

Optimized Transfer-Pricing Model for Asia Pacific

by

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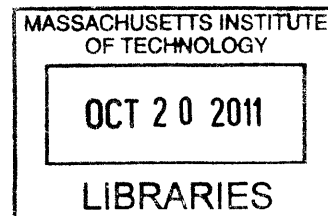
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I. Abstract

Transfer price is an important field of study for profit maximization. As more multinational enterprises (MNEs) are involved in global trading in the recent decades, the objective to set an optimized transfer price is more crucial than ever since the difference in tax rates and tariffs have sophisticated impacts on the overall profit for the corporation. In this thesis, which focuses primarily on Asia Pacific, I will review historical transfer pricing methods, explore the factors that affect transfer price determination, and construct a mathematical model to determine the optimal transfer price by comparing and contrasting the different transfer pricing methods with data from a hypothetical company. Particularly, I will illustrate the effects of taxes and tariffs on the determination of transfer price. Consequently, I will perform sensitivity analysis with respects to tariffs, taxes, and shipping costs. The thesis will conclude with recommendations on the optimized transfer pricing methods and insights on the implications for the method.

II. Inspiration: Overview of the Problem

Transfer price refers to the price at which a subsidiary of a company charge and trade with each other. As the world becomes more globalized, the role of transfer price is becoming increasingly important since more and more goods are being manufactured, produced, and transferred across borders, and transfer price is the standard way to account for goods transferred internationally. Transfer pricing is at the heart of discussion for many multinational enterprises (MNEs) because it directly affects the profit margin of the company, and can shift profit from one country to another. Due to these reasons, MNEs have been focusing on understanding transfer price and how it relates to tax minimization in order to maximize profits.

2.1 What is the problem? Why is it important?

For MNEs, the study and understanding of transfer pricing is of critical importance because studies have shown that many companies gained additional profits through manipulations of transfer price from a country with lower tax to another country with higher tax. Consider Ireland where corporate profit is taxed at 12.5%, a rate that is one-third of the tax rate of the United States; the low tax rate makes Ireland an attractive place for MNEs to shift sales to in order to enjoy the benefit of the tax havens. Sikka and Willmott showed in their paper an example of how Microsoft did this through establishing a foreign owned subsidiary that is operated in Dublin. Within three years of operations, the foreign subsidiary was in control of 22% of Microsoft's global profits. The foreign subsidiary's income came from licensing software codes to Europe, Middle East and Africa that were originated from the US. The foreign subsidiary has absorbed other Microsoft units to move intellectual property to Ireland. These actions had allowed Microsoft to save at least \$500 million in tax (Sikka 351). This is just one of the many examples of tax avoidance, many other US-based MNEs such as Dell, Oracle, Apple, and HP have also relocated part of their research and development centers to Ireland for the purpose of enjoying the lower corporate tax rate.

Nevertheless, transfer pricing practice does not present a win-win situation for both the MNE and the government. Transfer pricing practice means one gain for one party is one loss for another. Due to the widespread of practices, the US government, as well as other high tax countries, has experienced the loss of tax revenue. To minimize the impact of transfer price and to control the flow of revenue from one country to the other, many countries have enacted and

adopted the guidelines for transfer pricing practices developed by the Organization for Economic Cooperation and Development (OECD).

2.2 What is the issue that this thesis is aiming to solve?

For this thesis, I will illustrate my model and calculation with a hypothetical company called Company X. The objective of my thesis is to build a mathematical model that determines the optimal transfer pricing method and price for Company X that fits with the company culture and organizational structure. A section on sensitivity analysis will be performed at the end to illustrate the effects of taxes, tariffs and incremental costs on profit.

In this thesis, I will start off with a literature review to review the common definitions in the context transfer price, followed by the OECD regulations, and the various types of transfer pricing determination methods. Next, I will go into describing the roles of tariffs and taxes. Mainly, the effects they have on transfer price. Before providing some actual examples of how transfer prices could be determined, I will illustrate all the factors that affect a transfer pricing model setup. The bulk of the literature review will focus on the analysis of the historical papers on the optimization of transfer price. The subsections of the historical analysis including an optimized transfer pricing model when the arms-length principle is followed, and when it is not followed. In particular, I will examine two different models (1) when a company adopts two transfer prices, one for tax purposes and one for internal accounting purposes, and (2) the combined effects of tariffs and corporate taxes on transfer price.

The next chapter of the thesis hypothesizes a baseline, or “current” set of practices for Company X. The next section of the thesis will focus on the mathematical model. Specifically, I will concentrate on building a model for determining the optimized transfer price for Company X, given some of its initial conditions. I then review some sensitivity analysis given changes in corporate tax rates, changes in tariffs, and changes in incremental transportation costs. Lastly, I conclude the thesis with a set of recommendations that Company X can use for its future transfer price evaluation.

In Chapter 2 below, I review the proofs and discussions of the optimized transfer pricing models derived from other research papers.

III. Literature Review

Transfer price has long been an important issue for multinational companies. As globalization becomes increasingly important, big corporations are paying even more attention on transfer pricing practices as profits can be greatly improved based on the transfer price strategies implemented. In this chapter, I summarize and analyze the literature on the topic of transfer price.

To understand the concept of transfer price, I conducted research on the commonly used terminology, the current OECD regulations, a review on various types of transfer pricing methods, the role played by taxation and tariffs on transfer price, and an historical analysis on optimized transfer prices. This research focuses primarily on US-based multinational enterprises (MNEs) that conduct businesses in Asia Pacific.

3.1 Definitions

The definition of transfer price varies across different sources, according to OECD, “transfer prices are the prices at which an enterprise transfers physical goods and intangible property or provides services to associated enterprise” (OECD 21).

It is important to understand the accounting language in order to comprehend the concept of transfer price. In the following section, I provide the basic definitions for the most commonly used terms in the area of transfer price.

- Multinational Enterprise (MNE): An international company that does trade and sales across borders. For the purpose of this thesis, I will focus primarily on US-based MNEs.
- Arm’s Length Principles: A guideline ratified by OECD for regulating the transfer pricing practices of MNEs. “Arm’s Length Principle is the international transfer pricing standard that OECD member countries have agreed to use for tax purposes by MNE groups and tax administrations” (OECD 33).
- Arm’s Length Price: A price that dictates the amount charged by one related party to another for a given product must be the same as if the parties were not related.
- Organization for Economic Cooperation and Development (OECD): “OECD is a unique organization where the government of 30 democracies works together to address the economic, social, and environmental challenges of globalization. It publishes a reference

on transfer pricing methods and regulations for MNEs. These guidelines serve as the baseline for tax audit for the government.” (OECD 4)

3.2 OECD Regulations

Due to the large amount of transfer pricing practices in the recent decades, OECD implemented a set of guidelines and regulations for MNEs that conducts a great amount of businesses internationally. The transfer pricing principle in OECD dictates that the transfer price set by MNE must a “price that would be paid for similar goods in similar circumstances by unrelated parties dealing at arm’s-length with each other. Failure to comply with the principle may result in penalty” (OECD 33). Arm’s length price is a range of prices that can be charged on a good transferred among different divisions in a firm.

