government regulation of transfer prices in *one* country – the home, or parent, country. The model is constructed to examine how the introduction of transfer pricing regulations, through the use of government conducted audits and penalties, affect a multinational firm's choice of transfer price, as well as the choice to either export or make foreign direct investments (FDI). The results suggest that transfer pricing regulations do, in fact, move the optimal transfer price closer to the statutory arm's length price. However, the regulations may also be associated with lower multinational firm expected profits, lower final good and intermediate good output, and higher final good price. The firm is less likely to make foreign direct investments when compared to the case of no regulations. Contrary to conventional wisdom, with a shift in production regimes, tax policies designed to minimize income shifting through transfer prices may reduce the amount of foreign direct investments (FDI) as well as local tax revenues.

\* I would like to thank Jim Markusen and Yongmin Chen for their comments on earlier drafts. Any remaining errors are my own.

## 1 Introduction

Since 1995, approximately fifteen developed countries, in addition to the US, have adopted transfer pricing regulations and penalty policies in accordance with the OECD Guidelines on Transfer Pricing.<sup>1</sup> Given this recent trend in tax policy, the issue of how these regulations impact on the operations of multinational firms becomes increasingly relevant. Transactions that occur between a multinational firm's related parties are referred to as intracompany transfers. Unlike export prices, market forces do not determine prices charged by a parent company to its foreign subsidiaries. Rather, the firm itself sets its internal prices to minimize its global tax liabilities, distribute risks, and provide incentives for local managers, among other things. The practice of setting intrafirm prices is referred to as transfer pricing. This paper focuses on the firm goal of maximizing its global profits and abstracts from non-tax determinants of its transfer prices.

When differences in tax rates exist, we expect transfer prices to adjust to reduce the total tax liability of the firm; firms engage in legal tax avoidance. This has the effect of partially offsetting the negative effects of the imposition of the tax on profits. However, these changes in transfer prices will potentially cause the taxable income in a high tax country to decline, hence, tax revenues might decline. While the multinational firms' activities have not necessarily moved to other locations, the returns to those activities potentially have. For this reason, governments have implemented transfer pricing regulations which require firms to set their transfer prices equal to the comparable arm's length price (commensurate with income) – the price at which the good would sell between unrelated parties – thus reducing the outflow of taxable income to low-tax countries.

---

<sup>1</sup> US Internal Revenue Code §482 governs transfer pricing practices and the sourcing of multinational firm income in the United States. The OECD Transfer Pricing Guidelines provide an international standard by which countries may model their own regulations.

The relevant literature has been concerned about whether arm's length prices are consistent with those that would exist in the absence of tax differentials. If not, multinationals may be paying more than their fair share in taxes in a given country without an equal reduction in the amount of taxes they pay elsewhere. If multinationals' worldwide profits are negatively impacted by these regulations, then the benefits to investing abroad could potentially be reduced. Cho (1988) emphasizes that foreign direct investment and intrafirm trade are intricately related in the sense that intracompany trade may be imbedded as one prominent advantage in making initial investments abroad. Thus, unregulated intrafirm trade may, on the margin, justify the multinational firm's decision to make foreign direct investments. If regulated, the firm may not choose to invest in the foreign location, thus changing the tax revenue base of a number of countries.

Much of the literature on transfer pricing assumes that firms have already made the investment in their foreign operations. However, it is worth considering under what conditions, given enforceable regulations and established corporate tax rates, a firm's decision to either locate production in a foreign market or export to that market is affected.<sup>2</sup> In the case of tangible assets, this choice is influenced by the existence of differences in factor prices (i.e. production costs), transport costs and tariffs, and agglomeration benefits. Existing literature on the theory of the multinational firm examines how differences in tax rates across countries can induce a change in the choice of mode of production. This research will examine how the introduction of transfer pricing regulations, or more restrictive tax policies, affect a firm's investment decision. By examining the endogenous investment decision, within this context, as compared to a benchmark result under no

---

<sup>2</sup> The firm might also choose to locate all production in the low-tax foreign country. However, as noted by Hines (1999), this is somewhat improbable, in spite of the appeal of low foreign tax rates, given tax and

regulations, the effects of government policy on optimal price, output, and final goods price are explored. The effect of policy on tax revenues is also considered.

A firm may structure itself in a number of ways, one of which is to establish itself as a parent company with subsidiaries in foreign countries (or host countries). The benefits of this particular structure usually lie in reduced costs or risks. There is a body of economic literature dedicated to explaining the multinational enterprise and the offsetting advantages that must exist to compensate for the added fixed costs of setting up foreign operations. The OLI approach developed by Dunning (1977) and expanded on by Krugman (1991) and Markusen (1995) assumes that operating across national boundaries is costly and, therefore, ownership, location or internalization benefits must exist for the multinational venture to be fruitful.

Horstmann and Markusen (1992) developed a model of endogenous market structures in international trade and considered the impact on optimal trade policy. They model an endogenous market structure in which the equilibrium is a function of both firm specific and plant-specific fixed costs. Devereux and Griffith (1998) use a similar static model to examine how differences in *tax rates* across countries can induce a change in the choice to supply a foreign market through export or by locating production there.<sup>3</sup> The production choice depends on the costs of transporting the product to the foreign market relative to any gains from concentrating in one location. In this model, profits taxes affect both marginal factor costs and the effective average tax rate. The former has implications for the user cost of capital and therefore optimal output; the latter has a direct effect on net profits. Without explicitly solving for market structure, Devereux and Griffith use this

---

regulatory costs associated with relocation and also the “unwillingness of governments to impose excessively heavy tax burdens that encourage widespread departures.”

conceptual framework to undertake an empirical study of FDI flows into the US and find that the benefits of low cost of capital may be outweighed by high effective average tax rates. This paper considers the discrete production choice but in the presence of transfer pricing regulations and solves for market structure.

