THE EFFECT OF TRADE LIBERALIZATION
ON TAXATION AND GOVERNMENT REVENUE

by

SUPARERK PUPONGSAK

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Abstract

This thesis investigates the trade and revenue impact of trade liberalization. The purpose is to address the following issues: to examine the effect of trade liberalization on the volume of imports and exports, taxation, and its association with the enhancement of the performance of overall tax system. An empirical analysis is conducted by, first, adding liberalization factors to the import and export demand functions to assess their impact on imports and exports. The results indicate that, for Thailand, trade liberalization does not lead to the deterioration in the trade balance. Instead, it helps improve export performance. However, trade deficit may still occur due to a high income elasticity of demand for imports, rooted from its import structure. Although trade liberalization is not found to be associated with the problem of trade imbalance, the fiscal imbalance may still persist due to the mechanism of tariff reduction. In order to deal with the fiscal problem, the government needs to implement domestic tax reform. The consequence of reform may vary since liberalization impacts on taxation differ greatly depending on various factors. The study examines its effect on taxation, by applying a tax effort model and employing a two-way fixed effect approach. The results suggest that tax reform in less developed and developing countries, by moving away from trade tax to domestic taxes, may be inapplicable since domestic taxes may also severely suffer from liberalization. However, tax reform is still necessary and thus the study applies the concept of tax buoyancy and elasticity to evaluate the ability of Thailand's tax system to mobilize its revenue after the reform. The results reveal that the tax system as a whole is buoyant and elastic due to the high tax-to-base buoyancy of corporate income tax, especially in the post-AFTA period. The main findings from empirical studies have important policy implications for tax strategies of Thailand and other developing countries.

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Chapter 1

INTRODUCTION

1.1. General Introduction and Motivation

Since World War II, most countries have experienced a rapid pace of the integration of domestic economies into the international economy through the intensification of the process of globalization. Globalization is a phenomenon which involves increases in the flows of trade, capital, information and technology, as well as the mobility of labour across borders. This period of rapidly increased globalization is associated with a substantial expansion in international trade, world production, and consequently, a rise in world economic welfare. In general, globalization encourages a free flow of trade and investment across countries via the process of trade liberalization. Trade liberalization is normally associated with the reduction, removal and elimination of taxes on goods and services (including tariffs and import duties), and other trade barriers such as quotas on imports, subsidies, and non-tariff barriers to trade. It also includes the removal of trade-distorting policies, free access to market, free access to market information, the reduction of monopoly or oligopoly power, free movement of capital and labour between and within countries, and the creation of free trade zones. Trade liberalization may also take many forms such as free trade zones, free trade area, trade blocs, and free trade agreements at bilateral, multilateral, or regional agreements.

The spread of trade liberalization over the world in the last decade has been driven by its numerous benefits. The most outstanding advantage of free trade, which induces most countries to walk toward free trade regime, is that open trade policies lead to a better economic performance. In fact, the possible gains from trade have long been pointed out by the early classical theorists; David Ricardo and Eli Heckscher. They suggest that these gains result from specialization in production due to international trade. If a country specializes according to its comparative advantage, the allocation

of domestic resource can be enhanced. This achievement improves the efficiency of production because resources which have formerly been employed in the production of other goods are now shifted to the production of the goods which a country produces best. Consequently, the income and welfare of all trading partners will be improved. Although an economy grows over time as a result of increases in its productive resources and technology innovation, most of the economic literature suggests that trade liberalization potentially improves the allocation of domestic resources and consequently leads to an increase in economic welfare. According to Dornbusch (1992), Salehezadeh and Henneberry (2002), and Dennis (2006), every kind of import restrictions raises the price of import goods relative to export goods. The removal of trade restrictions through the process of trade liberalization encourages a shift of domestic resources from the production of import substitutes to the production of export-oriented goods. Thus, the new allocation of resources due to trade based on comparative advantage provides large benefits to domestic production and generates growth in the medium to long term. On contrary, trade liberalization may also have a negative effect on economic growth since it exposes a country to volatility of output and terms of trade. Grossman and Helpman (1991) and Srinivasan (2001) have developed endogenous growth models in the study of trade liberalization and suggested that free trade may be growth-hindering since it leads to more volatility in some specific sectors. Trade liberalization is also often followed by financial liberalization with the later associates with more financial fragility. Through these channels, trade liberalization is considered as a potential source of macroeconomic volatility which is an important determinant of a wide variety of adverse outcomes including fluctuation in GDP growth. There are many recent studies which suggest important adverse impacts of trade liberalization, for example, Ramey and Ramey

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(1995) point out that higher macroeconomic volatility tends to lead to lower growth; Pallage and Robe (2003) and Barlevy (2004) suggest that if output and consumption smoothing is an issue for the government to stabilize the domestic economy, output and consumption volatility will finally lead to the reduction of economic welfare; Gavin and Hausmann (1998) and Laursen and Mahajan (2005) indicate that trade liberalization induces inequality and poverty in developing countries. These studies are supported by Harrison (1996), Harrison and Hanson (1999), Rodríguez and Rodrik (1999), which suggest that the positive association between trade liberalization and economic growth found in many previous studies is flawed, particularly due to the chosen measures of trade openness and model specification. They conclude that those results are not robust and they fail to establish the relationship between more open trade regimes and long-run economic growth. However, Greenaway, Morgan, and Wright (1998) and Bolaky and Freund (2004) suggest that trade liberalization may result in either an increase or a decrease in economic growth, depending on the country's characteristic and condition.

However, there are many examples which strongly support the argument that openness to international trade brings more rapid growth to the country. According to the World Bank (2002), almost half of developing countries which have lowered their average tariffs by about 30 percentage points, are associated with an increase in trade relative to income by over 80 percent in the post-1980 period, and experienced growth of per capita income by 4 percent per annum in the 1980s, and 6 percent in the 1990s. By contrast, the remaining developing countries, which have lowered average tariffs by only 10 percentage points, are experienced very little or even no growth in GDP per capita in the post-1980 period. From this evidence, many authors suggest that the channel through which trade liberalization results in economic growth is by increasing

the volume of trade between countries.[1] Since the empirical evidence suggests that policies to promote trade openness, supported by sound domestic policies, leads to faster growth, and, in line with the experience that the earlier strategy of attempting to achieve growth through import substitution has been conclusively proved to have failed, most developing countries have switched their trade policies from import substitution to export promotion by implementing trade liberalization policy since 1980s.

Generally, there are three routes for trade to generate growth; the increase in domestic demand, import substitution, and export promotion. An increase in domestic demand is associated with the stimulation of expenditures inside the country, while import substitution and export promotion are related to international trade effects. In general, most developing and less developed countries have begun their economic development by inducing an import substitution strategy in the first phase. Import substitution is a strategy which reduces the country's foreign dependency and appreciates the domestic production by substituting the imported goods with the locally produced goods. This strategy aims to protect domestic industries, i.e. infant industries, until they are able to compete with the foreign industries. However, it appears that the country that can benefit from an import substitution strategy is generally rich and must have a large economy and huge internal market. Unfortunately, most of the less developed and developing countries appear to have smaller economies with lower per capita income. These countries are less likely to succeed with an import substitution strategy. Therefore, in practice, the majority of less developed and developing countries have shifted their policies from import substitution in the first phase to serve for an export promotion strategy in the next

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[1] See Sengupta and Espana (1994) and Ramos (2001), for example.

phase, by hoping that an export promotion strategy will stimulate growth more rapidly. On the other hand, an export promotion strategy, instead of promoting industries which produce import substituted goods and protect infant industries, particularly promotes the industries that have the potential for developing and competing with foreign rivals in the world market. In order to gain an access to a foreign market, liberalization policy is implemented to assist an export promotion strategy. According to Edwards (1993), more liberalized economies have faster growth of exports and in turn, this results in more rapidly growing country's income. Thus, over the past few decades, liberalizing the external trade regime has been one of the central and most visible elements of many less developed and developing countries to achieve accelerated exports, and consequently economic growth.

However, not all countries have benefited from the gains of trade liberalization. From a trade perspective, while trade liberalization is generally associated with a substantial increase in the volume of imports, there is nothing to guarantee that every country participating in free trade will experience a considerable increase in the volume of exports. Furthermore, if, after trade is liberalized, exports do not increase proportionately as an increase in imports, the trade balance will be worsened further and further. High imports without corresponding increases in exports leads to a trade deficit and further results in a current account problem. On the fiscal side, trade liberalization is likely to lead to a substantial decrease in international trade tax revenue through the reduction of tariffs. The fiscal problem is more serious if a country is highly dependent on international trade tax and if it places this tax as a major source of government revenue. Usually, this fiscal problem is found in less developed and developing countries. Thus, trade liberalization may in turn potentially

lead the country to a profound problem of deficits which includes both trade deficit and fiscal deficit, at least in its transition period.

Generally, countries' reliance on international trade tax is inversely related to their income levels. This is because most of less developed and developing countries usually lack administrative capacity which in turn reduces the efficiency of tax collection. In addition, these countries also have large informal and subsistence sectors which mean that a considerable amount of transactions cannot be taxed. Furthermore, the influence of powerful lobbies creates a limitation for the tax authorities to collect revenue in some sectors. Since domestic tax bases are limited, the government has to meet its fiscal need by charging high rates on such an easy-to-tax source as trade taxes and placing high dependence on international trade taxes. With governments operating under a liberalization regime, revenue-declining concerns are often considered as a serious issue for governments in implementing trade and tax reform.

Although the revenue from an international trade tax has become less important over the past few decades, it still continues to be a major source of government finance in many less developed and developing countries. According to the WTO (2002), international trade tax has generated on average 24.3 percent of total current revenues over the last decade; for less developed and developing countries the share goes up to 36.2 and 28.7 percent, respectively. This compares to 1.3 percent for high-income Organization for Economic Cooperation and Development (OECD) countries and 3.7 percent for developed countries. Thus, while the data show a decreasing trend worldwide, less developed and developing countries are still highly dependent on this tax source. As a consequence, even countries that are persuaded to enjoy substantial economic growth and to reap other benefits from trade liberalization, most of less

developed and developing countries may fear of the very high cost of trade liberalization in terms of the loss of tax revenue.

Certainly, domestic taxation is the first option for a government to manage with fiscal problem rooted from trade liberalization since it is the most important instrument for augmenting revenue, especially for less developed and developing countries. Economists suggest that, in order to mitigate the loss of international trade tax revenue, one strategy is to raise both domestic direct and indirect taxes, particularly increasing revenue from goods and services tax, by implementing domestic tax reform. By substituting revenue sources from international trade tax to broad-based domestic taxes, economists believe that the negative impact of trade liberalization can be offset or reduced. However, the suggestion that the fiscal problem can be eliminated if trade liberalization is coordinated with domestic direct and indirect tax may not be able to efficiently follow since trade liberalization may not only have a directly negative impact on international trade tax, but it may possibly have an indirectly adverse impact on various individual tax revenues. For example, trade liberalization is always accompanied with other processes including privatization, restructuration, and automation, which potentially cause tremendous job losses. These processes may also link with cuts in wages and wage dumping. Consequently, the process of trade liberalization may result in the contraction of the personal income tax base, and thus the decline in personal income tax revenue. However, it is difficult to draw any firm conclusions on the impact of trade liberalization on employment since it is highly dependent on the growth effect of trade liberalization, country-specific effect, and other contingent factors. Trade liberalization may also have an impact on corporate income tax through changes in the exchange rate. Normally, exchange rate depreciation occurs after trade is liberalized, while the price of imports is usually low

relative to price of domestic goods. This will possibly lead to a decline in the real exchange rate, a rise in the relative price of imported inputs used by corporations in production, and finally lower profitability of firms. However, in the currency depreciation situation, exporters might benefit through stronger sales, but whether it can be offset by higher input costs is still questioned. Thus, the impact of trade liberalization on the corporate income tax base is still ambiguous. Trade liberalization may be harmful to the tax on goods and services, mainly through changes in its tax base. Generally, tariffs are applied to the import value. Then, excise tax is levied on the base inclusive of tariffs. When imported goods enter into the domestic market, such a goods and services tax as VAT is levied on the base inclusive of tariffs and excise duties. Normally, trade liberalization is associated with the reduction or elimination of tariffs. This possibly leads to a fall in the tax base since tariffs constitute an element of the goods and services tax base. However, a high reduction of tariffs may lead to a drastically increase in the volume of imports, offsetting the decline in the value of imports. In addition, goods and services tax revenue may also decline if there is a decrease of the output of import-substituted goods. However, in the long term, if trade liberalization leads to economic growth, the growth of the economy is likely to expand the consumption tax base, and consequently results in an increase in the goods and services tax. Thus, again, the firm conclusion of how trade liberalization affects the goods and services tax cannot be drawn.

Another strategy to mitigate the loss of international trade tax revenue is to strengthen tax administration and collection and to improve the effectiveness of the tax system. However, as discussed above that trade liberalization may have various adverse impacts on many tax types, as a result, the performance of overall tax system would be deteriorated. Until recently, many less developed and developing countries still

have experienced the difficulty in raising tax revenue to the level which is required to promote the growth of their economies. A poor tax performance, in terms of raising tax revenue, can mean either deficiency in the capability of tax administration, an inadequate effort to collect or the deterioration of tax bases, or both. In order to improve the performance of the overall tax system, domestic tax reform is a necessary process. Tax reform is usually a basic component of trade liberalization. The key objective of tax reform under the trade liberalization regime is to ensure that the tax system is productive enough to mitigate the fiscal imbalance. In general, countries which embark on the liberalization path also perform domestic tax reform at the same time, in order to modernize their tax systems, with the hope that tax reform will reduce compliance and collection costs, improve tax administration, and consequently enhance revenue collection. Therefore, it is important to review tax revenue performance as well as tax design and administration changes during the liberalization period.

Thus, the following questions are addresses in this thesis:

1. What are the factors determining imports and exports? How does trade liberalization affect the volume of imports and exports in both the short run and the long run?

2. What is the impact of trade liberalization on domestic and international trade taxes? How does the impact differ among countries with different level of development?

3. How is trade liberalization associated with the enhancement of the performance of the overall tax system? Which components of tax structure have been the most responsive or rigid?

1.2.Various Issues Related to Trade Liberalization

1.2.1. Trade Liberalization and Structural Adjustment

During the 1980s and 1990s, there has been significant trade liberalization by developing countries under the aegis of structural adjustment programs suggested by the World Bank and the IMF. According to the original Washington Consensus, a term attributed to Williamson (2003), the components of structural adjustment reforms, in addition to trade liberalization, are;

1) Fiscal discipline; government budget deficits must be reduced.

2) Reorientation of public expenditures; public expenditures must be reprioritized, especially to education, health care, and infrastructure investment.

3) Tax reform; tax structure must be reformed by broadening the tax base and adopting moderate marginal tax rates.

4) Financial market liberalization; lower interest rates must be set and subsidies on interest rates must be eliminated. Financial markets must be deregulated.

5) Unified and competitive exchange rates; since international debt and trade deficits are the major problems which lead to structural adjustment programs, exchange rate devaluation is necessary because it solves the overvaluation of exchange rates.

6) Openness to foreign direct investment; it is necessary to increase the rate of the investment in developing countries and bring resources which would otherwise be unavailable for economic growth.

7) Privatization; the ownership of a business, enterprise, agency, and public service must be transferred from public sector to private sector in order to reduce the role of inefficient and corrupt government.

8) Deregulation; any government rules and regulations that impede market entry or restrict competition must be removed or simplified.

9) Secure property rights; property rights must be clearly established in legal frameworks so that the incentives under structural adjustment programs could be pursued.

Because structural adjustment programs have usually been imposed on developing countries governments rather than on those of developed economies, and because they imposed substantial hardship on populations, these programs have not always been embraced nor pursued fully. Incomplete adoption of the Washington consensus has led to some controversy concerning its effectiveness. Some critics have argued that the failure of structural adjustment to work in many countries is not only due to too little or too much reform, but also due to the reform is too soon for a country to prepare, and also there are wrong sorts of reforms. Among critics with various opinion, Rodrik (2006) pointed out a factual paradox; the fact that China and India turn out to be successful in stimulating growth while their general economic policies have remained opposite to the recommendations of the Washington consensus. And since the evidence that the effects of the reform of macroeconomic policies, fiscal policies, and trade openness on national growth rates is quite weak, Rodrik (2006) suggested that those reforms are ineffective because the reform does not specifically focus on the area which has the most binding constraints on economic growth. He suggested that, after identifying the most binding constraints, appropriate policy responses must be generated and institutional reform must be taken place. A

government is needed to ensure appropriate institutions are put in place. Institutions are crucial to both the success of structural adjustment programs and to economic development. Legal and regulatory frameworks must be established and new market structures are needed.

Considering trade liberalization, the most common policy reform recommended to developing countries, Rodrik (2006) indicated that trade liberalization must be accompanied by complementary adjustment policies, particularly macroeconomic reform, and must go along with a long list of conditions, in order to be effective and to be ensured to enhance welfare. One of many conditions is that there must be no adverse effects on the fiscal balance, or if there are, there must be alternative and expedient ways of making up for the lost fiscal revenues. Although he believes that trade policy is overemphasized, and that macroeconomic reform and institutional innovations are far more important in fostering economic growth, he agrees that trade liberalization accompanies development and that in long run an economy which fails to integrate with international markets will grow more slowly.

1.2.2. Trade Liberalization, Economic Growth, and National Welfare

Under certain circumstances, a country's overall welfare is in some sense improved by freer trade, which should thus be viewed as desirable. In simplest terms, the welfare gains from trade come from the fact that a country that moves from autarky to free trade gets to trade at a price ratio different from the autarky price ratio. As a result, this must make a country better off. This is the most basic form in which a country enjoys welfare benefits in moving from autarky to free trade. Opening up to trade offers an opportunity to trade at international prices rather than domestic prices. This opportunity in itself offers a gain from exchange, as consumers can buy cheaper

imported goods and producers can export goods at higher foreign prices. Further, there is a gain from specialization as the new prices established in free trade encourage industries to reallocate production from goods that the closed economy was producing at relatively high cost to goods that it was producing at relatively low cost. Thus, the static gains from trade arise from shifting the mixed outputs toward goods of comparative advantage, by holding fixed the economy's technology and endowments so its production possibility frontier (PPF) remains static, while permitting consumers to take advantage of the new price. However, the fact that technological change is endogenous means that a move from autarky to free trade has additional dynamic welfare effects. The static analysis ignores many dynamic consequences of trade liberalization. There are many authors suggesting that a dynamic setting free trade is harmful to economic growth. For instances, Findlay (1980) presented the use of a dynamic two-region model, each region producing a distinctly different product. In order to embody interregional differences, he proposed that the labour markets of each region have dissimilar structures. Specifically, the North is assumed to manufacture the investment good using the services of all available capital and labour. In contrast, labour is in perfectly elastic supply at a constant real wage in the South, a primary consumption good producer. By assuming these asymmetries between regions, he developed a vigorous formal analysis and showed that trade is the engine of growth for the South. The power of the engine is determined, however, by the natural growth rate of the North, and in this sense the South does not have its own growth engine. Technological improvements also have asymmetrical results. Hicks-neutral or Harrod-neutral shifts in the production function of the North leave the terms of trade unchanged in the long run and increase its real per-capita income. In the South, however, a Solow-neutral shift in the production

function leads to a proportional decline in the terms of trade and brings about a decrease in its real per-capita income measured in terms of manufactured goods.

Another well-recognized dynamic analysis of welfare gains from freer trade is Krugman (1981). In order to show that initial discrepancy in capital-labour ratios of the two adjacent, competing regions will cumulate over time, and will inevitably lead to the division into the capital-rich, industrial region and capital-poor, agricultural region, he developed a two region model of uneven regional development and examined the effect of international trade upon the world distribution of income when there are external economies to physical capital accumulation in the manufacturing sector. That is, more-industrialized countries cumulatively accumulate capital than less-industrialized countries under the assumption of increasing return of technology. In his model, there are two countries, North and South, which have the same amount of labour force and produce two goods, a manufacturing good and agricultural product. A single world price of manufacturing goods in terms of agricultural products was assumed. In other word, a single world price of agricultural products was set to unit. Manufacturing production was assumed as a function of capital input and labour input, and its technology is increasing return, while agricultural products were assumed to be produced by labour alone. In addition, labour forces were assumed to consume agricultural goods alone, and their saving ratios are zero which means unit labour cost to be one. Under these assumptions, he first investigated the North-South relationship by assuming there is international trade but no international capital movement. Because the profit rate of the manufacturing sector of the North is higher than that of the South, capital accumulation in the North is faster than in the South. If North-South relation starts where Northern capital stock is larger than Southern capital stock, northern manufacture will grow faster and finally North will

become industrial region and South will be specialized in agriculture (or at least less-industrial region). He then allowed international investment by assuming the movement of capital between two regions. With capital mobility, there is a two-stage pattern of development which trade is the engine of growth in North through increasing exports of manufactures in the first stage and then exports of capital in the second stage, suggesting the justification of imperialism. In conclusion, freer trade in dynamic aspect might a country (which is initially a "rich" country) to grow faster than others (which are mostly "poor" and underdeveloped country) and this is the Krugman's theory of uneven development.

The concern that freer trade possibly leads to unequal development was also proposed by Matsuyama (1992). In general, sectors differ in the degree of increasing returns to scale and in growth potential. When freer trade leads to specialization in sectors with low growth potential, it may have detrimental effects. Similarly, trade liberalization can lead to the agglomeration of industrial increasing returns to scale activities in few countries and this may have an adverse effect in the remaining regions of the world. Countries which have comparative disadvantage in industrial sectors, especially in less developed and developing countries, have a higher risk to suffer from the negative impact of trade liberalization and globalization. From this concept, Matsuyama (1992) constructed a model of a two-sector economy, agriculture and manufacturing, with endogenous growth to demonstrate that a country specializing in agriculture may be worse off after trade than in autarky. The key assumption of the model is that the industrial sector is the engine of growth because learning by doing. He shows that a high agricultural productivity is beneficial in closed economy, as it releases resources that can be employed in the industrial. However, it may be detrimental for a small open economy, as it may induce specialization in agriculture.

For the closed economy case, higher agricultural productivity, which is assumed to be exogenous, translate into higher growth by shifting labour to manufacturing. However, for the small open economy case, the small open economy will grow faster than the world economy if it has a comparative advantage in the productivity in manufacturing and vice versa, because growth is proportional to the fraction of labour employed in manufacturing. Freer trade expands the sector of comparative advantage and then learning by doing amplifies the initial comparative advantage. So, an economy with less productive agriculture allocates more labour to manufacturing and will grow faster. Thus, in this case, there is a negative link between agricultural productivity and growth.

1.2.3. Trade Liberalization and "Contractionary" Devaluation

Governments embark on trade liberalization program in the hope to gain long-term benefits from competition and comparative advantage. However, whatever long-run benefits might be anticipated, the issues of short- and medium-run adjustment costs are usually raised by those who oppose free trade since the costs are considerably high. One of the most interesting issues related to trade liberalization is the contractionary devaluation. Typically, trade liberalization is accompanied by devaluation. The major policy objective of devaluation is to generate a readjustment in the relative price of tradable and nontradable goods and to improve the external position of the country. However, a number of authors recently have questioned the effectiveness of devaluation as a policy tool. There is an argument that even though nominal devaluation may achieve their goals of generating a relative price readjustment and improving trade balance, these goals may be achieved at a very high cost. In particular, it has been pointed out that one of such costs is the decline in total

output generated by devaluation. This critique has finally considered as the contractionary devaluation problem.

From an analytical point of view, devaluation has an influence on the economy through a number of channels. According to the more traditional view, devaluation will either have an expansionary effect on aggregate output, or the worst case will leave aggregate output unaffected. On one hand, if there is unutilized capacity, nominal devaluation will be expansionary and total aggregate output will finally increase. On the other hand, if the economy is operating under full employment, nominal devaluation will be translated into equiproportional increase in prices, with the real exchange rate and aggregate output being unaffected. Contrary to the traditional view, there are several theoretical reasons which explain why devaluation can be contractionary and how it generates a decline in aggregate real activity, including employment. For example, Krugman and Taylor (1978) provided a framework following a simple Keynes-Kalecki model of an open economy to analyze the potential short-run effects of nominal devaluation. The assumptions underlying their model are; i) there are two distinct sectors, one produces the (non-tradable) home goods for domestic markets while the other produces the export goods for international markets. ii) The price of home goods is determined by a mark-up over direct input costs, while that of the imported input is fixed in terms of international currency. iii) The nominal wage rate is constant in terms of the domestic currency. iv) In the short run, substitution responses of both exports and imports to price changes are negligible. v) Interest rates are kept constant by action of the monetary authorities. Following these underlying characteristics, Krugman and Taylor (1978) concluded that devaluation can lead to short-run contraction through three channels. First, in general, a country which devalues its currency is in deficit at the time. In the presence

of a trade deficit, the valuation effect of an exchange rate change will be greater on imports than on exports because of the greater initial volume of the imports. As a consequence, there is the greater valuation effect of devaluation on imports in the presence of a trade deficit and when measured in terms of the domestic currency. Second, devaluation can generate a redistribution of income from groups with a low marginal propensity to save to groups with a high marginal propensity to save, resulting in a decline in aggregate demand and output. Third, a redistribution of revenues from the private sector to the government sector which reduces demand for the home goods, given a fixed level of government spending. Thus, in conclusion, trade liberalization, when accompanied by devaluation policy, is likely to have undesirable effects on economy by shifting the income distribution against labour and reducing output and employment.

1.2.4. Trade Liberalization and Poverty Reduction

Among the most important concerns as trade liberalizes and economy integrates with the world economy is the link between economic globalization and poverty. In general, global economic integration has complex effects on income, culture, society, and environment. However, in the debate over globalization's merits, its impact on poverty is particularly important. If international trade and investment primarily benefit the rich, many people will feel that restricting trade to protect jobs, culture, or the environment is worth the costs. But if restricting trade imposes further hardship on poor people in the developing countries, many of the same people will think otherwise. In a recent paper, Dollar and Kraay (2000) provided empirical evidence in support of a positive and significant relationship between changes in trade and changes in inequality, reaching the conclusion that expansions in trade raised growth as well as incomes of the poor. They investigated the link between the income of the

poor and overall income (per capita GDP at PPP in 1985 international dollars). The analysis was based on a sample of 80 countries over four decades and the poor are defined as the bottom one fifth of the income distribution. From their paper, it can be concluded that; i) On average across countries and over time, growth is distribution neutral. ii) any factor which increases the growth rate is good for the poor. iii) The income of the poor rises one-for-one with overall growth and the effect of growth on the income of the poor is no different in poor countries than in rich countries. iv) The income of the poor do not fall more than proportionately during economic crises. v) The poverty-growth relationship has not changed in recent years. vi) Openness to foreign trade benefits the poor to the same extent that it benefits the whole economy. vii) Good rule of law and fiscal discipline benefit the poor to the same extent that they benefit the whole economy. viii) No evidence is found that formal democratic institutions or public spending on health and education have systematic effects on the income of the poor. ix) World Bank and IMF policy packages increase the growth rate and therefore, these policy packages should be the core of poverty reduction strategies.

On the other side, antiglobalization activists are convinced that economic integration has been widening the gap between the rich and the poor. Globalization benefits the rich but does very little for the poor, perhaps even making them lot harder. There is a number of criticisms and argument about the result of the work of Dollar and Kraay (2000) placed by many authors such as Weisbrot *et al* (2001), and Nye, Reddy, and Watkins (2002). The main criticisms of Dollar and Kraay (2000) can be concluded as follows; i) The policy conclusions inferred by Dollar and Kraay (2000) from their regressions are not persuasive as in most cases the results are statistically insignificant. ii) The paper has no theoretical underpinnings or foundations. That is,

presumed relationships are not derived from any theoretical models. This comes to the question of why there should be a one-to-one relationship between increases in per capita income and the income of the poor. iii) Instead of using time series data, the study is based on cross-country data, although some countries have very small observations. This tells us very little about how individual countries will develop over time. Although cross-country studies may indicate average trends, individual country experiences can differ quite significantly. In fact, the use of a cross country regression, based on the variability of income between countries, to infer the likely temporal variability as economies grow is a very strong assumption. iv) The work of Dollar and Kraay (2000) did not give any insight of how the income of the poor changes when there are significant changes in the size distribution of income. In addition, the case that the income growth of every quantile is proportionate to the overall growth of GDP is not likely to be true. v) The definition of poverty used by Dollar and Kraay (2000) is open to question. Taking the bottom quantile of the income distribution as an indication of the extent of poverty is inadequate because it is neither a measure of absolute poverty, nor is it an appropriate measure of relative poverty. It tells us nothing about the relationship between the average income of the bottom 20 per cent of income recipients and the poverty line, and it cannot highlight changes that may occur in income distribution within the bottom quantile. Even if economic growth does benefit the poor on a one-to-one basis, the poor would still fall behind the rest of the population in absolute terms. vi) There are critical of the openness index used by the work of Dollar and Kraay (2000) and further argue that the regressions show no direct relationship between openness and the income of the poor. That is, if freer trade is good for poverty reduction, it must have an indirect effect through growth rather than a direct effect on poverty *per se*. vii) The variables

in the regressions show little or nothing about the relationships between most of the variables examined, except for the correlation between economic growth and the income of the poor. However, correlation does not imply causation. Even if there is a relationship between the variable on the left hand side of the equation and the independent variables on the right hand side, it may run in both directions and the postulated regression is then a set of relationships characterizing the interrelationships among jointly determined variables.

In conclusion, although there is strong evidence that economic growth normally reduces income poverty, freer trade-led-growth still has many controversies. Since there is no firm conclusion that freer trade leads to faster economic growth, there are many argument whether freer trade should really reduce poverty, even in the long run. In addition, the available cross-country data provide no clear evidence that trade liberalization reduces poverty, at least in the short run. Thus, trade liberalization in the hope that it will help reduce poverty should be done with care. Countries which embark on trade liberalization need to have well-functioning social safety nets in order to ease the tension between implementing trade reforms and alleviating poverty. They also need to prepare some government budgets for offsetting some adverse effects which trade liberalization may potentially lead to.

1.2.5. Trade Liberalization and External Shocks

Theoretically, there is only little evidence to support the claim that openness to trade is associated with greater volatility. Moreover, even if this were the case, the idea that the political system would then optimally deliver more insurance in the form of bigger government is doubtful. As a consequence, recently, there has been interest in investigating the relationship between trade openness and the size of government.

Among a number of papers, Rodrik (1998) demonstrated that a positive correlation between trade openness and the size of government exists for a broad sample including both developed and developing countries. He presented evidence to support the hypothesis that larger governments provide social insurance in more open economies facing higher terms of trade risk. If openness is associated with greater risk, it is expected that openness is related to greater public expenditure to provide greater social insurance. Rodrik (1998) used cross-country data to investigate the nature of the relationship between trade openness (measured by the ratio of imports plus exports to GDP) and government size (measured by the ratio of government consumption to GDP) and found that there is a strong positive causation from the former to the latter. Challenging the view that regards market and government as substitutes, Rodrik (1998) took this evidence to suggest that there may be a degree of complementary between them. Particularly, he argued that the causal relationship between openness to trade and government size can be explained by compensation hypothesis – that is the increased volatility brought about by growing exposure to, and dependence on developments in the rest of the world creates incentives for governments to provide social insurance against internationally generated risk. Since trade openness raises exposure to risk, this reflects an increase in consumption volatility and uneven income distribution, which is then reduced by a larger government size.

From the suggestion that trade liberalization brings with it the necessity for larger government to mitigate the volatility and external shocks, the capacity to tax for the government in order to meet higher expenditure is of concern, especially for the government in less developed and developing countries. In fact, the influence of government in an economy goes beyond its spending and tax collection. State

ownership of enterprises, price control, mandate, and restrictions on competition are examples of government intervention that can have profound effect on an economy. All of these raise concerns that trade liberalization may have led to fiscal difficulties and even inefficiently large government.

1.3. Outline of the Thesis

This thesis consists of three main chapters, all devoted to investigate the various impacts of trade liberalization on trade and tax performance. In order to address the first question, an empirical analysis is presented in Chapter 3 and investigates whether there exists a long-run relationship between trade and its major determinants. It also examines the impact of trade liberalization on the volume of imports and exports. In the analysis of trade liberalization and the formation of trade policy, one of the major concerns of policy makers is the responsiveness of trade flow to change in income and relative price. The impact of trade liberalization policy is highly dependent on the size of income, import price, and export price elasticities. As far as the analysis of import price, export price, and income elasticities is concerned, the empirical investigation of import and export demand functions is one of the most interesting research areas of international economics. International economists have dedicated a substantial amount of effort to the estimation of import and export demand functions, both at the aggregate and disaggregated levels. Estimated elasticities are very important for policy makers since they represent a crucial link between trade policies and changes in trade flow, the degree to which trade policies affect the balance of payments and a country's economic performance.