IRS issued the first set of transfer pricing regulations in 1968. Transfer price can be applied for five kinds of intrafirm transactions, loans, rentals, sales of tangible property, transfer or use of intangible property, and performance of various business services. For this thesis, I will focus primarily on transfer pricing method for sales of tangible property (Eden 605).

3.3 Common Transfer pricing Methods Review

There is no one-size-fits all model for the determination of transfer prices. Firms choose transfer pricing methods based on their needs and organizational structures. In the section below, I illustrate the most widely used transfer pricing methods in business today. Specifically, the transfer pricing methods can be divided into two different categories as illustrated in figure 1 below. The first category is based on merchandise transaction and the second category is based on profit. I will explain each of them in details below (Eden 605-610).

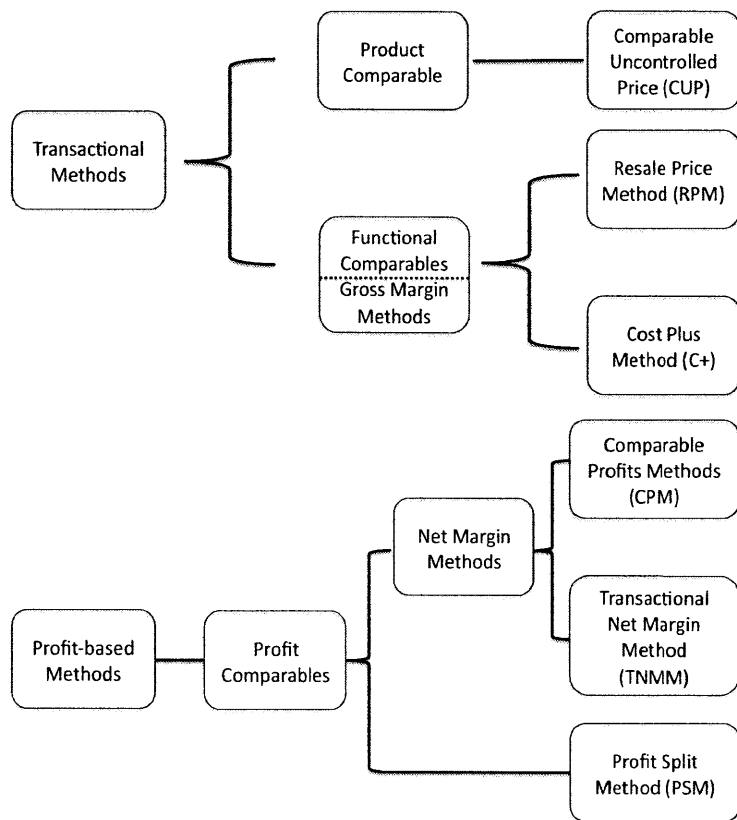


Figure 1: Two different types of transfer pricing approach with applicable methods. (Eden 605)

Transactional Methods:

- Comparable Uncontrolled Price Method (CUP): This method is based on the third-party price that is charged on a similar good. Typically, the firm should charge the price for the identical good at comparable price range. In this case, the price charged of a same good between two unrelated parties is used as the transfer price. The product can be the same product sold by the MNE to an unrelated party, or a similar good that is been traded between two unrelated parties.
- Resale Price Method (RPM): This method is useful when the reseller adds little to no value to the final product. Under this method, the transfer price is determined by reducing an amount charged from the final sales price of the good.
- Cost Plus Method (C+): In this method, the transfer price is determined by adding a comparable gross mark-up to the total costs of the finished good. This is related to the resale price method above, but in this case, the final distributors do add value to the good.

Transactional transfer pricing methods such as CUP, RPM, and C+ are usually preferred and more reliable, but due to the lack of external data, these methods are not always applicable, especially for non-tangible goods. In that case, profit-based methods will be employed.

Profit-based Methods:

- Comparable Profits Method (CPM): This is a method where one uses the average industry net profit margin of comparable firms to calculate for the transfer price.
- Transactional Net Margin Method (TNMM): This is similar to the comparable profit method above. To determine the transfer price, one compares the net profit margin from a non-arm's length transaction with the net profit margin realized by arm's length parties from similar transactions and deduces the transfer price. This focuses more on a bottom up approach (comparable transactions) rather than on the top down approach (comparable firms).
- Profit Split Method (PSM): To determine the transfer price of a good, consider the two steps below:
 - First is to determine the total profit earned from a good
 - Second is to split the profits among the parties involved based on the value that each of the parties added to the final product

3.4 Background Setting

Before I dive into illustrating the factors that affect transfer price, it is crucial to set the plot and variables that I will use throughout the thesis. I will use the same terminology and notations for the entire thesis. All definitions for the variables used in the thesis can be found in Appendix I.

First, let us consider a US-based multinational company with two subsidiaries in Country 1 and Country 2. Country 2 buys goods from Country 1 and sells it domestically in Country 2. I also assume that each division is a separate legal entity, that is, each division will be taxed at its own taxable income. Affiliate 1 produces and sells quantity Q_1 in Country 1 and affiliate 2 buys quantity Q_2 from Country 1 to sell in Country 2. I will assume that Country 1 does not purchase product from Country 2 for the sake of simplification. Let c denotes the unit cost for each good

produced and let us assume that it is constant regardless of the quantity produced. Then, the cost function for affiliate 1 is

$$(c)(Q_1 + Q_2) \tag{1}$$

while the cost function for affiliate 2 is the purchase of Q_2 from affiliate 1. Let t denotes the transfer price for the MNE. Therefore, the cost function for affiliate 2 is

$$(t)(Q_2) \tag{2}$$

Additionally, I will assume that the tax rates are different between Country 1 and Country 2. Let τ_i denote the tax rate specific to country i , where $i = \{1, 2\}$. In all cases below, I will assume that the tax rate at Country 1 is lower than the tax rate at Country 2, that is, $\tau_2 > \tau_1$. Since $\tau_2 > \tau_1$, it makes sense for the MNE to have incentives to set the transfer price as high as possible to shift revenues from Country 2 to Country 1 in order to maximize the overall profits for the corporation.

Nevertheless, OECD guideline restricts MNEs firm to set the transfer price to be within the arm's length range and let $[\hat{a}, \hat{a}]$ be the range of the arm's length price. For the ease of illustration, I assume that the Arm's Length Principle takes only one value instead of a range of number and I denote it "a". Let R denotes the revenue function for affiliates i and π denotes the profit function for affiliate i , where $i = \{1, 2\}$. I further assume that the number of quantity produced and transferred is equal to the number of items sold.

3.5 Tariffs and Taxes

3.5.1 The Role of Tariffs

Many forms of tariffs could be imposed on the goods trade among countries. Some of the most common ones are listed below.