Another body of literature takes the firm investment decision to be exogenous and focuses on how multinationals behave with respect to setting transfer prices. Horst (1971) first developed a simple model of transfer pricing in which a multinational maximizes its after-tax earnings, or the sum of the after-tax profits in the two countries in which it operates. He demonstrates that a monopoly firm selling in two countries will optimally choose the lowest (highest) possible transfer price from parent to subsidiary, given that the tax rate in the country in which the subsidiary is located is lower (higher) than that of the parent. Kant's (1990, 1995) theoretical developments are an expansion on this theme; his model determines the impact of transfer prices on intrafirm trade and government revenues. Incorporating penalties, he considers the tradeoff between optimal transfer price and probability of penalty. He concludes that price is set closer to arm's length than would be optimal in minimizing global tax liabilities. He also explores the potential for perverse trade effects and demonstrates how tax-minimizing behavior can lead to intrafirm trade originating in the country with the higher marginal costs.

Using the theory developed by Kant, Clausing (1998) analyzes the impact of tax minimization strategies on intrafirm trade balances and suggests a clear relationship between effective tax rates and intrafirm trade flows. She conducts an empirical analysis using data on trade flows between US companies and their foreign affiliates for the years 1982 to 1994. She finds that an affiliate country with an effective tax rate ten percentage points higher than

---

<sup>3</sup> A firm can also elect not to serve the foreign market. The authors further consider the foreign production

another affiliate will have an intrafirm trade balance with the US that is 4.4 percentage points greater assuming the same transference of goods. In other words, consistent with expectations, this result suggests that firms behave in such a way as to minimize their worldwide tax burden, moving taxable profits out of high-tax jurisdictions.

In this paper, the theory of endogenous investment choice is combined with transfer pricing theory and evidence on global tax minimization to construct a model of endogenous investment choice in the presence of tax differentials and regulations on transfer pricing behavior. Such a model is unique in that it incorporates both the standard location advantages (differences in factor prices, tax rates, tariffs, and access to resources) for a firm deciding on whether to export or invest abroad, and the potential net benefits of income shifting in the presence of regulations. Presently, governments use a multitude of policy instruments to control the tax base of multinational corporations, only two of which are considered here:

- tax audits
- penalties for non-compliance with the arm's length standard

This paper does not consider the choice of tax rate or tax competition, nor does it analyze the appropriateness of the arm's length standard of pricing intracompany transfers. For the purposes of this paper, 'tax policies' refers only to the probability of audit and the penalty rate set by the local tax authority.

A firm's tax liabilities may be reduced through a subsidiary in a low tax jurisdiction in two ways. First, profits on activities performed in that country will be taxed at a lower rate than would be otherwise. Second, additional income from activities performed in the home country (parent company location) may be shifted to the foreign location through changes in

the company's intrafirm transfer prices and also taxed at a lower rate.<sup>4</sup> In a model where the investment decision is endogenous, transfer pricing regulations potentially impinge on or altogether cutoff both sources of location advantage when tax rate differences exist.

This paper limits its focus to the following question: Under what conditions - probability of audit and penalty rates - is a firm's investment decision actually reversed as compared to the case of no regulation? A firm, taking the appropriate factors into account, will face a regime shift in its decision to either set up foreign operations or export that will be dictated by government tax policies.

If the existing policies, designed to contain a country's tax base, are changing the nature of investment such that the tax base of a given country is actually eroding, then these regulations are counterproductive. The basic research proposed here provides the foundations for exploring these positive issues. However, the incorporation of national welfare is reserved for the more complex treatment of the model in future research. As is always the case, the theory does not capture the full range of choices multinationals might exercise, be they financial or real. Thus, the results may over- or understate any impact of the current tax regime on firm decisions. Furthermore, it is beyond the scope of this research to identify and test all possible types of regulations on multinational taxable income.

This paper is organized into five additional sections. Section 2 lays out the benchmark case of a single multinational firm maximizing its profits in the presence of bilateral taxes and in the absence of government regulation of transfer prices. The optimal transfer price is derived assuming a tax differential exists between two countries. This exercise is strictly informative and is used for comparative purposes in subsequent sections.

---

<sup>4</sup> In fact, empirical work indicates that firms do engage in this activity. See Kopits (1976), Kant (1990, 1995), and Klassen, Lang and Wolfson (1993).

Section 3 sets out the basic framework of the model with transfer pricing regulations and proceeds to analyze the endogenous investment choice. It describes the functions that will allow for a comparison of a firm's profits under two scenarios: 1) as a multinational faced with unilateral transfer pricing regulations, and 2) as a national firm in the home country that strictly exports to unrelated parties in the foreign country. The main contribution of this paper is this direct comparison, which is elaborated on in Section 4 of this paper. For the first time, the investment choice of the firm is endogenized in the presence of transfer pricing regulations, and the real effects on input and output decisions are considered in Section 5 using a GAMS simulation. Finally, conclusions are presented in Section 6.

## **2 Model of Firm Decision Making without Transfer Pricing Regulations**

Markusen (1998) developed something of a road map to the fundamental principles underlying multinational firm behavior, which is, to some extent, incorporated into the model that follows. It is assumed that operating across national boundaries is costly and that multinationals are typically associated with relatively high levels of research and development, human capital, intangible assets, and product differentiation, and low levels of plant scale economies. In addition, Markusen's research suggests that foreign direct investment (FDI or investment) will generally take place among countries with similar relative factor endowments and per capita income, and among those that are high-income, developed countries.<sup>5</sup>

---

<sup>5</sup> To a large extent, intrafirm trade flowing out of the US is in intermediate manufactures, from a US manufacturing parent to their foreign manufacturing affiliate. In contrast, most intrafirm trade flowing into the US from foreign parents to their US affiliates is in the form of wholesale goods to be marketed and distributed domestically. See BEA (1997 Survey).