Therefore, Chapter 3 highlights one of the key issues which currently has a wide academic and political controversy by focusing on the question whether trade

liberalization really brings about an increase in international trade. This chapter seeks to estimate the likely impact of trade liberalization policies on the volume of imports and exports using aggregated import and export demand functions in Thailand for the period 1960 to 2007. Thailand is one of the developing countries that grew rapidly during the past two decades. Thailand, like many other developing countries, has switched from a closed economy to a more open economy by inducing free trade policies in the hope that trade liberalization will bring an improvement in its overall economic performance and address balance of payments difficulties. Thailand has formally introduced trade liberalization policy with its membership of AFTA in 1992 and the WTO in 1995, though its tariffs have been gradually reduced over time. By opening the country, Thailand primarily hopes to achieve better export performance and hence alleviate the ongoing trade deficit problem. Although, there is still a concern that trade liberalization is generally found to be positively associated with the volume of imports, while it may not lead to an increase in the volume of exports in the same proportion, it is found that, for Thailand, the volume of exports has exceeded the volume of imports for almost all years in the post-liberalization period.

Thus, in Chapter 3, we put an effort to assess empirically the major determinants of import and export demand functions in Thailand using the cointegration technique to estimate the long-run relationship and error-correction mechanism to examine the dynamic behaviour. We, then, estimate the income and price elasticities from both import and export demand functions by using an Autoregressive Distributed Lagged (ARDL) model. We also compare these estimates with the estimates obtained using cointegration techniques and an ECM. Finally, we analyze the impact of trade liberalization on the volume of imports and exports in both the short run and long run.

When compared with the studies of free trade related growth, employment, or trade creation and diversion, there have been a relatively small number of both theoretical and empirical studies on the revenue impact of trade liberalization. This is an equally important area of inquiry, because if trade liberalization leads to a reduction in tax revenues, this can have serious implications for fiscal reform of countries that have a budget constraint. Hence, after we investigate the impact of trade liberalization on trade performance, we turn our focus to its impact on tax revenues, in order to shed light on a controversy whether trade liberalization is a potential source of fiscal instability, especially for countries which have high dependency on trade tax for their public revenue. Although some authors suggest that trade liberalization could proceed while adverse consequences can be avoided by coordinating liberalization with potential government budget spending, sound macroeconomic policies, and effective measures on the revenue; including raising domestic direct and indirect taxes, widening and developing new tax bases, improving effectiveness of public spending, raising public saving, and strengthening tax collection and administration, many countries find that it is very difficult in practice to prevent the adverse effects on the fiscal revenues.[2] The problem is due to various restrictions such as the level of development, the political instability, the constrained institutional capacities, and the limitation of country's geography.

Therefore, Chapter 4 is devoted to examine the effect on both international trade tax and domestic taxes after trade is liberalized. As discussed above, although trade liberalization is usually associated with the reduction of trade restrictions including tariffs, and hence tends to lower international trade tax revenue, the relationship between trade liberalization and other domestic tax revenues is still ambiguous, or

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[2] See Glenday (2002) and Keen and Ligthart (2004), for example.

even the impact on trade tax revenue itself is an empirical matter. In addition, tax reform, in practice, is a very difficult task for many less developed and developing countries to pursue. If trade liberalization is found to have a negative impact on domestic tax revenues, domestic tax reform by using those instruments may be inapplicable. This raises the further question of whether these countries should implement the reform in the same way as it did in developed countries.

As stated earlier, the impact of trade liberalization on tax revenues may vary depending on the level of development. Chapter 4 uses panel data of 134 countries over 24 years covering the period 1980-2003 and divides countries into four groups; low income, lower-middle income, upper-middle income, and high income countries. However, the study concentrates on the impact of trade liberalization on tax revenues of low and middle income countries since the sufferings from the loss of tax revenues, if exist, are much higher for countries that have constrained government's income sources. Chapter 4 employs the traditional and extended tax effort model, using a fixed-effects approach, with a two-way estimate, incorporating time and individual country effects in order to obtain reliable results.

The impact of trade liberalization on tax revenue is investigated in more detail in terms of the performance of the overall tax system. Domestic tax reform, which usually is implemented at the same time as trade is liberalized, is an important instrument for raising tax yield. In general, the productivity of the overall tax system should be improved after the tax reform takes place. However, as mentioned earlier, the effect of trade liberalization on the overall tax system is ambiguity. Trade liberalization may either improve or deteriorate tax bases, depending on many different factors. On one hand, fiscal revenue can be improved if trade liberalization is accompanied by such supportive situations as a large expansion in international trade

volume, economic growth, employment, a rise in income level, and devaluation of exchange rate. On the other hand, fiscal revenue can be deteriorated if trade liberalization is associated with a shrink in trade volume, job losses, and deterioration in corporate profit. Although it is difficult to determine accurately the direction of change in overall tax revenue as a result of trade liberalization, changes in tax revenue can be measured by applying the concept of tax buoyancy and tax elasticity since tax revenue depends crucially on revenue productivity and tax structure (Suliman, 2005).

Growth in tax revenues may occur through automatic responses of the tax yield through changes in national income and/or through the imposition of new taxes, revision of the rate-structure of existing taxes, expansion of the tax bases, tax amnesties, and tougher compliance and enforcement measures. Changes in tax yield resulting from the modification of tax parameters (i.e., rates, base) are called "discretionary changes" which stem from legislative action. Generally, tax buoyancy and tax elasticity are the measures used to evaluate the ability of country's tax system to mobilize its revenue (Asher, 1989). Tax buoyancy measures the change in the overall tax yield from changes in GDP whereas tax elasticity measures the change in tax yield resulting from variations in national income with tax parameters held constant (i.e., discretionary changes being removed). In Chapter 5, a measure of revenue productivity of the tax system is used to determine whether the responsiveness of tax revenues is high or low in Thailand relative to the other three founding countries of the ASEAN Free Trade Area (including Indonesia, Malaysia, and Philippines). By using the buoyancy and elasticity framework, Chapter 5 applies the concept of tax buoyancy and elasticity to evaluate the implications of the process of trade liberalization on revenue mobilization. The main objective of Chapter 5 is to estimate tax buoyancy and tax elasticity of the Thailand tax system, compared to

those of its three neighbour countries. The evaluation is done to measure the response of the tax system to trade liberalization by AFTA in 1992. By estimating tax buoyancy and tax elasticity, this chapter addresses the question of whether Thailand's major trade liberalization by becoming AFTA members results in the enhancement of the flexibility of the tax system. In addition, Chapter 5 decomposes tax buoyancy to obtain the buoyancy of tax revenue with respect to its tax base and the buoyancy of tax base with respect to income. The decomposition of tax buoyancy is beneficial since it gives us capability of identifying factors which are responsible for rapid or lagged revenue growth.

Finally, Chapter 6 reports the main findings, and draws policy implications. Possible extensions for future research are also presented.

Chapter 2

A SURVEY OF THE THEORY OF TRADE LIBERALIZATION

2.1. Introduction

When developing countries have reduced tariffs on tradable goods to improve the allocation of their productive resources, these tariff cuts almost always lead to a loss of government revenue. In most developed economies where their domestic tax bases are well developed, the revenue loss can easily be offset by raising tax on consumption. However, in most less developed and developing countries where the international trade tax is the major source of tax revenue and the domestic tax bases are not well developed, how to make up the shortfall in trade tax revenue, if there is any, through other compensatory domestic taxes is still a major concern. With such a heavy dependence on international trade tax as a major source of revenue, a key concern for these countries is how to recover, from other tax sources, the revenue loss that trade liberalization potentially entails.

In addition to widening the tax base and improving tax administration, a country which undertakes a reduction in a tariff rate usually seek alternative domestic taxes to substitute for the lost trade tax revenue. There are generally two strategies to offset the revenue shortfall following a reduction in the tariff rate. The first is the strategy using a domestic indirect tax, more specifically, a consumption tax. This strategy is widely supported since using a broad-based consumption tax for revenue compensation seems to be the most applicable approach in practice. The other strategy is to use a domestic direct tax, more specifically a profit tax, to offset the revenue shortfall. The rationale to use a profit tax as compensation is that the producers are those who reap the profit from tariff reduction by reducing the price at a very small proportion of tariff reduction to consumers. Therefore, producers are the group who should receive this tax burden and a profit tax should be applied as a compensatory measure.

This chapter provides theoretical underpinnings for the strategies to offset the revenue shortfall from the loss of a tariff revenue due to tariff cut in order to provide a bird's eye view of the major theoretical contributions to the revenue implication of trade liberalization. Section 2 is devoted to the strategy to offset the revenue shortfall as a result of tariff reduction by using a broad-based consumption tax. Section 3 examines the strategy to compensate the revenue shortfall by using a profit tax, a relative narrow-based direct tax. The conclusion is contained in Section 4 of this chapter.

2.2. The Strategy to Offset Revenue Shortfall from The loss of Foreign Trade Tax by Using Domestic Indirect Tax

Conventional models of trade liberalization typically assume that a fall in tariff revenue in the post-liberalization period is offset by increasing consumption tax. Keen and Ligthart (1999, 2004) suggest that, although the issue of trade tax revenue reduction in many less developed and developing countries is very acute because tax on international trade is their large source of revenue and their tax administration capability is generally poor, there is still room for enhancing revenue in the period of tariff reduction by coordinating a cut of tariff with a point-for-point increase in domestic consumption taxes. With some rigorous conditions, this strategy ensures that countries liberalizing their trade will end up with increases in both tax revenues and welfare.

The following gives a brief summary of the model. The model considers a small open economy and comprises three sectors; a representative household, a perfectly competitive production sector, and a government. There are T tradable commodities. World prices are denoted by p. Taxes include tariffs (τ) and consumption taxes (t). Thus producer prices are $p + \tau$ and consumer prices (q) are $p + \tau + t$.

The expenditure function of the representative household is defined as $E_q(q,u)$; $E_q > 0$, where q is consumer prices and u is utility.

The revenue function of the representative firm is defined as $R_p(p+\tau)$; $R_p > 0$, where $p+\tau$ is producer prices.

It is assumed that public revenue from tariffs and consumption taxes (G) will be returned to consumers in the form of a lump-sum transfer. Thus, the income-expenditure identity can be represented as:

Market Clearing Condition : $$E(q,u) = R(p+\tau) + G \qquad (2.1)$$

Where $$G = t \cdot E_q(q,u) + \tau \cdot \left[E_q(q,u) - R_p(p+\tau) \right] \qquad (2.2)$$

The revenue from consumption taxation is denoted by the first term of equation (2.2), while the revenue from tariffs is denoted by the second term of equation (2.2).

Consider a simultaneous tax reform by reducing tariffs by $\Delta\tau = \tau_n - \tau_o < 0$ (where τ_n and τ_o represent the "new" and "old" tariffs, respectively) and increasing consumption taxes by an exactly offsetting amount $\Delta t = t_n - t_o > 0$ (that is, $-\Delta\tau = \Delta t$). This simultaneous reform results in the change of producer prices and so the domestic production (as a reflection of tariff reduction), while consumer prices are entirely unaffected (as a reflection of a point-for-point increase in consumption taxes). Tarff reduction will result in an improvement in production efficiency and the rearrangement of domestic production will consequently induces increases in the value of output at world price. Since the value of output at world price increases, welfare increases. Consider an increase in tax revenue. Initially, the government collects revenue from a narrow-based tariff on imported commodities. The use of the

consumption tax will expand the tax base in which tax will be collected not only on imported goods, but also on import substitutes produced domestically. As a consequence, a coordinated tariff reduction with a point-for-point increase in consumption taxes which maintain consumer prices unchanged will lead to an increase in both government revenue and welfare.

Alternatively, this can be shown by using a simple diagrammatic interpretation as presented in Figure 2.1.

Figure 2.1: Partial Equilibrium of Coordinated Tax-tariff Reform
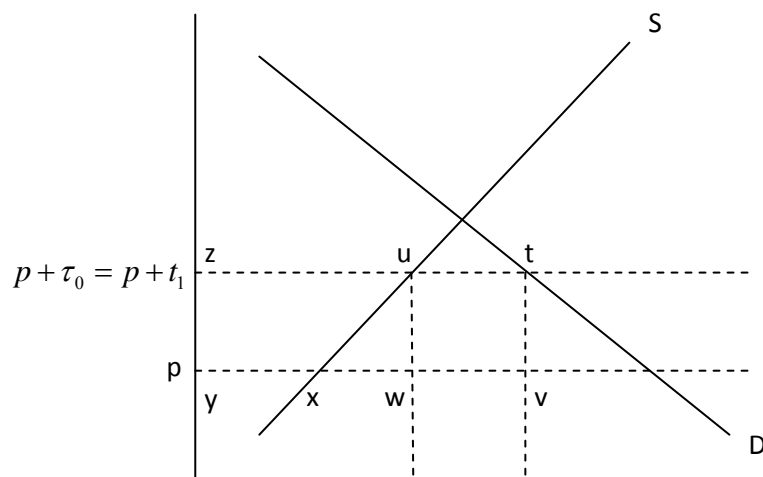
For simplicity, we suppose that there are initially no consumption taxes. The only tax that is collected by the government is the tariff and is set at τ_0. Initially, consumption is at point t (line zt), domestic production is at point u (line zu), the amount of imports is ut, and the public revenue is the area tuvw. After implemented a coordinated tax-tariff reform by replacing the tariff (τ_0) with a consumption tax (t_1) at exactly the same rate $(\tau_0 = t_1)$, the consumption still remains at point t but the domestic production drops to point x (line yx), while the amount of imports increase from ut to

xv. The initial (domestic) producer surplus (uxyz) disappears. However, public revenue rises from tuvw to tvyz, with the additional revenue uwyz exceeding the reduction in initial producer surplus (uxyz) by the amount of the improvement in production efficiency (uwx). Thus, in summary, a reduction in tariffs accompanied by an increase in consumption taxes that leaves consumer prices unchanged obviously increases both tax revenue and welfare.

The main importance of this model is that it makes a first attempt to offer a formal theory of policy reform to offset the loss of revenue caused by the tariff reduction. While the advantage of this model is its ease of use, the assumption underlying the model that it is base on perfect competition may be far from the real economy. In addition, the result cannot be extended to deal with the reduction of tariffs on intermediate goods used to produce tradable goods since it is not possible to offset a tariff reduction by increasing consumption tax without affecting consumer price.

Following Keen and Ligthart (1999, 2004), many other economists have developed a variety of models by changing the assumption from perfect completion to imperfect competition in order to get closer to the real economy. Some models concentrate on tariff reduction on intermediate inputs since these goods tend to be a major import in most of less developed and developing countries. Other strategies besides using consumption taxes to offset the loss of revenue are also proposed. In the following section, we discuss a theoretical model in terms of imperfect competition and using domestic direct tax to mitigate revenue loss from tariff reduction.

2.3. The Strategy to Offset Revenue Shortfall from The loss of Foreign Trade Tax by Using Domestic Direct Tax

While Keen and Ligthart (1999, 2004) focus their study on offsetting the loss of tariff revenue by using broad-based consumption taxes, other studies propose a strategy to offset this loss by using a relatively narrow-based but less distorted profit tax. Mujumdar (2004) gives two rational suggestions why the government should rely more on a tax on firm profits instead of a commodity tax in order to achieve the offset objective. First, many industries in most of less developed and developing countries tend to have a very high oligopolistic power. Suppose that countries liberalize their trade and if the price elasticity of demand is very low, which is likely to be, especially in the case of the short run. Instead of reducing the price at the same proportion of tariff reduction, producers may pass on only a small percentage of tariff reduction to consumers by lowering the price by a very little amount and they may reap a "windfall" profits of this tariff reduction. Therefore, it is reasonable for government to collect tax revenue from such profits. Second, since it is generally perceived that firms may make substantial profits from tariff reduction, there may be a very high resistance from consumer groups if the government chooses to recover the revenue shortfall by placing a higher consumption taxes and this possibly causes further political problems. In fact, when the tariff rate of the intermediate input is reduced, this will reduce tariff revenue on one hand, and will increase the firm's profit by reducing the cost of production of the final goods on the other hand. The higher profits, together with the higher profit tax rate, will increase the profit tax revenue. This revenue could be used to offset the shortfall generated by tariff reduction.

Tariff Reduction on an Intermediate Input under Imperfect Competition

Mujumdar (2004) suggests that though intermediate inputs constitute a large share in world trade and thus deserves special treatment, very little effort has been made to develop a tariff-tax reform strategies for this class of goods. In addition, he argues that the model proposed earlier by Keen and Ligthart (1999) can be devised only under the condition of a perfectly competitive production sector and hence cannot be extended to cover an imperfectly competitive case. Thus Mujumdar (2004) considers the question of whether government can make up a shortfall in revenue if it reduces a tariff on an intermediate input under imperfect competition, while the make up by using profit tax must ensure that both consumers and producers must be better off in the post-liberalization period. The assumptions underlying the model are that an industry comprises N identical firms, importing the same intermediate input, so they all have the same cost function. Each firm assembles all inputs to make a final tradable product and sells its entire output in the domestic market.

Let P^w denote the import price of the intermediate input. The model adopts the small and open economy assumption by further assuming that all firms are price takers with respect to the import price (P^w) and changes in total quantity demanded of intermediate inputs do not affect the import price (P^w). The (*ad valorem*) tariff collected by the government is applied to the intermediate input at the rate t. The cost of assembling intermediate input to produce each unit of output is assumed to be identical across firms and is equal to c.

Let q_i denote the output of firm i here $i = 1, 2, ..., N$. Thus, the total cost function of firm *i* can be represented as:

$$C_i = \left[P^w \cdot (1+t) + c \right] \cdot q_i \tag{2.3}$$

The aggregate demand for the industry's product can be shown as the inverse demand function of firms' output:

$$P = a - bQ \tag{2.4}$$

where P is the market price, and $Q = \sum_{i=1}^{N} q_i$, is the total industry output. It is also assumed that purchasing the product from the domestic market is cheaper than importing it.

Later, the firm profits will be taxed at the rate T (where $0 \leq T < 1$). Since the price of output is equal to P throughout the market, all firms are assumed to compete in quantities.

The objective of any firm i is to maximize its after-tax profit and it can be shown by maximizing firm's profit, that is;

$$\text{Max } \prod_i = (1-T)\left\{ Pq_i - \left[P^w(1+t) + c \right] q_i \right\}$$

The model assumes that the firms compete like Cournot oligopolists in the product market. Thus, for Cournot competition with many firms, the equilibrium output level of each individual firm is:

$$q_i^c = \frac{a - c - P^w(1+t)}{(N+1)b} \tag{2.5}$$

and thus the total equilibrium industry output is:

$$Q^c = Nq_i^c = \left(\frac{N}{N+1} \right) \left[\frac{a - c - P^w(1+t)}{b} \right] \tag{2.6}$$

Now, consider the tariff reduction. The reduction of tariff will lower the equilibrium price and hence make consumers better off. Although the government raises the profit tax rate in order to generate revenue to offset the shortfall, this will not affect the price and thus not lower consumers' welfare. This will leave the government to be concerned only with how to raise revenue to exactly match the deficit and how to ensure that producers' welfare will be increased after liberalization. Therefore, there are two conditions to be met when a government determines a profit tax rate, the first condition focuses on tax revenue, while the second condition focuses on producers' welfare;

1) Total revenue in the post-liberalization period must be equal to total revenue from the pre-liberalization period.

$$T_A \prod_A^P + t_A P^w Q_A^c = T_B \prod_B^P + t_B P^w Q_B^c \; ; \; t_A < t_B \qquad (2.7)$$

2) The industry's after-tax profit in the post-liberalization period is higher than its after-tax profit in the pre-liberalization period. (This can be implied that each producer has higher after-tax profit and thus higher welfare).

$$(1 - T_A) \prod_A^P > (1 - T_B) \prod_B^P \qquad (2.8)$$

The subscript, A, attached to any variable is used to denote its value after trade is liberalized (the post-liberalization period) and the subscript, B, is for its value before trade is liberalized (the pre-liberalization period). $\prod^P$ denotes the equilibrium pre-tax profit of the industry. P^c is the equilibrium market price.

Equation (2.8) can be rearranged as;

$$\prod_A^P - \prod_B^P > T_A \prod_A^P - T_B \prod_B^P \qquad (2.9)$$

From equation (2.7), $T_A \prod_A^P - T_B \prod_B^P = t_B P^W Q_B^c - t_A P^W Q_A^c$. Substitute this into the right-hand-side (R.H.S.) of equation (2.9) and we have;

$$\prod_A^P - \prod_B^P > t_B P^W Q_B^c - t_A P^W Q_A^c \qquad (2.10)$$

The tariff reduction reduces tariff revenue if;

$$a > c + P^w (1 + t_B + t_A) \qquad (2.11)$$

It is assumed that the condition stated in equation (2.11) holds. If equation (2.11) is satisfied, it ensures that firm i will produce in the market.

The expression for $\prod_A^P$ and $\prod_B^P$ in equation (2.10) can be re-written as;

$$\left[P_A^c - c - P^w (1 + t_A) \right] Q_A^c - \left[P_B^c - c - P^w (1 + t_B) \right] Q_B^c > t_B P^W Q_B^c - t_A P^W Q_A^c \qquad (2.12)$$

Re-arranging terms in equation (2.12) and we have;

$$\left[P_A^c - c - P^w \right] Q_A^c > \left[P_B^c - c - P^w \right] Q_B^c \qquad (2.13)$$

Since the terms $\left[P_A^c - c - P^w \right]$ and $\left[P_B^c - c - P^w \right]$ are both positive, we can rewrite the equation as;

$$\frac{Q_A^c}{Q_B^c} > \frac{P_B^c - c - P^w}{P_A^c - c - P^w} \qquad (2.14)$$

Substituting Q_A^c and Q_B^c and simplifying equation (2.14), we have;

$$\frac{a - c - P^w (1 + t_A)}{a - c - P^w (1 + t_B)} > \frac{a - c - P^w + NP^w t_B}{a - c - P^w + NP^w t_A} \qquad (2.15)$$

Since the numerator and the denominator on each side of equation (2.15) are positive, we can re-arrange them to get;

$$t_A \left[(N-1)(a-c) \right] + P^w t_A \left[1 - N - N t_A \right] > t_B \left[(N-1)(a-c) \right] + P^w t_B \left[1 - N - N t_B \right] \quad (2.16)$$

If $N = 1$ and the tariff is lowered but not eliminated, equation (2.15) gives us that $t_A < t_B$, which is true. If $N = 1$ and now the tariff is eliminated $(t_A = 0)$, instead of reduced, equation (2.16) gives us that $0 > -P^w (t_B)^2$, which is also true. This can be implied that when the industry is a monopoly, the government can determine a profit tax rate (T_A) in order to make up for revenue shortfall and make producers still better off.

Now, consider when $N > 1$ and tariff is eliminated $(t_A = 0)$. The left-hand-side (L.H.S) of equation (2.16) turns out to be equal to zero, while the first term on the R.H.S of equation (2.16) is positive but the second term is negative. Thus the net value of the R.H.S cannot be determined and we cannot say that the L.H.S > the R.H.S. We also cannot assert that the L.H.S > the R.H.S when $N > 1$ and the tariff is only reduced, but not eliminated. Thus, this implies that when there is more than one firm in the industry, the government may not be able to determine a profit tax rate (T_A) in order to make up for revenue shortfall and make producers still better off.

Therefore, from the model, Mujumdar (2004) concludes that only when the industry is a monopoly can it be certain that raising the profit tax alone will generate enough revenue to make up for the shortfall following a tariff reduction. This strategy can also ensure that consumers and producers are better off in the post-liberalization period as a result of an increase in welfare. However, the larger number of firms in the industry lowers the probability that raising the profit tax alone is able to achieve the purpose of the revenue offset and increasing welfare. This, consequently, leads the government to use the more distortionary form of taxation, such as the consumption tax, in order to meet the shortfall of tax revenue.

Tariff Reduction under the Condition of Product Differentiation

Haque and Mukherjee (2004) argue that the results proposed by Mujumdar (2004), which indicate that only if the industry is a monopoly can we be certain that the government could use the profit tax to make up any shortfall in tariff revenue and also make both consumers and producers better off, are not robust when the products are differentiated. When product differentiation is taken into the analysis, their model shows that there always exists a degree of product differentiation such that the government can achieve these objectives for any finite number of firms in the industry. Thus, their results are more supportive for the government to reduce import tariffs than those of Mujumdar (2004).

Following Mujumdar's (2004) model, Haque and Mukherjee (2004) make assumptions very similar to those used in Mujumdar's (2002) work. The model assumes a small open economy with an industry with N symmetric firms so that the input price remains constant irrespective of the imports by the firms. The assumption of symmetric firms means that all firms have the same cost function and import a certain key input. It is also assumed that one unit of output requires one unit of input and the assembling cost of each unit is identical across firms. Unlike Mujumdar's (2004) model, they assume zero cost of assembly for simplicity since this does not affect the qualitative results. They also assume no any other costs of production. For each unit of import input, the ad valorem tariff t is imposed so the total cost of the ith firm is;

$$C_i = P^w(1+t)q_i \qquad (2.17)$$

The model assumes that the ith firm faces the inverse demand function as;

$$P_i = a - q_i - \theta \sum_{j=1}^{N-1} q_j \tag{2.18}$$

where $i = 1, 2, ..., N$ and $i \neq j$. θ denotes the degree of product differentiation and ranges from 0 to 1. The value of $\theta = 0$ implies isolated goods, while $\theta = 1$ implies homogeneous products which corresponds to Mujumdar (2004).

The objective of the ith firm is to maximize profit which can be expressed as;

$$\text{Max } \Pi_i = (1-T)\left\{ P_i q_i - \left[P^w(1+t) \right] q_i \right\}$$

The equilibrium output of the ith firm, $i = 1, 2, ..., N$ is:

$$q_i^c = \frac{a - P^w(1+t)}{2 + \theta(N-1)} \tag{2.19}$$

and thus the total equilibrium industry output is:

$$Q^c = N q_i^c = \frac{N\left[a - P^w(1+t) \right]}{2 + \theta(N-1)} \tag{2.20}$$

and the equilibrium price charged by the ith firm is:

$$P_i^c = \frac{a + \left[1 + \theta(N-1) \right] P^w(1+t)}{2 + \theta(N-1)} \tag{2.21}$$

Consider when a tariff is reduced, equations (2.19) and (2.21) obviously show that output of each firm has been increased while the price has been decreased, and thus make the consumers better off. Again, the government has two objectives left to be achieved; the revenue and producers' welfare objectives.

In order for the government to be able to determine the profit tax in a way to make up the shortfall in revenue, the increase in the industry's pre-tax profit must be greater than the shortfall in tariff revenue. Referring to equation (2.12), the only difference in

the following equation is that it assumes no cost of assembly. Thus, this case can be written as;

$$\left[P_A^c - P^w(1+t_A) \right]Q_A^c - \left[P_B^c - P^w(1+t_B) \right]Q_B^c > t_B P^W Q_B^c - t_A P^W Q_A^c \qquad (2.22)$$

and equation (2.14) can be re-written as;

$$\frac{Q_A^c}{Q_B^c} > \frac{P_B^c - P^w}{P_A^c - P^w} \qquad (2.23)$$

Substituting Q_A^c, Q_B^c and P_A^c, P_B^c by using equations (2.20) and (2.21) and simplifying equation (2.23), then we have;

$$\frac{a - P^w(1+t_A)}{a - P^w(1+t_B)} > \frac{a - P^w + (1+\theta(N-1))P^w t_B}{a - P^w + (1+\theta(N-1))P^w t_A} \qquad (2.24)$$

and then we can re-arrange equation (2.24) to get;

$$a\theta(N-1)t_A - P^w t_A \left[\theta(N-1) + \left(1+\theta(N-1)\right)t_A \right] > a\theta(N-1)t_B$$
$$-P^w t_B \left[\theta(N-1) + \left(1+\theta(N-1)\right)t_B \right] \qquad (2.25)$$

or

$$\theta < \frac{P^w(t_A + t_B)}{(N-1)\left[a - P^w(1+t_A+t_B) \right]} \equiv \theta^* \qquad (2.26)$$

From equation (2.26), since $\theta^* > 0$ for any finite number of firms (as from equation (2.11), $a - c + P^w(1+t_B+t_A) > 0$), the government can always find a profit tax to achieve the revenue-welfare objective when the products are sufficiently differentiated. This implies that for any given finite number of firms, there always exists a degree of product differentiation such that the government can achieve this goal. This result is in contrast to that of Mujumdar (2004). Haque and Mukherjee (2004) suggest that because outputs and profits are continuous with respect to the

degree of product differentiation, each firm becomes a near monopolist for its products when the products are sufficiently differentiated. Therefore, the government can use higher profit tax revenue to offset the shortfall of tariff revenue when the degree of product differentiation is sufficiently high. However, if the products are not very much differentiated, this will generate higher competition between the producers as products become more substitutes. The higher competition between the final goods producers, after the tariff rate is reduced, will not significantly increase their profits and thus profit tax revenue may not be high enough to compensate the loss of tariff revenue.

Equation (2.26) also presents the negative relationship between N and θ^*. As the number of firms (N) increase, the competition between the final goods producers increases. θ^* has been reduced, meaning that the product differentiation may not be high enough to increase profits significantly, and hence the likelihood that the government can use a profit tax to cover the loss of tariff revenue has been decreased.

Tariff Reduction under the Condition of Free Entry with a Certain Entry Cost

Haque and Mukherjee (2005) extend the analysis from their previous study by examining whether the market under free entry with a certain entry cost can recover the revenue loss as a result of tariff reduction on an intermediate input. Although the analysis is on the intermediate goods in an imperfectly competitive product market so the firms have significant market power, they allow for free entry with a certain entry cost and find different revenue implications depending on the cost of entry. From their findings, they suggest that, in the long run, a sufficiently large entry cost will generate higher tariff revenue and profit tax revenue due to the entry of new firms into the industry, and hence the market itself will compensate for any shortfall in revenue as a

consequence of the tariff reduction and the government does not need to depend on any other forms of taxation to maintain its total tax revenue while making both consumers and producers better-off in the post-liberalization period.

Following the same assumption used in their previous work; a small open economy with an industry with large number of symmetric firms (firms have the same cost function and import a certain key input), one unit of intermediate input is used for the production of one unit of output, and the cost of assembling each unit is identical across firms and assumed to be zero, they assume that the aggregate demand for the industry's product is represented by the inverse demand function;

$$P = a - Q \tag{2.27}$$

Now, it is assumed that firms produce in a market with free entry and incur certain cost of entry (k^2) and their profit is taxed at a rate $T \in (0,1)$. Firms will continue to enter into the industry until the profit-after-tax equals the entry cost, and thus the free-entry equilibrium can be shown by the following zero-profit condition;

$$(1-T)\prod_i = k^2 \tag{2.28}$$

The optimum output and gross profit of each firm $i = 1, 2, ..., N$ can be represented as;

$$q_i^c = \frac{a - P^w(1+t)}{N+1} \tag{2.29}$$

$$\prod_i^c = \left(\frac{a - P^w(1+t)}{N+1}\right)^2 \tag{2.30}$$

Using the free entry equilibrium in (2.28), the equilibrium number of firms, total industry output, and industry profit can be represented as;

$$N = \frac{\sqrt{1-T}\left[a - P^w(1+t)\right]}{k} - 1 \tag{2.31}$$

$$Q^c = Nq_i^c = \frac{\sqrt{1-T}\left[a - P^w(1+t)\right] - k}{\sqrt{1-T}} \qquad (2.32)$$

$$\Pi^c = N\,\Pi_i^c = \frac{\left[\sqrt{1-T}\left(a - P^w(1+t)\right) - k\right]k}{(1-T)} \qquad (2.33)$$

From (2.29) and (2.30), it is obvious that tariff reduction will increase both output and profit of individual firm and will consequently reduce the price of the product if the number of firms remains fixed. With the assumption of free entry, new firms will continue to enter into the industry until their profit-after-tax is equal to the entry cost, k^2. This will finally increase the equilibrium number of firms in the industry, total industry output, and the gross industry profit as stated in equation (2.31) to (2.33).