- Ad valorem tariff: This form of tariff is calculated based on the value of the goods being transferred.
- Specific tariff: This tariff is based off the quantity of the goods transferred
- Revenue tariff: This is a set of rates that are set based on the product types
- Prohibitive tariff: An extremely high tariff that is set to restrict imports

- Protective tariff: A tariff that is set for the intention to protect domestic producers
- Environmental tariff: A tariff that is set for environmental control
- Retaliatory tariff: If country A is charging a tariff on country B, and country B decide to impose a similar tariffs, it is known as retaliatory tariff

In this thesis, I focus the majority of the discussion on *ad valorem* tariff since it is the most relevant one on the topic of transfer price. Other forms of tariffs, for example, the specific tariff, has no bearing on transfer price since they are volume based, not revenue based.

3.5.2 The Effects of Tariffs on Transfer Price

The effect of tariffs on company profits is well understood; primarily, the higher the import tariffs, the lower the company profits in the destination country. To understand tariff's effect on transfer price and the magnitude of the effect, let me start by examining a mathematical equation. Assume that Country 1 has no import tariffs and Country 2 is the importing country that is being imposed with an *ad valorem* tariff, τ_a . The overall profit function for the MNE is defined by equation (3) below.

$$\pi_{corporate} = [R_1 + tQ_2 - c_1(Q_1 + Q_2)] + [R_2 - c_2 - (1 + \tau_a)tQ_2] \quad (3)$$

From equation (3), we see that the profit for the corporate is a function of the tariffs imposed on the countries where the goods are being transferred. If we take the partial first derivative of equation (3) with respect to the tariff, we obtain the following.

$$\frac{\partial \pi}{\partial \tau_a} = -tQ_2 < 0 \quad (4)$$

Equation (4) indicates that tariffs have a negative effect on the profit function of the MNE, particular, with every dollar increase in tariff, there is a $-tQ_2$ decreases in the net profit for the MNE (Eden 279-281).

3.5.3 The Role of Taxes

Next, let us consider the same MNE with a parent company in the US and a foreign subsidiary in Country 1. In general, tax is imposed on MNE based on one of the two scenarios below (Eden 287),

- The home country levies a tax on the MNE, and the tax could be source-based, solely based on the profits the domestic division makes, or residence-based, which is based on the worldwide profits of the MNE. In this scenario, the foreign country does not levy taxes on the MNE.
- In the second case, both countries will only tax the division that locates in its nations. The foreign subsidiary will be taxed on a source basis and the parent division may use either the source or residence-based taxes.

For the first scenario, the transfer price policy of the MNE will only depend on one country's tax policy. For the second scenario, the transfer price policy will depend on both countries' tax rules.

3.5.4 The Effects of Taxes on Transfer Price

As with the case on tariffs, I am going to illustrate an example of how taxes incentivized the manipulation of transfer price. In my example, both countries tax its divisions on pure profits, not the worldwide profit. Again, consider a MNE headquartered in the US and have two foreign subsidiaries: Let $\tau_{\text{corporate}}$ equals to the tax rate of the parent firm, τ_1 equals to the tax rate of the foreign subsidiary in Country 1, and τ_2 equals to the tax rate of the foreign subsidiary in Country 2. Again, Country 2 imports goods from Country 1 for sales domestically, but Country 1 does not buy goods from Country 2. Assuming both the domestic and foreign divisions utilize the source basis for taxation purpose, we can easily setup the profit equation for the MNE as in equation (5) below.

$$\pi_{\text{corporate}} = (1 - \tau_1)[R_1 - c(Q_1 + Q_2)] + (1 - \tau_2)R_2 + (\tau_2 - \tau_1)t_1Q_2 - \varphi[\tau_2(t_1 - a)Q_2] \quad (5)$$

Taking the partial first derivative of the profit with respect to the transfer price yields

$$\frac{\partial \pi}{\partial t} = (\tau_2 - \tau_1)Q_2 \quad \begin{array}{l} > 0 \text{ if } \tau_2 > \tau_1 \\ < 0 \text{ if } \tau_2 < \tau_1 \end{array} \quad (6)$$

Equation (6) gives a simple relationship of the transfer price to the relative magnitude of the tax rates in each country. Namely, if the tax rate of the exporting country is lower than the tax rate of the importing country, then the transfer price should be set higher to maximize profit.

Nevertheless, if the tax rate of the importing country is higher, then the transfer price should be

set lower. For the case where one of the foreign divisions does not levied tax on profit, then we can set either τ_1 or τ_2 equal to 0.

It is important to note that for MNEs that are based in the United States, the foreign subsidiaries will not be taxed at the US tax rates unless those divisions are engaged in a business within the United States. Therefore, MNEs have much leeway to choose the foreign subsidiary with low tax rates to conduct businesses with.

Table 1 below compares the tax rates for most of the countries in Asia Pacific.

Countries	Tax Rate [%]
HK	16.5
China	25
Japan	41
South Korea	25
Taiwan	25
Singapore	17
Indonesia	25
Malaysia	25
Macau	12
Thailand	30
Vietnam	25
Australia	30
New Zealand	28

Table 1: Different profit taxation rates for countries in Asia Pacific. (KPMG 2006)

3.6 Factors that Affect Transfer pricing Model Setup

In section 3.5, I described the variables, particularly, tariffs and taxes that affect the value of the transfer price. In this section, I present the factors that will affect the setup of the transfer pricing model. That is, depending on the organizational structure and objectives of the MNE, the transfer pricing model is constructed and calculated differently. The different factors that influence the model include:

- Is the firm centralized or decentralized? How many transfer prices does a firm adopt?
- Whether there is an external market for the products being transferred?
- Whether or not the firm decides to comply with the arm's length principle?

In the remainder of this chapter, I elaborate on how each of the above questions affects the setup of the model.

3.6.1 Number of Transfer Prices: Centralized vs. Decentralized

A centralized organization is one in which the power of decision-making is focused primarily on the upper management of the company, without taking much input from below. A decentralized organization is one in which the power of decision-making is spread among different units of the business. With that said, it is obvious that the choice of transfer pricing model would be significantly different between a centralized and a decentralized corporation. According to Moore, it is easier for a centralized firm to choose a transfer price that is maximized for global profits than for a decentralized firm because a centralized firm can consolidate the transfer price decision. A decentralized firm may not be able to impact the transfer price decision and has to rely on each subsidiary to maximize its own profit. Often times, the transfer price that is determined by the subsidiary is not the optimal price for the firm as a whole (Moore 18). In a decentralized organization, the manager of each profit center's purpose is to maximize his/her own profit, which may or may not align with the objective of the corporation.

Transfer price serves two purposes for MNEs, (1) transfer price is used to determine the tax liability for MNE's divisions, and (2) transfer price is used to incentivize the transfer of goods from one division to another (Hyde 166). A transfer price's second role is less important for a centralized organization than for a decentralized organization since the parent firm controls the decision-making process. For decentralized organizations, however, a transfer price must be set so that both affiliates are incentivized enough to trade with each other. Therefore, the transfer price set for this case might be a compromised solution to the optimal value. For the sake of satisfying the duties for both incentive and tax purposes, some MNEs employ two sets of transfer price for intrafirm trades. In principal, the US does not require that MNEs to keep only one transfer price. In addition, if a firm decides to use two sets of transfer price, the two transfer prices need not to be the same (Hyde 166).