In the benchmark case (b), a multinational firm has operations in both the home market and a single foreign market. It is assumed that both output and transfer pricing decisions are centralized. Therefore, the multinational firm (m) maximizes global net-of-tax profits and determines its optimal intrafirm transfer price. The general setup of the model is as follows. There are two countries, home (1) and foreign (2). It is assumed that output is produced according to constant- or decreasing-returns-to-scale technologies (i.e. no plant-level economies of scale) and that the multinational has market power in the final goods market. Let  $q_b = D(p_b)$  be the demand for final good in the foreign country, where  $p_b$  is final good price. In the home country, the parent company produces an intermediate good,  $x(p_b)$ . The firm's cost function in country 1,  $C_{m1}(-)$ , is a function of the labor wage rate  $w_1$ , the capital rental rate  $r_1$ , and  $x(p_b)$ . The subsidiary operating in the foreign country purchases intermediates from its parent for further processing or assembly at a transfer price,  $p_{bt}$ . The firm's cost function  $C_{m2}(-)$  in country 2, exclusive of the cost of intermediate inputs, is a function of the labor wage rate  $w_2$ , the capital rental rate  $r_2$ ,  $q_b$ , and  $A$ , which represents local agglomeration effects.<sup>6</sup> Capital and labor are immobile.  $F_{mi}$  is the fixed costs of operation in country  $i=1,2$ . The fixed parameter  $s_m$  represents per unit transport costs, inclusive of tariffs, for the multinational.

The foreign tax rate on corporate profits,  $t_2$ , and the home tax rate,  $t_1$ , are taken as given where  $t_i \in (0,1)$ ,  $i=1,2$ . Assume the multinational firm defers repatriating its foreign profits to the home country and its subsidiary is fully owned.<sup>7</sup>  $\pi_{b1}$  represents the pre-tax

---

<sup>6</sup> Agglomeration effect refers to like companies co-locating near demand or resources.

<sup>7</sup> By precluding repatriation of foreign profits to the home country in the form of shareholder dividends, we abstract from issues of tax credits on foreign taxes paid and double taxation issues. It is reasonable to make this assumption at this stage, as firms are effectively able to keep investment income in the foreign location through the use of equity financing and profits may also be contained for a period of time. Hines (1999) and Connor (1999).

profits of the parent company in the home country and  $\pi_{b2}$ , pre-tax profits of the subsidiary located in the foreign country.

$$\begin{aligned} \mathbf{p}_{b1} &= p_{bt}x(p_b) - C_{m1}(r_1, w_1, x(p_b)) - s_m x(p_b) - F_{m1} \\ \mathbf{p}_{b2} &= p_m D(p_b) - C_{m2}(r_2, w_2, D(p_b), A) - p_{bt}x(p_b) - F_{m2} \end{aligned}$$

Letting  $\Pi_b$  be the sum of after-tax profits across locations (i.e. the global net profits of the multinational), the firm problem is as follows:

$$\begin{aligned} \underset{p_t, p}{Max} \quad & \Pi_b = (1-t_1)\mathbf{p}_{b1} + (1-t_2)\mathbf{p}_{b2} \\ \text{s.t.} \quad & p_{mc} \leq p_t \leq \bar{p} \end{aligned}$$

The transfer price is constrained to be greater than the marginal cost of the intermediate output, as in Horst's model, and less than some measurable upper bound,  $\bar{p}$ . This is based on evidence that transfer pricing behavior is also influenced by non-tax factors in setting its transfer prices. While these factors are not explicitly integrated into this model, the firm would not likely set transfer prices equal to zero or infinitely high. The maximization problem can be rewritten as a Lagrangian.

$$\underset{p_t, p, I_1, I_2}{Max} \quad \Pi_m - I_1(p_t - p_{mc}) + I_2(p_t - \bar{p})$$

The first order conditions are:

$$\begin{aligned}
 (i) \quad & \frac{\partial(\cdot)}{\partial p} = (1-t_1)x'(p_m)[p_t - C'_{m1}(\cdot) - s_m] + (1-t_2)[D'(p_m)(p_m - C'_{m2}(\cdot)) + D(p_m) - p_t x'(p_m)] = 0 \\
 (ii) \quad & \frac{\partial(\cdot)}{\partial p_t} = (1-t_1)x(p_m) - (1-t_2)D(p_m) - I_1 - I_2 = 0 \\
 (iii) \quad & \frac{\partial(\cdot)}{\partial I_1} = -(p_t - p_{mc}) \leq 0 \\
 (iv) \quad & \frac{\partial(\cdot)}{\partial I_2} = (p_t - \bar{p}) \leq 0
 \end{aligned}$$

where  $\lambda_1$  and  $\lambda_2$  are the multipliers on the lower and upper price bounds, respectively. By complimentary slackness conditions, either equation (iii) or (iv) is binding but not both.

Therefore, in the benchmark maximization, there is no interior solution for  $p_t$ . If  $t_2 < t_1$ , then

$p_t = p_{mc}$ . If, on the other hand,  $t_2 > t_1$ , then  $p_t = \bar{p}$ .

Without loss of generality, letting  $D(p) = x(p)$ , equation (i), the condition on final goods price, may be reorganized to look more familiar:

$$\begin{aligned}
 & \underbrace{(1-t_2)[p_m D'(p_m) + D(p_m) - C'_{m2}(\cdot) D'(p_m)] - (1-t_1)[D'(p_m) C'_{m1}(\cdot) + D'(p_m) s_m]}_{MR-MC} \\
 & \quad + \underbrace{(t_2 - t_1) D'(p_m) p_t}_{\text{Income Shifting Effect}} = 0
 \end{aligned}$$

The corner solutions are such that if  $t_1 < t_2$ , then the multinational will wish to set its transfer price to the foreign country as high as possible to bring income into the low tax country, the home country. The case of  $t_1 < t_2$  will prove to be uninteresting from the regulatory standpoint of the government tax authority in Country 1, given that the flow of income due

to strategic transfer pricing will favor the home country's tax revenues. So assume  $t_1 > t_2$  throughout the rest of the paper.