First, Haque and Mukherjee (2005) establish the condition under which the government needs to use non-distortionary taxation (profit tax) to recover the revenue loss, if there is any, as a result of tariff reduction. Thus, equation (2.34) presents the condition whether there is any possibility that tariff revenue might increase or stay the same after the tariff is reduced, without any change in the profit tax, T. Tariff reduction means that $t_A < t_B$.

$$P^w t_A Q_A^c \geq P^w t_B Q_B^c \qquad (2.34)$$

In previous work, the number of firms remains unchanged $(N_A = N_B)$. Referring to equation (2.11), tariff reduction reduces tariff revenue if and only if;

$$a > P^w(1 + t_A + t_B) \qquad (2.35)$$

If equation (2.35) is assumed to be satisfied, following equation (2.29), it ensures a positive output of the entering firms. Using the expressions for $Q_A^c = N_A q_{iA}^c$ and

$Q_B^c = N_B q_{iB}^c$, and utilizing equation (2.31), (2.32), and (2.35) into equation (2.34), we

can re-arrange equation (2.34) to get a critical level of entry cost, k^t, as follows;

$$k \geq \sqrt{1-T}\left[a - P^w\left(1 + t_A + t_B\right)\right] \equiv k^t \qquad (2.36)$$

Equation (2.36) proposes that, for any given profit tax rate, there always exists a level

of entry cost, $k \geq k^t$ such that tariff revenue will always increase following a reduction

in tariff rate. The reason underlying the above result is that tariff reduction reduces the

marginal cost of each firm and leads to an increase in profit. Higher profit attracts

more firms to enter into the industry and they continue entering until profit-after-tax

equals to the entry cost. This will lead to increase in import demand of intermediate

input and will consequently increase tariff revenue. However, tariff revenue would

fall for all $k \in \left(0, k^t\right)$.

Second, Haque and Mukherjee (2005) establish the condition under which the

reduction in tariff revenue can be compensated for by an automatic increase in

industry profit for all entry costs $k \in \left(0, k^t\right)$ and leaving the profit tax rate, T,

unchanged. From equation (2.33), for a given profit tax, when tariff is reduced, gross

industry profit will increase and finally lead to an increase in profit tax revenue. Thus,

if an increase in profit tax revenue (while keeping T fixed) dominates the reduction in

tariff revenue for $k \in \left(0, k^t\right)$, the total revenue will increase. This can be shown by the

following equation.

$$P^w t_A Q_A^c + T \prod_A^c \geq P^w t_B Q_B^c + T \prod_B^c$$

$$\text{or,} \quad T\left(\prod_A^c - \prod_B^c\right) \geq P^w\left(t_B Q_B^c - t_A Q_A^c\right) \qquad (2.37)$$

Using the expressions for $\prod_A^c = N_A \pi_{iA}^c$ and $\prod_B^c = N_B \pi_{iB}^c$ and utilizing equation (2.35), we can re-arrange equation (2.37) to get a critical level of the entry cost (k^{TR}) in which, for any value beyond this critical level, the government does not need to take any compensatory measure by raising profit tax. This can be shown by the following equation;

$$k \geq \frac{\sqrt{1-T}\left[a - P^w\left(1 + t_A + t_B\right)\right]}{T + \sqrt{1-T}} \equiv k^{TR} \tag{2.38}$$

where $k^{TR} < k^t$.

Equation (2.38) proposes that, for any given profit tax rate, T, there always exists a level of entry cost, $k \in [k^{TR}, k^t)$, such that tariff revenue will decline but total revenue will increase following a reduction in the tariff rate because an increase in profit tax revenue dominates the reduction in tariff revenue.

Last, Haque and Mukherjee (2005) consider the case where $k \in [0, k^{TR})$. From equation (2.38), it is very obvious that for any $k < k^{TR}$, total revenue decreases since an increase in profit tax revenue cannot offset the reduction in tariff revenue as a result of the reduction of the tariff rate. In this case, the government can make up the shortfall in its revenue by raising the profit tax rate from T_B to T_A. The revenue recovered can be achieved only if an increase in the industry's profit tax revenue is higher than the shortfall in tariff revenue. This can be presented as;

$$T_A \prod_A^c - T_B \prod_B^c \geq P^w \left(t_B Q_B^c - t_A Q_A^c\right) \tag{2.39}$$

Using the expressions for $Q_A^c = N_A q_{iA}^c$, $Q_B^c = N_B q_{iB}^c$, $\prod_A^c = N_A \pi_{iA}^c$ and $\prod_B^c = N_B \pi_{iB}^c$ and substituting them into equation (2.39), and assuming $k = 0$, equation (2.39) can be re-arranged as;

$$\sqrt{1-T_A}\sqrt{1-T_B}P^w(t_B-t_A)\left[a-P^w(1+t_A+t_B)\right]\leq 0 \qquad (2.40)$$

Equation (2.40) proposes that if the entry cost is zero, the condition would never hold since all the terms in the L.H.S. of (2.40) are positive. This means that if $k=0$, the government would never be able to compensate for the reduction in tariff revenue by imposing a higher profit tax. By continuity assumption, it can be argued that there exists an entry cost, say k^{TA}, such that for $k\in[k^{TA},k^{TR})$, government can compensate for the reduction in tariff revenue by imposing higher profit tax.

Thus, it can be concluded that for entry cost $k\in[0,k^{TA})$, the government can never compensate revenue loss by imposing a higher non-distortionary profit tax. For entry cost $k\in[k^{TA},k^{TR})$, the reduction in tariff revenue following a reduction in the tariff rate can be compensated for by an increasing rate of profit tax. For entry cost $k\in[k^{TR},k^t)$, tariff revenue decreases but total revenue increases as an increase in profit tax revenue dominates the reduction in tariff revenue. For entry cost $k\geq k^t$, both tariff revenue and profit tax revenue increase without raising the rate of profit tax.

2.4. Summary and Conclusion

In this chapter, we have surveyed the literature relating to the strategies to offset revenue shortfall from trade tax revenue loss following the reduction of a tariff which provides a useful framework to analyze revenue implication of trade liberalization.

Generally, there are two types of models dealing with this issue. The first type of model develops a more practicable strategy to combine a tariff cut with the reform of a broad-based consumption tax, which will consequently leave consumer price unchanged and increase both welfare and public revenue. With this model, a small

open economy is considered with three related sectors including a representative household, a perfectly competitive production sector, and a government. The model considers the reduction of tariff in tradable commodities which is combined with a point-for-point increase in the domestic consumption tax. A point-for-point adjustment of the consumption tax is needed to exactly offset the impact of the tariff reduction on the consumer price. The model does not only make a first attempt to offer a formal theory of policy reform to offset the loss of revenue caused by tariff reduction, but it also provides a remarkably simple and practicable way to reap the efficiency gain from tariff reduction while improve the government's revenue position. However, the assumption underlying the model is perfect competition which is far from the real economy. In addition, the model cannot be extended to deal with the reduction of tariffs on intermediate goods used to produce tradable goods since it is not possible to offset the tariff reduction by increasing consumption tax without affecting the consumer price.

The second type of model examines the reduction of a tariff on an intermediate input because trading in intermediate inputs accounts for a large share in world trade. The model investigates whether the government can make up a shortfall in revenue if the government reduces the tariff on an intermediate input under imperfect competition, while the make up by using profit tax must ensure that both consumers and producers must be better off in the post-liberalization period. The model shows that only when the industry is a monopoly can it be certain that raising the profit tax alone will generate enough revenue to make up for the shortfall following the tariff reduction. This strategy can also ensure that consumers and producers are better off in the post-liberalization period as a result of an increase in welfare. However, a model dealing with product differentiation shows that there always exists degree of product

differentiation such that the government can achieve these objectives for any finite number of firms in the industry. The model suggests that when the products are sufficiently differentiated, each firm becomes a near monopolist for its products and the government can use higher profit tax revenue to offset the shortfall of tariff revenue. A further developed model dealing with the entry costs shows that the possibility that the government can use a profit tax as a compensatory measure for the loss of tariff revenue may alter depending on the range of entry cost, from high to low. The model shows that a sufficiently large entry cost will generate higher tariff revenue and profit tax revenue due to the entry of new firms into the industry, and hence the market itself will compensate for any shortfall in revenue as a consequence of the tariff reduction and the government does not need to depend on any other forms of taxation to maintain its total tax revenue while making both consumers and producers better-off in the post-liberalization period. However, with a low entry cost, the government would never be able to compensate the reduction in tariff revenue by imposing higher profit tax.

Chapter 3

TRADE LIBERALIZATION AND
TRADE PERFORMANCE IN THAILAND

3.1. Introduction

The impact of trade liberalization on the volume of trade in developing countries remains an unsettled question in economics, although a number of related literatures have been recently studied (see, for example, Mouna and Ahmad Reza (2001); Thomakos and A. Ulubasoglu (2002); Santos-Paulino and Thirlwall (2004); Pacheco-Lopez (2005); Pacheco-Lopez and Thirlwall (2006); Wu and Zeng (2008)). Within this body of knowledge, numerous effort has been gone into estimate the import and export demand functions for many developing countries and the results have been mixed. This is unfortunate since import and export elasticities are generally highly dependent on income, relative prices, and trade policy in particular. The analysis of import demand and export demand is necessary to understand the effects of trade liberalization may have a wide range of effects on a country's economy. For example, if trade liberalization policies induce a higher volume of imports than exports, then this may adversely affect the balance of payments of the country in question. Given such an adverse influence, it is thus important to establish import and export demand functions. This chapter seeks to estimate the likely impact of trade liberalization policies on the volume of imports and exports using aggregated import and export demand functions in Thailand for the period 1960 to 2007.

This chapter has two main purposes. In the first place, within the international trade literature, it is generally found that trade relationships fluctuate over time because many macroeconomic variables, which determine trade relations, are non-stationary in nature. In addition, trade relationships are subject to both gradual and sudden changes over time (Goldstein and Khan, 1985). Gradual changes are regarded as changes in the macroeconomic environments which potentially have an impact on international trade in long term, such as the process of economic development, the

growth of the country, and the consequences of changes in government trade policies. Sudden changes are regarded as changes in macroeconomic variables which have an immediate effect on international trade, such as fluctuations in exchange rates and a substantial increase in oil price. Considering these concerns, our interest is to investigate whether there exists a long-run relationship between trade and its major determinants. A thorough understanding of the determinants behind imports and exports is necessary for policy makers to formulate appropriate trade policy.

The second aim of this chapter is to analyze the impact of trade liberalization on the volume of imports and exports in Thailand. Since 1960, many developing countries have switched from a closed economy to a more opened economy by inducing free trade policies in the hope that liberalization will bring an improvement on overall economic performance and address balance of payments difficulties.[3] In line with this general trend, Thailand has formally introduced trade liberalization policy since its accession to the AFTA in 1992 and the WTO in 1995, though its tariffs have been gradually reduced over the time. By opening the country, Thailand primarily hopes to achieve better export performance and hence alleviate the ongoing trade deficit problem. Theoretically and empirically, trade liberalization is generally found to be positively associated with the volume of imports, while it does not lead to an increase in the volume of exports in the same proportion. From the UNCTAD Trade and Development Report 1999, trade liberalization has often contributed to a widening of the trade deficit in developing countries in general. For most developing countries, the average trade deficit in the 1990s was higher than in the 1960s-1970s by approximately 3-5 percentage of GDP. However, in the case of Thailand, it is found

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[3] This is based on the history of the GATT in which its second phase (lasted from 1959 to 1979) and third phase (lasted from 1986 to 1993) and the replacement of the WTO, have focuses on the reduction and elimination of tariffs.

that the trade balance in the post-liberalization era has improved rather than worsened. For almost all years in the post-liberalization period, the volume of exports has exceeded the volume of imports. Still, a substantial increase in the volume of exports since the mid 1990s, which overwhelms an increase in the volume of imports, is mainly due to the currency depreciation after Asian financial crisis. Accordingly, in this chapter we examine whether trade liberalization has had any impact on the import and export performance of the Thailand economy.

Thus, with this background, the aims of this chapter are to assess empirically the major determinants of import and export demand functions in Thailand using cointegration technique to estimate the long-run equilibrium relationship and error-correction model to examine the dynamic behaviour. We, then, aim to estimate the income and price elasticities from both import and export demand functions. Finally, we need to ascertain the impact of trade liberalization on the volume of imports and exports in both the short run and the long run.

The rest of this chapter is divided into five main sections. Section 2 provides a comprehensive description of Thailand's trade profile and its trade policies as well as background information on the characteristics of Thailand's imports and exports over the studying period. Section 3 briefly reviews the related theoretical literature, and outlines the empirical studies on import and export demand function. Section 4 deals with model specification, data sources, and methodology used in this study. Section 5 discusses the results of the estimation procedures. The chapter ends with some brief summaries and concluding remarks in section 6.

3.2. Thailand's Import and Export and Trade Policies

Thailand's International Trade Sector

Since 1960, international trade has become more substantial in terms of its share of Thailand's Gross Domestic Product (GDP). As shown in Figure 3.1, trade (defined as the summation of imports and exports) as a percentage of GDP has steadily increased over time. From only 33 percent of GDP in 1960, trade accounted for almost 150 percent of GDP in 2005, though it went down to approximately 130 percent of GDP in 2007. Obviously, the international trade sector has become increasingly important for Thailand.

Figure 3.1: Trade as a Percentage of GDP
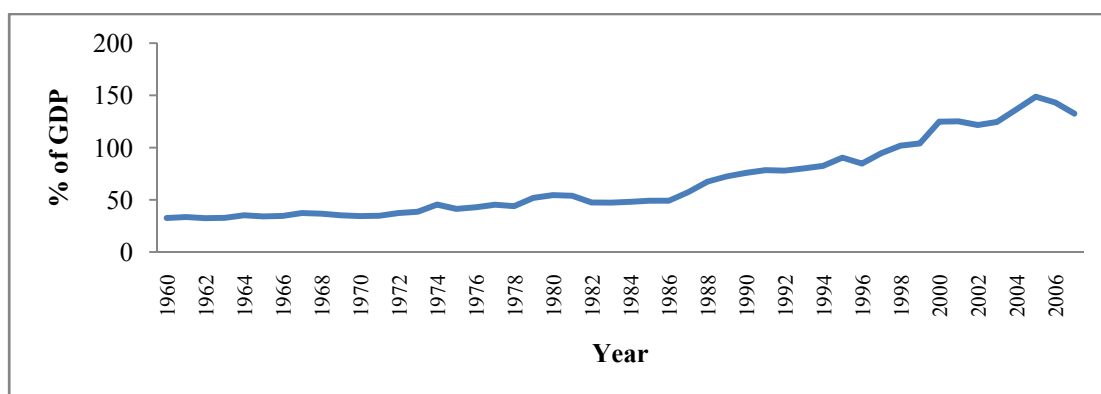
Source: World Bank; World Development Indicators (December 2008)

From Figure 3.2, trade in both goods and services have shown impressive rates of growth. The proportion of trade in goods to GDP rose from only about 30 percent in 1960 to approximately 105% in 2007, reaching its peak about 122% in 2005. The proportion of trade in services to GDP also rose gradually from only 3 percent in 1960 to 27% in 2007.

Figure 3.2: Trade in Goods and Services as a Percentage of GDP
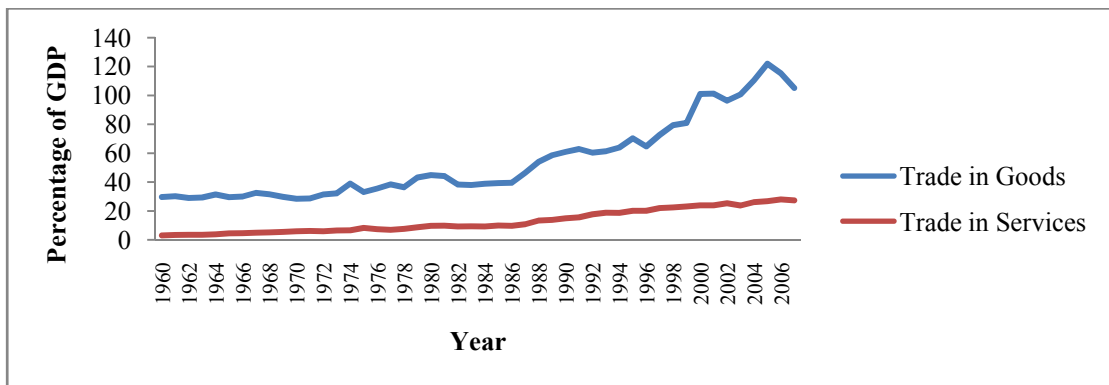
Over the studying period, the structure of Thailand's exports has considerably changed. From Figure 3.3, agricultural exports began to decrease in the early 1960s and have declined substantially for the whole period, while manufactured exports began to increase in the late 1960s and have dramatically risen since then. In 1960, agricultural exports accounted for almost 40 percent of merchandise exports, while manufactured exports only made up 2 percent. Thailand started promoting export-oriented industries in the early 1970s. Exports of manufactures goods have turned out to be higher than exports of agricultural goods since 1975. In 2007, manufactured exports reached the highest point, accounting for about 80 percent of merchandise exports, while agricultural raw materials exports, decreasing over the period, computed only 5 percent. This sharp rise in manufactured exports and fall in agricultural exports is another remarkable feature of Thailand's exports.

Figure 3.3: Share of Agricultural and Manufactures exports in Merchandise exports
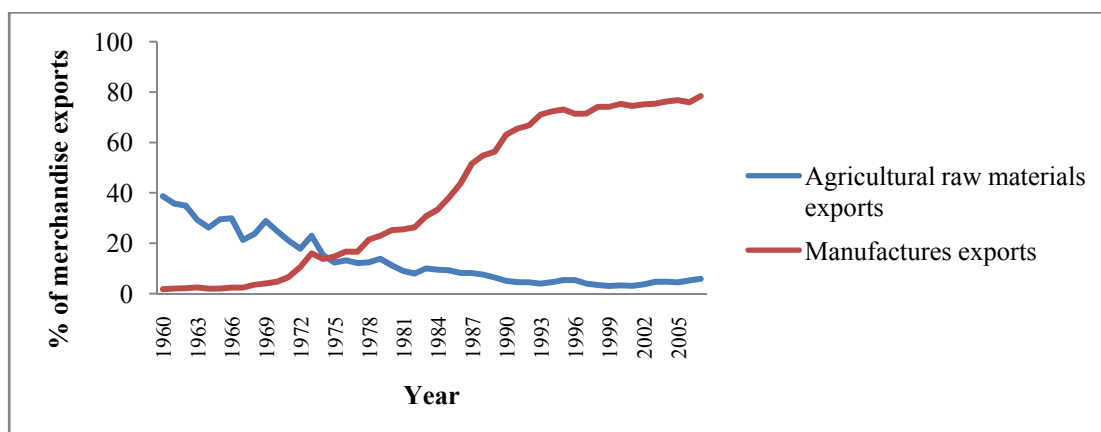
Source: World Bank; World Development Indicators (December 2008)

Considering imports, from Figure 3.4, it is found that imports of manufactured goods are much higher than imports of agricultural products. Although Thailand adopted an import-substitution policy in 1958 and switched from import-substitution industrialization to export-oriented industrialization in later years, imports of inputs, materials, and capital goods show no obvious sign of declining. In average, manufactured imports accounted for approximately 70 percent of merchandise imports, whereas agricultural imports made up only 3 percent of merchandise imports. This reflects the fact that Thailand is a big importer of manufactured products in which these products are needed in the production process of medium to high-technological goods. It also reflects the fact that Thailand has a high consumption in imported luxury goods.

Figure 3.4: Share of Agricultural and Manufactures imports in Merchandise imports
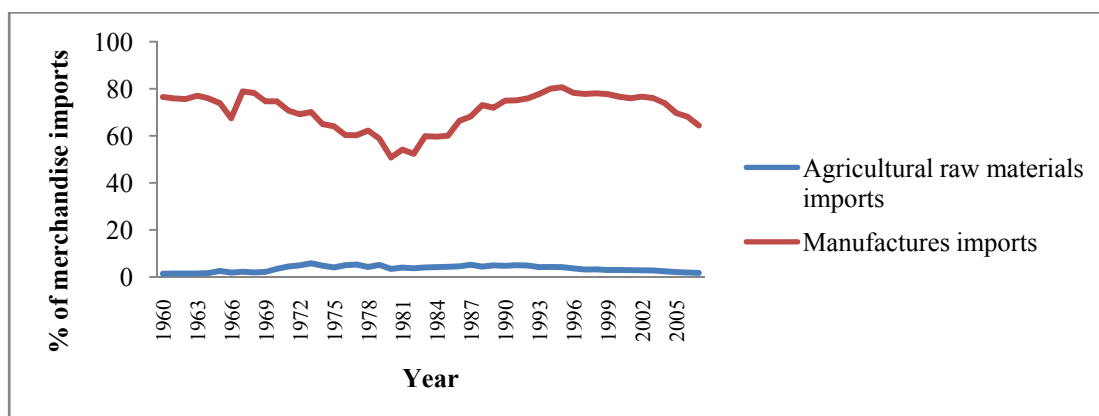
Figure 3.5 provides the picture of Thailand's imports and exports from 1960 to 2007. Before 1997, imports exceeded exports in almost all years. The main reason is that Thailand's exports are highly dependent on the imports of raw materials, machinery, and crude oil. In addition, the high consumption of imported luxury goods, when the economy was booming, resulted in the high demand for imported goods.[4] However, it is very obvious that exports substantially increased during 1997 and 1998, while imports slightly declined in 1998. Exports jumped from 39 percent of GDP in 1996 to 48 percent of GDP in 1997 and 59 percent of GDP in 1998. A substantial increase in exports was mainly due to the currency depreciation after the financial crisis in 1997. The majority of the growth in exports over the past decade was in manufactured goods, particularly high-tech products and the major source countries being Japan and NAFTA (North American Free Trade Agreement) countries, especially United States

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[4] According to Siamwalla (1999) and Warr (2005), we can divided Thai economy into 4 sub periods including;

  I. 1960-1985 (Pre-boom); is the period that Thai economy got its foundation right by investing in physical infrastructure which later help made economic growth high and stable. However, there was still high macroeconomic uncertainty.
  II. 1986-1996 (Boom); is the period that Thailand had an extraordinary high economic growth.
  III. 1997-1998 (Crisis); is the period that Thailand and Many ASEAN countries encountered with economic and financial crisis.
  IV. 1999-Present (Post-crisis); is the period that Thailand has recovered and challenged with world economic fluctuation.

of America. Due to the export jump in 1997, imports have turned out to be lower than exports from that year. However, the impact of currency depreciation on imports seems to be only one year after the crisis. Since 1999, imports have risen continually, as usual. Much of the increase in imports is in raw materials, intermediate goods, and capital goods, such as mineral and metal products, chemicals and plastic materials, electronic parts, and industrial machinery, industrial tools and parts, which are required in the production process of exports, rather than consumer goods and a substitution for domestic production. The main import sources of countries are Japan, United States, and China.

Figure 3.5: Imports and Exports of Goods and Services
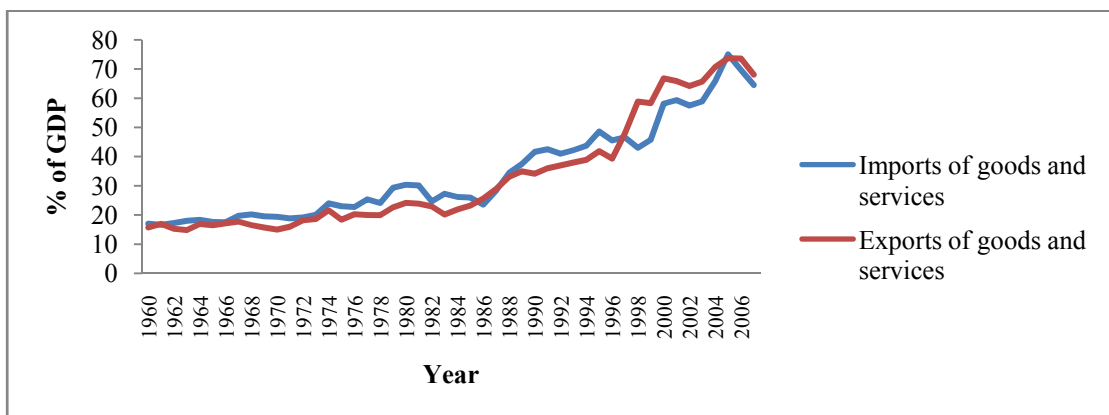
Source: World Bank; World Development Indicators (December 2008)

From Table 3.1, it can be seen that the balance of trade has made the greater contribution to the current account position. This, again, reflects the importance of the international trade sector in Thailand. From 1975 to 1996, Thailand suffered from a trade deficit, and hence a current account deficit in almost all years. The impact of currency depreciation was immediately seen in the trade balance and the current account. In 1997, trade balance turned out to have a surplus after ten years of a deficit. In 1998, net trade surplus jumped to over 16,000 million US dollars, accounting for

approximately a 10-fold increase from previous year. After 1996, Thailand has a trade

surplus, although the surplus has dropped in some years.

Table 3.1: Details in Current Account of Thailand, 1975-2007

Year	Million US$		
	Net current transfers	Net income	Net trade in goods
1975	80.67	10.99	-672.69
1976	46.86	-53.68	-193.14
1977	39.51	-38.14	-783.97
1978	40.13	-148.22	-858.37
1979	58.86	-277.87	-1,550.34
1980	210.14	-229.31	-1,902.47
1981	167.52	-502.43	-2,028.95
1982	183.09	-514.56	-730.56
1983	277.78	-227.09	-2,861.12
1984	174.97	-440.24	-1,897.74
1985	165.24	-597.13	-1,332.14
1986	224.73	-816.71	388.38
1987	223.77	-829.67	-424.46
1988	236.28	-894.37	-2,074.42
1989	246.25	-780.52	-2,916.11
1990	213.30	-853.39	-6,750.84
1991	260.90	-1,075.39	-5,989.18
1992	645.60	-1,707.72	-4,161.02
1993	749.64	-1,406.25	-4,288.13
1994	1,127.56	-1,730.80	-3,699.83
1995	486.51	-2,113.63	-7,968.06
1996	759.72	-3,385.33	-9,488.17
1997	478.81	-3,480.24	1,571.58
1998	414.39	-3,567.14	16,237.90
1999	353.18	-2,990.96	14,013.30
2000	585.86	-1,381.30	11,700.61
2001	600.73	-2,457.16	8,543.46
2002	603.42	-3,663.36	9,043.92
2003	940.93	-4,973.24	11,174.59
2004	2,131.49	-6,120.42	10,785.24
2005	3,003.63	-7,173.50	3,387.69
2006	3,368.01	-6,843.50	13,843.67
2007	3,938.05	-5,709.98	25,959.75

Source: World Bank; World Development Indicators (December 2008)

Figure 3.6 shows the declining trend in both Thailand and the world's average tariff

rates. In 1960, Thailand's average tariff rate was initially very high, approximately

70%, while the world's tariff rate was about 55%. From Figure 3.6, the average tariff rates of both Thailand and the world have gradually decreased over time. During the mid 1980s to the early 1990s, the gap between Thailand's average tariff rate and the world's tariff rate was very high because the country implemented the protection policies for the domestic substitutes industries. However, in 1994, there was a steep decline in Thailand's average tariff rate, from approximately 46% in 1993 to 23% in 1994. This is mainly due to an agreement made with ASEAN and GATT for the country to become a member of AFTA in 1992 and the WTO in 1995. Since then, Thailand's average tariff rate has been only little higher than that of the world. In 2007, Thailand's average tariff rate was reduced to only 10%, while the world's average tariff rate was recorded at 8%.

Figure 3.6: Trends in Average Tariff Rates
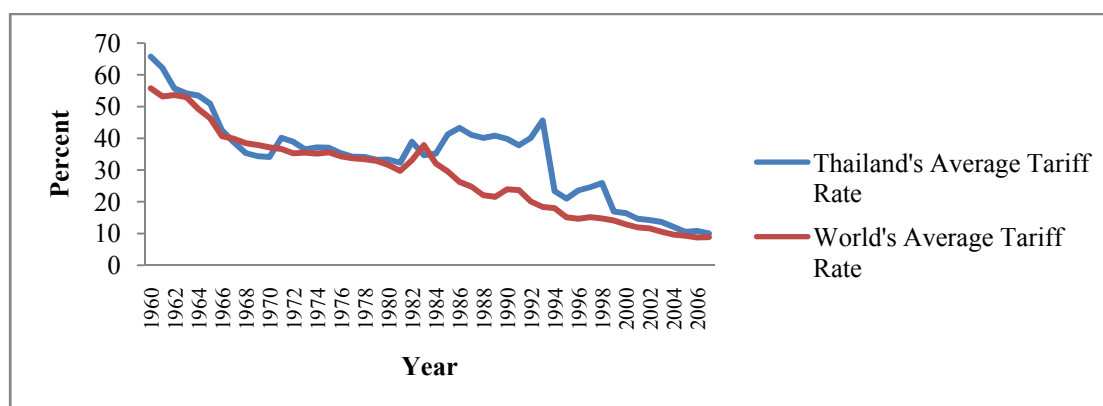
Source: United Nations Conference on Trade and Development (UNCTAD), 2007

In order to investigate the trend between imports and the tariff rate, we plot the graph of the share of imports in GDP against Thailand's average tariff rate. Figure 3.7 shows that there is a linkage between the country's average tariff rate and the share of imports in GDP. By looking at the diagram, there is evidence of a negative relationship between the two variables.

Figure 3.7: Thailand's Import Share of GDP and Thailand's Average Tariff Rate
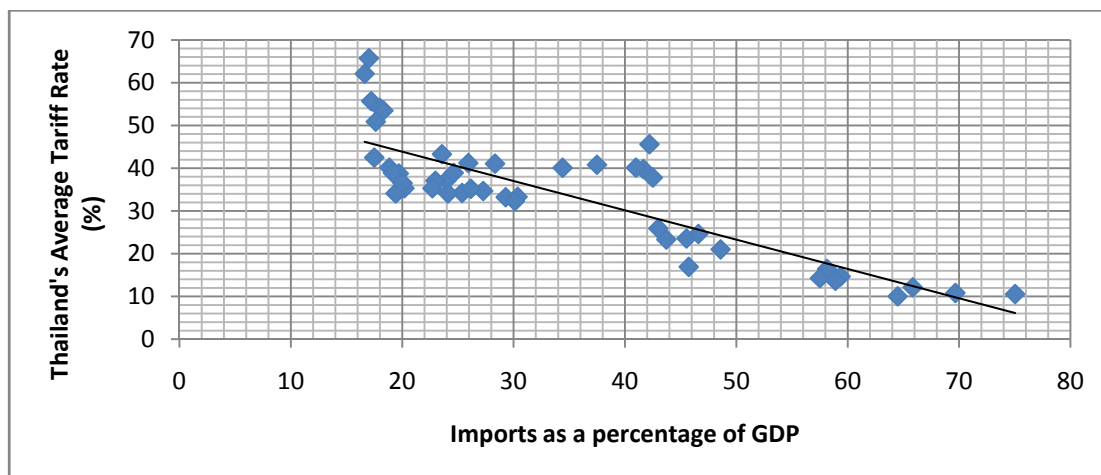
Source: WDI and UNCTAD

Trade liberalization was not only associated with the country's import share, but there also seemed to be a relationship with Thailand's export share. Similarly, we plot the graph of the share of exports in GDP against world's average tariff rate. Figure 3.8 shows that world's tariff reductions seemed to be associated with an increase in the share of export in GDP.

Figure 3.8: Thailand's Export Share of GDP and World's Average Tariff Rate
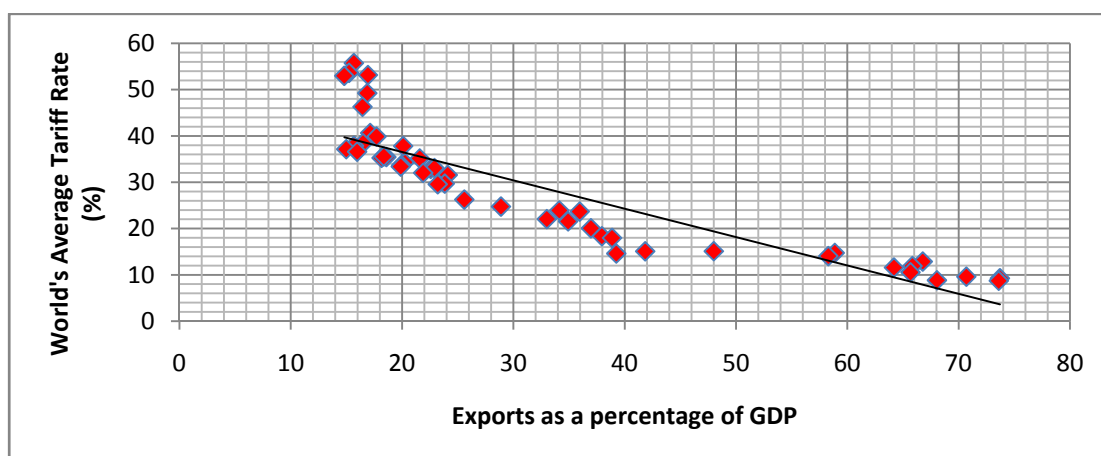
Source: WDI and UNCTAD

Having described the trade characteristics of Thailand, we now give a brief outline of Thailand's trade policy.