Often time, we see that decentralized organizations use two set of transfer price while centralized organizations use one set of transfer price. When a firm decides to adopt two sets of transfer price, one transfer price is for tax purpose and the other transfer price is for internal accounting or incentive purpose.

The advantage of keeping two transfer price is that a decentralized organization can use the incentive transfer price to motivating the buying division to buy from the supplying division, but to using the tax transfer price for tax minimization. The advantage of keeping one transfer price is that it can help to avoid the extra overhead expense of maintaining two sets of books for the corporation as well as “to avoid the risk that tax authorities may subpoena internal records in case of transfer pricing disputes since discrepancies between transfer pries used internally and those used for tax purposes could then become evidence in legal proceedings with the tax authorities” (Baldenius 598).

In section 3.7 below, I illustrate how to obtain the optimal transfer price in a centralized and decentralized organization with some mathematical examples. One will see that the optimized transfer pricing model for a centralized organization is a simple version of the decentralized one because the incentive transfer price is the same as the tax transfer price. Something we need to remember is that in a decentralized organization, the parent firm usually chooses the incentive transfer price while the buying division will choose the quantity to be transferred. Therefore, if the transfer price that the parent firm chooses is much higher than what the buying division could buy externally, the buying division will have no incentive to buy from its own company.

3.6.2 External vs. Internal Market

The next important factor that determines the setup of the transfer pricing model is market equivalent. If the good that is being transferred is an intermediate product and has no external market associated with it, then the MNE has a monopoly power over the transfer price. On the other hand, if the good is a final product and there is a competitive external market for the demand of the good, then the MNE has less freedom on setting the transfer price and the market-based transfer pricing method could be used as the transfer price. In the context of market power, monopolies and perfective competitive firms have very different authority in determining prices. Therefore, it is important to know the market power the selling firm has on the buying firm before an appropriate transfer pricing method could be chosen.

3.6.3 To Comply or Not to Comply

Lastly, the transfer pricing setup depends on the firm’s decision on whether or not it will comply with the Arm’s Length Principles governed by OECD. As mentioned previously, if a

MNE decides to violate the regulations by setting a transfer price higher than the arm's length price, the MNE might be subjected to external audit and a penalty fee would be charged. A firm may choose to do this, however, if the probability of an audit and the penalty fee is lower than the expected saving from adopting a higher transfer price. I will illustrate the relationship between the expected penalty fee and cost savings in section 3.7 below.

3.7 Historical Analysis – Optimized Transfer Price Examples

A lot of research had been done in the area of transfer price. Due to the complexity of the topic, there is no one single model that has been adopted widely by all firms. While there are many literature reviews on the topic of transfer prices, my primary focus of this section will be on what has been proved to be the optimal transfer pricing model. My literature review is not intended to cover non-optimal methods for transfer price determination.

In the subsequent chapters, I compare and contrast the different optimized models with information on Company X and make a recommendation at the end of the thesis.

Theoretically, in determining the optimized transfer pricing method, the firm has two initial decisions to make: (1) whether or not the firm will follow the arm's length principle on the transfer price and (2) how many transfer prices the firm adopts. Based on these variables, I divide the subsections below:

- Optimized Model with Two Transfer Prices
 - Special Case: Optimized Model with Two Transfer Prices & Complying with Arm's Length Principle

The examples above are in isolation of changes in tariffs. Lastly, I will also spend some times going over the optimized model with the combined effects of tariffs and taxes on transfer price.

3.7.1 Optimized Model with Two Transfer Prices

Using the same conditions described above, I am going to illustrate an example where the MNE utilizes two sets of transfer prices, one for incentive purpose and the other one for tax purpose. As mentioned, since $\tau_2 > \tau_1$, the MNE will have incentives to set the tax transfer price as high as possible to shift revenues from the subsidiary 2 to subsidiary 1 in order to maximize the overall profits of the corporation. Since $\tau_2 > \tau_1$, tax avoidance maybe an issue. In the case

where the MNE decides to violate the Arm's Length's Principle, there is a penalty for non-compliance with the OECD regulation. Let's denote the expected penalty by φ , and it is a function of the underpayment tax amount.

Now I will assume that the MNE's objective is to maximize its overall corporate profit. Since we are considering the case of a decentralized organization, each of the division's goals is to maximize its own after-tax profit, not the profit of the corporation. As discussed earlier, in a decentralized organization, the parent firm will choose both the incentive transfer price, t_i , and the tax transfer price, t_t . The buying subsidiary will choose the quantity of goods transferred.

In the case where the MNE decides not to comply with the Arm's Length Principle, a penalty will be added to the setup of the transfer pricing model and let φ denotes the expected penalty value for the company. If the MNE gets audited and a penalty fee is demanded, the MNE needs to figure out which division is responsible for the penalty. The penalty value, φ , is a function of the transfer price, t_i , and the quantity being transferred, Q_2 . Since t_i and Q_2 are decisions by the parent firm and the buying division, both divisions will have a share of the penalty fee. In determining how much penalty each division needs to pay, I introduce another variable, α , to be the share of the penalty fee based on the bargaining power of the division. α is a value between 0 to 1. If α is 0, then that means the specific division has all the bargaining power and thus that division owns no share of the penalty. If α is 1, then the specific division has no bargaining power and that division owns all share of the penalty. Given these, I set up the objective function for each of the divisions below (Choe 401-403).

$$\pi_1 = (R_1 + t_i Q_2) - c(Q_1 + Q_2) - \tau_1((R_1 + t_i Q_2) - c(Q_1 + Q_2)) \quad (7)$$

$$\pi_2 = (R_2 - t_i(Q_2)) - \tau_2(R_2 - t_i(Q_2)) - \alpha\varphi(\tau_2(t_i - a)Q_2) \quad (8)$$

$$\pi_{corporate} = (1 - \tau_1)[R_1 - c(Q_1 + Q_2)] + (1 - \tau_2)R_2 + (\tau_2 - \tau_1)t_i Q_2 - \phi[\tau_2(t_i - a)Q_2] \quad (9)$$

where the profit function is derived from the equation $\pi = \text{revenue} - \text{cost}$ and the total corporate profit is simply the sum of the profits from affiliate 1 and affiliate 2 as well as the share of the penalty fee for the corporation.