As noted by Raimondos-Moller and Scharf (1997), if tax rates were the only policy instrument available to governments, "then the multinational enterprise would simply over- or under-invoice the internal price of  $x$  so as to avoid tax." With the implementation of the US/OECD regulatory standard, price is statutorily restricted to equal the arm's length price. In practice, such a price is unlikely to exist due to the firm-specificity of multinational firm products. Therefore, with respect to tangible transfers, both the OECD Guidelines and US regulations allow transfer prices to be determined using a transactions-based method that relies on gross margins, or other methods that use other various profit-level indicators, such as operating profits. The margins – the appropriate one will depend on the type of functions being performed by the tested party – of comparable firms are used to establish a range in which the controlled company should fall.<sup>8</sup> To what extent the firm complies with the 'letter' of the regulations, in any case, depends on the extent of the enforcement of the policy and the tradeoff between the benefits from income shifting and the costs of non-compliance.

### **3 Model of Firm Decision Making with Transfer Pricing Regulations**

This model attempts to capture the tradeoff between optimal transfer price and the probability of penalties being levied by the home country tax authority in an endogenous model of firm choice of production mode. In the basic model presented below, a firm will choose between export and foreign investment. As an exporter, a national firm produces the final product in the home country for export to the foreign market. Alternatively, should the firm choose to invest in a foreign operation, the parent would

transfer its intermediate good from the home country to the foreign subsidiary, which supplies all demand in the local market. The subsidiary would pay a transfer price to the parent for intermediates purchased and undertakes the second stage of the production process, selling the final good in its own market. Transfer pricing regulations are imposed by a single tax authority, the home country tax authority.

### 3.1 Multinational Firm with Regulated Intrafirm Transfer Prices

#### 3.1.1 *The General Model*

Consider first the case of parent company and subsidiary. As in the benchmark case, there are two countries, home (1) and foreign (2). The multinational firm's pre-tax revenues less costs in the home country and foreign country are as before:

$$\begin{aligned}
 p_{m1} &= p_t x(p_m) - C_1(r_1, w_1, x(p_m)) - s_m x(p_m) - F_{m1} \\
 p_{m2} &= p_m D(p) - C_2(r_2, w_2, D(p_m), A) - p_t x(p_m) - F_{m2}
 \end{aligned}$$

Government tax authorities in both countries levy a profit tax on the firms operating in their tax jurisdiction such that  $t_1 > t_2$ . Where this maximization problem differs from that in the benchmark model is in the inclusion of a penalty parameter into an expected profit function which allows for an interior transfer price solution. The home government chooses a level of audit that determines the probability ( $\alpha$ ) of any one firm being audited and is dependent on firm price-setting behavior. Using methods developed by Kant (1990) as a framework, let the price,  $p_a$ , represent the arm's length transfer price.<sup>7</sup> This parameter is taken as given.

---

<sup>8</sup> Atkinson (1997).

<sup>7</sup> US IRS §482 Transfer Pricing Regulations and the OECD Guidelines, which establish an international standard for transfer pricing regulations, statutorily require firms to set transfer prices equal to the comparable arm's length price in determining taxes owed.

It is assumed that the probability of audit will depend on  $p_t$  relative to  $p_a$ . The closer the transfer price to the arm's length price, the lower the probability of audit.<sup>8</sup>

$$\mathbf{a}(p_a, p_t) \quad \text{and} \quad \mathbf{a} \in (0,1)$$

$$\text{For } p_t \leq p_a : \quad \mathbf{a}'(\cdot) \leq 0 \quad \text{and} \quad \mathbf{a}''(\cdot) \leq 0$$

Assuming  $t_2 < t_1$ , the transfer price, in general, is set such that it is less than or equal to the arm's length price to take advantage of the lower tax rates by moving less income out of the low tax country in the form of intracompany payments to the parent company.

If a firm is found non-compliant (i.e.  $p_a \neq p_t$ ), home government requires payment of the discrepancy in taxes owed plus a penalty, where the penalty rate ( $\beta > 0$ ) is applied to the underpayment in taxes and is a constant rate across transactions. The potential cost to the firm is thus:

$$t_1(p_a - p_t)x(p_m) + \mathbf{b}[t_1(p_a - p_t)x(p_m)] = (1 + \mathbf{b})t_1(p_a - p_t)x(p_m)$$

This penalty method is consistent with US regulations and those specified in the OECD guidelines.<sup>9</sup> Given the above assumptions and letting  $\Pi_m = (1-t_1)\pi_{m1} + (1-t_2)\pi_{m2}$ , the firm's expected profit function may be written as follows:

$$E(\Pi_m) = (1 - \mathbf{a}(\cdot))\Pi_m + \mathbf{a}(\cdot)[\Pi_m - (1 + \mathbf{b})t_1(p_a - p_t)x(p_m)]$$

If the firm is not audited, then it pays tax on the amount of profit reported. If the firm is audited and is in compliance, then it, again, pays tax on the amount initially reported.

<sup>8</sup> In general, the probability of audit can be assumed to be absolutely decreasing in  $p_t$  because for  $p_t > p_a$ , the probability of audit is assumed to be zero. Note that it will be shown below that even when  $t_1 > t_2$ , the case of  $p_t > p_a$  may arise.

<sup>9</sup> In 1995, the US §6662 regulations were issued, which impose a penalty of 20 to 40 percent of the tax underpayment if found not in compliance with §482. A similar penalty is recommended in the OECD Guidelines. OECD Transfer Pricing Guidelines (Update 1996).