Thailand's Trade Liberalization Policy

By implementing an open trade regime in its international trade, Thailand has been recognized as one of the fastest growing economies in the world. With the global trend, Thailand has used many trade measures as instruments to strengthen the competitiveness of domestic industries to compete in the world market. By pursuing the policy of freer trade-led-development, Thailand has participated in many international forums such as the Uruguay Round of GATT, the Asia-Pacific Economic Cooperation forum (APEC), and the ASEAN Free Trade Area (AFTA). Another important step to free trade was its accession to the World Trade Organization (WTO) on 1 January 1995. Since then, Thailand has implemented various measures in compliance with its commitments in the WTO. The tariff system has been restructured while many laws have been enacted in accordance with the Trade Related Aspects of Intellectual Property Rights (TRIPs) agreement. Most of the goods and services sectors are going through the liberalization process. Many quantitative restrictions on various types of agricultural products have been eliminated and replaced by tariff measures in line with the procedure prescribed in the agriculture agreement. In short, Thailand has attempted to open its economy by implementing many laws and regulations as its part of commitment to the WTO. As stated earlier, Thailand is also participating in many regional cooperation schemes. As one of the countries in the Asia-Pacific region, Thailand has closely followed development in APEC and tried to ensure that this forum is consistent with multilateralism, the concept created by the WTO. As one of the leading nations in ASEAN, Thailand has played an important role in the establishment of the ASEAN Free Trade Area (AFTA) which encourages free trade and cooperation among neighbouring countries in this region.

a) The Uruguay Round and the WTO

With the success of the Uruguay Round negotiation, Thailand believed that trade negotiations under GATT, the establishment of the WTO and the improvement of international trade rules and negotiations would create a more stable economic environment, greater economic development, and higher income from trade. By being involved in the Uruguay Round and the creation of the WTO, the main objectives are to assure greater trade liberalization through the reduction and elimination of both tariff and non-tariff barriers, to improve the effectiveness of the rules and regulations governing international trade, to bring about fairness and transparency in the market, and to prevent new trade barriers that may obstruct international trade. With these beliefs, Thailand became a member of GATT in October 1982 and the 59th founding member of the WTO on 28 December 1994.

Under the WTO agreements, Thailand has to reduce an average of 24 percent of tariffs on agricultural products. The country also needs to eliminate non-tariff barriers for 23 agricultural products and convert these NTBs into tariff measures in accordance with the tariffication process. In addition, tariffs of over 4,000 items of industrial and fisheries products have to be reduced during this process and this results in an average of 28 percent of tariff reduction.

b) Asia-Pacific Economic Cooperation (APEC)

Created in 1989, Asia-Pacific Economic Cooperation (APEC) is aim to improve cooperation, trade, and investment in the region. In the context of APEC, liberalization, trade and investment facilitation, and technical cooperation in the APEC region are considered as a priority. Under APEC, the Free Trade Area of the Asia-Pacific Region (FTAAP) has been proposed by

the member nations in which its scope is not only focusing on the reduction of tariffs and other trade restrictions, but also the creation of a free trade zone. The development of FTAAP is now under study and may take many years to reach the conclusion. Considering Thailand, its policies toward APEC are made compatible with its commitment under the WTO. Under the 1994 Bogor declaration, Thailand has to reduce its tariffs to below 5 percent by 2020.

c)   The ASEAN Free Trade Area (AFTA)

Thailand is one of the founding members of ASEAN, which later established the ASEAN Free Trade Area (AFTA). The agreement was signed in Singapore on 28 January 1992. The main objective in the establishment of AFTA is to reduce and eliminate intra-regional tariffs on all manufactured items including capital goods and processed agricultural products to 0-5 percent and remove non-tariff barriers over 15 years, starting from the beginning of 1992 and finalizing by the end of 2008. As for Thailand, there are two packages of tariff reductions under AFTA which have been commenced on 15 February 1992. For the first package, from 1992, Thailand has reduced the tariff rates up to 30 percent on all manufactured items imported from ASEAN, except for certain sensitive products such as petrochemical, plastic products, and televisions. For the second package, from the end of 1994, Thailand has to reduce further tariff rates of products under the Fast Track Programme in accordance with the tariff reduction schedule as follows;

From 26-30 percent to 25 percent

From 21-25 percent to 20 percent

From 15-20 percent to 15 percent

From 11-14 percent to 10 percent

From 6-10 percent to 5 percent

However, under the meeting held in September 1994 in Chiang Mai, in view of the present economic challenges and the conclusion of the Uruguay Round multilateral negotiations, ASEAN has agreed to shorten the time frame that was initially set from 15 to 10 years. That is all reduction, elimination and removal of tariff and non-tariff barriers must be accomplished by 1 January 2003 instead of 2008.

In summary, as Thailand's economic performance has become more increasingly dependent on international trade, the country has joined a number of trade agreements with other countries. With the hope to achieve the benefit of attaining economic prosperity, Thailand has realized the importance of liberalization and open trade to the country's development.

3.3. General Review: Empirical Studies on the Relationship between Trade Liberalization, Imports, and Exports

For several decades, the determinants of trade, the behaviour of import and export demand functions have been analyzed in many different studies. Among an impressive range of empirical studies, the most important works include Houthakker and Magee (1969), Khan (1974), Murray and Ginman (1976), Salas (1982), Melo and Vogt (1984), Goldstein and Khan (1985), Bahmani-Oskooee (1986), Sarmad (1989), Clarida (1994), Carone (1996), Sinha (1997), Senhadji (1998), Thomakos and Ulubasoglu (2002), Aydin *et al* (2004), Santos-Paulino and Thirlwall (2004), Dutta and Ahmed (2004), Pacheco-Lopez (2005), Dash (2006), Huseyin (2006), and Aliyu (2007). For instance, Houthakker and Magee (1969) investigate demand elasticities for both imports and exports with respect to income (GNP in constant prices) and

prices for the United States comparing with a number of developed countries. Using the ordinary least-squares (OLS) method and annual data over the period 1951-1966, they found that the income elasticity of demand for imports for the U.S. and other developed countries is about the same, while the income elasticity of demand for exports for the U.S. is relatively low, resulting in trade balance problem as the world grows. The price elasticities estimated for all countries appeared to be very low. Khan (1974) examined the effect of prices on trade flow by estimating import and export demand functions using annual data for 15 developing countries over the period 1951-1969. By using two-stage least-squares method, he found that prices have a significant and substantial impact on both import and export demand for all countries used in his study. Murray and Ginman (1976) estimated the traditional aggregate import demand for the U.S. over the period 1950 to 1964 by using quarterly data. They found that the income elasticity varied from 0.96 to 1.94 whereas the import price elasticity was approximately equal to one. Salas (1982) investigated the structure of Mexican imports for the period 1961 to 1979 by focusing on private sector imports. He also determined the possibility of a structural break in the import demand functions for the period 1961-1977 and 1961-1979, since Mexico has changed its trade policies from traditionally protective international trade policies from 1976. He found that imports of Mexico were highly dependent on relative import price but had a very low response to income changes. The price elasticity was improved when the country adopted liberalization policies, while the income elasticity was dropped in the liberalized period. Melo and Vogt (1984) estimated real income and relative price elasticities of demand for imports of Venezuela by using disaggregated annual data covering the period 1962 to 1979. At the aggregate level, the price elasticity was very high (-2.086), comparing with other studies. The income elasticity was also found to be

higher than unity (1.879). At the disaggregated level, income and price elasticities for most goods were higher than unity, except for manufacturing imports which both price and income were highly inelastic. Goldstein and Khan (1985) provided a comprehensive survey of the literature on the determinants of trade focusing on the role of income and prices and estimated import demand function for 14 developed countries. They found that income seemed to have higher impact on import demand than prices. Bahmani-Oskooee (1986) used quarterly data from 1973 to 1980 period and provided the estimates of aggregate import and export demand functions for seven developing countries. He also provided estimates of price and exchange rates response patterns by introducing a distributed lag structure on the relative prices and on the effective exchange rate. After estimating import and export demand functions using the Almon procedure, it is found that developing countries generally were price inelastic, but income elastic concerning demand for imported goods. However, both income and price appeared to be highly inelastic for all countries under study. Sarmad (1989) estimated import demand functions for total imports of Pakistan for the period 1959 to 1986 at both the aggregate and disaggregate levels. He found that the aggregate elasticities for both income and relative price were lower than unity (0.923 for income elasticity and -0.415 for price elasticity). At the disaggregate level, the income elasticities ranged from 1.4 to as low as 0.45, depending on the type of import goods. Similarly, the disaggregate price elasticities ranged from -1.2 to -0.42.

More recent studies have applied cointegration and error-correction technique in the study of import and export demand functions. For example, Clarida (1994) derived an econometric equation used for estimating the parameters of the demand for imported nondurable consumer goods of the U.S. by using quarterly data covering the period 1967 to 1982. He estimated a long-run equilibrium relationship between consumer

goods imported, relative price of imports, and consumption of domestically produced goods and found that all these variables are cointegrated. The long-run price elasticity of import demand was estimated to average -0.95, while the elasticity of import demand with respect to a permanent increase in real spending was equal to 2.15. Carone (1996) estimated aggregate import demand for total and non-oil merchandise imports of the U.S. over the period 1970 to 1992 using cointegration and error-correction approaches. He found a statistically significant long-run relationship between the volume of imports and real income and relative prices. Sinha (1997) estimated import demand function for Thailand by using annual data covering the period 1953 to 1990 and applying cointegration and ECM approaches. He found that both price and income were inelastic in the short run. Relative import price was still inelastic in the long run while income turned out to be very elastic in the long run. Senhadji (1998) estimated a structural import demand function for 77 developing and industrial countries from 1960 to 1993 by using cointegration and the fully modified ordinary least squares estimator (FMOLS). He found that imports seem to be inelastic in the short run but are more responsive to relative prices in the long run (average short-run price elasticity is -0.26, while average long-run price elasticity is -1.08). Similarly, he found that imports respond more to income in the long run than in the short run (average long-run income elasticity is equal to 1.45, whereas average short-run income elasticity is equal to 0.45). He also found that industrial countries tend to have higher income elasticities and lower price elasticities than developing countries. Aydin *et al* (2004) developed a single equation and a vector auto-regression framework and used quarterly data covering the period 1987 to 2003 to estimate import demand for the Turkish economy. They found that both long-run and short-run income elasticities were higher than unity (1.999 and 1.188 for long-run and short-

run, respectively), while both long-run and short-run price elasticities were lower than unity (-0.402 for long-run and -0.527 for short-run). Dash (2006) investigated the behaviour of the import demand function for India using annual data from 1975 to 2003. Economic activity (GDP), import price, foreign exchange reserves, and price of domestically produced goods were included as determinants of aggregate import demand. It is found that the aggregated import volume was cointegrated with all variables stated earlier and the import demand of India was largely explained by price of domestically produced goods, GDP, lag of import and foreign exchange reserves. Huseyin (2006) estimated an aggregate demand function for Turkey using monthly data during the period 1994 to 2003 and applied cointegration and error correction modeling approaches to investigate the long-run relationship and the dynamics of short-run adjustment process. It is found that there was a unique equilibrium relationship existing among the real quantity of imports, relative prices, and real GNP. The value of income elasticity of import demand was lower than price elasticity, suggesting that Turkey's imports were sensitive more to import price changes than to income changes. In addition, the speed of adjustment to long-run equilibrium was not very high. Aliyu (2007) examined the determinants of import and export demand functions for Nigerian economy using data covering the period of 1970 to 2004. It is found that current income had very little influence on both imports and exports while lag income highly affected both, especially on export demand. Nigeria's exports expanded substantially because of very high income elasticity. In addition, the price elasticity of imports appeared to be higher than price elasticity of exports.

There are many studies investigating the role of trade liberalization on trade flow. The analysis was generally done by including the measures of trade liberalization into both import and export demand functions. For example, Thomakos and Ulubasoglu (2002)

analyzed the impact of trade liberalization on import demand of Turkish economy by using annual disaggregated data for the period 1970 to 1995 covering 26 industries. In order to analyze the impact of trade liberalization, they tested for different elasticities over "closed" and "open" economy periods, and found that the effects of the trade reforms of the 1980s were significant for a number of industries. The elasticities estimated from many types of products were found to have changed notably as a result of liberalization. Santos-Paulino and Thirlwall (2004) used panel data analysis to examine the impact of trade liberalization on exports, imports, and the balance of payments for 22 developing countries that have adopted trade liberalization policies since the mid-1970s. Using different techniques such as the fixed effects and generalized method of moments (GMM) for panel data analysis, they found that reductions in export and import duties had significantly affected the growth of exports and imports, with the impact on import growth greater. The impact of a more liberalized trade regime raised import growth by more than exports. They also found that liberalization increased income and price elasticities of both the demand for imports and for exports. However, trade liberalization increased the price elasticity of demand for imports greater than for exports, and hence the balance of trade was possibly deteriorated after trade liberalization. They also suggested that the impact of liberalization differed depending on the level of initial protection of the country. Dutta and Ahmed (2004) investigated the behaviour of Indian aggregate imports during the period 1971 to 1995. In order to capture the effect of the import liberalization policy on import demand, they included a dummy variable with a value 1 for 1992-1995, the liberalization period. They found that aggregate import volume was cointegrated with relative import prices and real GDP. In the estimated ECM, import prices, lags of real GDP and a liberalization dummy were found to be important determinants of import

demand function for India, with quite a slow speed of adjustment to equilibrium. Import demand in India was largely explained by real GDP but appeared to be less sensitive to import price changes, implying the noncompetitive nature of India's imports. An estimate of liberalization dummy was equal to only 0.14, showing little effect of import liberalization policy on aggregate import volume. Pacheco-Lopez (2005) investigated the impact of trade liberalization, during the mid 1980s from the participation of the North American Free Trade Agreement (NAFTA) on exports, imports, the balance of payments and growth in Mexico using annual data covering the period 1970 to 2000. In order to identify the long-run relationship between the dependent and independent variables, an autoregressive distributed lag (ARDL) estimation technique were adopted in his study. He used a liberalization dummy to capture the impact of trade liberalization. On export side, he found that export growth responded substantially to the growth of the U.S. economy, but the price elasticity of Mexican exports is quite low. NAFTA was found to have no impact on Mexican export performance. On the import side, he found that import growth responded substantially to both income and price changes. It is found that NAFTA had a significant positive impact on import growth.

3.4. The Model and Methodology

In this study, we firstly apply the traditional import (export) demand functions and then use the Autoregressive Distributed Lag (ARDL) model to estimate the short-run and long-run elasticities in Thailand's import (export) demand over the period 1960-2007. We also compare these estimates with the estimates obtained using cointegration techniques and an ECM.

3.4.1. The Model Specification and Equations

Although there is a large amount of literature on the import and export demand modelling in general, the question how import and export models are appropriately specified is still of interests. Although the specification of the models depend on a number of factors, Goldstein and Khan (1985) suggested that the most important things should be considered are the purpose of modelling exercise, the type of the good being trade, institutional framework under which trade takes place, and the availability of data. From trade theory, there are two basic models often used in the studies of international trade; model of perfect substitutes and model of imperfect substitutes. On one hand, perfect substitution model assumes perfect substitutability between domestic and foreign goods. Thus, under the key assumption of perfect substitution, a country could only be either an exporter or an importer of a traded good, but not both. Since this is not observed in the real world, the perfect substitution model is less popular in the empirical studies than the imperfect substitution model. However, the perfect substitution model is typically used in the case of highly disaggregate data set. On the other hand, the fundamental assumption underlying the imperfect substitution model is that neither imports nor exports can be considered perfect substitutes for the domestic products. This model is thus more realistic and is more suitable for the case of aggregate data.[5]

Regarding the demand-supply relationships in the export and import equations, theory suggests that one should emphasize the simultaneous relations between quantities and prices, and hence demand and supply of import (export) equations should be simultaneously solved in the system in order to avoid any possible biased results.[6]

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[5] See Goldstein and Khan (1985)
[6] See Stern, Francis and Schumacher (1976)

However, like many other studies, since we concentrate on the estimation of import and export demand equation, another important assumption must be applied to the supply relationships. Typically, it is assumed that the import and export supply price elasticities facing any individual country are infinite. The important advantage of this assumption is that it allows the estimation of the import and export demand equations by using single-equation method, in which the price variables are treated as exogenous variables. However, Goldstein and Khan (1978) pointed out the drawback of this assumption that although infinite price elasticity of supply may be justified in the case of import supply, it seems to be unreasonable in the case of the supply of exports of a small open economy. They argued that if the world demand for the goods from a certain small individual country substantially increases, the country will not be able to meet the demand without changing in price of exports (unless there exist large idle resources). Still, the assumption of infinite price elasticity is necessary for our analysis and must be hold in this study.

Following the relevant literature (see, for example, Houthakker and Magee (1969); Leamer and Stern (1970); Khan (1974); Goldstein and Khan (1985); Carone (1996); Bahmani-Oskooee and Niroomand (1998); and Santos-Paulino and Thirlwall (2004)), we use the standard import and export demand functions to analyze the impact of trade liberalization on the volume of imports and exports for Thailand. The standard specification of the import and export demand models is similar to any other demand model. The quantity of imports and exports demanded will be treated as endogenous variables while the relative price of imports (price of imported goods relative to the price of domestic goods), the relative price of exports (price of exported goods relative to the world export price), world's real income and country's real income will

be considered as exogenous variables. By assuming the price and income elasticities of demand are constant over time, the import function can be specified as follows:

$$M_t = A\left[\frac{P_M}{P_D}\right]_t^{a_1} Y_t^{a_2}$$
(3.1)

where M_t is the volume of imports at time t; A is a constant; $(P_M/P_D)_t$ denotes relative import prices at time t; Y_t is the level of country's income at time t.

There are still other assumptions underlying the imperfect substitute model. We assume that the import demand is always equal to the level of imports $(M_d = M)$ so that we are able to apply the demand function in our study. Another basic assumption is that, by using the relative price as a determinant, we assume that there is no money illusion, homogeneity implying in prices.[7]

Regarding the appropriate specification of import demand, there is no theory providing a specific functional form for this demand function. However, Thursby and Thursby (1984) tested specifications of import demand and concluded that the log-linear form is more desirable than the linear form. Other advantages of the logarithmic form are their convenience and the ease of interpretation.[8] Thus, following previous studies[9], taking the logs of the above function, the import function can be transformed into logarithmic form as follow:

$$\ln M_t = a_0 + a_1 \ln Y_t + a_2 \ln RPM_t + u_t$$
(3.2)

where RPM is the relative price. However, Goldstein and Khan (1976) have argued that if imports of the country are considered as the difference between consumption

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[7] See Carone (1996) for more details
[8] See Carone (1996)
[9] See Khan and Ross (1977) and Boylan et al. (1980) for example

and production of domestically produced import substitutes, production may rise faster (slower) than consumption in response to a rise (fall) in real income. Therefore, imports could fall (rise) as real income increase, resulting in a negative (positive) sign for income elasticity.

In order to capture the impact of trade liberalization on the import demand function, we modify the basic model by including Thailand's average tariff rates (TT) and a liberalization dummy variable (LIB). The dummy variable takes the value 1 from 1992 and 0 otherwise; this is based on Thailand joining the ASEAN Free Trade Area (AFTA) from 1992 and a member of the World Trade Organization (WTO) since 1995. We expect a negative coefficient for TT and a positive coefficient for the liberalization dummy. Thus, the augmented import demand function can be written as equation (3.3):

$$\ln M_t = a_0 + a_1 \ln Y_t + a_2 \ln RPM_t + a_3 \ln TT_t + a_4 LIB_t + u_t \qquad (3.3)$$

As for the export demand model, again following the literature, we assume that the main determinants of a country's exports are relative export prices and world income. Thus, we assume that the export demand function for each country can be represented as follows:

$$X_t = B \left[\frac{P_X}{P_{XW}} \right]_t^{b_1} W_t^{b_2} \qquad (3.4)$$

where X_t is the volume of exports at time t; B is a constant; $(P_X / P_{XW})_t$ is export price relative to world export price at time t; W_t is the level of world's income at time t.

Following the same approach used for the import demand function, the export demand function takes the following form after taking logs:

$$\ln X_t = b_0 + b_1 \ln W_t + b_2 \ln RPX_t + u_t \tag{3.5}$$

where RPX is the relative (export) price (to world export price). Generally, an increase in export prices relative to that of the rest of the world is expected to be harmful for a country's exports, resulting in a negative export price elasticity (b_1). Economic theory also suggests that an increase in the world income is related to increase in a country's exports, yielding a positive income elasticity (b_2).

Then, we modify the traditional export demand model by introducing our measures of trade liberalization; World's average tariff rates (TW) on one hand and a liberalization dummy variable (LIB) taking the value 1 from 1992 onwards on the other. Since trade liberalization is expected to be associated with a devaluation of the exchange rate, exports should increase after trade has been liberalized. Thus, we expect a positive coefficient for the liberalization dummy and a negative coefficient for TW. Thus, the augmented estimating equation can be written as equation (3.6)

$$\ln X_t = b_0 + b_1 \ln W_t + b_2 \ln RPX_t + b_3 \ln TW_t + b_4 LIB_t + u_t \tag{3.6}$$

3.4.2. The Data

In order to avoid any misinterpretation of the empirical results, this section provides the description of all variables appearing in the estimated equation. We have estimated our trade models using annual data covering the period from 1960 to 2007. Data are obtained from the IMF's *International Financial Statistics* (IFS) and World Bank, *World Development Indicators* (WDI). The data set consists of the following items:

Imports (M):

Imports of Goods and Services; constant 2000 US$. Source; World Bank, *World Development Indicators* (WDI), December 2008.

Exports (X):

Exports of Goods and Services; constant 2000 US$. Source; World Bank, *World Development Indicators* (WDI), December 2008.

Domestic Income (Y):

Thailand GDP; constant 2000 US$. Source; World Bank, *World Development Indicators* (WDI), December 2008.

World Income (W):

World GDP; constant 2000 US$. Source; World Bank, *World Development Indicators* (WDI), December 2008.

Relative Import Price (RPM):

Relative Import Price used in the import demand function is the ratio of import price to domestic price $\left(P_M / P_D \right)$, where P_M (Thailand's import price index) is defined as import unit values; and P_D (Thailand's domestic price index) is defined as consumer price indice. Both import unit values and consumer price indices are measured in index number form and the selected base year is 2000. The source of international price index data is IMF's International Financial Statistics (IFS), January 2009. IFS publishes these series (having the interpretation of implicit price deflators) for a wide

selection of countries all expressed in US dollars. The most recent base used in IFS for various countries is 2000 and is the base used in this study.

Relative Export Price (RPX):

Relative Export Price used in the export demand function is the ratio of export price to world export price $\left(P_X / P_{XW} \right)$, where P_X (Thailand's export price index) and P_{XW} (the world's export price index) are defined as export unit values of Thailand and the world, respectively. Both indices are measured in index number form and the selected base year is 2000. The source of export price index data is IMF's International Financial Statistics (IFS), January 2009.

Thailand's Average Applied Tariff Rates (TT):

Thailand's average tariff rates (unit; unweighted in percent) are calculated by the United Nations Conference on Trade and Development (UNCTAD). The calculation is based on unweighted averages for all goods in *ad valorem* rates, or applied rates, or MFN rates whichever data are available. Source; UNCTAD TRAINS database, 2007.

World's Average Applied Tariff Rates (TW):

World's average tariff rates (unit; unweighted in percent) are calculated by the United Nations Conference on Trade and Development (UNCTAD). The calculation is based on unweighted averages for all goods in *ad valorem* rates, or applied rates, or MFN rates whatever data are available for 169 countries. Source; UNCTAD TRAINS database, 2007.

Trade Liberalization Dummy (*LIB*) :

The dummy variable takes value of 1 from 1992 onward, the year which Thailand joined AFTA and later in 1995 becomes a member of WTO, and 0 otherwise.

3.4.3. The Methodology

The findings in the early cointegration literature that in regression models containing non-stationary I(1) variables, standard statistical inference is in general not valid, led to the widespread use of cointegration methods and ECMs in estimating short-run and long-run elasticities, instead of the traditional ARDL approach. However, in this study, in order to investigate the empirical relationship between imports (exports), domestic (world) real income, and relative import (export) prices and to examine the constancy of their relationship, especially in the light of trade liberalization, in terms of tariff reduction and the AFTA and WTO membership, we apply one of the traditional and the most widely used methods, known as the Autoregressive Distributed Lag (ARDL) model to study both long-run and short-run relationship between them. Unfortunately, there is a major limitation of applying the ARDL model when variables concerned are non-stationary. Regressions among such variables are often spurious unless the variables are cointegrated. In order to test for stationarity of time series data and the order of integration of variables, we apply two formal unit root tests. The details are described below.

a) Unit Root Tests

In a time series model, the presence of a unit root causes a violation of the assumptions of the classical linear regression model. A unit root means that the observed time series is not stationary. When non-stationary time series are used in a

regression model, one may obtain apparently significant relationships from unrelated variables. This phenomenon is called the spurious regression problem.

The first stage involves testing for stationarity of each time series variable. A test of stationarity of time series data that has become the most popular in econometric analysis is the unit root test. Dickey and Fuller (1979, 1981) provide a formal procedure to test for the presence of a unit root. In the DF test, it is assumed that the error term is uncorrelated. However, the DF test is only valid for an AR(1) process. In the case that the time series is correlated at higher lags, Dickey and Fuller have developed a test by adding lag differences of the time series, known as the Augmented Dickey-Fuller (ADF) test. The ADF test provides the appropriate tests statistics to determine whether a series contains a unit root, unit root plus drift, and/or unit root plus drift plus a time trend. In order to choose the optimum lag length for ADF test, Akaike and Schwartz Information Criteria (AIC and SIC, respectively) is normally considered. In this study, we consider only the lowest value of SIC.

Phillips and Perron (1988) have developed a more comprehensive theory of unit root nonstationarity by using nonparametric statistical methods to take care of the autocorrelation in the error terms without adding lagged difference terms. The test is similar to an ADF test, but it incorporates an automatic correction to the DF procedure to allow for autocorrelated residuals. The Phillips-Perron (PP) test usually gives similar conclusions as the ADF test but the calculation of the PP test statistics is more complex.

In this study, we test variables for their order of integration using both the Augmented Dickey-Fuller (1981) and Phillips-Perron (1988) tests for unit roots.

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Next, since the ARDL model assumes the existence of a unique long-run relationship among the variables, cointegration analysis should be used to establish the existence of such a relationship. Thus, we test for the existence of a long-run relationship between the volume of imports (exports), domestic (world) real income, and relative import (export) prices for the standard import (export) model. Later in the study, we add Thailand (World) average tariff rates for the augmented import (export) model as a measure for trade liberalization.

b) Cointegration Analysis

Although there is a number of methods for testing cointegration proposed in the literature, two methods including the Two-Step Approach proposed by Engle and Granger (1987) and the Full Information Maximum Likelihood Approach proposed by Johansen and Juselius (1990) are the most popular and widely used in time series analysis.

Engle-Granger (EG) Cointegration Test

Engle and Granger (1987) have proposed that if a linear relationship genuinely exists between two non-stationary variables, the error term should be stationary over time. However, if the error term is not bounded, the variables are not related - they are not cointegrated. The first step of the EG cointegration test is to run a standard OLS regression on the variables, which are assumed to be I(1), and obtain the residuals. The second step is to perform an ADF test on the residuals to see if they have a unit root. If a unit root is not present, the residuals are stationary and the variables are cointegrated. The ADF test conducted in this step is similar to that used to test variables for a unit root.

Johansen-Juselius (JJ) Cointegration Test

When there are more than two variables used in the equation, the maximum likelihood approach of Johansen and Juselius provides more robust results than other cointegrating methods (Asteriou, 2006). In order to avoid the use of two-step estimators, Johansen and Juselius (1990) have applied the maximum likelihood procedure, then estimated and tested for the presence of multiple cointegrating vectors. The JJ procedure relies heavily on the relationship between the rank of a matrix and its characteristic roots. This method sets up the non-stationary time series as a vector autoregressive (VAR) model of the form;

$$\Delta X_t = \sum_{i=1}^{p-1} \prod_i \Delta X_{t-i} + \prod X_{t-p} + \varepsilon_t \qquad (3.7)$$

where X_t is a vector of non-stationary (in levels) variables. $\prod_i = -I + A_1 + ... + A_i$ with $i = 1,..., p.$

Before the JJ procedure is conducted to find the number of cointegrating vectors, the optimum lag is needed to be determined. Sims (1980) has recommended utilizing likelihood ratio tests to select an optimum lag length. Alternatively, Enders (1995) has suggested that the optimum lag length can be selected by using Akaike AIC information criterion or Schwarz SIC information criterion. Cheung and Lai (1993) study supported this point, that for autoregressive processes, standard lag selection criteria such as the AIC and the SIC can be useful for choosing the right lag order for the JJ test. Thus, in this study, we determine the optimum lag length used in equation (3.7) by SIC.

The rank of the matrix $\prod$ is determinant in finding the number of cointegrating vectors. The rank of the matrix $\prod$ is equal to the number of independent cointegrating vectors. There are three possible ways;

- If the matrix $\prod$ has rank n, then X_t is stationary and all the components are I(0) – time series at level can be used in the estimation.

- If the matrix $\prod$ has rank 0, the matrix is null, and it represents nonstationarity and no long-run equilibrium relationship. Hence, equation (3.7) can be estimated as a usual VAR model only after first differencing.

- If the matrix $\prod$ has rank r and $0 < r < n$, then there are $n - r$ unit roots in the system and r linear combinations which are stationary. In other words, there are r cointegrating relationships and time series in level can be used in the estimation.

Johansen and Juselius (1990) have provided two different test statistics that can be used for the hypothesis of the existence of r cointegrating vectors; the trace test and the maximum eigenvalue test. The two statistics take the following forms;

Trace Test;
$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \tag{3.8}$$

The trace statistic tests the null hypothesis that the number of cointegrating vectors is less than or equal to r against a general alternative.

Maximum Eigenvalue Test;
$$\lambda_{max}(r, r+1) = -T \ln(1 - \lambda_{r+1}) \tag{3.9}$$

The maximum eigenvalue statistic tests the null hypothesis that the number of cointegrating vectors is exactly equal to r against the alternative of r+1 cointegrating vectors.

As stated earlier, since ARDL presumes the existence of a unique long-run relationship, the JJ analysis seems to be the most appropriate approach because it is able to test for the number of cointegrating relationships among a set of non-stationary variables. However, if the number of cointegrating vector is larger than one, we have to impose different identification restrictions on each of the vector in order to interpret them economically. In this study, the investigation of long-run equilibrium relationship is conducted by means of the Johansen and Juselius method of cointegration test.

c) Autoregressive Distributed Lag (ARDL) Model

In this study, an ARDL(p,q) model for imports (exports) is constructed in order to estimate a dynamic relationship for Thailand's import (export) demand. The standard model can be written as;

$$\text{Imports; } \ln M_t = \alpha_0 + \sum_{i=0}^{p} \alpha_i \ln M_{t-i} + \sum_{i=0}^{q} \alpha_{1i} \ln Y_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \ln RPM_{t-i} + u_t \qquad (3.10)$$

$$\text{Exports; } \ln X_t = \beta_0 + \sum_{i=0}^{p} \beta_i \ln X_{t-i} + \sum_{i=0}^{q} \beta_{1i} \ln W_{t-i} + \sum_{i=0}^{q} \beta_{2i} \ln RPX_{t-i} + u_t \qquad (3.11)$$

And the augmented import (export) can be written as;

Imports;

$$\ln M_t = \alpha_0 + \sum_{i=0}^{p} \alpha_i \ln M_{t-i} + \sum_{i=0}^{q} \alpha_{1i} \ln Y_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \ln RPM_{t-i} + \sum_{i=0}^{q} \alpha_{3i} \ln TT_{t-i} + u_t \qquad (3.12)$$

Exports;

$$\ln X_t = \beta_0 + \sum_{i=0}^{p} \beta_i \ln X_{t-i} + \sum_{i=0}^{q} \beta_{1i} \ln W_{t-i} + \sum_{i=0}^{q} \beta_{2i} \ln RPX_{t-i} + \sum_{i=0}^{q} \beta_{3i} \ln TW_{t-i} + u_t \qquad (3.13)$$

d) Error-Correction Model (ECM)

The concepts of vector autoregression (VAR) model, error correction models, and cointegration are closely related in time series analysis and often used together to characterize the relationships between the series being studied. In essence, it can be shown that, with re-parameterization, the error-correction model is a standard VAR in first differences augmented by error-correction terms. Moreover, according to the Granger Representation theorem, a vector error correction (VEC) represents for a set of variables that are integrated of order one I(1), and implies cointegration among variables and vice versa (Engle and Granger, 1987).