Since $\tau_1 < \tau_2$ and the transfer is from affiliate 1 to affiliate 2, it is the profit function for affiliate 2 that I want to study and optimize. Given this, I will want to take the first derivative of

π_2 with respect to Q_2 . Since Q_2 is a decision made by affiliate 2 and affiliate 2 will want to choose Q_2 to maximize its profit. Equation (10) below shows the resulting equation.

$$\frac{\partial \pi_2}{\partial Q_2} = (1 - \tau_2)R'_2(Q_2) - (t_i - \tau_2 t_i) - \alpha \tau_2 (t_i - a) \phi'[\tau_2 (t_i - a) Q_2] = 0 \quad (10)$$

Rearranging equation (10) will yield the following:

$$R'_2(Q_2) = \frac{t_i - \tau_2 t_i + \alpha \tau_2 (t_i - a) \phi'[\tau_2 (t_i - a) Q_2]}{1 - \tau_2} \quad (11)$$

Equation (11) reveals that the maximum profit for affiliate 2 means choosing a quantity, Q_2 , where its after-tax revenue equals to its marginal cost (Choe 401-403).

Next, let's take a look at Q_2 in the perspective of the MNE's corporate headquarter. Similar to the approach above, I will take the first derivative of equation (9) with respect to Q_2 resulting in,

$$\frac{\partial \pi_{corporate}}{\partial Q_2} = -(1 - \tau_1)c + (1 - \tau_2)R'_2 + (\tau_2 - \tau_1)t_i - \tau_2 (t_i - a) \phi'[\tau_2 (t_i - a) Q_2] = 0 \quad (12)$$

$$R'_2(Q_2) = \frac{(1 - \tau_1)c - (\tau_2 - \tau_1)t_i + \tau_2 (t_i - a) \phi'[\tau_2 (t_i - a) Q_2]}{1 - \tau_2} \quad (13)$$

Again, equation (13) proves that the optimal Q_2 for the MNE should be when its after-tax marginal revenue equals to its after-tax marginal cost. Since there is only one value of the Q_2 , I can equate equation (10) and (12) to solve for the incentive transfer price in equation (14) below.

$$t_i = [(1 - \tau_1)c + \tau_1 t_i] + (1 - \alpha) \tau_2 (t_i - a) \phi'[\tau_2 (t_i - a) Q_2] \quad (14)$$

Equation (14) is an important result since it shows that the optimal incentive transfer price for MNE should be a sum of two components. The first term is a weighted average of the marginal cost and the tax transfer price, where the weight is the tax rate in affiliate 1. The second term is a fraction of the penalty for adopting a price that is not within an arm's length (Choe 402).

Once the optimal incentive transfer price is determined, we can use those results to calculate for the optimal tax transfer price by taking the derivative of the corporate profit function with respect to the tax transfer price.¹

$$\frac{\partial \pi^*_{corporate}}{\partial t} = (\tau_2 - \tau_1)Q_2^* - \tau_2 Q_2^* \varphi'[\tau_2(t_i - a)Q_2^*] = 0 \quad (15)$$

where the first term of equation (15) is “the marginal benefit from tax arbitrage and the second term is the marginal cost due to the penalty for non-arm’s length pricing” (Choe 402). Solving for t_i yields,

$$t_i = a + \frac{1}{\tau_2 Q_2^*} (\varphi')^{-1} (1 - \frac{\tau_1}{\tau_2}) \quad (16)$$

From observing equation (16) above, we see that the optimal tax transfer price will always be greater than a , the Arm’s Length Principle value.

Given the results above, we can calculate for the values of Q_2 , t_i , and t_t simultaneously by solving equation (12), (14) and (16).

Special Case: Optimized Model with Two Transfer Prices & Complying with Arm’s Length Principle⁵

In the case where the firm decides to comply with the Arm’s Length Principle at all times, the expected penalty, φ , will be zero since the firm will always choose a transfer price that is within the OECD guided principle. Given this condition, the last term on equation (14) and (16) will cancel out to become

$$t_i = [(1 - \tau_1)c + \tau_1 t_t] \quad (17)$$

$$t_i = a \quad (18)$$

In this case, the incentive transfer price will be a simple weighted average of the marginal cost of production and the tax transfer price.

In the case where only one transfer price is used, the incentive transfer price is simply the same as the tax transfer price.

¹ The optimal quantity for affiliate 2, Q_2^* is a function of the incentive and tax transfer prices.

3.7.2 Optimized Model with the Effects of Tariffs and Corporate Taxes on Transfer Price

As a last example, let us examine a case with the combined effects of tariffs and taxes. Using the same mythology, I will set up the profit function for the MNE as follow,

$$\pi_{corporate} = (1 - \tau_1)[R_1 + tQ_2 - c_1(Q_1 + Q_2)] + (1 - \tau_2)[R_2 - c_2(Q_2) - (1 + \tau_a)tQ_2] \quad (19)$$

To determine the optimal transfer price for profit maximization, we will differentiate equation (19) with respect to t resulting in

$$\frac{\partial \pi_{corporate}}{\partial t} = ((1 - \tau_1) - (1 - \tau_2)(1 + \tau_a))Q_2 = [(\tau_2 - \tau_1) - \tau_a(1 - \tau_2)]Q_2 \quad (20)$$

From equation (20), we observe that the transfer price varies with both tariffs and taxes but in opposite directions. It is also easy to see that the MNE will alter its transfer price higher or lower depending on the combined effects of tariffs and taxes. In Chapter 6, I will illustrate the relationship of transfer price with taxes and tariffs with a detailed sensitivity analysis and recommend on when to trade off one for the other.

IV. Company X Baseline Practices

As illustrated in the previous sections, many decisions need to be made and issues need to be considered to set up a model for transfer price. Due to regulations and penalties imposed by OECD, MNEs are bounded to follow these regulations. If MNEs decide not to follow the laws, there will be penalty fees as well as reputational concerns once they get audited.

In order to fully understand how transfer price affects corporate profit, I will invent a hypothetical company called “Company X,” for the purpose of illustration. Company X’s hypothetical company structure and transfer pricing practice will serve as the basis for my model.

Let us assume that Company X is a US-based corporation that does its business worldwide. It has subsidiaries in different countries in the world and each subsidiary is considered a single legal entity by itself; that is, each entity will be taxed at its revenue without influence from the other entities. However, my thesis will concentrate on Company X’s hypothetical subsidiary in Asia Pacific.

Assume that Company X’s headquarters in Asia Pacific is located in Hong Kong. Hong Kong is a likely location for three reasons: (1) it has a low income and corporate tax rate, (2) it is geographically close to many countries in Asia and has ports that support feasible and timely transportation, and (3) it has no import tariffs on almost all goods except for alcohol, tobacco, and oil products.

I also assume that Company X’s current transfer pricing method is determined by a percentage of the final retail price at which the good will be sold. For example, if the retail price of a good is \$100 in Korea and if the company chooses 25% as the percentage for transfer. The transfer price of the good from Hong Kong to Korea will be \$75. Lastly, I assume Company X is currently utilizing the same transfer pricing model for all goods trade among all countries in Asia Pacific regardless of profit margins, distance, or other economic factors.

For Company X, most of the goods that are sold within Asia Pacific could be manufactured from four different regions, China, Europe, North America, or the rest of the Asia countries. These goods will be shipped to Hong Kong after manufacturing for distribution to the rest of Asia at a fixed transfer pricing method.