If the firm is audited and is not in compliance (i.e.  $p_a - p_t \neq 0$ ), then it must pay the tax and penalty on the discrepancy in revenues. The multinational maximizes *expected* global profits by choosing the optimal transfer price,  $p_t$ , and final price,  $p_m$ , taking the arm's length price,  $p_a$ , and transfer pricing regulations  $(\alpha, \beta)$  as given. Again letting  $q_m = D(p_m) = x$  without loss of generality, the firm problem is as follows:

$$\begin{aligned} \underset{p, p_t}{\text{Max}} \quad & (1 - t_1)[p_t D(p_m) - C_{m1}(r_1, w_1, D(p_m)) - s_m D(p_m) - F_{m1}] \\ & + (1 - t_2)[p_m D(p_m) - C_{m2}(r_2, w_2, D(p_m), A) - p_t D(p_m) - F_{m2}] \\ & - \mathbf{a}(p_a, p_t)(1 + \mathbf{b})t_1[p_a - p_t]D(p_m) \end{aligned}$$

where the first term is net of tax profits in the home country; the second term, net of tax profits in the foreign country; and the third term represents expected penalty payments.

$$\begin{aligned} \frac{\partial E(\Pi_m)}{\partial p_m} = & (1 - t_2)[p_t D'(p_m) - C'_{m1}(\cdot)D'(p_m) - s_m D'(p_m)] \\ & + (1 - t_2)[D(p_m) + p_m D'(p_m) - C'_{m2}(\cdot)D'(p_m) - p_t D'(p_m)] \\ & - \mathbf{a}(\cdot)(1 + \mathbf{b})t_1[p_a - p_t]D'(p_m) = 0 \end{aligned} \quad (1)$$

$$\frac{\partial E(\Pi_m)}{\partial p_t} = (1 - t_1)D(p_m) - (1 - t_2)D(p_m) + \mathbf{a}(\cdot)t_1(1 + \mathbf{b})D(p_m) - \mathbf{a}'(\cdot)(1 + \mathbf{b})t_1(p_a - p_t)D(p_m) = 0 \quad (2)$$


---

The first order conditions are:

$$(i) \quad \underbrace{(1-t_2)[D(p_m) + p_m D'(p_m) - C'_{m2}(\cdot)D'(p_m)] - (1-t_2)D'(p_m)[C'_{m1}(\cdot) + s_m]}_{MR-MC} + \underbrace{(t_2 - t_1)[p_t D'(p_m)]}_{Income \text{ Shifting Effect}} - \underbrace{\mathbf{a}(\cdot)t_1(1+\mathbf{b})[p_a - p_t]D'(p_m)}_{Penalty \text{ Tradeoff Effect}} = 0$$

$$(ii) \quad p_t = p_a - \frac{(t_2 - t_1)}{\mathbf{a}'(\cdot)t_1(1+\mathbf{b})} - \frac{\mathbf{a}(\cdot)}{\mathbf{a}'(\cdot)}$$

Rewriting equation (1) above, the optimal choice of  $q_m$  must satisfy optimality condition (i). Marginal revenue and marginal cost appear, as usual, in the first expression. The second expression represents the reduction in the tax distortion that comes about from shifting income through intracompany transfer prices to the low tax jurisdiction – in this case, country 2. The third expression may be interpreted as the tradeoff to shifting income in the form of a penalty and payment on the tax discrepancy if audited by the government. In essence, the second and third terms will move in opposite directions and will shift the marginal cost curve down and up, respectively. The second condition (ii) yields the optimal intrafirm transfer price.

**Proposition 1:** *The multinational firm's transfer price is less than the arm's length price if and only if*

$$\frac{(t_1 - t_2)}{t_1} > \mathbf{a}(\cdot)(1 + \mathbf{b})$$

Furthermore,  $p_t = p_a$  when the above equation holds with equality. The proof follows from the optimality condition for  $p_t$  above.

$$p_t = p_a + \frac{1}{\mathbf{a}'(\cdot)} \left[ \frac{(t_1 - t_2)}{t_1(1 + \mathbf{b})} - \mathbf{a}(\cdot) \right]$$

where the first derivative of  $\alpha$  is less than or equal to zero. This result underscores the significance of the interplay of tax tools. When the divergence in tax rates is large, the firm is more likely to under-invoice its intermediate goods price because the benefits from shifting income to the subsidiary in the low-tax country is also large. Similarly, when the probability of audit or penalty rate is relatively low, the firm will under-invoice its intermediates since the costs of doing so are relatively low. Note that in the event that it is optimal for the firm to set its transfer price above the arm's length price (perverse policy effects) and the probability of audit is greater than zero, then the firm actually receives a subsidy from the government. It is implicitly assumed that the transfer price is restricted to be less than the arm's length price, such that the condition in Proposition 1 holds based on the fact that the tax authority would not provide subsidies to intrafirm trade.

**Proposition 2:** *If  $t_1 > t_2$ , then the multinational firm's transfer price is increasing in (i) the penalty rate,  $\mathbf{b}$ , and (ii) in the stringency of the audit policy (i.e. probability of audit).*

$$(i) \quad \frac{\partial p_t}{\partial \mathbf{b}} = \frac{(t_2 - t_1)}{\mathbf{a}'(\cdot)t_1(1 + \mathbf{b})^2} > 0 \quad (ii) \quad \frac{\partial p_t}{\partial \mathbf{a}} = -\frac{1}{\mathbf{a}'(\cdot)} > 0$$

Both results are quite intuitive. When the tax rate is lower in the foreign country, the multinational has an incentive to set its transfer price as low as possible to move income from the high tax jurisdiction to the low tax jurisdiction. As the transfer is assumed to be from parent to foreign subsidiary, a low purchase price results in fewer monetary units leaving the low-tax, foreign country. However, for higher levels of penalty rates,  $\beta$ , the firm faces more dire consequences if its underpricing practices are detected. Therefore, a higher penalty rate is associated with a higher transfer price. Similarly, a stricter standard for audit

will induce the firm to set its transfer price closer to the arm's length standard, thus foregoing the potential tax savings from shifting income to the low tax jurisdiction.