An Error-Correction Mechanism (ECM) model is a way of combining the long run, cointegrating relationship between the levels variables and the short-run relationship between the first differences of the variables. The principle behind the error-correction model is that there often exists a long-run equilibrium relationship between two economic variables. In the short run, however, there may be disequilibrium. With the error-correction mechanism, a proportion of the disequilibrium is corrected in the next period. The error-correction process is thus a means to reconcile short-run and long-run behaviour.

Consider the following bivariate model;

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{n} \alpha_i \Delta Y_{t-i} + \sum_{i=1}^{n} \beta_{1i} \Delta X_{t-i} + \delta Z_{t-1} + \varepsilon_t \qquad (3.14)$$

In the error-correction model, the right-hand side contains the short-run dynamic coefficients (i.e., α_i, β_{1i}) as well as the long-run coefficient (i.e., δ). The long-run coefficient δ is expected to be negative and significant, and, less than one (in absolute value), which is required for the error to bring the system back to the equilibrium. The

absolute value of δ decides how quickly the equilibrium is restored. Before performing ECM, we also perform weak exogeneity test. Details are shown in the next section.

In summary, the estimation of the demand for imports and exports in Thailand is made up of five steps:

1. Detect the order of integration of the variables comprising our dataset using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests.

2. Run OLS static regression (Engle-Granger approach) and then apply ADF test on the estimated error term in order to test for cointegration (We also provide Johansen's Full-Information Maximum Likelihood (FIML) approach for comparison purpose).

3. Estimate Autoregressive Distributed Lag (ARDL) models for imports (equation (3.10) and (3.12)) and exports (equation (3.11) and (3.13)).

4. Test for the weak exogeneity for variables used in the study.

5. Investigate the dynamic behaviour by

   5.1 Apply Engle and Granger procedure to obtain restricted Error Correction Mechanism (ECM) models.

Estimate unrestricted Error-Correction Mechanism (ECM) models based on the previous ARDL(p,q).

3.5. Empirical Analysis

In this section, we use the autoregressive distributed lag (ARDL) model to estimate a dynamic relationship for Thailand's import and export demand and to investigate the impact of trade liberalization on imports and exports. The analysis employs annual data for the period 1960-2007.

3.5.1. Import Demand

3.5.1.1. The Analysis of the Long-run Total Import Demand

1) Stationary Test: Unit Root Analysis

We start the investigation of import demand by evaluating the time series properties of the variables. To this end, we first establish the variables' orders of integration. Briefly stated, a variable is integrated of order d, written I(d), if it requires differencing d times before it achieves stationary. To test for the integration properties of the variables concerned, we employ standard unit root tests by applying two asymptotically equivalent tests: the augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. Our observed time series include aggregate import volume (M), real domestic GDP (Y), relative import prices $(RPM = PM / PD)$, and Thailand's average tariff rates (TT). All variables have been transformed by taking natural logarithms. The results from these tests for each variable are provided in the table below can be seen that the ADF and PP tests suggest that each variable is non-stationary when expressed in levels.

Table 3.2: ADF and PP Unit Root Tests for Stationarity (Import Model)

	Test for I(0)				Test for I(1)			
	ln(M)	ln(Y)	ln(RPM)	ln(TT)	Δln(M)	Δln(Y)	Δln(RPM)	Δln(TT)
ADF								
without trend	-1.00	-1.61	-2.48	-0.16	-5.35	-3.86	-4.49	-7.02
with trend	-2.84	-1.62	-2.46	-1.29	-5.34	-4.15	-4.44	-5.88
PP								
without trend	-1.00	-1.68	-1.92	-0.03	-5.19	-3.92	-4.28	-7.04
with trend	-2.35	-1.04	-1.92	-1.12	-5.22	-4.15	-4.22	-7.11

Note: The Augmented Dickey-Fuller (ADF) test assumes that the y series follows an AR(p) process and adding p lagged difference terms of the dependent variable y to the right-hand side of the test regression:

$$dy_t = \alpha\, y_{t-1} + x_t{}'\delta + \beta_1 dy_{t-1} + \beta_2 dy_{t-2} + \ldots + \beta_p dy_{t-p} + \upsilon_t$$

The test reported is a t-ratio which it is used to test the null hypothesis that the variable employed in the study has a unit root. 95% critical values are -2.93 (for the case without trend) and -3.51 (for the case with trend).

The Phillips-Perron (PP) test modifies the t-ratio of the α coefficient so that serial correlation does not affect asymptotic distribution of the test statistic. The PP test is based on the statistic:

$$\tilde{t}_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0} \right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2\, f_0^{1/2}\, s}$$

Testing the same null hypothesis that the series are not stationary, 95% critical values are also the same as those for ADF test.
Source; Eviews 6

From Table 3.2, the tests indicate that the variables under consideration are stationary in their first differences. From the results we conclude that the variables are integrated of order 1.

If the time series are non-stationary in their levels, they are integrated with integration of order 1, when their first differences are stationary. These variables can also be cointegrated if there are one or more linear combinations among the variables that are stationary. If these variables are cointegrated, then there is a constant long-run linear relationship among them. In the next section, a formal test of cointegration is performed following the Engle-Granger method and the Johansen (1988) and Johansen-Juselius (1990) maximum likelihood technique. Both approaches are applied to investigate whether there is a long-run stationary steady state between Thailand's real imports, real GDP, and relative import prices. Besides these main determinants, Thailand's average tariff rates series is included as an additional determinant for import demand.

2) Cointegration Analysis

Since it has been determined that the variables are integrated of order 1, cointegration analysis is performed. In this section, the cointegration test, using the two-step estimation suggested by Engle and Granger, is employed. In the first step, the OLS regression is performed in order to obtain the long-run equilibrium relationship among variables of interest. In this step, the standard import model is estimated by regressing the volume of import on real GDP and relative import price. Then, the augmented import model, which includes Thailand's average rate as an independent variable, is estimated. The result is as follows;

Standard Import Model

$$\ln M_t = -7.94 + 1.29 \ln Y_t - 0.52 \ln RPM_t \qquad (3.15)$$

$\qquad$ [-15.37 [6.10] $\qquad$ [-3.76]

$R^2 = 0.98 \qquad SER = 0.13 \qquad DW = 0.63$

Cointegration Tests

CRDW; 0.511, 0.386, 0.322 (1, 5 and 10 percent critical values)

ADF = -2.90 [-1.95] $\qquad\qquad$ PP = -2.94 [-1.95]

where the numbers in parentheses below the estimated parameters are t statistics.

From the cointegrating equation shown above, an economic interpretation of the results can be presented as follows; the long-run income elasticity of demand for imports is quite high (one percent increase in GDP increases imports by 1.29 percent), while the long-run price elasticity of demand for imports is rather low (one percent decrease in relative import price increases imports by only 0.52 percent).

In the second step, we test whether the residuals obtained from equation (3.15) are I(0). If it appears that the series of residuals obtained in the first step is stationary, it

can be included as the error-correction term in the estimation of the short-run dynamics of imports in the ECM model. First, we employ the ADF test to check the stationary of residuals. The result shows that the t-statistic is -2.90, while the 95% critical value for the test is -1.95. We are then inclined to reject the null hypothesis of unit root in the residuals at 5% significance level. The PP test also supports the result obtained from the ADF test. The test statistic is equal to -2.94, which is greater than the PP (-1.95) in absolute value at 5% critical level. Both results obtained from the ADF and PP tests infer about cointegration between variables.

Next, we perform the Cointegrating Regression Durbin-Watson (CRDW) test as Gujarati (2003) suggested. The null hypothesis is that there is a unit root in the residuals. The DW statistic obtained from equation (3.15) is 0.63 which is greater than the critical values (0.511, 0.386, 0.322 for 1%, 5% and 10% levels of significance respectively), and thus we can reject the hypothesis that the residuals are non-stationary and confirm the hypothesis of cointegration.

Now, we include Thailand's average tariff rate as our liberalization measure. The results are presented as follows;

Augmented Import Model

$$\ln M_t = -5.67 + 1.22 \ln Y_t - 0.39 \ln RPM_t - 0.17 \ln TT_t \tag{3.16}$$

$\quad\quad$ [-5.43] $\quad$ [35.03] $\quad$ [-2.74] $\quad\quad$ [-2.47]

$R^2 = 0.98 \quad\quad\quad SER = 0.13 \quad\quad DW = 0.61$

Cointegration Tests

CRDW; 0.511, 0.386, 0.322 (1, 5 and 10 percent critical values)

ADF = -2.87 [-1.95] $\quad\quad\quad\quad$ PP = -2.95 [-1.95]

where the numbers in parentheses below the estimated parameters are t statistics.

The income and price elasticities in the augmented import model are similar to those found in standard model. The long-run income elasticity is higher than unity (1.22), while the long-run price elasticity is low (-0.39). Imports also do not highly respond to changes in the country's average tariff rate since one percent decrease in Thailand's average tariff rate is associated with only 0.17 percent increase in imports.

We then perform the unit root test for the series of residuals obtained from equation (3.16). The ADF test shows that the t-statistic is -2.87, which is over than the ADF 95% critical value (-1.95). Likewise, the t-statistic obtained from the PP test is -2.95, higher than the PP (-1.95) at 5% critical level. The CRDW test also points out in the same way. The DW statistic obtained from equation (3.16) is 0.61 which is greater than the critical values (0.511, 0.386, 0.322 for 1%, 5% and 10% levels of significance respectively). Thus, we can then reject the null hypothesis of unit root in the residuals at 5% significance level and it can be concluded that there is cointegration between variables.

Another test for cointegration, Johansen-Jusellius (JJ) method, also known as Full-Information Maximum Likelihood Approach: FIML Estimation, is conducted to determine whether any combinations of the variables are cointegrated. The approach is essentially a vector autoregression based test, treating all variables as potentially endogenous. The test is also capable of identifying multiple cointegrating vectors. Accordingly, it overcomes the inherent weaknesses of the traditional two-step Engle-Granger test. Before undertaking the cointegration test, we first specify the relevant order of lags (p) of the Vector Autoregression (VAR) model. The lag order is determined using the Schwarz criterion. By doing this, we find that the optimum lag length is equal to 1.

After the optimum lag length is found, we now can perform the cointegration test. According to Johansen and Juselius (1990), there are two statistics testing the number of cointegrating relations. The first method is based on the maximum eigenvalue, and thus it is called maximum eigenvalue test. The second test statistic is based on likelihood ratio test about the trace of matrix, and hence it is called the trace test. Table 3.3 reports the results of these tests.

Table 3.3: Johansen Tests for the Number of Cointegrating Vectors: Standard Import Model

		Tests			
		Maximal eigenvalues		Eigenvalue Trace	
Null	Alternative	Statistics	95% critical value	Statistics	95% critical value
$r = 0$	$r = 1$	25.91	21.13	34.62	29.80
$r \leq 1$	$r = 2$	16.04	18.73	19.48	22.14
$r \leq 2$	$r = 3$	5.86	14.26	8.71	15.49
$r \leq 3$	$r = 4$	3.63	9.18	5.92	10.57
$r \leq 4$	$r = 5$	2.85	3.84	2.85	3.84

Note: r denotes the number of cointegrating vectors.

Table 3.4: Cointegration Vector: Standard Import Model

Cointegration vector:		
ln(M)	ln(Y)	ln(RPM)
-1.00	1.31	-0.61
	[3.28]	[-4.42]

Note: t ratio is shown in parentheses [ ]

For the standard import model, the results indicate the presence of a unique integrating vector (the cointegration vector is reported in Table 3.4). The null hypothesis of no cointegration (r = 0) is rejected at the 5 percent significance level while the null hypothesis of at most one cointegrating vector cannot be rejected. Similarly, when we add Thailand's average tariff rates, both maximal eigenvalue and trace statistics at the 5 percent significance level indicate the presence of a unique

cointegrating vector. Results of the test are reported in Table 3.5 and the cointegration vector is reported in Table 3.6.

Table 3.5: Johansen Tests for the Number of Cointegrating Vectors: Augmented Import Model by Including Thailand's Average Tariff Rates

		Tests			
		Maximal eigenvalues		Eigenvalue Trace	
Null	Alternative	Statistics	95% critical value	Statistics	95% critical value
$r = 0$	$r = 1$	31.90	28.59	58.91	54.08
$r \leq 1$	$r = 2$	18.05	22.30	27.01	35.19
$r \leq 2$	$r = 3$	15.16	18.14	21.48	27.83
$r \leq 3$	$r = 4$	6.28	15.89	8.96	20.26
$r \leq 4$	$r = 5$	2.68	9.16	2.68	9.16

Note: r denotes the number of cointegrating vectors.

Table 3.6: Cointegration Vector: Augmented Import Model by Including Thailand's Average Tariff Rates

Cointegration vector:			
ln(M)	ln(Y)	ln(RPM)	ln(TT)
-1.00	1.25	-0.50	-0.18
	[2.50]	[-3.16]	[-1.96]

Note: t ratio is shown in parentheses [ ]

It is worth noting that the coefficients estimated obtained from the JJ method are very similar to those obtained from the two-step EG method. In addition, our estimated long-run income and price elasticities are consistent with those often found in other studies which concentrate on developing countries.[10] Those results usually present income elastic and price inelastic.

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[10] See Sinha (1997) for example

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3) Autoregressive Distributed Lag (ARDL) Model

The autoregressive distributed lag (ARDL) model has been a widely used model for estimating demand relationships in a time-series context. In an import model, the level of imports is explained by lags of itself and current and lagged values of a number of explanatory variables (income, relative import prices, openness, tariffs, etc.), and hence the ADRL model has an appealing separation of short- and long-run effects. For ARDL model, it is assumed the existence of a unique long-run relationship among variables. Cointegration analysis can be used to establish the existence of such a relationship. The JJ analysis seems to be particularly well-suited in this respect since it makes it possible to test for the number of cointegrating relationships among a set of non-stationary variables. However, if the number of cointegrating vectors is larger than one, the ARDL approach will be failed because it can only estimate one long-run relationship and it might be that the estimated relationship is a linear combination of the true underlying relationships. Thus, the ARDL approach is considered as a supplement to the cointegration approach which is useful when it has been established that there is only one long-run relationship among the considered variables.

In this section, we use the ARDL approach to estimate a dynamic relationship for Thailand's import demand 1960-2007. As shown above, ADF and PP tests confirm that I(1) hypothesis cannot be rejected at 5% level of significance. Then, the JJ test for the number of cointegrating relationships among variables indicates the presence of a unique long-run relationship. Thus we can now proceed to estimate the ARDL model. In estimating the Autoregressive Distributed Lag Model for Thailand's import demand, we pick the lag-lengths (p,q) using the Schwarz's criterion. This results for the lag length are (1,1) which is reasonable since we are dealing with annual data. Thus, the ARDL model for Thailand's import demand can be presented as follow;

$$\ln M_t = \alpha_0 + \alpha_1 \ln M_{t-1} + \alpha_2 \ln Y_t + \alpha_3 \ln Y_{t-1} + \alpha_4 \ln RPM_t + \alpha_5 \ln RPM_{t-1} + u_t \qquad (3.17)$$

The estimated model is shown is Table 3.7:

Table 3.7: Autoregressive Distributed Lag Model for Thailand; Standard Import Model

Estimated Model			
$\ln M_t = -2.77 + 0.71 \ln M_{t-1} + 2.41 \ln Y_t - 2.02 \ln Y_{t-1} - 0.19 \ln RPM_t - 0.07 \ln RPM_{t-1}$			
[-3.41] [7.54] [6.39] [-5.01] [-0.91] [-0.31]			
Long-run Solution			
$\ln M_t^* = -9.47 + 1.34 \ln Y_t^* - 0.86 \ln RPM_t^*$			
$R^2 = 0.99$	SER = 0.08	JB NORM = 4.22	HET $F(6,40)$; 2.04
Adjusted $R^2 = 0.99$	DW = 1.94	ARCH $F(1,44)$; 2.23	RESET $F(1,42)$; 1.87

Note: Figures in parentheses below coefficient estimates are t values. SER is the standard error of the regression. JB NORM is the Jarque-Bera statistic for testing normality. HET is the White's test for heteroscedasticity. ARCH is a Lagrange multiplier (LM) test for autoregressive conditional heteroscedasticity. RESET is Regression Specification Error Test, proposed by Ramsey (1969) for testing functional form misspecification.

From the estimated model, we can obtain an estimate for the adjustment coefficient (λ) by using the fact that $\alpha_1 = 1 - \lambda$. So, we have that 1-0.707809 = 0.292. This tells us that a 100% deviation from equilibrium will be corrected by an adjustment of 29.2% each year. The coefficients of $\ln Y_t$ and $\ln RPM_t$ in Table 3.7 represent the short-run income and price elasticities, respectively. The short-run income elasticity is 2.41 and the short-run price elasticity is -0.19. Because of the non-stationarity in the independent variables, inference based on the standard errors is not valid. However, the results of this model can be rearranged in order to derive long-run elasticities by using the following equation.

$$\ln M_t^* = \frac{\alpha_0}{\lambda} + \frac{(\alpha_2 + \alpha_3)}{\lambda} \ln Y_t^* + \frac{(\alpha_4 + \alpha_5)}{\lambda} \ln RPM_t^* \qquad (3.18)$$

where $(\alpha_2 + \alpha_3)/\lambda$ = long-run elasticity of imports with respect to income and

$(\alpha_4 + \alpha_5)/\lambda$ = long-run elasticity of imports with respect to relative import price

So, we have the long-run solution as appeared in Table 3.7.

We also estimate the autoregressive distributed lag model for augmented import model which now includes Thailand's average tariff rates as a liberalization measure. Again, by using the Schwarz's criterion, we find that the optimum lag using in the estimation is (1,1). The estimated model is as follow and the estimated results are reported in Table 3.8.

$$\ln M_t = \alpha_0 + \alpha_1 \ln M_{t-1} + \alpha_2 \ln Y_t + \alpha_3 \ln Y_{t-1} + \alpha_4 \ln RPM_t + \alpha_5 \ln RPM_{t-1}$$
$$+\alpha_6 \ln TT_t + \alpha_7 \ln TT_{t-1} + u_t \tag{3.19}$$

Table 3.8: Autoregressive Distributed Lag Model for Thailand; Augmented Import Model

Estimated Model			
$\ln M_t = -2.39 + 0.70 \ln M_{t-1} + 2.21 \ln Y_t - 1.82 \ln Y_{t-1} - 0.11 \ln RPM_t - 0.08 \ln RPM_{t-1} - 0.23 \ln TT_t + 0.21 \ln TT_{t-1}$			
$\quad\ \ [-2.75]\quad\ [7.39]\qquad\quad [5.81]\qquad [-4.58]\qquad\ [-0.53]\qquad\quad [-0.40]\qquad\quad [-2.51]\qquad\ [2.18]$			
Long-run Solution			
$\ln M_t^* = -7.96 + 1.28 \ln Y_t^* - 0.64 \ln RPM_t^* - 0.07 \ln TT_t^*$			
$R^2 = 0.99$	SER = 0.08	JB NORM = 2.93	HET $F(8,37)$; 1.69
Adjusted $R^2 = 0.99$	DW = 2.21	ARCH $F(1,44)$; 2.75	RESET $F(1,41)$; 1.12

Note: Figures in parentheses below coefficient estimates are t values. SER is the standard error of the regression. JB NORM is the Jarque-Bera statistic for testing normality. HET is the White's test for heteroscedasticity. ARCH is a Lagrange multiplier (LM) test for autoregressive conditional heteroscedasticity. RESET is Regression Specification Error Test, proposed by Ramsey (1969) for testing functional form misspecification.

After estimating the model, we can obtain an estimate for the adjustment coefficient (λ) which is equal to 0.30. In the augmented model, the short-run income elasticity is 2.21 and the short-run price elasticity is -0.11. The short-run elasticity of imports with respect to tariff is -0.23. The long-run demand for import can be calculated as shown above in Table 3.8.

4) Exogeneity; Import Demand Function

One of the conditions necessary to perform inference in a single-equation framework is weak exogeneity of the cointegrating variables. Johansen (1992) shows that, under weak exogeneity, single-equation estimation remains efficient in a cointegrated

system, whereas if weak exogeneity fails, then system modelling is needed despite the super consistency of estimators in I(1) processes.[11] In some cases, the failure of weak exogeneity can lead to a large loss of efficiency.[12] Thus, testing for weak exogeneity is as important in non-stationary cointegrated systems as it is in stationary cases.[13]

According to Harbo, Johansen, Nielsen, and Rahbek (1998), weak exogeneity can be tested by estimating the conditional model with assumed exogeneity and inserting the estimated cointegrating vectors back into the marginal model. Weak exogeneity is established by statistical insignificance of the cointegrating vectors in the marginal model. More specifically, weak exogeneity of Thailand's real income, relative import price, and Thailand's average tariff rates will be accepted if the error-correction term of conditional model for import demand is statistically insignificant.

Therefore, we start by specify three autoregressive marginal models for domestic income $(\Delta \ln Y)$, relative import price $(\Delta \ln RPM)$, and Thailand's average tariff rates $(\Delta \ln TT)$. In order to obtain well specified marginal processes, an appropriate dummy variable is added into each model, including 1) in marginal model for $\Delta \ln Y$, dum1997 for taking into account the Asian financial crisis in 1997; 2) in marginal model for $\Delta \ln RPM$, dum1973 for taking into account the oil price shock in 1973 and; 3) in marginal model for $\Delta \ln TT$, dum1992 for taking into account the membership of AFTA and the WTO membership which Thailand joined since 1992 and 1995, respectively. The value of the dummies is 1 for the observations indicated by their names and 0 elsewhere. Then, we add the error-correction term $(\ln M_{t-1} - \alpha_3 \ln Y_{t-1} + \alpha_5 \ln RPM_{t-1} + \alpha_7 \ln TT_{t-1})$ into the marginal models of real

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[11] See Philips (1990), and Philips and Loretan (1991) for example.
[12] See Hendry and Mizon (1991) for example.
[13] See Ericsson (1992)

income, relative prices, and average tariff rates, and re-estimate them to investigate the significance of the error-correction term. We also provide various diagnostic tests and these tests uniformly suggest that, in all case, marginal models for $\Delta \ln Y$, $\Delta \ln RPM$, and $\Delta \ln TT$ do not suffer from problems of non-normality, serial correlation, heteroscedasticity, and mis-specification. The results are reported below:

Marginal model for $\Delta \ln Y$ augmented by the error-correction term

$$\Delta \ln Y_t = -0.13 + 0.28\Delta \ln Y_{t-1} - 0.06dum1997 - 0.04ecm_{t-1}$$
$$[-1.84] \quad [1.95] \qquad\qquad [-2.97] \qquad [-1.55]$$

$R^2 = 0.39$ $SER = 0.03$ $DW = 1.82$

$NORM; JB = 0.73$ $ARCH; F(1,43) = 2.54$ $HET; F(5,40) = 0.79$

$RESET; F(1,41) = 0.20$

Marginal model for $\Delta \ln RPM$ augmented by the error-correction term

$$\Delta \ln RPM_t = -0.20 + 0.35\Delta \ln RPM_{t-1} + 0.15dum1973 - 0.04ecm_{t-1}$$
$$[-1.79] \quad [2.92] \qquad\qquad [3.86] \qquad [-1.45]$$

$R^2 = 0.38$ $SER = 0.05$ $DW = 1.92$

$NORM; JB = 0.78$ $ARCH; F(1,43) = 2.57$ $HET; F(5,40) = 0.68$

$RESET; F(1,41) = 0.09$

Marginal model for $\Delta \ln TT$ augmented by the error-correction term

$$\Delta \ln TT_t = 0.26 - 0.33\Delta \ln TT_{t-1} - 0.45dum1992 + 0.06ecm_{t-1}$$
$$[1.92] \quad [-2.47] \qquad\qquad [-5.16] \qquad [1.04]$$

$R^2 = 0.39$ $SER = 0.11$ $DW = 1.95$

$NORM; JB = 1.16$ $ARCH; F(1,43) = 0.16$ $HET; F(5,40) = 0.51$

$RESET; F(1,41) = 0.24$

It is clear from the results that the coefficient of the error-correction term is insignificant for all three models, confirming that Thailand's real GDP, relative

import price, and Thailand's average tariff rates can be considered as weakly exogenous.

5) Dynamic Adjustment Estimates

In this section, we determine how well the dynamic process which generates Thailand's level of imports can be captured by a single-equation error-correction model (SEECM). From results presented above, the presence of a cointegrating vector together with the evidence of weak exogeneity suggest that we can use a single-equation error-correction representation without the loss of either efficiency or the ability to perform proper inference.[14] From our general ARDL model;

Standard Import Model:

$$\ln M_t = \alpha_0 + \sum_{i=0}^{p} \alpha_i \ln M_{t-i} + \sum_{i=0}^{q} \alpha_{1i} \ln Y_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \ln RPM_{t-i} + u_t$$

and Augmented Import Model:

$$\ln M_t = \alpha_0 + \sum_{i=0}^{p} \alpha_i \ln M_{t-i} + \sum_{i=0}^{q} \alpha_{1i} \ln Y_{t-i} + \sum_{i=0}^{q} \alpha_{2i} \ln RPM_{t-i} + \sum_{i=0}^{q} \alpha_{3i} \ln TT_{t-i} + u_t$$

By differencing the ARDL model and rewriting ARDL to ECM, a re-parameterization of the ARDL equation in the form of an error-correction model (SEECM) can be written as;

Standard Import Model:

$$\Delta \ln M_t = A(L)\Delta \ln M_{t-i} + B(L)\Delta \ln Y_t + C(L)\Delta \ln RPM_t + \varphi[\ln M_{t-1}^* - \ln M_{t-1}] + \mu_{1t}$$

and Augmented Import Model:

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[14] See Banerjee et al. (1986, 1993)

$$\Delta \ln M_t = A(L)\Delta \ln M_{t-i} + B(L)\Delta \ln Y_t + C(L)\Delta \ln RPM_t + D(L)\Delta \ln TT_t$$
$$+ \varphi[\ln M_{t-1}^* - \ln M_{t-1}] + \mu_{2t}$$

where *A(L)*, *B(L)*, *C(L)*, and *D(L)* are finite polynomials, and Δ is the first difference operator. The findings of the unit root tests suggest us to transform all variables in the dynamic model by taking first differences of logarithms. The term $[\ln M_{t-1}^* - \ln M_{t-1}]$ represents our error-correction term, that is the deviation of import demand from the long-run equilibrium. The SEECM can be estimated in two different ways;

1) By changing the error-correction term from the form $[\ln M_{t-1}^* - \ln M_{t-1}]$ to

   $[\ln M_{t-1} - \alpha_3 \ln Y_{t-1} + \alpha_5 \ln RPM_{t-1}]$ for standard import model and to

   $[\ln M_{t-1} - \alpha_3 \ln Y_{t-1} + \alpha_5 \ln RPM_{t-1} + \alpha_7 \ln TT_{t-1}]$ for augmented import model,

   and thus we obtain an unrestricted ECM.

2) By using residuals from the estimated cointegration vector as a measure of the

   equilibrium error and applying OLS to the resulting restricted model.

A dummy variable (*LIB*), which is equal to 1 from 1992, the year that Thailand embarked on its trade liberalization with membership of AFTA in 1992, is included in the augmented import model to take into account formal trade liberalization in Thailand. Our final results for both unrestricted ADRL model and restricted model applying the EG approach and the JJ Full-Information Maximum Likelihood (FIML) are reported in Table 3.9.

Table 3.9: Error-Correction Model for Import Demand ($\Delta \ln M$)

Variable	Standard Model			Augmented Model			Augmented Model (dummy)		
	Unrestricted	Restricted EG	Restricted JJ	Unrestricted	Restricted EG	Restricted JJ	Unrestricted	Restricted EG	Restricted JJ
$\Delta \ln Y_t$	2.41*** (0.38)	2.26*** (0.36)	2.31*** (0.37)	2.21*** (0.38)	2.15*** (0.33)	2.13*** (0.36)	2.35*** (0.41)	2.37*** (0.39)	2.25*** (0.42)
$\Delta \ln RPM_t$	-0.19 (0.21)	-0.10 (0.20)	-0.21 (0.22)	-0.11 (0.20)	-0.08 (0.18)	-0.15 (0.21)	-0.09 (0.20)	-0.12 (0.19)	-0.17 (0.21)
$\Delta \ln TT_t$				-0.23*** (0.09)	-0.26*** (0.09)	-0.22*** (0.09)	-0.19* (0.10)	-0.22** (0.09)	-0.20* (0.10)
ecm_{t-1}		-0.30*** (0.09)	-0.31*** (0.12)		-0.30*** (0.09)	-0.28** (0.11)		-0.32*** (0.09)	-0.28** (0.11)
$\ln M_{t-1}$	-0.29*** (0.09)			-0.30*** (0.09)			-0.34*** (0.10)		
$\ln Y_{t-1}$	0.39*** (0.12)			0.39*** (0.12)			0.42*** (0.12)		
$\ln RPM_{t-1}$	-0.25** (0.10)			-0.19* (0.10)			-0.17* (0.10)		
$\ln TT_{t-1}$				-0.02 (0.05)			-0.01 (0.05)		
LIB_t							0.06 (0.06)	0.03 (0.02)	0.02 (0.03)
Constant	-2.77*** (0.81)	-0.06** (0.03)	-0.06*** (0.03)	-2.39*** (0.87)	-0.06*** (0.02)	-0.06** (0.03)	-2.31*** (0.87)	-0.09*** (0.03)	-0.07** (0.03)
R^2	0.59	0.57	0.54	0.65	0.64	0.60	0.65	0.65	0.60
$\bar{R}^2$	0.54	0.54	0.51	0.58	0.60	0.56	0.58	0.60	0.55
SER	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
DW	1.94	1.84	2.34	2.22	2.17	2.25	2.18	2.18	2.16
$NORM$	JB = 1.14	JB = 1.22	JB = 2.00	JB = 2.93	JB = 2.16	JB = 0.01	JB = 2.53	JB = 2.28	JB = 0.10
$ARCH$	F(1,44) = 3.18	F(1,44) = 2.07	F(1,42) = 3.34	F(1,44) = 2.75	F(1,44) = 2.31	F(1,42) = 1.75	F(1,44) = 2.19	F(1,44) = 2.37	F(1,42) = 1.58
HET	F(10,36) = 2.10	F(6,40) = 1.89	F(6,38) = 0.80	F(14,32) = 3.93	F(8,38) = 3.14	F(8,36) = 1.05	F(15,31) = 3.63	F(9,37) = 2.45	F(9,35) = 1.01
$RESET$	F(1,40) = 0.61	F(1,42) = 0.71	F(1,40) = 0.45	F(1,38) = 0.44	F(1,41) = 1.04	F(1,39) = 0.01	F(1,37) = 0.45	F(1,40) = 1.16	F(1,38) = 0.01

Note: The asterisks (***), (**), (*) indicate statistical significance at the 10%, 5%, and 1% significance level, respectively.

Figures in parentheses below coefficient estimates are standard errors.

SER is the standard error of the regression. DW is the Durbin-Watson Statistic. NORM is the Jarque-Bera statistic for testing normality. ARCH is the test for autoregressive conditional heteroscedasticity. HET is the White's test for heteroscedasticity. RESET is Regression Specification Error Test, proposed by Ramsey (1969) for testing functional form misspecification.

From Table 3.9, the results of the two models (unrestricted and restricted) are very similar. Although we interpret our results based on comparison purpose, we focus our economic interpretation on the restricted SEECM using EG approach, since this model is more preferable on the ground of goodness-of-fit criteria. First, considering both the standard and augmented import model, the R^2 value can be considered good (0.59 to 0.65). The estimated standard error of regression, in all cases (0.08) are not higher than those of the general unrestricted autoregressive model (in fact, SER of the restricted model is slightly lower than that of unrestricted model when working to a

number of decimal places), suggesting the validity of the parameter-reduction process. All the diagnostic tests confirm the appropriateness of the specification which suggest to us that all import demand models are appropriately set.