Company X adopts only one transfer price for both tax and resources allocation purpose. This method is chosen for simplicity reason and the ease of keeping track of internal transfers. Furthermore, the current transfer pricing method has not been changed since it was implemented from the beginning. Lastly, assume that Company X is largely a centralized corporation in which the choice of the transfer price is determined by the parent company to maximizing global profit, not profit of the individual subsidiary.

The choice of the transfer pricing method by Company X is a top down approach. The transfer price is chosen to be at 40% of the retail price because the cost structures of the goods could be legitimately justified if audited by IRS.

Given the current conditions of Company X, Chapter 5 and 6 will go into details to illustrate whether the company's hypothetical baseline/current practices offer the best return on investment and what improvement the company could do to increase profits.

V. Mathematical Model

In this section, I am going to build a mathematical model that compare and contrast the different types of transfer pricing methods. I use theoretical data to calculate for the optimal transfer pricing method that should be adopted based on given a tariff and tax rates. The model that I build is based on the organizational structure of Company X; nevertheless, one can modify it to fit one's need. For the model that I am going to develop, the following conditions will be held:

- Only one transfer price is considered; that is, the firm uses one transfer price for both tax and incentive purposes
- The company will comply with OECD regulation
- The company is a centralized organization; that is, the parent firm will choose the optimal transfer price and optimal quantity for transfer

The model is simplified to include only two subsidiaries, one is the supplying division, where the goods are being transfer from, and one is the buying division, where the goods are being transferred to. The profit function for the corporation would simply be the sum of the profit of each of the individual subsidiaries. In reality, the profit function for the corporation will be much more complex since it included all the subsidiaries the MNE does business with. In addition, there are many products for transfer among the subsidiaries, since each product incurs a different cost structure, the model will be much more difficult. Nevertheless, my model can be expanded to include all of these complexities.

Before dive into the model, it is important review the assumptions that I make while building the model. Any MNE could easily adopt this model for its accounting department by inputting its real costs.

Assumptions & Data:

- Cost is based on overall production costs. I assumed \$15 as the total overall production costs for goods arrive at Country 1. In this case, country 1 will be Hong Kong.
- I assume that this is a company where its price is determined by how much the customers are willing to pay, not by cost. Therefore, it enjoys a huge gross margin. The price in

Country 1 is determined by multiplying the overall production cost in Country 1 to the expected gross margin.

- The price in Country 2 is a function of the price in Country 1, the differences in costs between Country 1 and Country 2, the transfer price set between the two countries, and the tariffs levy on Country 2. The price in Country 2 is also determined in a similar manner as that in Country 1, except that I add in an extra cost differential from shipping the goods physically from Country 1 to Country 2 as well as the costs for handling the goods.
- For the incremental transportation costs, I gathered the information from a global shipping company. It is based on a rate of \$165 for each 40 feet tall dry container. I assume that each container will fit 1000 units of good. This rate is quoted from Hong Kong to Malaysia.² In my model, I assume Malaysia is Country 2.
- I assume both countries sell approximately the same number of goods.

The mathematical model is built using Excel. Excel is chosen for a couple of reasons. First, Excel is simple to use. The ultimate goal of the model is to help MNEs to find an optimal transfer price for their goods. I am hoping that MNEs can integrate the mathematical model a way to determine their transfer price without changing too much of their current system configuration. Due to its functionality and the ease of use, Excel is the ideal choice for the model. Equation (19) in chapter 2 is the primary equation that I use for calculating the profit function in my model.

In Chapter 3, I reviewed six different transfer pricing methods, which included CUP, RPM, C+, CPM, TNMM, and PSM. My Excel model, however, only considered four out of the six different methods. Particularly, I considered CUP, RPM, PSM, and TNMM. RPM and C+ are both functional comparables/gross margin transfer pricing method and company usually chooses one or the other when decided to use the gross margin transfer pricing method. In our case, RPM is more relevant because affiliate 2 does not add value to the goods that it obtains from affiliate 1. In addition, between TNMM and CPM, I will not use CPM since comparing an industry's

² Shipping costs from Maersk Line BAF

average margin is not accurate since not all items sold by the same firm has the same profit margin. Figure 2 below outlines the general set up of the model.

Countries	Manufacturing Country <i>China</i>	Intermediate Hub <i>Hong Kong</i>	Final Destination <i>Malaysia</i>
Tariff		0.00%	12.00%
Profit Tax		16.50%	25.00%
Price		\$60.00	\$67.53
Quantity		150	150
Cost		\$15.00	\$15.33

Objective Function	Optimized Profit	Optimized Method	Optimized Transfer Price
	\$9,609.74	RPM	\$27.01

Decision Variables				
Method	CUP	RPM	PSM	TNMM
Transfer Price	\$60.00	\$27.01	\$48.75	\$60.00
Price 2	\$67.53	\$67.53	\$66.18	\$67.53
Profit	\$9,585.00	\$9,609.74	\$9,441.56	\$9,585.00

Equation $\pi_{corporate} = (1 - \tau_1)[R_1 + tQ_2 - c_1(Q_1 + Q_2)] + (1 - \tau_2)[R_2 - c_2(Q_2) - (1 + \tau_a)tQ_2]$

Variables	Hong Kong Tax	16.5%	
	Malaysia Tax	25%	
	Price @ HK	\$60.00	
	Quantity sold @ HK	150	
	Quantity sold @ Malaysia	150	
	Costs for goods sold in HK	\$15.00	include all production costs
	Costs for goods sold in Malaysia	\$15.33	add on extra transportation costs
	Tariff @ Malaysia	12%	
	Price 3rd party (CUP)	\$60.00	
	% of Retail Price (RPM)	40%	
	Profit Splitting (PSM)	\$33.75	
	Margin (TNMM)	\$45.00	

Figure 2: Sample model that illustrates how the optimal transfer pricing method was determined.

Particularly, figure 2 illustrates an example of how an optimal transfer price could be determined from my model. Given the costs and prices data that I used, the optimal transfer pricing method for the MNE to adopt from Hong Kong to Malaysia is the Resale Pricing Method with a transfer price at \$27.01. This solution will hold true at the values that I indicated. In Chapter 6 below, I will analysis the volatility of this solution to changes in tariffs, tax rates and incremental shipping costs.

In summary, the model allows us to compare four most commonly used transfer pricing methods and capable to illustrate mathematically which one is the optimal by evaluating the actual profit data for the corporation.

VI. Sensitivity Analysis

After building the model to determine the optimal transfer price. It is important to spend some time to investigate on some sensitivity analysis of the data. Particularly, I would like to understand how sensitive are the optimal transfer price varies with changes in tariffs and profit tax rates as well as with changes in the incremental transportation costs.

6.1 Changes in Tariffs, Profit Tax Rates

We know that profitability depends heavily on the choice of transfer price and this can be confirmed with our mathematical model. Equation (19) explicit states that profit is indeed a function of transfer price. Nevertheless, my sensitivity analysis contradicts the common belief that the higher the transfer price, the better the profit margin. Figure 3 below exemplifies the relationship between transfer price and profit by studying four different transfer pricing methods. In the sensitive analysis, I hold everything constant while changing only the tax rates and tariff rate.