**Proposition 3:** *If  $t_1 > t_2$ , then the multinational firm's transfer price is (i) decreasing in the home country tax rate,  $t_1$ , and (ii) increasing in the foreign country tax rate,  $t_2$ .*

$$(i) \quad \frac{\partial p_t}{\partial t_1} = \frac{1}{\mathbf{a}'(\cdot)t_1(1+\mathbf{b})} + \frac{(t_2 - t_1)}{\mathbf{a}'(\cdot)t_1^2(1+\mathbf{b})} < 0 \quad (ii) \quad \frac{\partial p_t}{\partial t_2} = -\frac{1}{\mathbf{a}'(\cdot)t_1(1+\mathbf{b})} > 0$$

Again, these results are consistent with expectations. For higher home country tax rates, the potential savings from shifting income to the low-tax foreign market are greater. Holding all else constant, for higher home tax rates, the firm will set its transfer price lower. Likewise, when the foreign tax rate is high, the tendency will be for the multinational to set its transfer prices higher, *ceteris paribus*. Note again that the case of  $t_1 < t_2$  is uninteresting given that in this model only one tax authority, the home government, has a transfer pricing tax policy. And with lower tax rates in the home country, money will flow in not out.

### 3.1.2 Constant Marginal Costs and Linear Demand Model

By setting the value function of profits for the multinational equal to the value function of profits for the exporter, an analysis of how government transfer pricing policies affect the firm's choice of production mode, and consequently the tax base, is possible. To do this, functional forms are specified. Assume the firm is a monopolist with linear final and intermediate good demand and constant marginal costs.

$$\begin{aligned}
D(p) &= 1 - p \\
C_1(\cdot) &= c_1 x \\
C_2(\cdot) &= c_2 q \\
\mathbf{a}(\cdot) &= \mathbf{g} \left[ 1 - \frac{p_t}{p_a} \right]
\end{aligned}$$

Expected global net-of-tax profits for the multinational firm is as follows:

$$\begin{aligned}
E(\Pi_m) &= (1 - t_1)[p_t q_m - c_{m1} q_m - s_m q_m - F_{m1}] \\
&\quad + (1 - t_2)[p_m q_m - c_{m2} q_m - p_t q_m - F_{m2}] \\
&\quad - \mathbf{g} \left[ 1 - \frac{p_t}{p_a} \right] t_1 (1 + \mathbf{b})(p_a - p_t) q_m
\end{aligned}$$

As before, the production function is such that  $q_m = D(p_m) = x$ . By maximizing the above expression of expected profits, taking the derivatives with respect to final goods output,  $q_m$ , and the transfer price,  $p_t$ , the following first order conditions may be obtained:

$$\begin{aligned}
q_m^* &= \frac{(1 - c_{m2})}{2} - \frac{(1 - t_1)}{2(1 - t_2)}(c_{m1} + s) + p_a \frac{(t_2 - t_1)}{2(1 - t_2)} + p_a \frac{(t_2 - t_1)^2}{8\mathbf{g}_1(1 + \mathbf{b})(1 - t_2)} \\
p_t^* &= p_a + \frac{(t_2 - t_1)p_a}{2\mathbf{g}_1(1 + \mathbf{b})}
\end{aligned}$$

**Proposition 4:** *If  $t_1 > t_2$ , demand is linear and marginal costs are constant, then the multinational firm's final good output, and thus intermediate output, is decreasing in (i) the penalty rate,  $\mathbf{b}$ , and (ii) the enforcement mechanism,  $\mathbf{g}$ .*

$$\begin{aligned}
(i) \quad \frac{\partial q_m^*}{\partial \mathbf{b}} &= -\frac{(t_2 - t_1)^2}{8\mathbf{g}_1(1 - t_2)(1 + \mathbf{b})^2} \leq 0 \\
(ii) \quad \frac{\partial q_m^*}{\partial \mathbf{g}} &= -\frac{(t_2 - t_1)^2}{8\mathbf{g}^2 t_1(1 + \mathbf{b})(1 - t_2)} \leq 0
\end{aligned}$$

These results follow directly from taking the derivative of the optimal expression for output and signing the equation. This suggests that higher values of  $\gamma$  and  $\beta$  are associated with lower levels of intermediate output and final good output and higher final good price. The regulations can be 'effective' in the sense that certain values of  $\gamma$  and  $\beta$ , depending on the tax rates in the two countries, will cause the multinational to raise its transfer price. The effects on government tax revenues is ambiguous assuming there are costs associated with enforcing the regulations and the potential for a shift in investment regimes. The regime shift is explored throughout the rest of this paper. The real effects of the transfer pricing regulations on national welfare are considered in complimentary research.

**Lemma:** *Provided costs are linear in quantity (i.e. marginal costs are constant) and demand is linear, then the value function for profits may be stated as follows:*

$$V(\Pi) = (1-t)b(q^*)^2$$

$$\text{given } \Pi = (1-t)[(a-bq)q - c^*q]$$

For  $p=(1-q)$ , such that  $a=1$  and  $b=1$ , plugging in the optimal  $q^*$  yields:

$$V(E\Pi_m) = (1-t_2) \left[ \frac{(1-c_{m2})}{2} - \frac{(1-t_1)}{2(1-t_2)}(c_1 + s) + p_a \frac{(t_2 - t_1)}{2(1-t_2)} + p_a \frac{(t_2 - t_1)^2}{8g_1(1+b)(1-t_2)} \right]^2$$

$$- (1-t_1)F_1 - (1-t_2)F_2$$

Thus, the value of after-tax profits for the multinational firm is negatively impacted by values of  $\gamma, \beta > 0$ .

### 3.2 The Exporting Firm

In case of the national firm, all operations are located in the home country (1). The firm manufactures the final good in the home country and exports output,  $q_e = D(p_e)$ , to a third party at price  $p_e$ . All output is sold in the foreign market by the importer. As was the case with the multinational firm, the good is produced according to constant or decreasing-returns-to-scale technologies. The national firm has market power in exports and the importer, market power in the foreign market. The good cost function,  $C_e(-)$ , is a function of wage rate,  $w_e$ , capital rental rate,  $r_e$ , and  $q_e$ . Capital and labor are, again, immobile.  $F_e$  is the fixed costs of operations for the national firm;  $s_e$  are per unit transport costs, inclusive of tariffs; and corporate profits are subject to tax rate  $t_1$ .