In both standard and augmented models, the coefficient of the error-correction term, which reflects the impact of having $\ln M_{t-1}$ out of the long-run equilibrium, appears highly significant at 1% level and has the correct (negative) sign, suggesting the significance of the speed of adjustment in response to a deviation from the long run equilibrium. The error-correction coefficient of standard model, estimated at -0.30, is almost equal to that of augmented models (-0.32 for augmented model with dummy). This shows a slow speed of convergence to equilibrium, which is accounted approximately 30% each year.

Next, considering the short-run income elasticity, this estimate for both the standard and the augmented models is larger than the long-run elasticity (+2.26 for standard model, +2.15 for augmented model without liberalization dummy, and +2.37 for augmented with liberalization dummy), suggesting that the income change has a potentially comtemporaneous effect on the change of the volume of imports. The size of the coefficients shows a large and immediate impact of a change in GDP on import demand. However, the price elasticity does not appear to be significant in the short-run, though it is significant in the long run and has an expected sign.

Considering the measures of trade liberalization, on one hand, the coefficient of the average tariff rates is significant with an expected sign, implying that the effect of change in tariff rates on the volume of imports is negative. The estimated coefficient indicates that a 1 percent change in tariff rates leads to approximately 0.2 percent change in the level of imports. It is also found that the short-run elasticity is larger

than that of the long run. On the other hand, trade liberalization dummy appears to be insignificant both in standard and augmented models.

The insignificance of relative import price elasticity must be carefully taken care of. As mentioned in Carone (1996), this may be due to the measurement errors in the data coming from the method of calculation of our import price, in which we use the import unit value index as a proxy for import price. Carone (1996) has suggested that it could possibly lead the estimated coefficient to be biased toward zero. Another explanation is on the downward bias which could possibly have arisen from the use of a domestic price index. This is because this index is composed of both tradable and non-tradable goods. However, these two indices are the only close approximations for the calculation of relative import prices now available over a long period of time.

3.5.2. Export Demand

3.5.2.1. The Analysis of the Long-run Total Export Demand

1) Stationary Test: Unit Root Analysis

Now, we turn our investigation from import to export demand. Again, we first conduct tests for the time series properties of the variables concerned. Like for import demand, we employ standard unit root tests by applying two asymptotically equivalent tests: the augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. Our observed time series include aggregate export volume (X), world GDP (W), relative export price $(RPX = PX / PW)$, and world's average tariff rates (TW). All variables have been converted to natural logarithms. The results from these tests for each variable are provided in the table below and can be seen that the ADF and PP tests suggest non-stationarity of each variable when expressed in levels.

Table 3.10: ADF and PP Unit Root Tests for Stationarity (Export Model)

	Test for I(0)				Test for I(1)			
	ln(X)	ln(W)	ln(RPX)	ln(TW)	Δln(X)	Δln(W)	Δln(RPX)	Δln(TW)
ADF								
without trend	-0.59	-2.49	-2.01	0.60	-6.81	-3.73	-6.72	-5.69
with trend	-1.60	-3.05	-2.22	-1.39	-6.73	-4.39	-6.71	-5.58
PP								
without trend	-0.59	-2.51	-1.90	1.04	-6.81	-3.66	-8.70	-5.62
with trend	-1.65	-2.89	-2.21	-1.42	-6.73	-4.29	-11.06	-5.76

From Table 3.10, the tests indicate that the variables under consideration are stationary in their first differences. From the results we conclude that the variables are integrated of order 1.

2) Cointegration Analysis

Since it has been determined that the examined variables are integrated of order 1, cointegration analysis is performed. First, the cointegration test using the two-step estimation, suggested by Engle and Granger, is employed. The results of the OLS regression are shown below:

Standard Export Model

$$\ln X_t = -19.24 + 1.82 \ln W_t - 0.52 \ln RPX_t \tag{3.20}$$

$$[-18.99] \quad [32.26] \quad [-5.24]$$

$$R^2 = 0.99 \qquad SER = 0.10 \qquad DW = 0.96$$

Cointegration Tests

CRDW; 0.511, 0.386, 0.322 (1, 5 and 10 percent critical values)

ADF = -2.72 [-1.95]   PP = -2.72 [-1.95]

From the cointegrating equation shown above, an economic interpretation of the results can be presented as follows; the long-run income elasticity of demand for exports is high (one percent increase in world's GDP increases exports by 1.82

percent), while the long-run price elasticity of demand for exports is rather low (one percent decrease in relative export price increases exports by only 0.52 percent).

In the second step, we test whether the residuals obtained from equation (3.20) are I(0). If it appears that the residuals obtained in the first step is stationary, they can be included as error-correction term in the estimation of the short-run dynamics of exports in ECM model. First, we employ the ADF test to check the stationary of residuals. The result shows that the t-statistic is -2.72, while the 95% critical value for the test is -1.95. We are then inclined to reject the null hypothesis of a unit root in the residuals at the 5% significance level. The PP test also supports the result obtained from the ADF test. The test statistic is equal to -2.72, which is greater than the PP (-1.95) at 5% critical level. Both results obtained from the ADF and PP tests infer about cointegration between variables.

Next, we perform the Cointegrating Regression Durbin-Watson (CRDW) test as Gujarati (2003) suggested. The null hypothesis is that there is a unit root in the residuals. The DW statistic obtained from equation (3.20) is 0.96 which is greater than the critical values (0.511, 0.386, 0.322 for 1%, 5% and 10% levels of significance respectively), and thus we can reject the hypothesis that the residuals are non-stationary and confirm the hypothesis of cointegration.

Now, we include world's average tariff rate as our liberalization measure. The results are presented as follows;

Augmented Import Model

$$\ln X_t = -5.99 + 1.31 \ln W_t - 0.20 \ln RPX_t - 0.62 \ln TW_t \qquad (3.21)$$

[-2.64]   [14.16]   [-2.28]   [-6.20]

$R^2 = 0.99$ SER = 0.10   DW = 1.14

Cointegration Tests

CRDW; 0.511, 0.386, 0.322 (1, 5 and 10 percent critical values)

ADF = -2.98 [-1.95]   PP = -2.98 [-1.95]

The income and price elasticities in augmented export model are lower than those found in standard model. The long-run income elasticity is higher than unity (1.31), while the long-run price elasticity is quite low (-0.20). Exports moderately respond to changes in the world's average tariff rate since a one percent decrease in world's average tariff rate is associated with only 0.62 percent increase in exports.

We then perform the unit root test for the series of residuals obtained from equation (3.21). The ADF test shows that the t-statistic is -2.98, which is over than the ADF 95% critical value (-1.95). Likewise, the t statistic obtained from the PP test is -2.98, lower than the PP (-1.95) at 5% critical level. The CRDW test also points out in the same way. The DW statistic obtained from equation (3.21) is 1.14 which is greater than the critical values (0.511, 0.386, 0.322 for 1%, 5% and 10% levels of significance respectively). Thus, we can then reject the null hypothesis of a unit root in the residuals at the 5% significance level and it can be concluded that there is cointegration between variables.

Next, the cointegration test using the JJ method is undertaken to determine whether any combinations of the variables are cointegrated. Before carrying out the cointegration test, we first specify the relevant order of lags (p) of the Vector

Autoregression (VAR) model. The lag order is determined using the Schwarz criterion. By doing this, we find that the optimum lag length is equal to 1.

After the optimum lag length is found, we now can perform the cointegration test. According to Johansen and Juselius (1990), there are two tests for the number of cointegrating relations; the maximum eigenvalue and the trace test. Table 3.11 and 3.13 report the results of these tests for cointegrating relationship between variables. The results indicate that there exists only one cointegrating relationship, both for the standard and the augmented export models and the cointegration vectors are presented in Table 3.12 and 3.14, respectively.

Table 3.11: Johansen Tests for the Number of Cointegrating Vectors: Standard Export Model

		Tests			
		Maximal eigenvalues		Eigenvalue Trace	
Null	Alternative	Statistics	95% critical value	Statistics	95% critical value
$r = 0$	$r = 1$	29.84	21.13	42.16	29.80
$r \leq 1$	$r = 2$	10.41	14.26	12.32	15.49
$r \leq 2$	$r = 3$	0.04	1.91	1.91	3.84

Note: r denotes the number of cointegrating vectors.

Table 3.12: Cointegration Vector: Standard Export Model

Cointegration vector:		
ln(X)	ln(W)	ln(RPX)
-1.00	1.77	-0.52
	[4.77]	[-2.81]

Note: t ratio is shown in parentheses [ ]

Table 3.13: Johansen Tests for the Number of Cointegrating Vectors: Augmented Export Model by Including the World's Average Tariff Rates

		Tests			
		Maximal eigenvalues		Eigenvalue Trace	
Null	Alternative	Statistics	95% critical value	Statistics	95% critical value
$r = 0$	$r = 1$	36.61	27.58	59.59	47.86
$r \leq 1$	$r = 2$	13.88	21.13	22.98	29.80
$r \leq 2$	$r = 3$	8.67	14.26	9.11	15.49
$r \leq 3$	$r = 4$	0.44	3.84	0.43	3.84

Note: r denotes the number of cointegrating vectors.

Table 3.14: Cointegration Vector: Augmented Export Model by Including World's Average Tariff Rates

Cointegration vector:			
ln(X)	ln(W)	ln(RPX)	ln(TW)
-1.00	1.34	-0.27	-0.71
	[4.76]	[-2.42]	[-3.78]

Note: t ratio is shown in parentheses [ ]

Again, it is found that the coefficients estimated obtained from the JJ method are very similar to those obtained from the two-step EG method.

3) Autoregressive Distributed Lag (ARDL) Model

In this section, we use the ARDL approach to estimate a dynamic relationship for Thailand's export demand over the period 1960-2007. In the export model, the volume of exports is explained by lags of itself and the current and lagged values of a number of explanatory variables (world income, relative export prices, world tariffs), and hence the ADRL model has an appealing separation of short- and long-run effects. As shown above, the ADF and PP tests confirm that the I(1) hypothesis cannot be rejected for each variable at the 5% level of significance. Then, the JJ test for the number of cointegrating relationships among variables indicates the presence of a unique long-run relationship. Thus we can now proceed to the estimation of the

ARDL model. In estimating the Autoregressive Distributed Lag Model for Thailand's Import Demand, we pick the lag-lengths (p,q) using Schwarz's criterion. This results in lag length equal to (1,1) which is reasonable since we are dealing with annual data. Thus, the ARDL model for Thailand's import demand can be presented as follow;

$$\ln X_t = \beta_0 + \beta_1 \ln X_{t-1} + \beta_2 \ln W_t + \beta_3 \ln W_{t-1} + \beta_4 \ln RPX_t + \beta_5 \ln RPX_{t-1} + u_t \qquad (3.22)$$

The estimated model is shown is Table 3.15:

Table 3.15: Autoregressive Distributed Lag Model for Thailand; Standard Export Model

Estimated Model			
$\ln X_t = -3.82 + 0.80 \ln X_{t-1} + 0.75 \ln W_t - 0.39 \ln W_{t-1} - 0.19 \ln RPX_t + 0.09 \ln RPX_{t-1}$ [-2.20]　　[9.58]　　　　[2.45]　　　[-1.18]　　　　[-1.82]　　　　[0.81]			
Long-run Solution			
$\ln X_t^* = -19.52 + 1.85 \ln W_t^* - 0.55 \ln RPX_t^*$			
$R^2 = 0.99$	SER = 0.07	JB NORM = 1.75	HET $F(10,36)$; 0.48
Adjusted $R^2 = 0.99$	DW = 2.16	ARCH $F(1,44)$; 0.71	RESET $F(1,40)$; 3.24

From the estimated model, we can obtain an estimate for the adjustment coefficient (λ) by using the fact that $\beta_1 = 1 - \lambda$. So, we have that 1-0.804 = 0.196. This tells us that a 100% deviation from equilibrium will be corrected by an adjustment of 19.6% each year. The coefficients of $\ln X_t$ and $\ln RPX_t$ in Table 3.15 represent the short-run income and price elasticities, respectively. The short-run income elasticity is 0.75 and the short-run price elasticity is -0.19. Because of the non-stationarity in the independent variables, inference based on the standard errors is not valid. However, the results of this model can be rearranged in order to derive long-run elasticities by using the following equation.

$$\ln X_t^* = \frac{\beta_0}{\lambda} + \frac{(\beta_2 + \beta_3)}{\lambda} \ln W_t^* + \frac{(\beta_4 + \beta_5)}{\lambda} \ln RPX_t^* \qquad (3.23)$$

where $(\beta_2 + \beta_3)/\lambda$ = long-run elasticity of exports with respect to world income

$(\beta_4 + \beta_5)/\lambda$ = long-run elasticity of exports with respect to relative export price

So, we have the long-run solution as it appeared in Table 3.15.

We also estimate the autoregressive distributed lag model for the augmented export model which now includes world's average tariff rates as a liberalization measure. Again, by using the Schwarz's criterion, we find that the optimum lag using in the estimation is (1,1). The estimated model is as follow and the estimated results are reported in Table 3.16.

$$\ln X_t = \beta_0 + \beta_1 \ln X_{t-1} + \beta_2 \ln W_t + \beta_3 \ln W_{t-1} + \beta_4 \ln RPX_t + \beta_5 \ln RPX_{t-1} \\ \beta_6 \ln TW_t + \beta_7 \ln TW_{t-1} + u_t$$

(3.24)

Table 3.16: Autoregressive Distributed Lag Model for Thailand; Augmented Export Model

Estimated Model			
$\ln X_t = -2.64 + 0.75 \ln X_{t-1} + 0.66 \ln W_t - 0.29 \ln W_{t-1} - 0.18 \ln RPX_t + 0.11 \ln RPX_{t-1} - 0.49 \ln TW_t + 0.41 \ln TW_{t-1}$			
[-1.46] [6.88] [2.24] [-0.94] [-1.78] [1.13] [-2.93] [2.46]			
Long-run Solution			
$\ln X_t^* = -10.66 + 1.48 \ln W_t^* - 0.25 \ln RPX_t^* - 0.34 \ln TW_t^*$			
$R^2 = 0.99$	SER $= 0.07$	JB NORM $= 1.18$	HET $F(14,32)$; 0.81
Adjusted $R^2 = 0.99$	DW $= 2.03$	ARCH $F(1,44)$; 0.24	RESET $F(1,38)$; 1.12

After estimating the model, we can obtain an estimate for the adjustment coefficient (λ) which is equal to 0.25. In the augmented model, the short-run income elasticity is 0.66 and the short-run price elasticity is -0.18. The short-run elasticity of exports with respect to tariff is -0.49. The long-run demand for import can be calculated as shown above in Table 3.16.

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4) Exogeneity; Export Demand Function

Following the same step, we specify three autoregressive marginal models for the world's real income $(\Delta \ln W)$, relative export prices $(\Delta \ln RPX)$, and world's average tariff rate $(\Delta \ln TW)$. We include a dummy variable for each marginal model and the detail is as follows; 1) in marginal model for $\Delta \ln W$, dumREC for taking into account the world economic recession resulting from the oil crisis, when world economic growth was weak between 1973-1975; 2) in marginal model for $\Delta \ln RPX$, dum1973 for taking into account the oil price shock in 1973 and; 3) in marginal model for $\Delta \ln TW$, dumGATT for taking into account the two phases of GATT including Tokyo Round and Uruguay Round.[15] The error-correction term $(\ln X_{t-1} - \beta_3 \ln W_{t-1} + \beta_5 \ln RPX_{t-1} + \beta_7 \ln TW_{t-1})$ is again added into the marginal models of world real income, relative export price, and world's average tariff rate, and each model is re-estimated in order to investigate the significance of the error-correction term. The test results are listed below;

Marginal model for $\Delta \ln W$ augmented by the error-correction term

$$\Delta \ln W_t = -0.13 + 0.51 \Delta \ln W_{t-1} - 0.01 dumREC - 0.01 ecm_{t-1}$$
$$\quad [-1.18] \quad [3.86] \qquad\qquad [-1.85) \qquad [-1.33]$$

$R^2 = 0.35$ $\qquad\qquad$ $SER = 0.01$ $\qquad\qquad$ $DW = 1.95$

$NORM; JB = 0.02$ $\qquad$ $ARCH; F(1,43) = 0.01$ $\qquad$ $HET; F(5,40) = 1.72$

$RESET; F(1,41) = 0.05$

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[15] Tokyo Round is the final round in the second phase, starting from 1973 and covering for 74 months. This round focuses on the reduction tariff barriers. This round is considered as a major tariff reduction round since tariffs worth more than 300 billion US dollars were reduced between 1973 and 1979. The third phase of GATT consists only of Uruguay Round which starts from 1986 to 1994. In this round, not only tariffs were continually reduced, but new areas such as textiles, clothing, and agricultural products were also included in trade negotiations. Intellectual property rights were also considered. After this round, the GATT becomes the WTO in 1995.

Marginal model for $\Delta \ln RPX$ augmented by the error-correction term

$$\Delta \ln RPX_t = 1.14 - 0.45 \Delta \ln RPX_{t-1} + 0.30 dum1973 - 0.11 ecm_{t-1}$$
$$[1.68] \qquad [-2.45] \qquad\qquad [6.65] \qquad [-1.41]$$

$R^2 = 0.50$ $\qquad\qquad$ $SER = 0.05$ $\qquad\qquad$ $DW = 1.83$

$NORM; JB = 0.56$ $\qquad\qquad$ $ARCH; F(1,42) = 0.14$ $\qquad$ $HET; F(5,39) = 0.75$

$RESET; F(1,39) = 0.08$

Marginal model for $\Delta \ln TW$ augmented by the error-correction term

$$\Delta \ln TW_t = -0.59 - 0.56 \Delta \ln TW_{t-1} - 0.58 dumGATT - 0.05 ecm_{t-1}$$
$$[-0.40] \quad [-4.36] \qquad\qquad [-5.81] \qquad [-0.38]$$

$R^2 = 0.45$ $\qquad\qquad$ $SER = 0.11$ $\qquad\qquad$ $DW = 1.88$

$NORM; JB = 0.41$ $\qquad\qquad$ $ARCH; F(1,42) = 0.23$ $\qquad$ $HET; F(5,39) = 0.74$

$RESET; F(1,39) = 0.39$

The results presenting above show that, for all marginal models, the coefficient on the error-correction term is insignificant. This is a strong evidence of weak exogeneity. Therefore, we can conclude that $\Delta \ln W$, $\Delta \ln RPX$, and $\Delta \ln TW$ are weakly exogenous and it is possible to condition the short-run model on these variables.

5) Dynamic Adjustment Estimates

In this section, we determine how well the dynamic process which generates Thailand's volume of exports can be captured by a single-equation error-correction model (SEECM). From results presented above, the presence of a cointegrating vector together with the evidence of weak exogeneity suggest that we can construct a single-equation error-correction model. From our general ARDL model;

Standard Export Model:

$$\ln X_t = \beta_0 + \sum_{i=0}^{p} \beta_i \ln X_{t-i} + \sum_{i=0}^{q} \beta_{1i} \ln W_{t-i} + \sum_{i=0}^{q} \beta_{2i} \ln RPX_{t-i} + u_t$$

and Augmented Export Model:

$$\ln X_t = \beta_0 + \sum_{i=0}^{p} \beta_i \ln X_{t-i} + \sum_{i=0}^{q} \beta_{1i} \ln W_{t-i} + \sum_{i=0}^{q} \beta_{2i} \ln RPX_{t-i} + \sum_{i=0}^{q} \beta_{3i} \ln TW_{t-i} + u_t$$

By differencing the ARDL model and rewriting ARDL to ECM, a re-parameterization of the ARDL equation in the form of an error-correction model (SEECM) can be written as;

Standard Export Model:

$$\Delta \ln X_t = A(L)\Delta \ln X_{t-i} + B(L)\Delta \ln W_t + C(L)\Delta \ln RPX_t + \varphi[\ln X_{t-1}^* - \ln X_{t-1}] + \mu_{1t}$$

and Augmented Export Model:

$$\Delta \ln X_t = A(L)\Delta \ln X_{t-i} + B(L)\Delta \ln W_t + C(L)\Delta \ln RPX_t + D(L)\Delta \ln TW_t$$
$$+ \varphi[\ln X_{t-1}^* - \ln X_{t-1}] + \mu_{2t}$$

where $A(L)$, $B(L)$, $C(L)$, and $D(L)$ are finite polynomials, and Δ is the first difference operator. The findings of the unit root tests indicate that transforming the variables by taking first differences of logarithms, we can use the statistical inference on the dynamic model. The term $[\ln X_{t-1}^* - \ln X_{t-1}]$ represents our error-correction term, that is the deviation of export demand from the long-run equilibrium. The SEECM can be estimated in two different ways;

1) By changing the error-correction term from the form $[\ln X_{t-1}^* - \ln X_{t-1}]$ to

   $[\ln X_{t-1} - \beta_3 \ln W_{t-1} + \beta_5 \ln RPX_{t-1}]$ for standard export model and to

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$[\ln X_{t-1} - \beta_3 \ln W_{t-1} + \beta_5 \ln RPX_{t-1} + \beta_7 \ln TW_{t-1}]$ for augmented export model,

and thus we obtain an unrestricted ECM.

2) By using residuals from the estimated cointegration vector as a measure of the

equilibrium error and applying OLS to the resulting restricted model.

A dummy variable (*LIB*), which is equal to 1 from 1992, the year that Thailand started the liberalization process with membership of AFTA, is included in the augmented export model to take into account formal trade liberalization in Thailand. Our final results for both unrestricted ADRL model and restricted model applying JJ Full-Information Maximum Likelihood (FIML) are reported in Table 3.17.

Table 3.17: Error-Correction Model for Export Demand ($\Delta \ln X$)

Variable	Standard Model			Augmented Model			Augmented Model (dummy)		
	Unrestricted	Restricted EG	Restricted JJ	Unrestricted	Restricted EG	Restricted JJ	Unrestricted	Restricted EG	Restricted JJ
$\Delta \ln W_t$	0.75** (0.31)	0.73*** (0.29)	0.65** (0.29)	0.66** (0.29)	0.71*** (0.27)	0.57** (0.27)	0.58* (0.32)	0.55*** (0.16)	0.45* (0.25)
$\Delta \ln RPX_t$	-0.19* (0.11)	-0.19* (0.10)	-0.15* (0.08)	-0.18* (0.10)	-0.18** (0.09)	-0.14* (0.07)	-0.18* (0.10)	-0.18* (0.09)	-0.14* (0.08)
$\Delta \ln TW_t$				-0.49*** (0.17)	-0.52*** (0.15)	-0.43*** (0.15)	-0.51*** (0.17)	-0.55*** (0.16)	-0.46*** (0.16)
ecm_{t-1}		-0.20** (0.08)	-0.15* (0.07)		-0.26** (0.11)	-0.14* (0.07)		-0.24** (0.11)	-0.13* (0.07)
$\ln X_{t-1}$	-0.20** (0.08)			-0.25** (0.11)			-0.23* (0.12)		
$\ln W_{t-1}$	0.36** (0.16)			0.37** (0.16)			-0.10 (0.11)		
$\ln RPX_{t-1}$	-0.11 (0.07)			-0.06 (0.07)			-0.06 (0.07)		
$\ln TW_{t-1}$				-0.09 (0.11)			-0.10 (0.11)		
LIB_t							0.03 (0.05)	0.02 (0.02)	0.02 (0.02)
Constant	-3.82** (1.74)	0.06*** (0.02)	0.06*** (0.02)	-2.64* (1.50)	0.04** (0.02)	0.05** (0.02)	-2.36* (1.37)	0.05** (0.02)	0.06*** (0.02)
R^2	0.22	0.22	0.19	0.36	0.34	0.31	0.37	0.35	0.33
$\bar{R}^2$	0.13	0.17	0.13	0.25	0.28	0.25	0.23	0.28	0.24
SER	0.07	0.07	0.07	0.07	0.06	0.07	0.07	0.06	0.07
DW	2.16	2.15	2.19	2.03	1.98	2.18	2.09	2.03	2.19
NORM	JB = 1.75	JB = 2.04	JB = 2.62	JB = 1.18	JB = 1.18	JB = 2.46	JB = 1.18	JB = 1.60	JB = 3.19
ARCH	$F_{(1,44)}$ = 0.71	$F_{(1,44)}$ = 0.69	$F_{(1,44)}$ = 0.16	$F_{(1,44)}$ = 0.24	$F_{(1,44)}$ = 0.26	$F_{(1,44)}$ = 0.03	$F_{(1,44)}$ = 0.26	$F_{(1,44)}$ = 0.06	$F_{(1,44)}$ = 0.01
HET	$F_{(10,36)}$ = 0.45	$F_{(6,40)}$ = 0.53	$F_{(6,40)}$ = 0.69	$F_{(14,32)}$ = 0.62	$F_{(8,38)}$ = 1.12	$F_{(8,38)}$ = 1.51	$F_{(15,31)}$ = 0.73	$F_{(9,37)}$ = 1.35	$F_{(9,37)}$ = 1.66
RESET	$F_{(1,40)}$ = 1.36	$F_{(1,42)}$ = 1.18	$F_{(1,42)}$ = 2.73	$F_{(1,38)}$ = 0.14	$F_{(1,41)}$ = 0.10	$F_{(1,41)}$ = 2.06	$F_{(1,37)}$ = 0.25	$F_{(1,40)}$ = 0.01	$F_{(1,40)}$ = 1.49

As reported in Table 3.17, like those of imports, the results of the two models (unrestricted and restricted) are very similar. However, when considering both the standard and augmented export model, the R^2 values appear to be somewhat lower than those of import models (0.19 to 0.37). The estimated standard errors for the augmented models, in all cases, are lower than those of the general unrestricted autoregressive model, suggesting the validity of the parameter-reduction process. All the diagnostic tests confirm no evidence of high correlation, no serial correlation, no any problem of heteroskedasticity, and no problem of non-normality in the residuals.

The estimated coefficient of error-correction term has a negative sign which is consistent with the theory. However, the estimated values of the parameters are low for both standard and augmented models, which indicate a slow speed of adjustment towards the equilibrium state. The coefficients on the error-correction term can be interpreted as the yearly speed of adjustment respect to short-run disequilibria. We can read the estimated coefficient as if approximately 20-26% of any disequilibrium inherited from the last period is eliminated in the next period.

Considering the short-run income elasticity, the coefficients, in all cases, are significant with correct sign. The estimates for both standard and augmented models are lower than unity (+0.73 for standard model, +0.71 for augmented model without liberalization dummy, and +0.55 for augmented with liberalization dummy), suggesting that world income change has a small immediate impact on change in the volume of exports. However, the income impact seems to be larger in the long run than in the short run.

For the short-run price elasticity, while the import price elasticity is insignificant in short run, the short-run export price elasticity is negatively significant, showing an

immediate effect on export demand. However, the values are all approximately equal to 0.2, which indicate a low short-run inelastic response of the quantity of exports to relative export price change.

The short-run elasticities of the world's average tariff rate are -0.52 and -0.55. The estimates are highly significant and have a negative sign as expected. This implies that world trade liberalization has an immediate impact on export demand. However, the trade liberalization dummy appears to be insignificant, implying that trade liberalization in Thailand (as becoming a member of AFTA and the WTO) does not have any significant impact on export demand in the short run.

3.5.3. Comparison

We have used a battery of tests, and utilized all possible variants of estimation methods for both the short run and the long run, in analyzing both the import demand as well as the export demand function for Thailand. The reason for employing so many tests, and considering both standard and non-standard estimation methods, is to check on the robustness of the results. Since policy makers wish to re-structure policy (trade liberalization or tariff reduction or alleviation of the trade deficit or currency alignments), on the basis of the import and export demand functions, it is vital that we get consistent, sensitive and robust results. Thus, we need to analyse carefully what the estimated elasticities are and what implications they may have on trade policy. However, simply because of the plethora of results, the variety of consistent estimates used, and the many different parameter values of the estimated equations, it is imperative to do a comparison and draw appropriate conclusion about the nature and range of price/income elasticities in a small and highly open developing economy like Thailand. In the following table, the empirical findings as for elasticities are summed

up and then these values are discussed carefully later. In what follows, we summarise the results in tabular form and then conduct a comparative discussion drawing conclusions on the policy implications of our results.

Table 3.18: Short-Run and Long-Run Elasticities

	Imports						Exports					
	Thailand's GDP		Relative Import Price		Thailand's Average Tariff Rate		World's GDP		Relative Export Price		World's Average Tariff Rate	
	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run
Long Run OLS (EG)		1.22		-0.39		-0.17		1.31		-0.20		-0.62
Cointegrating Vector (JJ)		1.25		-0.50		-0.18		1.34		-0.27		-0.71
ARDL(1,1)	2.21	1.28	-0.11	-0.64	-0.23	-0.07	0.66	1.48	-0.18	-0.25	-0.49	-0.34
Unrestricted ECM	2.21		-0.11		-0.23		0.66		-0.18		-0.49	
Restricted ECM (EG)	2.15		-0.08		-0.26		0.71		-0.18		-0.52	
Restricted ECM (JJ)	2.13		-0.15		-0.22		0.57		-0.14		-0.43	

From Table 3.18, it is shown that the results are close to each other and, in some cases, identical. The coefficients on short-run income and price elasticities obtained from the unrestricted ECM appear to be identical to those derived in ARDL(1,1). As a matter of fact, the unrestricted ECM is nothing more than a re-parameterization of the standard ARDL; therefore they give similar results. However, the other methods of estimation also have similar values of the elasticity parameters. We interpret this as an example of robustness.

Considering first the import model, it appears that domestic income has a very high influence on imports, with the impact in the short run always greater than the long run. The empirical result shows that imports to Thailand are found to be income elastic (greater than unity), which suggests that, as Thailand's economy grows, the demand for imports will grow at a faster rate. The implication is that this high income elasticity of import demand will lead to an automatic worsening in trade balance,

ceteris paribus. The problem is particularly serious in the short run since it is found that the income elasticity of import demand is greater than 2 i.e. extremely high elasticity. Any increase in the growth rate will increase the trade deficit and generate a large current account deficit both in short and long run.

The high income elasticity of import demand also reflects many trade and production aspects of Thailand. First, it can be implied that economic growth does not necessarily lead to an increase in the production of import substituted goods, given that imports are equal to domestic demand minus domestic production of import substitutes. Since the early 1970s, when Thailand has switched its trade policy from import-substitution industrialization to export-oriented industrialization, import substitution industries have no longer been subsidized nor protected; since then Thailand has been a big importer of manufactures products since these products are needed in the production process of medium to high-technological goods which are a main component of Thai exports. Most parts of Thailand's import composition include raw materials, intermediate products, and capital goods such as metal and mineral products, chemical and plastic materials, electronic parts, and industrial machinery, industrial tools and parts, which are required in the production process of export goods rather than consumer goods and a substitution for domestic production. Second, this fact is in line with the suggestion given by Goldstein and Khan (1985) who mentioned that income elasticity of import demand is not homogeneous across all product categories. They suggested that the income elasticity of demand for imports tends to be high for a country which has a high proportion of manufacture good in its import composition, while the country which imports a high proportion of non-manufactured goods tends to have a lower income elasticity of import demand. Third, this further implies that, for most developing countries which have experienced a substantial change in their

economic structure and the composition of imports, the improvement in the level of economic development tends to be associated with an increase in the income elasticity of import demand. This view is supported by the study of Lo *et al* (2007), which investigated the link between economic development and the income elasticity of demand for imports. They proposed that a rising level of economic development of a country tends to generate a higher income elasticity of its import demand because in the process of economic development, there is a tendency for the percentage of manufacturing import in total imports to rise. As the composition of imports changes to manufactured, intermediate, and capital goods, there is a tendency for a developing country to grow to be an industrialized country, and thus this economic development reflects in a high income elasticity of demand for imports. Finally, in addition, Thailand is not only a big importer of manufactured and intermediate goods, but it also is a big importer of luxury goods. A high income elasticity of import demand reflects the fact that the bulk of the imports to Thailand are luxury goods, rather than essential goods. Thailand is one of the most outstanding Asian countries, which experienced a transition from underdeveloped status to become a more industrialized export base country following export promotion policy. This generates a rapid economic growth rate and substantially changes the structure of its economy during the process of economic development. This growth phenomenon results in the high consumption of imported luxury goods, when economy was booming, the high demand for import luxury goods and consequently, the high income elasticity of demand for imports.