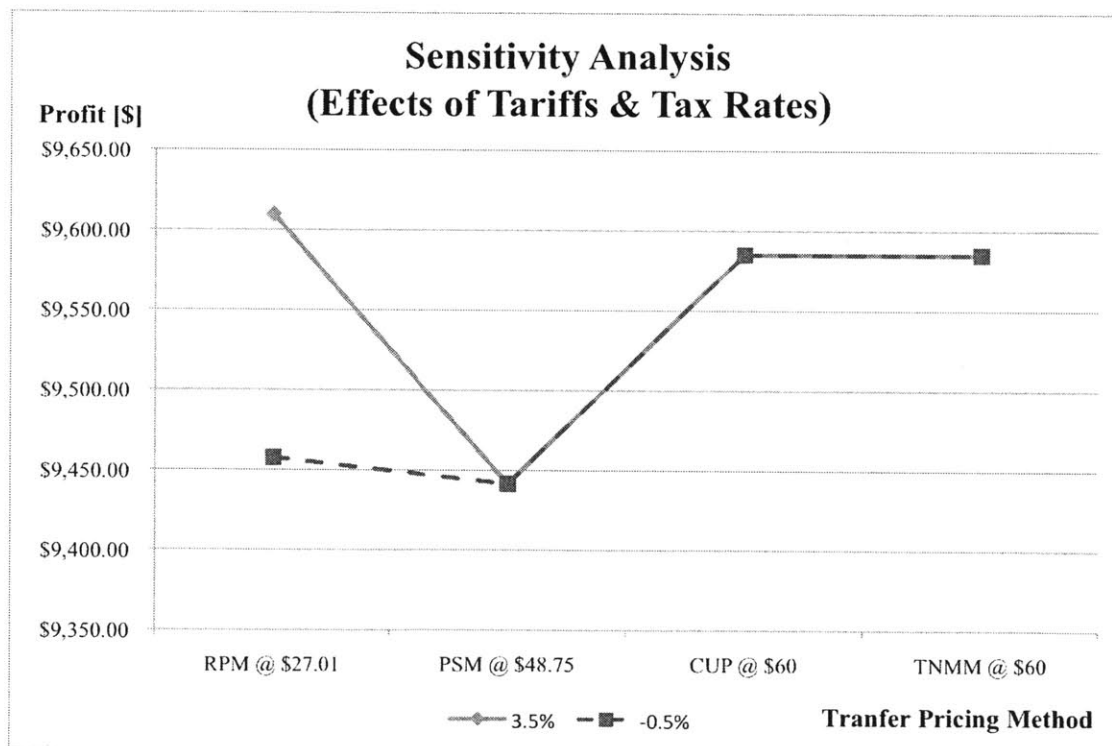


Figure 3: Sensitivity analysis on profit with changes in tariffs and tax rates.

From the graph, we see a paradox. Particularly, the solid line in the graph indicates that the lower the transfer price, the higher the profit. However, the dotted line indicates that the higher the transfer price, the higher the profit.

The graph exams two different scenarios, which is based on the percentage difference between tariffs and profit tax rates. For example, the solid line says the difference between the tariffs and the tax differential is 3.5%. The dashed line says the difference between the tariffs and the tax differential is -0.5%.

To explain this phenomenon, we will take a closer look of equation (19) below (Eden 302).

$$\pi_{corporate} = (1 - \tau_1)[R_1 + tQ_2 - c_1(Q_1 + Q_2)] + (1 - \tau_2)[R_2 - c_2(Q_2) - (1 + \tau_a)tQ_2] \quad (19)$$

We can see from Equation (19) that transfer price varies with both tariffs and tax rates. Nonetheless, tax rates and tariffs affect transfer price in opposite direction, which can be deduced when one studies Equation (20) carefully. The same effect can also be seen graphically from Figure 3.

$$\frac{\partial \pi_{corporate}}{\partial t} = ((1 - \tau_1) - (1 - \tau_2)(1 + \tau_a))Q_2 = [(\tau_2 - \tau_1) - \tau_a(1 - \tau_2)]Q_2 \quad (20)$$

Then how should we determine the proper transfer price then, since transfer price does not vary with profit tax and tariffs in the same direction. To do that, let us exam Figure 3. We see that the overall profitability increases as transfer price increase when the differences between the tariffs and the tax differential is -0.5%, yet the overall profitability increases as transfer price decreases when the differences between the tariffs and the tax differential are 3.5%. We see that only when the tax differential exceeds the effective tariff rate will the MNE try to set the transfer price as high as possible. Therefore, this contradicts the belief that the higher the transfer price is the best one. Particularly, if the tax differential $(\tau_2 - \tau_1)$ exceeds the effective tariff rate adjusted from the tax saving $\tau_a(1 - \tau_2)$, then the MNE will likely to set the transfer price higher. Nevertheless, if it is the other way around, then the MNE will set the transfer price lower. Therefore, MNE must be really conscious when deciding on a transfer pricing method when both tariffs and taxes are in the equation. The relationship between tariffs and tax rates are hard to define and MNE should try it graphically in order to see the effect.

6.2 Changes in Incremental Costs (Shipping, Loading & Unloading)

Company X is using Hong Kong as the intermediate hub for the goods. Goods that are produced elsewhere are physically passing by Hong Kong before landing to the final destination. By having products transferred to Hong Kong, there is an incremental shipping costs associated with it. Now, let us study the effect of incremental costs by physically transfer goods from Hong Kong instead of transferring directly to the final destination. That is, I would like to study whether the saving from tax rates is big enough to offset the increase in shipping and transportation costs.

For the basis of my sensitivity analysis, I am using the same conditions as I did for the other examples. That is, tax rate at Hong Kong is 16.5%, tax rate at Malaysia is at 25%, and import tariff for Malaysia is at 12.5%. Under this condition, the difference between the tariff and tax differential dictates the transfer pricing method to be RPM. The following graph shows the tax saving an MNE could have earned by transferring the goods from Hong Kong to Malaysia.