National firm net-of-tax profits are then given by:

$$\Pi_e = (1 - t_1)(p_e D(p_e) - C_e(w_e, r_e, D(p_e)) - s_e D(p_e) - F_e)$$

Using the functional forms specified in the multinational firm problem:

$$\text{Max}_{q_e} (1 - t_1)[(1 - q_e)q_e - c_e q_e - s_e q_e - F_e]$$

$$\frac{\partial \Pi_e}{\partial q_e} = (1 - t_1)[1 - 2q_e - c_e - s_e] = 0$$

The first order condition is then:

$$q_e^* = \frac{(1 - c_e - s_e)}{2}$$

The national firm value function for profits is easily derived.

$$V(\Pi_e) = (1 - t_1) \left[ \left( \frac{1 - c_e - s_e}{2} \right)^2 - F_e \right]$$

#### 4 Equilibrium Regimes and Regime Shifting with Endogenous Investment Choice

In order to conduct a meaningful analysis of regime shifting, the following assumptions, consistent with the theory on multinational firms, are made regarding costs:

- multinational firm's aggregated marginal costs are lower than the national firm's such that  $c_{m1} + c_{m2} < c_e$ .
- national firm's fixed costs are lower than the multinational firm's aggregated fixed costs such that  $F_e < F_{m1} + F_{m2}$ .
- transport costs and tariffs are lower for the multinational, or  $s_m < s_e$ .

Regime shifts may be identified by setting up the following equality and solving for conditions under which the firm will not be indifferent between FDI and export :

$$\Pi(\mathbf{a}, \mathbf{b}) = \Pi_e$$

Critical values of the penalty rate and the enforcement mechanism will instigate a shift in the investment regime. The above equation may be written as follows:

$$(1-t_2) \left[ \frac{(1-c_{m2})}{2} - \frac{(1-t_1)}{2(1-t_2)} (c_{m1} + s_m) + p_a \frac{(t_2-t_1)}{2(1-t_2)} + p_a \frac{(t_2-t_1)^2}{8g_1(1+\mathbf{b})(1-t_2)^2} \right]^2 - (1-t_1)F_{m1} - (1-t_2)F_{m2} = (1-t_1) \left[ \left( \frac{1-c_e-s_e}{2} \right)^2 - F_e \right]$$

Using the prescribed linear demand and constant marginal cost functions, the benchmark, no-regulations, value of multinational profits can be rewritten as follows:

$$V(\Pi_b) = (1-t_2) \left[ \frac{(1-c_{m2}-c_{m1})}{2} - \frac{(1-t_1)}{2(1-t_2)} s_m \right]^2 - (1-t_1)F_1 - (1-t_2)F_2$$

Assume tax rates and the value of profits through export are constant. When compared with the value of expected profits under no regulations, the firm facing transfer pricing regulations will be indifferent between FDI and export only for higher levels of marginal costs of production and transport costs in the case of the exporter. Said another way, *ceteris paribus*, the shift to the export regime will occur over lower values of marginal costs and transport costs in the presence of transfer pricing regulations, compared with the case of no regulations. This follows from the fact that the value of profits under regulations will be less than the value of expected profits without. This result confirms the hypothesis that regulations, on the margin, affect investment decisions of firms. Specifically, at a given point in time, fewer firms are likely to invest in foreign production relative to the case of no regulation.

The implications for tax revenues in country 1, not factoring in the costs of policy enforcement, are not immediately obvious. Revenues under the multinational firm regime take into account only taxes collected on profits accumulated in country 1 and any penalties assessed.

$$TR_m = t_1[q_m^*(p_t^* - c_{m1} - s_m) - F_{m1}] + g \left[ 1 - \frac{p_t^*}{p_a} \right] (1 + \mathbf{b}) t_1 (p_a - p_t) q_m^*$$

Under the export regime, tax revenues are derived by simply multiplying the value of firm profits under export by the tax rate.

$$TR_e = t_1 \left[ \left( \frac{1 - c_e - s_e}{2} \right)^2 - F_e \right]$$

The simulation results of the next section provide a more complete analysis of the effects of policy on tax revenues for the home country.

## 5 GAMS Simulation Results Under Varying Probabilities of Audit and Penalty Rates

Using simulation methods to generate the Regulations model, tax policy, the regime shift and their effects on tax revenue are examined in depth. In Figures 1-7, the penalty rate,  $\beta$ , is indexed over one axis of the base of the diagrams and the enforcement mechanism,  $\gamma$ , on the other. Recalling that  $D(P)=1-p$ , the vertical axis is in US dollars. Assuming a fifteen percent tax differential between countries, various combinations of  $\gamma$  and  $\beta$  will induce a shift in regime from one of investment in foreign production to one of export. This shift occurs over higher values of  $\gamma$  and  $\beta$  and is depicted in Figure 1, with greater sensitivity to the likelihood of audit by the tax authority. Figure 2 demonstrates the change in (expected) profits for different tax policies, where under the export regime, profits are constant no matter the policy. Profits are decreasing in both penalty rates and degree of enforcement.

Figures 3 and 4 show that final good price is higher under more restrictive transfer pricing policies, and output lower. The effect is most noticeable at the point of the regime shift; the magnitude will depend on the differences in variable costs under each regime. Figure 5 is illustrative of the fact that tax revenues are not strictly increasing over the range of policy instruments. Tax revenues increase up to the point where the regime shift occurs – and with the firm exporting, tax revenues drop considerably and are constant over the range. With a shift in production regimes, tax policies designed to minimize income shifting through transfer prices may reduce the amount of foreign direct investments (FDI) as well as local tax revenues. The diagrams in Figures 6 and 7 show transfer prices and penalty assessments moving in the expected directions.

## 6 Conclusions

There is sufficient empirical evidence to suggest that firms adjust transfer prices in intracompany transactions with the goal of reducing their total tax liability. It appears that an increasing number of tax authorities are responding to this and the potential loss of tax base to other regulating countries in choosing to adopt transfer pricing regulations similar to those implemented in the U.S. The consequences of this for tax revenues and the allocation of international economic activity have not been fully examined in economic theory.