Although the income elasticities in the short and long run are both greater than unity, implying that imports are a superior good, it is interesting to note that the long run elasticities are relatively smaller. Both the cointegrating long run equations with

stable elasticities (the first two rows of Table 3.18) show that income elasticity is of the order of 1.25 substantially lower than the short run easticities greater than 2. Thus it is clear that although imports are a superior good and tend to form an increasing share of rising GDP, it is not excessively high. Ultimately, a level of unity would mean that the long run share of import in national output remains constant. An elasticity of around 1.2to 1.25 is therefore indicative of relatively stable import shares.

Change in relative import price seems to have very little effect on imports in the short run but the magnitude of the impact is considerably higher in the long run. The low price elasticity of import demand reflects the fact that, despite having a good resource base, Thailand's strategy to pursue export-led economic growth since the 1970s has placed emphasis on the manufacturing sector, and hence this has pushed the country to rely heavily on the imports of intermediate inputs and capital goods to enhance the production capacity. In other words, Thailand's export structure is highly dependent on the imports of intermediate inputs, materials, and capital goods, which are used in the production process of medium and high technology products. Thus, the change in price has a little effect on imports of these manufactured goods. In addition, many types of manufacturing imports, especially intermediate inputs and capital goods, are not manufactured in Thailand. This means that an increasing proportion of imports of these intermediate inputs and semi-finished components is complimentary to, rather than competitive with, Thailand production. Since the range of import substitutes are relatively low, a change in price is not expected to affect the volume of imports. Its level is based on input-output needs of the final product industries rather than on price measures. Of course, in the long run, the impact of prices is higher since the economy has managed to adjust to these changes and have found substitutes for imports within the domestic economy. A fast growing economy, allows product diversification and

import demand can be reduced, with higher prices, because import substituting industries have managed to develop.

The reduction of Thailand's average tariff rate seems to increase imports in both short run and long run, but the impact is quite small. As stated earlier, Thailand's import structure comprises the imports of intermediate inputs and capital goods in a high proportion. In order to promote an export-led growth policy, the government generally does not impose a tariff, or if there is one the rate is low, on these types of products because the low input tariff makes it less costly to produce the final goods, and thus improves the competitiveness of the country's export goods. Instead, many types of tariffs are imposed on final goods. Since raw materials, intermediate inputs, and capital goods are imported at zero or low tariff rates, as a result, tariff reduction does not have a substantial impact on Thailand's import pattern.

For the export model, although the change in the world's income appears not to have a large immediate impact on exports, its impact is considerably high in the long run. This evidence is consistent with other studies (see, for example, Houthakker and Magee (1969)), that, in general, fast-growing countries seem to face a high income elasticity of demand for exports. The empirical evidence of high income elasticity of demand for exports has an important implication for exports of Thailand and other developing countries in general. That is, the export growth of Thailand as well as that of most developing countries is highly dependent on the economic performance of developed countries. With reference to the high long-run income elasticity of demand for exports, this can be implied that Thailand's manufactured exports have a high degree of exposure to its traditional export markets such as the U.S., Japan, and among ASEAN countries. However, the effect of change in relative export price on exports is very low in both short run and long run. On one hand, the low price

elasticity of export demand can be implied that the developing countries, including Thailand, are not capable of using price competition to maintain or increase exports. On the other hand, it can be implied that Thailand's export markets are fairly established. However, the high income elasticity of demand for exports could also be viewed as an upward bias since there is an argument obtained from Krugman (1989), that in the case of a high proportion of manufactured exports, the absence of a variable to capture product quality improvements or product diversification will tend to bias the estimated income elasticity of demand for exports upwards.

An interesting empirical observation from Table 3.18 is that the long run world income elasticity of exports is similar to the long run domestic income elasticity of imports (the former being somewhat higher). If for example, world income grew at a similar rate as Thailand GDP, the impact on the trade balance would be negligible since exports and imports would grow at a similar rate. In fact, because Thailand has consistently grown faster than the rest of the world that there has been an enduring issue about trade deficits.

Unlike the import model, world's tariff reduction seems to improve exports of the country in both short and longer terms. Through the increased integration of the world economy as a result of the continued liberalization of trade and investment, the manufacturing industries of Thailand have expanded significantly in terms of exports, employment, and output. Manufactured exports have contributed significantly to the growth and the economic development of the country. Currently, the bulk of manufactured exports, which make up the largest share of the country's total exports, comprise the exports of computer and computer parts, transformer, generator and motor, electrical appliances and electronic products, telecommunication equipments, and integrated circuit. From the empirical result, Thailand seems to be successful in

gaining from the global tariff reduction since it is able to diversify its exports into more manufactured goods and boost manufacturing through technology upgrading, research and development, education and training, and these in turn strengthen the country's supply capacity.

To summarize, when comparing income effect between imports and exports, although the magnitude of impact in long run is almost the same, the impact of change in domestic GDP on imports seems to overwhelm that of a change in the world's GDP on exports in the short run. This may finally result in the problem in trade balance in the short run, as stated above. However, this should not be a problem in the long run. Thus policy makers need not be overly concerned about trade deficit unless it creates a sort of currency and financial crisis of the past. Under 'normal' circumstances, the trade negative balance will correct itself over time. The price effect on both imports and exports is obviously very low in the short-run. However, in the long-run, it appears that the impact of relative import price on imports is higher than the impact of relative export price on exports.

Considering tariff reduction, the impact of world's tariff reduction on exports seems to be higher than the impact of Thailand's tariff reduction on imports of its own country. This can be inferred that global trade liberalization through the reduction of international tariff structures is beneficial for the country. It is clear that the various WTO negotiations have overall benefited Thailand much more.

3.6. Conclusion

In this study, we analyze the impact of trade liberalization on the volume of imports and exports in Thailand by means of the reduction of tariffs and joining AFTA and the WTO membership by applying the traditional import (export) demand functions

and then using the Autoregressive Distributed Lagged (ARDL) model to estimate the short-run and long-run elasticities in Thailand's import (export) demand over the period 1960-2007. We also compared these estimates with the estimates obtained using the cointegration techniques and an ECM. It turns out that the ARDL approach and the cointegration and ECM approach give very similar results.

On one hand, in the aggregate import demand function for Thailand, the aggregate import volume is cointegrated with Thailand's GDP, Thailand's relative import price, and Thailand's average tariff rate. On the other hand, in aggregate export demand function for Thailand, the aggregate export volume is cointegrated with the world's GDP, Thailand's relative export price, and the world's average tariff rate. Results of the estimated dynamic specification of the functions show that Thailand's import demand is largely explained by the country's GDP, while Thailand's export demand is largely influenced by world's GDP. As domestic income increases, Thailand's import expands more than proportionately. However, prices seem to have very little effect on imports. This reflects the pattern of imports of the country that the country is highly dependent on the imports of raw materials, intermediate goods, and capital goods, such as mineral and metal products, chemicals and plastic materials, electronic parts, and industrial machinery, industrial tools and parts, which are required in most of the production process (also the production for exports), rather than consumer goods and a substitution for domestic production. As for exports, it is found that exports react moderately fast to a change in world income but relatively slowly to movement in their relative price. The results of both import and export demand functions are consistent with other studies, which generally find that developing and industrial countries tend to have significantly higher income elasticities and lower price elasticities.

In general, a country liberalizes its trade because it hopes that it will gain special access to the market of its trading partner. More specific, a country agrees to reduce or eliminate its trade barriers when it reaches agreement that other trading partners will also reduce or eliminate their trade barriers. By this means, a country expects that the loss from opening its market is overwhelmed by the gain from freer trade. However, there is nothing to guarantee that every country participating in free trade will experience a considerable increase in the volume of exports. Furthermore, if, after trade is liberalized, exports do not increase proportionately as an increase in imports, the trade balance will be worsened. High imports without a corresponding increase in exports increase the trade deficit and further lead to current account problem. Our results provide strong evidence that trade liberalization in terms of tariff reduction promotes both imports and exports, with the impact of world's tariff reduction on exports is much higher than the impact of Thailand's tariff reduction on its imports. Thus, it can be concluded that, for Thailand, trade liberalization through tariff reduction does not ultimately lead to the deterioration in trade balance per se. In addition, liberalization in Thailand could be construed as a beggar-thy-neighbour policy, in which Thailand can seek benefit from trade liberalization all over the world at the expenses of other countries. In a world of tariff reductions, Thai imports will rise but its exports will rise far more. However, we find no evidence of a statistically significant effect of institutionalized trade liberalization, in terms of joining AFTA and the WTO, on both imports and exports.

Chapter 4

ESTIMATING THE IMPACT OF
TRADE LIBERALIZATION ON TAX REVENUE

4.1. Introduction

While trade liberalization has long been investigated by a number of studies and believed to provide benefits for those countries which promote freer trade by inducing trade creation, lowering consumer prices, raising countries' welfare and increasing competition for the domestic economy which finally may help domestic markets reach higher efficiency[16], very few studies paid attention to issues concerning the consequence of trade liberalization decreasing tax revenues, not only on international trade taxes as a result of tariff reduction, but also on domestic taxes as a result of erosion of tax bases. This leads to a controversy whether trade liberalization is a potential source of fiscal instability, especially for countries which have high dependency on trade tax for their public revenue. Each step in liberalizing trade for many developing and less developed countries is now very sensitive because it raises the issue of revenue losses which may continue to be a very big problem for any budget-constrained government where trade tax is the major revenue source of the country. Although it is found that trade taxes are not a significant source of revenue in OECD countries since they are accounted for only 0.5 percent of total tax revenues, the dependency on trade taxes is much higher in middle income countries; around 16 percent in average. The fear of the impact of trade liberalization seems to be substantial in low income countries because the percentage of trade tax in total tax revenues is as high as 26 percent on average.[17] Because of such a high dependence on trade tax for revenue, any country which has that tax structure and commits itself to any form of trade liberalization must be concerned about how to mitigate the revenue loss, a serious problem that trade liberalization potentially entails.

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[16] See Viner (1950), Lipsey (1957), Kemp and Wan (1976), Wonnacott and Lutz (1989), Krugman (1991) and Summers (1991) for example.
[17] See Pelzman (2004).

There are some studies suggesting that the revenue problem can be solved if trade liberalization is co-ordinated with potential government budget spending, sound macroeconomic policies, and effective measures on tax revenue, including raising domestic direct and indirect taxes, widening and developing new tax bases, improving effectiveness of public spending, raising public saving, and strengthening tax collection and administration.[18] However, what is good in theory may not be applicable in practice. Many countries find it is very difficult to implement these responses in order to prevent the adverse effects on fiscal revenues. The reason that most developing and less developed countries usually rely heavily on trade tax is not only because of the ease of collection, but also because they have some constraints. Their restrictions may have various explanations such as the political instability, the constrained institutional capacities, and the limitation of a country's geography. Generally, countries, which have a small geographical area, tend to have small domestic market, small population size, and un-diversified production. These attributes result in narrow tax bases, leading to the difficulty in switching revenue sources from trade tax to other domestic taxes. In addition, the structure of income and consumption taxes, especially for Value Added Taxes (VAT) is much more complicated than that of trade tax, so the replacement from these alternative sources requires a good design of country's tax practice reform. Developing and less developed countries always face the problem of domestic tax reform because of their relative lack of skillful authorities and efficient tax system. Moreover, the empirical work constructed by Pelzman (2004) suggests that, although countries may be going through the liberalization process, the trade tax continues to be a major source of revenue, especially for budget-constrained countries. Increases in domestic taxes, in

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[18] See Peters (2002), Mujumdar (2004), Keen and Ligthart (2004), and Glenday (2000) for example.

order for countries to compensate for the loss in tariff revenue, yield diminishing returns. He also finds that as domestic taxes increase, more and more economic activities are pushed into the informal sector. Hence, he concludes that trade liberalization tends to have a negative impact on the domestic revenue for developing countries. The level of countries' economic development also has a significant influence since developing and less developed countries generally have relatively low institutional quality, corrupt governments, and low technology, causing a problem in the improvement of tax collection and administration. Cutting down the government expenditure as a consequence of the decrease in revenue seems not to be feasible since it directly reduces welfare. In addition, government spending on the social sector, infrastructure, national defense, and poverty reduction cannot easily be cut because it may also raise political issues. If it chooses to do this, the government may easily be pressured by affected groups and those who oppose free trade.

Although some countries are able to cope with the negative fiscal effects of trade liberalization by using a mix of tax and non-tax policy, the non-tax policy seems to play a limited role. The results of non-tax policies such as improving macroeconomic performance, controlling inflation, controlling public spending, and increasing the reliance on non-tax revenues are likely to be uncertain and these policies are able to be accomplished only in the long term. The most possible efficient alternative to deal with fiscal difficulties in the short and medium term is to use the tax policy response by introducing domestic tax reforms, for both income and consumption taxes. However, since trade liberalization could possibly lead to a reduction in output, corporate profits, and employment in certain sectors that face greater competition from lower-cost foreign products, this impact on domestic tax bases could finally result in the reduction of domestic taxes. Although the net outcome depends crucially

on many factors such as the flexibility of wages and prices to allow the full adjustment of relative prices after trade is liberalized, the ability of domestic firms to face higher competition, the structure of economy, and the structure of country's tax system, the adverse effect of trade liberalization on domestic tax revenues is an important issue to be taken care of when a country walks along the liberalization path. For many developing and less developed countries, the loss of trade tax revenue is itself a very big problem. If trade liberalization is also associated with the reduction in other domestic tax revenues, it will be a much hard work for governments in these countries to pursue domestic tax reform by substituting their sources of revenue from trade taxes to income and consumption taxes which may consequently end up with unsuccessful replacement, and hence the failure of tax reform.

Although a large number of studies have tried to investigate the net impact of trade liberalization on trade tax revenue, very little attention has been devoted to examining the impact of trade liberalization on domestic taxes. The aim of this chapter is to examine the effect on both trade taxes and domestic taxes after trade is liberalized, focusing particularly on low and middle income countries. This chapter attempts to investigate this issue by adopting the traditional tax effort model, using a panel data approach for 134 countries over 24 years covering the period 1980-2003 and employing the two-way fixed effects approach.

This chapter is organized as follows: the next section is devoted to a brief literature review. Section 3 provides a background for the traditional tax effort model. Section 4 describes the extended model, data, and estimating procedure. Section 5 presents and discusses the results for full sample and each income group. Section 6 concludes the chapter.

4.2. General Review: Theoretical and Empirical Background on the Relationship Between Trade Liberalization, International Trade Tax, and Domestic Taxes

In this section, the literature survey starts with some notable works pointing that it is possible for countries to be unsuccessful in implementing domestic tax reform while they are in the process of trade liberalization. Some restrictions are revealed since they possibly account for the failure of tax reform. Then, some related studies are reviewed to highlight how trade liberalization may affect each type of taxes.

4.2.1. The Failure of Revenue Source Substitution

The most obvious way of how trade liberalization affects tax revenue is that it reduces trade restrictions including tariffs, and hence tends to lower trade tax revenue. However, the relationship between trade liberalization and other domestic tax revenues is still ambiguous, or even the impact on trade tax revenue itself is an empirical matter. Compared with the studies of free trade related growth, employment, or trade creation and diversion, there have been a relatively small number of both theoretical and empirical studies on the revenue impact of trade liberalization. Among the studies, there is an attempt to investigate the possibility of mitigating the decrease in trade tax revenue since this is the major concern of most developing and less developed countries which decide to liberalize trade. Aizenman and Jinjarak (2006) study the relationship between globalization and the changes in the "easy to collect" and "hard to collect" taxes; defining the "easy to collect" taxes are the revenues from tariff and seigniorage, while the "hard to collect" taxes are the revenues from Value Added Tax (VAT), and using two measures of globalization; trade openness and financial integration by taking them as exogenous factors. From the hypothesis that globalization may lead to a reduction of the countries' tax

revenues, especially for most developing countries, by shifting tax base from "easy to collect" to "hard to collect" taxes, they show that the revenue of "easy to collect" taxes declined by about 20%, while the revenue of "hard to collect" taxes increased only 9% between the period 1980-1999.

The results of Aizenman and Jinjarak (2006) seem to be supported by the work of Baunsgaard and Keen (2005). They examine whether countries can recover their loss of trade tax revenue, as a result of trade liberalization, from increasing domestic tax revenues by running regressions on both full sample and three separate groups; low, middle, and high income countries. The results show that, for the full sample, although openness is significantly positively related to domestic tax revenues, its impact is quite small. The degree of revenue recovery is only 20 to 50 cents per dollar. For low income countries, openness is positively significant with a stronger impact than that of full sample. However, the recovery rate is the lowest; less than 30 cents per dollar. For middle income countries, openness is still positively significant. The recovery rate is a bit higher, from 45 to 65 cents per dollar. For high income countries, openness is insignificant in all specifications. However, the recovery rate is more than offset since domestic tax increases from 1.5 to 3 dollar, especially for those which adopt VAT.

In addition to the evidence that countries may fail to shift their tax bases from trade tax to other domestic taxes and they may not be able to recover their loss of trade tax by raising domestic tax revenues, there is also evidence that trade liberalization itself is likely to hinder the substitution of tax revenues. Agbeyegbe, Stotsky, and WoldeMariam (2004) construct an empirical study using panel data of 22 countries in Sub-Saharan Africa over 1980-1996 to address the question whether trade liberalization leads to a reduction in total tax revenues through its effect on

international trade tax and other domestic taxes. The results strongly support the uncertain effect of trade liberalization. Although the results suggest that trade liberalization leads to stronger total tax revenues and trade tax revenue, there is evidence that trade liberalization is associated with weaker income tax and goods and services tax. A reduction in domestic taxes may potentially result in the difficulty of replacing sources of revenue.

Even if trade liberalization has no effect on domestic taxes, tax reform is a very difficult task for many less developed and developing countries to pursue. Now, if trade liberalization has a negative impact on domestic tax revenues, reform by using these sources may be inapplicable. This raises the question whether these countries should implement the reform in the same way as developed countries. What is the difference between these countries and most developed countries? In the next section, the exploration of some unique features of developing and less developed countries is provided in order to investigate their restriction which may cause the failure of tax reform.

4.2.2. Characteristics of Developing and Less Developed Countries: Self Constraints

The impact of trade liberalization seems to be substantial in developing and less developed countries since the revenue of these countries tend to be highly dependent on international trade tax. Actually, these countries have long used trade tax and subsidies, import and export quotas, and other non-tariff barriers to adjust their international trade. The traditional trade tax has been used to achieve two major purposes; increasing revenue for the public sector and protecting their infant and local industries. However, since the beginning of the liberalization period, many industrial

nations have attempted to promote the high and sustainable growth to the global economy. One of their policies is to pursue global trade liberalization through the World Trade Organization (WTO) or Free Trade Agreements (FTAs). No matter how well the economic structures of developing and less developed countries are prepared or no matter how willing they are to liberalize their trade, they have already and automatically been forced to walk along the path of globalization and liberalizing programme.

As stated in Khattry and Rao (2002), policy options which are developed for advanced economies are not appropriate and cannot be implemented in low and middle income countries since they possess unique features which are the important constraints and cause the transition problematic. Those limited features can be categorized into three groups.

1. Geographical constraints

The size disadvantages have widely and obviously been observed in standard economic theories. First, a small country has a small domestic market which results in industries being unable to obtain economies of scale. Second, a small nation tends to have less domestic competition within its internal market which leads to an inefficient allocation. Third, as it is pointed by Helpman and Krugman (1985) about the lack of strategic trade policy, a small nation has less potential in preparing their domestic firms to enter the world market and it also has limited potential to use import-substitution policy. Fourth, many small nations have poor domestic resources, leading to a narrow range of domestic output. As a result, these countries are highly dependent on imports and exports which make them quite vulnerable to external economic shocks.

Smallness does not only have an impact on production, allocation, and competition as stated above, size also affects a country's tax receipt. Since small and less developed countries tend to have high dependence on trade tax for their revenue, trade liberalization, especially by the reduction of tariffs, severely seems to decrease trade tax revenue, and hence causes fiscal problems. According to Peters (2002), he explores the fiscal effects of trade liberalization for the Caribbean Community (CARICOM), as the case of small open economies, by using descriptive analysis and concludes that because CARICOM possesses two restrictive characteristics; small size and low level of development, these countries usually have small domestic markets and un-diversified or even mono-production. These features force this community to be highly dependent on external trade and have narrow tax bases. He also points that although the magnitude of the impact of trade liberalization is difficult to assess, there could be a shortfall in the short-run trade tax revenue as much as 45 percent. The mitigation of the decline in revenue by introducing broad based consumption taxes (i.e. VAT) seems to be difficult due to the many countries' restrictions such as the size of domestic markets and the level of economic development.

There are several traditional arguments for substituting trade-based tax to more a broad-based consumption tax such as VAT. For instance, while a trade tax imposes distortions on both consumption side and production side, consumption taxes distort only consumption, hence a trade tax generates more distortion and a consumption tax is more preferable than a trade tax. Among those reasons, one of the most predominant arguments is that the tax base of a consumption tax is generally much larger than that of a trade tax so a consumption tax could potentially be used to mitigate the loss of trade tax receipts or even to raise overall tax revenues. However,

this argument is likely to be practicable only for large size countries because in order to gain the revenue from the consumption tax, a large consumption base is needed. It is very difficult for small countries to raise a considerable amount of consumption tax revenue since they have only a small domestic market and hence limited consumption. In addition, there is some evidence that poverty levels and income distribution tend to be more uneven in smaller than in larger countries. This may also push the level of consumption in small countries down and as a result reduce the amount of consumption tax collection.

However, the problem of fiscal compensation for lost revenue from trade liberalization is not likely to be limited in small countries. Rajaraman (2003) attempts to investigate where the fiscal compensation can be sourced by using descriptive analysis and reviewing the literature since he finds that the loss in tariff revenues in India have resulted in diminishing aggregate tax revenue. Although the theoretical results from Keen and Ligthart (1999) suggest that the loss in tariff revenues can be replaced by domestic indirect taxes, more specifically a price-neutral VAT and conclude that VAT could enhance both revenue and welfare, the empirical work using cross-country regressions for 183 countries of Ebrill *et al* (2001) shows the contradictory results that VAT is not significant in raising tax revenues.[19] Together with the lack of empirical evidence on revenue enhancement by VAT adoption, Rajaraman (2003) concludes that there is not enough evidence to ensure that India's loss in trade tax revenue can be compensated by a consumption tax.

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[19] Note that openness is also included in the regression as one of tax revenues determinant and it is found that openness has a significant positive impact on tax revenues.

2. Structural constraints

In *"Economic Development with Unlimited Supplies of Labour"*, Lewis (1954) constructs a two-sector model and demonstrates that a country becomes more urbanized as its economy grows. As countries develop, it has been observed that tax bases grow more than proportionately to the growth of income. That is the capacity to tax grows with the growth of GDP (Musgrave, 1969). Supported by later work, Tanzi (1987) studies the relationship between tax levels and economic development and conclude in the same way that, as countries grow, they become urbanized. Urbanization leads to an increase in both the need for tax revenue and the capacity to tax. On the demand side, urbanization leads to higher demand for public services and hence the government needs to raise more income from tax revenue in order to support its public activities. On the supply side, urbanization leads to larger tax bases and higher development in public services facilitating tax collection which in turn improves the capacity to tax of the government.

Unlike developed economies, low and middle income countries tend to be more rural. Rural economic activities are much more difficult to tax because they compose dispersed, small-scale firms and produce primary products which are associated with the subsistent economy rather than commercial economy. Even if there is a surplus for commerce, these firms often escape tax collection. In addition, because these firms are informal in their nature, their income is very difficult to assess and hence it is hard to include them in the income tax base. As a result, the government usually levies taxes on agricultural exports which is much easier instead of attempts to assess their income. This is one of the reasons why low and middle income countries tend to have a high proportion of trade tax in their total tax revenues. Moreover, most population in less developed and developing countries tend to be children and elders, falling in the

age-dependency group. With a high age-dependency ratio, the income tax bases in less developed and developing countries are much narrower than income tax bases in developed countries. These aspects limit the possibility to substitute sources of tax revenues from trade tax to income tax when tax reform is preceded after trade liberalization.

3. Institutional and political constraints

Institutional quality has a direct effect on a country's tax collection. In less developed and developing countries, there is weak management, with poor information, auditing and supervision of staff, in line with inefficient and high corruption tax administrations, leading to the difficulty in assessing taxes. These factors, when combined with high tax evasion as a result of the weakness of the rule of law and the lack of administrative capacity, result in low level of tax revenues in low and middle income countries. These features contribute to the use of trade tax in these countries because, when compared with income base tax or consumption base tax, trade tax is relatively easy to assess and monitor and has less problems of tax evasion.

In low and middle income countries, there is also political obstruction which impedes the domestic tax reform and domestic tax base expansion. The influence of powerful lobbies makes some sectors be exempted from taxation. It is demonstrated by Ndikumana (2001) that political power used by some interest groups results in lobbying and tax exemption. This results in the limited use of both personal income and corporate income taxes. In addition, it is found that low quality institution and political instability have a negative influence on goods and services tax collection (Aizenman and Jinjarak, 2006). Thus, it can be concluded that low quality of institutional factors is an obstruction to the mitigation of the loss in trade tax.

So far, we have investigated the reasons why a country may fail to recover the loss in trade tax revenue and be unsuccessful in reforming its domestic taxes by using the explanation of country's attributes and excluding the effect of trade liberalization on tax revenues from the frame. In the next section, we introduce trade liberalization into the picture and review the studies which show how trade liberalization may affect each tax type.

4.2.3. The Effect of Trade Liberalization on Tax Revenues

Trade liberalization may have a different impact on different kinds of tax revenue. This section reviews the literature studying the revenue impact of trade liberalization by dividing tax revenues into 4 categories, including international trade tax, personal income tax, corporate income tax, and goods and services tax.

1. International Trade Tax

Generally, international trade tax revenue is thought to decrease after countries liberalize their trade. Many studies point out that the reduction in import tariffs, associated with trade liberalization, often leads to a drop in trade tax revenue, especially for small open economies which their tax revenues tend to be more heavily dependent on international trade. Peters (2002) investigates this issue by taking the case of countries in the Caribbean community which are constrained by having a small size and lower level of development. Although the trade tax revenue effect of trade liberalization is generally uncertain depending on many factors such as countries' conditions, initial position of tariffs, and the level of import elasticities of substitution, he finds the evidence that trade liberalization in these countries usually leads to a reduction in trade tax receipt and finally a decrease in total tax revenues.

Ebrill *et al*. (1999) provide a clear-cut explanation of the effect of trade liberalization on trade tax. They state that the revenue implications depend largely on the volume of imports after trade is liberalized. Generally, trade restrictions are composed of two major components, tariff barriers and non-tariff barriers. Although the main aim of trade liberalization is to reduce or eliminate both restrictions, most liberalization usually considers the removal of quantitative restrictions at the first phase and then the continual reduction of tariff rates in the second stage. They reason that goods, which are restricted by quotas, usually are tariff imposed. If quotas of these goods are removed, it is possible that trade tax revenue may increase at least in the very first stage of liberalization as the volume of imports is likely to increase. This may also be true in the case of the replacement of quantitative restriction such as quotas by tariffs.

The initial tariff levels, their coverage, and the extent to which they are reduced, play a significant role in determining the impact on international trade tax revenue. Ebrill *et al* (1999) reason that if the initial tariff rates are high, tariff reduction may lead to an increase in trade tax revenue since price elasticities of demand and supply are not constant over the entire range of prices. This effect can be illustrated by a Laffer curve, which demonstrates the relationship between trade tax revenue and trade restrictions (Figure 4.1). When the initial tariff rate is prohibitively high, trade volumes are likely to be severely compressed and trade tax revenue will be very low. Reducing tariffs will lead to a substantial increase in trade volumes and a decrease in the incentive to evade taxes. These combinations are more than compensating for the lower tariff rate, which results in higher tariff revenue. However, if there is a further reduction after trade is fairly liberalized at the revenue maximizing rate, the increase in trade volume will not be large enough to offset the lower tariffs and now the direct effect of tariff reduction will result in the loss of revenue. As a result, overall tariff

revenue will therefore decrease (Ebrill *et al*, 1999; Khattry and Rao, 2002; and Agbeyegbe *et al*, 2004).

Figure 4.1: Laffer Curve
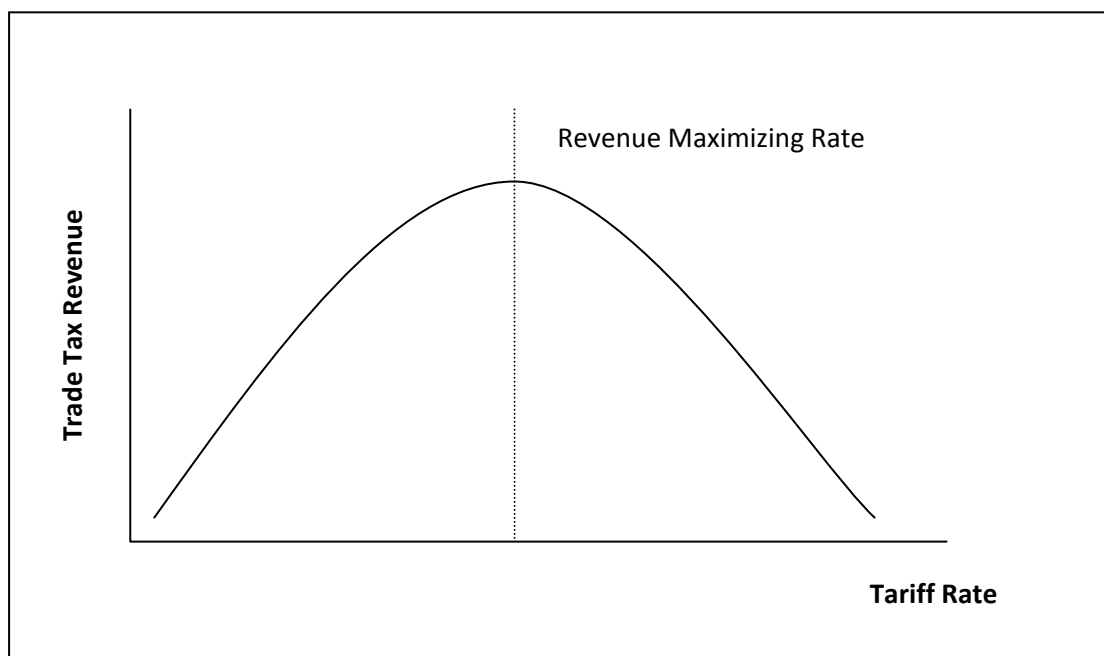
Ebrill et al (1999) also mention that if the liberalization is accompanied with the reduction in tariff dispersion, trade tax revenue may increase. The rationale is that a reduction in the dispersion of tariffs is often done by lowering the higher tariffs and increasing the lower ones in order to reduce them to average value and usually, highly elastic demanded goods such as final consumption goods stated above are also high tax levied. As a result, a reduction in tariff dispersion may lead to an increase in trade tax revenue. In addition, the reduction in tariffs is often associated with the reduction of tax evasion and tariff exemptions. It is intuition that the higher the tariffs, the higher the tax evasion since evasion leads to high marginal benefit for importers. Many works find that there is a positive relationship between tariff rates and tax

evasion.[20] Recent research shows empirical evidence that a one percent increase in tariff rates is associated with a three percent increase in tax evasion (Fisman and Wei, 2001). The tariff reduction, of course, raises the costs for tax evaders and hence lowers the level of tax evasion, thus it may bring an increase in trade tax revenue. For tariff exemptions, Pritchett and Sethi (1993) find that high tariff rates do not necessary lead to high trade tax revenue. Very similar to the case of tax evasion, they argue that higher tariff rates lead to higher incentives for importers to attempt to seek exemptions. The reverse relationship is also true. The lower tariff rates may not bring a decrease in trade tax revenue since the temptations for abuse of any system of exemptions will decrease with the lower level of tariffs.

Trade tax revenue may also depend on the price elasticity of demand for imports and the price elasticity of supply of import substitutes. According to Ebrill *et al* (1999) and Agbeyegbe *et al* (2004), if either the price elasticity of demand for imports or the price elasticity of supply of import substitutes is high enough, there may be revenue gain in later stage of liberalization if the new value of imports (higher volume of imports multiplied by lower tariff rates) exceeds the value of imports before liberalization take places. The volume of imports can be increased in two ways. On one hand, since the prices of imported goods are cheaper after the restrictions are removed, if the price elasticity of demand for imports is elastic enough, the volume of imports may increase to the point which import values offset the loss from tariff reduction. On the other hand, the prices of import substitutes domestically producing are forced to be lowered when imported goods increase due to competition. As a result, domestic output decreases and thus imports increase. However, the elasticity issue might be very complicated because it depends on the timing and characteristic

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[20] See Clotfelter (1983), Fisman and Wei (2001) for example.

of each good. Generally, imported consumer durable goods respond to the price changes more than do intermediate goods and raw materials (Clarida, 1996). In addition, most countries always reduce their restrictions from raw materials, intermediate goods to final consumption goods which are usually import competing goods, consecutively, in order to avoid political contention (Ebrill et al, 1999). In this case, an increase in trade tax revenue may occur only in later stage when tariffs of final consumption goods, which are often taxed at high rates, are eliminated.