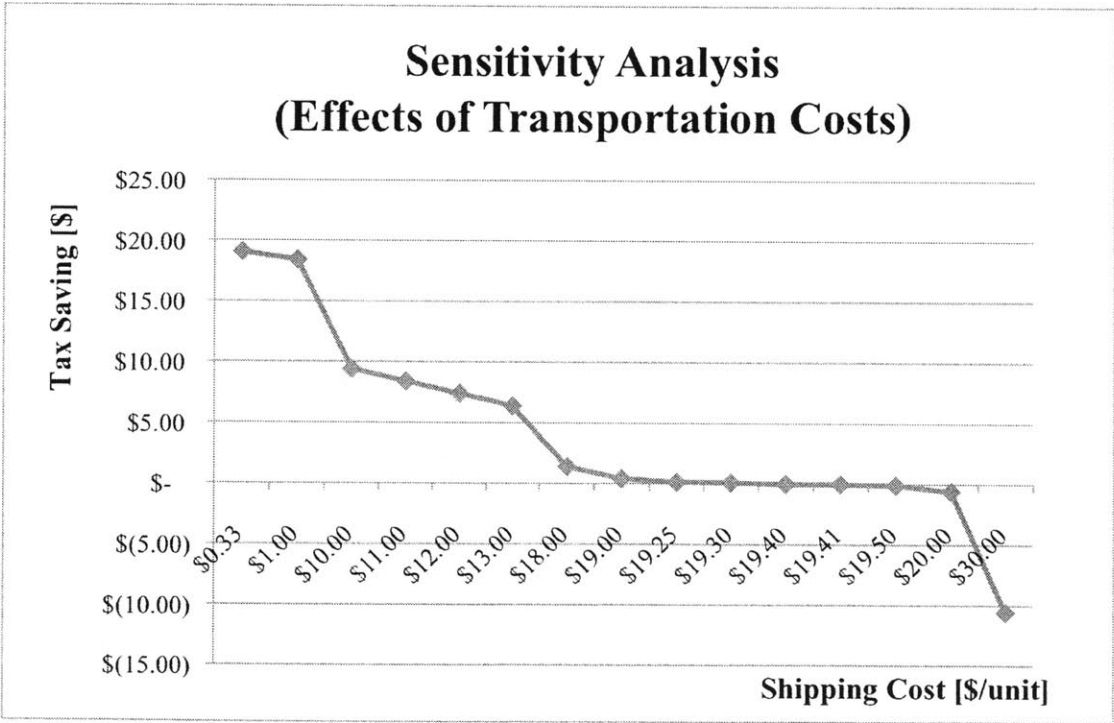


Figure 4: Sensitivity analysis on the overall profit with changes in transportation costs.

As one can see, the break-even point occurs at transportation costs of \$19.41 per unit of good. That is, if the transportation cost of shipping the good from the intermediate hub to the final

destination goes above \$19.41 per unit, it is no longer worthwhile to use Hong Kong as the intermediate place for tax saving purpose. This analysis could be done for other countries and tax rates.

VII. Recommendation & Conclusion

As one can see that transfer price is an extremely important yet confusing concept. The art of knowing how to master the transfer pricing practice would pay great dividend for the corporation in the long run.

Just to summarize, there are approximately six different methods to determine transfer price, namely, Comparable Uncontrolled Price Method (CUP), Resale Price Method (RPM), Cost Plus Method (C+), Comparable Profits Method (CPM), Transactional Net Margin Method (TNMM), and Profit Split Method (PSM). As my model illustrates, the choice of which transfer price to use depends heavily on a MNE's organizational structure and willingness to comply with the OECD regulation. In addition, as my sensitivity analysis shows, transfer price varies greatly with tariffs rates, tax rates, and incremental transportation costs. Therefore, the best thing for MNEs to do is not to stay with one transfer price, but to employ different transfer price for different countries based on factors such as taxes, tariffs, costs, and etc. Nevertheless, since there may not be one transfer price that works the best for all goods and for all the subsidiaries for the MNEs, MNEs would probably need to maintain different sets of transfer price for different divisions and goods. Although there is no rule saying how often a transfer price can change or how many transfer prices a firm can adopt, MNEs may choose to compromise on tax saving in order to maintaining fewer transfer prices for the organization. This is so because having multiple transfer prices requires keeping multiple sets of accounting books. The more accounting books, the more costs the MNEs will incur. In addition, having more than one set of accounting book requires more administration and dedication when it comes to internal audit at the end of the year.

One thing to note is that the model I illustrated in my thesis only considers economic factors; yet, economic concerns should not be the sole reasons in making decisions. As I conclude my thesis, I will bring up some implications for discussion other than economic incentive that could drive transfer pricing determination.

7.1 Implications

7.1.1 Lead Time Considerations

One thing that worth discussing is that by having goods physically transferred to an intermediate hub before shipping them to the final destination will not only incur extra shipping costs as a result of an extra leg, but it will also increase the lead-time for the goods. One thing that MNEs should be aware is that whether or not high service level and short lead-time are important. If the products were subjected to price variability due to season change or other factors, then shorter lead-time is preferred. In that case, MNEs would probably be disincentive to use an intermediate hub.

7.1.2 What constitutes an intermediate hub?

The choice of intermediate hub is also important for the MNEs. It is not always the case to choose the intermediate hub with the lowest tax or tariff rates. Other important determinants should include the convenience of the place as an intermediate hub. For example, Hong Kong offers advantage from board shipping links and sophisticated logical infrastructure.

As a conclusion, when determining transfer price, MNEs should use the method that yield the highest profits, but MNEs should also understand non-economical reasons and the roles they play in transfer price.

VIII. Acknowledgements

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IX. Appendix I

The key below illustrates all the variables that are involved in the thesis.

Keys:

- h = domestic division of the MNE
- f = foreign subsidiary of the MNE
- Q = units quantity of goods transferred
- c = unit cost of good
- τ_i = pure profit tax rate, where $i = \{1, 2, \text{corporate}\}$
- τ_a = ad valorem tariff on the importing country
- t_i = transfer price for incentive purpose when the firm adopts two transfer pricing models
- t_t = transfer price for tax purpose when the firm adopts two transfer pricing models
- t = transfer price when the firm adopts one transfer pricing model
- $[\hat{a}, \tilde{a}]$ = range of transfer price that is within the Arm's Length Principle set by OECD
- a = Arm's Length Principle value
- R = revenue, which is a function of the quantity sold
- π = profit function
- φ = expected penalty for the MNE
- α = bargaining power and share of penalty for a subdivision

X. Bibliography

- Baldenius T., et al. "Integrating Managerial and Tax Objectives in Transfer pricing." The Accounting Review 79 (2004): 591-615
- Choe, Chongwoo., et al. "Multinational Transfer pricing, Tax Arbitrage and the Arm's Length Principle." The Economic Record, 83 (2007): 398-404
- Eden, Lorraine. Taxes, Transfer pricing, and the Multinational Enterprise. Oxford, UK: Oxford University Press
- Eden, Lorrain. Taxing Multinationals. Toronto, Canada: University of Toronto Press, 1998.
- Hyde, Charles E., et al. "Keeping Two Sets of Books: The Relationship Between Tax and Incentive Transfer Prices." Journal of Economics & Management Strategy, 14 (2004): 165-186
- KPMG's Corporate Tax Rate Survey, (2006)
<<http://pages.stern.nyu.edu/~adamodar/pdfiles/articles/KPMGtaxratesurvey.pdf>>
- Moore, Craig Thomas. "Transfer pricing in Multinational Enterprises: Empirical Tests." Diss. Syracuse University, 1980.
- "OECD Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations." 2010.
- Sikka, Prem., et al. "The Dark Side of Transfer pricing: Its Role in Tax Avoidance and Wealth Retentiveness." Critical Perspectives on Accounting 21 (2010): 342-356.