A penalty payment consistent with OECD guidelines is modeled here in an expected profit function that allows for an interior transfer pricing solution. We find that changes in the optimal transfer price, given changes in the probability of audit,  $\alpha$ , and the penalty rate,  $\beta$ , have the expected sign given enforceable regulations. Increases in the probability of audit or the penalty rate move the transfer price closer to the statutory arm's length price, reconfirming Kant's findings. However, under certain conditions the regulations are also associated with lower multinational firm expected profits, lower final good and intermediate good output, and higher final good price. Because the firm is less likely to make foreign direct investments when compared to the case of no regulations, there are potentially negative consequences for tax revenues in the regulated market, as well as for other markets.

The novel aspect of this model is that a firm's foreign direct investment decision is not taken as given, but determined endogenously. Intuitively, it is expected that when the home country tax rate is higher than the host country's rate, the firm is less likely to choose the multinational structure in the presence of transfer pricing regulations than in an unregulated environment. This might result due to the tradeoff between gains from income shifting and the probability of audit and penalties from engaging in this activity. If

regulations effectively offset income shifting gains derived from a multinational's foreign location, on the margin the firm may choose to export rather than invest in the host country.

In fact, the findings indicate that transfer pricing regulations offset potential gains from income shifting and reduce multinational global profits. These policy instruments may also decrease final good output and increase price, potentially negatively affecting its own revenue base and consumer welfare. However, this paper does not consider the multinational decision in the context of a two-stage game in which the government maximizes national welfare. Such an analysis is necessary to draw any conclusions with respect to welfare.

This theoretical examination confirms that foreign direct investment decisions and intrafirm trade are related and that the particular type of regulation of transfer prices being adopted globally, one that relies on audit policy and penalty rates, affect investment decisions of firms. Thus, tax authorities should take into account that fewer firms are likely to invest in foreign production relative to the case of no regulation. Contrary to the conventional wisdom that transfer pricing regulations increase government tax revenues, tax policies designed to minimize income shifting through transfer prices can actually reduce local tax revenues.

## Bibliography

---

Atkinson, Mark, and David Tyrrall, "International Transfer Pricing: The Taxman Cometh," *Management Accounting – London* (December 1997), Vol. 75 (11), pp.32-34.

Bureau of Economic Analysis, *1997 Foreign Direct Investment Survey*, U.S. Department of Commerce, Washington DC.

Clausing, Kimberly A., "The Impact of Transfer Pricing on Intrafirm Trade," *NBER Working Paper* (August 1988), No. 6688.

Connor, John, "GAO Says Majority of Corporations Paid No Income Tax From '89-'95," *Dow Jones Business News* (April 4, 1999).

Devereux, Michael P. and Rachel Griffith, "Taxes and the location of production: evidence from a panel of US multinationals," *Journal of Public Economics* (1998), Vol. 68, pp.335-367.

Dunning, W.H., "Trade, Location of Economic Activity and MNE: A search for an eclectic approach," *The International Allocation of Economic Activity* (1977).

Eliztur, Ramy and Jack Mintz, "Transfer Pricing Rules and Corporate Tax Competition," *Journal of Public Economics* (1996), Vol. 60, pp.401-422.

Gresik, Thomas A., "Arm's Length Transfer Prices and National Welfare," Working Paper, (May 1998).

Hines, James R., "Lessons from Behavioral Responses to International Taxation," *National Tax Journal* (Forum on Mobility and Tax Analysis, 1999).

Horst, Thomas, "The Theory of the Multinational Firm: Optimal Behavior Under Different Tariff and Tax Rates," *Journal of Political Economy* (1971), Vol. 79(5), pp.1059-1072.

Hogan, David, "The Transfer Pricing Guidelines: Economic Analysis Shows Potential Unfairness," *Tax Management Transfer Pricing Special Report* (April 22, 1998), Vol. 6(26), pp.1-21

Horstmann, Ignatius J., and James R. Markusen, "Endogenous Market Structures in International Trade (natura facit saltum)," *Journal of International Economics* (1992), Vol. 32, pp. 109-129.

Kant, Chander, "Minority Ownership, Deferral, Perverse Intrafirm Trade and Tariffs," *International Economic Journal* (1995), Volume 9(1), pp.19-37.

Kant, Chander, "Multinational Firms and Government Revenues," *Journal of Public Economics* (1990), Volume 42, pp.135-147.

Klassen, K., M. Lang and M. Wolfson, "Geographic Income Shifting by Multinational Corporations in Response to Tax Rate Changes," *Journal of Accounting Research* (1993), Volume 31, pp.141-73.

Kopits, George, "Intra-firm Royalties Crossing Frontiers and Transfer-Pricing Behavior," *Economics Journal* (1976), Volume 86(344), pp.791-805.

OECD Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations, *Report of the Committee on Fiscal Affairs* (July 1995, Update March 1996).

Markusen J., J. Melvin, W. Kaempfer and K. Maskus, *International Trade: Theory and Evidence* (1995), McGraw Hill, Inc., Chapter 22.

Markusen, James R., "Multinational, Multi-Plant Economies, and the Gains from Trade," *Journal for International Economics* (1984), Volume 16, pp.205-226.

Markusen, James R., "Endogenous market structures in international trade (natura facit saltum)," *Journal of International Economics* (1992), Volume 32, pp.109-129.

Markusen, James R., "Multinational Firms, Location and Trade," *The World Economy* (August 1998), Vol. 21(6), pp.733-756.

Raimondos-Moller, Pascalis and Kimberly A. Scharf, "The Optimal Design of Transfer Pricing Rules: A Non-Cooperative Analysis," *Warwick Research Papers* (November 1996), No. 502.

Tang, Roger Y.W., *Intrafirm Trade and Global Transfer Pricing Regulations* (1997), Quorum Books.

Tirole, Jean, *The Theory of Industrial Organization* (1994), 7<sup>th</sup> Ed., MIT.

US IRS Transfer Pricing Regulations and Penalty Regulations, IRC §482 (1994) and 6662 (1995).