Trade liberalization does not only involve the reduction or removal of tariffs and quantitative restriction, but it may also involve the reduction or elimination of an export tax. Similar to the case of tariff cut, if the reduction of the export tax leads to a substantial increase in a country's export volume, a country may be able to collect more trade taxes. However, if the reduction of an export tax does not bring about a significant increase in export volume, trade tax revenue will be decreased.

However, countries may have a revenue problem due to the deterioration of their terms of trade.[21] It is possible that when many developing and less developed countries liberalize their trade simultaneously, there will be an excess supply of similar products which could lower the export prices and finally could exacerbate their terms of trade. This could directly affect a country's export sector and severely worsen export tax revenue.

In conclusion, it is very difficult to determine precisely the effect of trade liberalization on international trade tax revenue since trade liberalization may either decrease or even increase trade tax revenue, depending on the form, the level of liberalization and countries' environmental liberalization conditions. The net impact

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[21] See Devereux and Chen (1999) for example.

of trade liberalization on trade tax is an empirical matter. Trade tax revenue may also be affected by other important variables such as the level of economic development, the exchange rate, the macroeconomic environment, and the effectiveness of tax and customs administrations (Ebrill *et al*, 1999).[22]

2. Personal Income Tax

There seems to be no direct effect of trade liberalization on personal income tax. Trade liberalization, however, is likely to transmit its contribution to personal income tax revenue through economic growth. Ebrill *et al* (1999) point out that there is now considerable empirical evidence that trade liberalization is related to the higher level of economic growth. Frankel and Romer (1999) construct an empirical study to investigate the effect of trade on income by applying the gravity model and using geographic factors as an alternative instrument for trade. They find that trade substantially raises income since a one percent increase in the shares of imports and exports in GDP leads to a one-half to two percent increase in income per person. This means that trade liberalization which induces higher volume of trade is associate with higher income growth. Frankel and Rose (2000) estimate the consequences of currency unions that have on the long-run level and rate of growth of real income, via trade. The most interesting part of their study is the substantial impact of free trade agreements, a form of trade liberalization, on international trade in which they find that free trade agreements roughly triple the trade between countries. They suggest that the contribution of currency unions to an economy comes from the higher volume of trade which occurs as a result of trade encouragement after countries join the

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[22] The effect of exchange rate on tax revenue is still ambiguous as the results from different studies are mixed. For example, using the same data set and similar approach, Adam et al (2001) find a significant relationship between exchange rate and tax revenue, while Agbeyegbe et al (2004) find no evidence supporting the relationship between them.

union, rather than macroeconomic or financial influences. The benefit to a country's economy from being a member of a currency union comes through the promotion of trade, rather than through the benefit from any monetary policy as proponents of currency unions advertise. A more recent study, Baier and Bergstrand (2005) construct a gravity framework using differenced panel data and find that the effect of free trade agreements on trade flows is almost quintupled, again supporting the hypothesis that free trade agreements lead to an increase in trade volume which stimulates economic growth.

Economic growth is likely to have a direct impact on both personal income tax and total tax revenues. Higher per capita income leads to a wider personal income tax base. Many previous literatures reached a conclusion that there is a significant positive relationship between economic development and personal income tax revenue. For instance, Musgrave (1984) provides a solid theory supporting a causal relationship between per capita income and tax level in his tax base and tax handle theory. He states that an increase in per capita income raises the size of public sector which in turn increases a country's tax base and taxable capacity. Tanzi (1987) demonstrates the association between economic growth and tax by using regression analysis and found in the same way that overall tax revenue is positively influenced by the level of per capita income. Although the correlation is not strong, he also finds that per capita income growth has a positive impact on personal income tax.

However, it is pointed out by Tanzi (1987) that personal income tax is much less important in developing and less developed countries than it is in developed countries (in terms of actual collection). This may be due to the difficulty in assessing personal income, high administrative costs and other structural constraints. As stated in Aizenman and Jinjarak (2006), most developing and less developed countries have

low level of investment in their tax capacity, leading to poor ability of auditing. In addition, personal income tax, in those countries, is relatively easy to be evaded because most developing and less developed countries generally have weak penalty on tax evasion and structural factors that increase the ease of tax evasion. Moreover, in developing and less developed countries, personal income tax is usually levied on wages of public sector employees and the employees of the large, and often foreign, corporations (Tanzi, 1987). All of these depress the personal income tax base, resulting in a narrower base in developing and less developed countries than in developed countries, and hence lower revenue from this tax.

Inflation is another factor which may affect personal income tax. There is large a literature on the effect of inflation on taxation, especially in the 1970s and early 1980s when inflation was high. Most studies suggest that the impact of inflation on personal income tax could be considerably large. Inflation may affect personal income tax, especially for capital gain tax, by leading to an increase in effective tax rates because this tax is computed as a fraction of changes in nominal value.[23] Theoretically, inflation affects income tax in three ways; altering real factor incomes, affecting the measurement of taxable income, and changing the real value of deductions, exemptions, credits, ceilings and floors, bracket widths, and all other tax provisions legally fixed in nominal terms (Aaron, 1976). There are also many empirical studies which prove their relationship, for example, Greytak and McHugh (1978) point that there is a substantial increase in personal income tax revenue, occurring as a result of purely a nominal increase in income which appears during inflationary periods. The large increase of tax receipts is due to the progressive nature of this type of tax.

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[23] See Aaron (1976), Bailey (1976), and Tanzi (1980) for example.

3. Corporate Income Tax

Corporate income tax is found to be more important to less developed and developing countries. In these countries, corporate income tax is usually collected from a few large corporations which have sizable profits. In addition, taxing a few large firms is administratively easy for government in less developed and developing countries (Tanzi, 1987).

The effect of trade liberalization on corporate income tax is also very difficult to estimate. Like international trade taxes, how trade liberalization affects corporate income tax depends on many factors such as the volume of trade, the price elasticity of demand for imports and the price elasticity of supply of import substitutes, and the initial domestic prices. If trade liberalization leads to a higher volume of imports or exports, import and export companies, which generally have a large share of output in most less developed and developing countries, may benefit from increasing volume of trade and consequently result in higher corporate income tax. After trade is liberalized, there is the price adjustment of import goods and domestic goods. If the initial prices of domestic goods are lower than the prices of import goods, the domestic production of import substitutes is likely to be increased because domestic prices are higher after a country liberalized its trade. Consequently, a tax on corporate income which is derived from the increase in production of import substitutes should increase. However, if the relative prices of import substitutes are higher before trade is liberalized, trade liberalization tends to lower domestic prices and decrease the production of domestic goods, and hence lower corporate profits and corporate income tax.

The deterioration in terms of trade, which possibly occurs when countries that export the same or similar items liberalize simultaneously, could potentially affect corporate income tax revenue. Because exporters now export less, income earned from exports decreases, and hence corporate income tax collected from export companies tend to be diminished.

Like personal income tax, trade liberalization influences corporate income tax through the growth effect. Generally, firm's profits grow with the growth of the economy. Tanzi (1987) finds a significant positive relationship between economic growth and corporate income tax. He also points out that the impact of economic development on corporate income tax is greater than on personal income tax.

4. Goods and Services Tax

Tax on consumption is usually considered as a good solution for offsetting the decrease in fiscal revenue since a consumption tax has broader base and distorts the economy less than a trade tax (e.g., Keen and Ligthart, 1999; Peters, 2002; Mujumdar, 2004; Baunsgaard and Keen, 2005).[24] However, the impact of trade liberalization and other physical constraints may make the domestic tax reform a lot harder for developing and less developed countries. The impact of trade liberalization on goods and services tax is more complicated to assess since the effect is indirect and also depends on many factors such as the price elasticity of demand for imports and the price elasticity of supply of import substitutes. For example, when tariffs are reduced, the relative price of imports to import substitutes produced domestically decreases,

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[24] Although the substitution from trade tax to consumption tax is acceptable, an increase in domestic consumption tax as a strategy of offsetting reductions in tariffs is later refused by Keen and Ligthart (2004). They reproduce model under imperfect competition and find that an increase in consumption tax rate potentially reduces overall domestic welfare, contrary to the model formed under perfect competition in Keen and Ligthart (1999) in which they find umambiguous benefit.

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and hence domestic consumers tend to switch their consumption from domestically produced import substitutes to imports. This leads to a decrease in tax revenue collected from domestically produced import substitutes and an increase in tax revenue obtained from imports. However, the net change in tax revenues cannot be generally predicted.

The domestic tax reform itself by switching the reliance of taxes from international trade tax to consumption tax may also affect the revenue. If the domestic consumption tax is levied only on domestically produced goods (import substitutes), trade liberalization tends to lowers the revenue from domestic indirect tax. But, if taxes are levied on both imports and domestically produced goods, goods and services tax tends to be increased. Ebrill et al (1999) state that trade liberalization may affect goods and services tax revenue if the imported goods, which their tariffs are reduced, are included, at a significant proportion, in the domestic tax base. The direction of its impact depends on the volumes of imports after trade is liberalized. If there is no significant change in import volumes, leading to an unchanged import values, trade liberalization may immediately lower goods and services tax revenue. However, if the import volumes increase at a significant level, goods and services tax revenue may also increase.

The indirect effect of trade liberalization on goods and services tax revenue can also be viewed through its impact on economic growth, like personal income and corporate income taxes as stated above. Because tax bases grow as countries grow, this should also be true for the consumption tax base since its base also relates to the growth of income. People should have more money in their hand as GDP grows, which means that there is higher purchasing power and higher demand for domestic consumption. However, surprisingly, the results shown in Tanzi (1987) stated that

there is no correlation between the share of domestic tax on goods and services in GDP and per capita income.

Besides economic growth, a country's size could play an important role in determining the domestic consumption tax (Peters, 2002). Generally, a consumption tax is a more significant revenue source in the bigger countries than in the smaller countries because the amount of tax collection depends directly on the domestic consumption. Larger countries tend to have a high population and a large domestic market whereas smaller countries seem to have less population and their size of domestic market is smaller. As a result, switching sources of revenue from a trade tax to a broad-based consumption tax, although applicable for developed countries, may cause fiscal problems for developing and less developed countries.

In conclusion, the empirical literature on trade liberalization and taxation supports the claim that the net effect of trade liberalization is uncertain and the net change in tax revenue as a result of liberalizing trade is an empirical matter. In addition, the impact on each tax type depends on many different factors. The following section applies the traditional tax effort model and employs an econometrics approach in order to investigate further the relationship between trade liberalization and countries' tax revenue.

4.3. The Basic Model of Tax Effort

A considerable number of studies have attempted to find measures of fiscal performance. In previous works, the tax ratio has always served as a rough index of a country's tax performance or a measure of the relative effort of a country.[25] Generally, tax ratio analysis aims to explain the main determinants of differences in

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[25] See Bahl (1971), Ansari (1982), and Stotsky and WoldeMariam (1997) for example.

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the tax ratio across countries. Most research concludes that the reason why there are such differences is because countries have different "capacities" to tax. Among early studies, Musgrave (1969) makes a great contribution to the explanation of why less developed countries usually have a low level of tax revenue by presenting a key term, "Tax handles". Tax capacity or tax handle has been introduced as a key to increasing tax effort. For low income countries, it is much more difficult to impose and collect taxes than in an advanced economy. He reasons that it is not only the skills and facilities of tax administration in those countries that are less developed, but also the structure of their economies can afford fewer and less adequate "handles" on which to collect taxes. Thus, the relative absence of adequate tax handles in less developed economies is a main reason in explaining why their tax to GDP ratios is lower than those of highly developed economies.

In the previous studies, a variety of methods have been tried to estimate tax effort. However, the most commonly used approach is to regress the tax performance on variables that serve as proxies for a country's tax handles. This means that the independent variables used in this approach are represented as the major determinants for tax effort. By regressing tax effort, the stochastic model is used where T is the total tax revenue, Y is a proxy for income (either GDP or GNP), and T/Y is the tax ratio. The independent variables which are expected to influence the tax ratio are represented by X_i (i=1, 2,..., n) and u is the error term. This can be expressed in the following functional relationship:

$$T/Y = f(X_i,...,X_n,u) \qquad\qquad (4.1)$$

The most traditional explanatory variables in the conventional tax effort studies are those controlling for a country's economic structure. These variables reflect the idea

that the availability of tax handles influences the level of tax effort. The following is the list of explanatory variables suggested by economic theory and by many previous empirical works. An overview of empirical results from some related literature is summarized in Appendix 4A. The independent variables that have been widely used by previous research are:

(1)   Level of Economic Development: measured by GDP per capita. Higher income, reflecting a higher level of development, is usually associated with higher capacity of tax payers to pay taxes as well as a greater capacity of the government to collect taxes from them. In addition, rich countries tend to have a higher degree of monetization of the economy and better tax administration (Agbeyegbe *et al*., 2004). Moreover, rich countries often tax proportionately higher than poor countries. Hence, it is expected that there is a positive relationship between the ratio of total tax revenue to GDP and GDP per capita.

(2)   Composition of GDP: measured by the share of the agricultural sector and the industrial (including mining) sector in GDP. The share of the agricultural sector in GDP is used for reflecting the difficulty of taxing different economic components since the agricultural sector is generally the major sector in less developed countries and most agricultural activities are related with many small firms which organize their activities at the subsistent level. It is relatively difficult to assess the income of the agricultural sector for income tax purpose and consumption taxes such as VAT are usually exempted for agricultural products. In addition, the agricultural sector reflects a possible degree of tax evasion in the economic sector. Thus, the share of agriculture in GDP is expected to be negatively related with total tax revenue. By contrast, more developed economies usually show a large share of industrial sector in their

GDP. This sector is relatively easy to tax and, in line with the quality of tax administration of developed countries, this sector yields a large amount of tax revenue for developed countries. Therefore, the share of the industrial (including mining) sector is expected to have a positive impact on total tax revenue.

(3)   Openness: measured by the ratio of imports plus exports to GDP. For a public sector and a fiscal policy study, openness has long been considered as an important determinant and used for studying the impact on the tax level.[26] The ratio of trade to GDP has been constructed as a tool for different measurement such as the level of trade barriers, the degree of globalization, and the extent of a country's foreign trade sector, depending on the purpose of study. Although it is quite difficult to assess the direct impact of openness on tax revenues since openness may influence taxation indirectly by affecting many economic variables which in turn affect tax revenue, most studies find a strong association between the degree of openness and tax revenue.[27] Since tax revenues of less developed economies, especially from a trade tax perspective, tend to have high dependency on the international trade sector, an increase in the degree of trade openness is expected to bring higher trade tax. Thus, a positive relationship is expected between them.

4.4. The Extended Model, Data, and Empirical Methodology

In this study, in addition to the degree of trade openness, two more indices are introduced to investigating the impact of trade liberalization, including average tariff rates and the number of free trade agreements, which will be discussed later. This

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[26] See Lotz and Morss (1970), Alícia and Boix (2002), and Wibbels and Arce (2003) for example.
[27] See Ebrill, Stotsky and Gropp (1999), Agbeyegbe, Slotsky and WoldeMariam (2004), Baunsgaard and Keen (2005), and Aizenman and Jinjarak (2006) for example.

study divides samples into four categories (low-income countries, lower-middle income countries, upper-middle income countries, and high-income countries) in order to investigate how different groups of countries are affected by trade liberalization. In order to investigate the effect of trade liberalization on each tax type, this study not only investigates the impact of trade liberalization on total tax revenue, but also extends the study to four sub-category including international trade tax, personal income tax, corporate income tax, and goods and services tax. The model specification changes in regard to the difference in the level of economic development and types of taxes.

From the previous section, since the level of economic development is assumed to be positively related to total tax revenue, it should also be expected that this variable is positively related to every type of tax, except for the trade tax. This is because higher level of income means that countries possess a higher quality of tax administration which is a necessary condition for them to achieve efficient tax collection.[28] However, the expected negative sign for trade tax is associated with the assumption that developed economies have relatively low reliance on trade tax.[29] As countries grow, they will use trade taxes less, and hence get lower receipt from trade tax revenue. Therefore, the level of economic development is expected to be negatively related to trade tax.

In this study, agricultural share is applied to the estimation of low and lower-middle income countries, while industrial share is applied to upper-middle income and high income countries. Since the share of the agricultural sector in GDP is assumed to have a negative relationship with total tax revenue by the reasons stated above, the same

[28] See Aizenman and Jinjarak (2006).
[29] See Ebrill et al. (1999), Agbeyegbe et al. (2004), Baunsgaard and Keen (2005), and Aizenman and Jinjarak (2006) for example.

relationship should also be expected between the share of agricultural in GDP and all types of taxes. By contrast, the share of the industrial sector in GDP is expected to have a positive relationship with total tax revenue, so it should also be expected to have the same relationship with every type of tax.

The model specification used in this study is drawn from the model which is generally used in the tax effort study. However, the traditional literature on tax effort has ignored the role of other key variables such as aid and debt, which could possibly be important factors influencing total tax revenue. Thus in order to investigate the role of these variables on taxation, they are included in the extended model with the assumption of their relationship with total tax revenue specified below;

(1) Transfer of Aid: measured by aid per capita. Aid and grants have been used as an important source for financing the development of a number of less developed and developing countries for a few decades. Aid dependence could potentially erode the quality of institutions by weakening governmental accountability and the state bureaucracies, increasing political instability, encouraging rent seeking and corruption, raising conflict over control of aid funds, and alleviating the incentive to reform inefficient policies and institutions, and therefore leads to a decrease in revenues from tax collection.[30] Hence, this variable is expected to have a negative relationship with total tax revenue.[31] Aid may directly reduce a government's dependence on domestic tax

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[30] See Meyer (1992), Maren (1997), Dollar and Pritchett (1998), and Brautigam (2000) for example.
[31] It is worth noting that although aid per capita is generally found to be negatively related with total tax revenues (see Franco-Rodriguez, Morrissey, and McGillivray, 1998, as an example), Gupta et al (2003) find that it could possibly related both positively and negatively with the overall level of tax revenue.

revenues or even be used for domestic tax reduction.[32] A negative relationship should also be expected for all types of taxes.

(2) Public Debt: measured by debt per capita. In many countries, especially for low income countries, a high level of public spending leads to large fiscal deficits and an increase in public debt.[33] The interest on the debt and the debt itself can be paid with current tax revenues. This may result in raising tax revenues in order for the government to finance its large debt. Hence, it is expected that public debt is positively related to total tax revenue. However, for debt payment, different countries may raise revenue from different types of taxes. This is an empirical matter.

For personal income tax, inflation should be added in the equation in order to investigate the effect of "bracket creep". Bracket creep is the situation that higher inflation leads companies to make a higher payment for their employees in order to compensate for the rising of inflation. This automatically pushes more taxable income into higher tax bracket and expands the personal income tax base by increasing the number of tax payers (pushing those who have never been taxed into tax bracket). Hence, higher inflation is possibly related to higher personal income tax.

(3) Inflation: measured by inflation rate. Since inflation leads to an increase in income in nominal term as stated above, it is assumed that inflation is positively related to personal income tax.

For international trade tax, the exchange rate may play an important role in determining the receipt of this tax. Since most part of trade tax relies on tariff revenue

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[32] See Feyzioglu et al. (1998), and Moore (1998) for example.
[33] See Tanzi and Blejer (1988) for further discussion on the association between fiscal deficits and public debt.

which depends on the volume of imports, a significant change in the exchange rate may result in a significant change in import volume and hence trade tax revenue.

(4) Exchange Rates: measured by national currency per US dollar. Currency appreciation could potentially lead to a higher volume of imports and higher tariff revenue as a consequence. Hence, a negative relationship is expected between exchange rates and trade tax.

Because trade liberalization can take many forms, this study introduces other proxies for trade liberalization including average tariff rates and the number of free trade agreements. The former will be applied as a regressor only for the trade tax equation because it is assumed that there is "Laffer effect" for trade tax revenue, while the latter will be applied for every type of tax. By including the average tariff rate as an explanatory variable for trade tax, it helps us investigate whether a further reduction in tariff rate results in the decrease in trade tax revenue.

(5) Average Tariff Rates: The relationship between the average tariff rates and trade tax is assumed to be nonlinear since it is expected to capture the existence of "Laffer curve". Hence, a quadratic form is used to estimate the effect of this indicator of trade liberalization on international trade tax revenue. The revenue-maximizing tariff rate is obtained by solving for ATR in the following equation:

$$b_1 + 2b_2(ATR) = 0 \text{, i.e., } ATR = \frac{-b_1}{2b_2}.$$

The most recent form of trade liberalization, free trade agreements, is accounted for in the model since there are many concerns about advantages and disadvantages which these agreements bring to the country. Hence, the variable FTA is included in every tax model to see how FTA may affect each type of tax.

(6)   Free Trade Agreements: measured by the summation of the number of free trade agreement that are signed. Instead of using 0-1 dummy, this study introduces a new indicator for trade liberalization by applying the summation of the number of agreements which each country has in force. Types of agreements included custom unions, preferential arrangement, service agreement, and free trade agreement. Trade liberalization is usually assumed to be harmful for less developed countries since these countries do not have a good preparation for tax reform. In addition, these countries are usually forced by developed countries to sign trade agreements even though such agreements are disadvantageous, in exchange for avoiding non-trade barriers used by developed countries (e.g. environmental concerns or intellectual properties). Free trade agreement may not only decrease trade tax by directly reducing tariff revenue, but may also affect other types of tax via reducing domestic companies' profits, leading to job loss. By contrast, most FTAs give privilege and opportunities for developed economies to enter to new markets, and hence leading to higher profit for companies in developed countries. Hence an FTA is expected to be harmful for less developed countries but to be beneficial for developed economies.

Hence, the basic model of tax effort can be extended as:

$$TTR = f(PCGDP, AGR, IND, OPEN, PCAID, PCDEBT, FTA, U) \qquad \text{(4.2a)}$$

$$ITT = f(PCGDP, AGR, IND, OPEN, PCAID, PCDEBT, EXR, ATR, FTA, U) \quad \text{(4.2b)}$$

$$PIT = f(PCGDP, AGR, IND, OPEN, PCAID, PCDEBT, INF, FTA, U) \qquad \text{(4.2c)}$$

$$CIT = f(PCGDP, AGR, IND, OPEN, PCAID, PCDEBT, FTA, U) \qquad \text{(4.2d)}$$

$$GST = f(PCGDP, AGR, IND, OPEN, PCAID, PCDEBT, FTA, U) \qquad \text{(4.2e)}$$

where TTR is the ratio of total tax revenue to GDP, ITT is the ratio of international trade tax revenue to GDP, PIT is the ratio of personal income tax revenue to GDP, CIT is the ratio of corporate income tax revenue to GDP, GST is the ratio of goods and services tax revenue to GDP, per capita GDP is deducted by PCGDP, AGR and IND are the share of agricultural sector and industrial sector in GDP[34], OPEN is the degree of trade openness measured by imports plus exports divided by GDP, PCAID is aid per capita, PCDEBT is debt per capita[35], EXR is the exchange rate, INF is inflation rate, ATR is average tariff rates, and FTA is the summation of the number of free trade agreements.

The following section explains the data set and methodology used in this study. The data set for GDP per capita, share of agricultural and industrial sectors in GDP, aid per capita, debt per capita, and inflation rate are obtained from World Development Indicators (WDI). Data for exchange rates are obtained from IMF Government Finance Statistics (GFS). For trade liberalization indicators, this study uses the traditional measure of trade openness; the ratio of exports plus imports to GDP at current prices. Data are obtained from Penn World Table 6.2 (PWT 6.2). Average tariff rates data are obtained from the WTO, IDB database and trade policy review. This study uses data for FTAs which are currently in force and notified to GATT/WTO. The FTAs data set are collected by the World Trade Organization (WTO). For tax revenue, data are obtained from the World Tax Database (WTD) and IMF Government Finance Statistics (GFS). In total, this study uses data of 134 countries covering the period 1980-2003.

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[34] AGR is used as a regressor for low income and lower-middle income countries, whereas IND is used as a regressor for upper-middle income and high income countries.
[35] Note that PCAID and PCDEBT are not used as regressors in tax models for high income countries.

Empirical studies of the effect of trade liberalization on tax revenues are usually either cross-country studies using aggregate data, or individual-country studies using country of interest's data. However, this study employs panel data estimation technique to estimate their relationship. Using panel data is an attractive alternative because it provides greater statistical power and offers greater flexibility in terms of explanatory variables. A set of 134 countries is taken and divided into four groups. Therefore, the panel data for 30 low income, 39 lower-middle income, 30 upper-middle income, and 35 high income countries over 24 years for the period 1980 to 2003 will be used to evaluate the impact of trade liberalization on the taxation of countries at different level of economic development. This study employs a fixed-effects approach, with a two way estimate, incorporating time and individual country effects. The fixed effects model is as follow:

$$T_{it}/Y_{it} = \alpha_0 + \alpha_i + \gamma_t + \beta X_{it} + \varepsilon_{it} \qquad (4.3)$$

This model has an overall constant term (α_0) as well as a group effect for each country (α_i) and a time effect for each period (γ_t). The ratio of tax to GDP (T_{it}/Y_{it}) is altered by each tax type stated above. X_{it} represents a set of control variables which vary depending on tax types and the level of economic development.

4.5. Empirical Results

Before estimating those equations stated above, a panel unit root test following Levin, Lin, and Chu (2002) was conducted in order to test the stationarity of our variables. The results of the test, presented in Appendix 4B, indicate that all variables are stationary at level. This section reports the results of estimating equation (4.2a) – (4.2e), by using the two-way fixed effects model considering both group and time

effects for all tax categories. Table 4.1 represents the results for the full sample while Tables 4.2-4.5 report results for four sub-samples defined by income level, comprising low, lower-middle, upper-middle and high income countries. The sequence of specification is different depending on each tax type and the country's income level. Although many independent variables are included, the discussion mainly focuses on the key question of interest: the effect of trade liberalization on tax revenue.

Table 4.1: Determinants of Tax Revenue; Full Sample

	Dependent Variable: ln of Tax Revenues				
	TTR	ITT	PIT	CIT	GST
ln PCGDP	0.655***	-0.382***	1.036***	1.186***	0.664**
	(0.163)	(0.092)	(0.371)	(0.323)	(0.280)
AGR	-0.007	-0.047	-0.009	-0.021	-0.015
	(0.012)	(0.033)	(0.018)	(0.017)	(0.013)
ln PCAID	-0.017	0.006	-0.179**	-0.028	-0.042
	(0.047)	(0.080)	(0.073)	(0.058)	(0.050)
ln PCDEBT	0.169***	0.169	0.196**	0.101*	0.257***
	(0.042)	(0.150)	(0.090)	(0.060)	(0.052)
INF	-	-	0.002**	-	-
			(0.001)		
ln EXR	-	-0.126***	-	-	-
		(0.030)			
OPEN	0.006**	0.009**	0.006	0.073**	0.043**
	(0.003)	(0.004)	(0.004)	(0.033)	(0.020)
ATR	-	0.027**	-	-	-
		(0.011)			
ATR-Squared	-	-0.0003***	-	-	-
		(0.0001)			
FTA	-0.088**	-0.089***	-0.061	-0.063	-0.103**
	(0.041)	(0.017)	(0.053)	(0.040)	(0.043)
R-Squared	0.711	0.791	0.725	0.738	0.713
Adjusted R-Squared	0.676	0.746	0.685	0.705	0.678
Number of Countries	90	87	81	85	90
Number of Observations	1149	660	928	1040	1144
Country Effects	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes

Source: Author's calculation
Notes:
Figures in parenthesis are standard errors
*** indicates that a coefficient is significant at the 1% level
** significant at the 5% level
*   significant at the 10% level

Table 4.1 contains the results for the whole sample of countries. Many of the

estimated coefficients for the explanatory variables are in line with the predictions and

largely coincide with previous findings in the literature. For domestic taxes, the level

of economic development is positively correlated with the use of more complicated

taxes. By contrast, as expected, the negative relationship between per capita GDP and trade tax indicates that countries tend to lower their dependency on trade tax as they grow. Overall, the higher level of income is associated with a higher total tax ratio. The share of agricultural sector in GDP, although shows negative sign, has no significant impact on all taxes. Aid per capita has a negative relationship only with personal income tax ratio, while debt per capita has a significant positive relationship with all domestic taxes but insignificant for trade tax. The positive sign of the coefficient for inflation indicates the presence of "bracket creep"; the situation when companies compensate their employees for rising inflation by giving them higher payment, which in turn push the tax-paying employees into higher income tax brackets. The pattern depends on the existence of a progressive tax system, in which marginal tax rates increase with higher income. Hence, inflation results in increased personal income tax collections by the government without any change to tax regulations. The result is in line with that of previous study (see for example, Greytak and McHugh, 1978) that higher inflation potentially pushes wages and salaries into higher tax brackets. The significant negative relationship between exchange rates and trade tax supports the hypothesis that currency appreciation leads to higher volume of imports, and hence increases trade tax revenue.

For trade liberalization indices, the positive relationship between the degree of trade openness and trade tax coincides with economic theory as trade liberalization, which leads countries to have higher trade volumes, results in an increase in trade tax. The positive relationship between openness and other taxes also points out that openness has a contribution to the collection of domestic taxes. Opening countries to world trade may help boost corporate profit and the flow of goods and services within countries. The relationship between average tariff rates and trade tax is significant for

the full sample of countries. The positive coefficient of ATR is indicative of a tradeoff between reduced international trade tax revenue and reduced protection. The negative magnitude of ATR^2 suggests that a potential "Laffer effect" exists for trade tax revenue. The coefficient for the number of free trade agreements turn out to have negative sign and significant for trade tax; supporting the assumption that, since most free trade agreements generally aim to reduce and eliminate trade barriers, especially tariff on imports, joining a trade agreement directly results in a decrease in trade tax revenue.

Next, the sample is split into four income groups. Table 4.2 presents panel fixed effects estimates for 30 low income countries. Overall, the results are more robust than those estimated for the full sample. The level of income has a significant positive impact on domestic taxes but a negative impact on trade tax, with a remarkable high magnitude. The significant negative effect of the agricultural sector, especially on corporate income tax, indicates the difficulty in taxing an economy with most parts being from the primary sector. There is no evidence supporting the view that aid reduces collecting tax in low income countries. However, debt seems to be a tax driving force. Higher debt is associated with higher tax collection, especially for all domestic taxes. Inflation still significantly leads to "bracket creep", and hence high personal income tax. The coefficient for the exchange rate is statistically significant with a negative sign, supporting the hypothesis that the appreciation of a currency leads to higher imports, and consequently trade tax revenue.

Now turn to variables of our interests, the degree of trade openness, average tariff rates, and the number of free trade agreements. The coefficients for trade openness are positively significant for all tax types with very similar magnitude. An increase in tax revenues, especially for trade tax, as a result of an increase in the international trade

sector in GDP strongly supports the hypothesis that tax revenues of low income countries have a high dependency on trading with other nations. The more the country opens itself to trade with the world, the more the benefits for taxation. There is one important notice for this positive relationship. Although the development of the tax system (e.g. the application of complicated taxes such as VAT) in most of low income countries is perceived that it is in the very first stage, the results show that these countries, at least, develop their tax system to the level that is able to reap the benefits which come with trade liberalization. Trade openness may raise the goods and services tax by increasing domestic buying, through an increase in the variety of goods and services. It may be associated with an increase in corporate income tax by enhancing the corporate profits of imports and exports companies. The association between trade liberalization and personal income tax is somewhat complicated. Many previous studies find that there is a positive relationship between openness to trade and income growth (see for example Frankel and Romer, 1999). As income grows, there is a shift in taxable income and taxpayers move into higher tax brackets, and this possibly results in higher amount of personal income tax collection.

For trade tax, the sign of the coefficients for ATR is positive and ATR^2 is negative, and both are significant, which illustrates the expected "Laffer effect". The revenue-maximizing tariff rate of international trade taxation is estimated to be approximately 43% while, from average tariff rates data, it is clear that the effective rate of tariff has already been reduced below this rate in all low income countries. Thus, for countries in this group, the further reduction in average tariff rates generally results in a decrease in trade tax revenue.

Trade liberalization via free trade agreements seems not to be the wisest way since the results show that the coefficients for free trade agreements are negatively significant

for all taxes. The remarkable high magnitude supports the hypothesis that a free trade agreement is harmful for less developed economies' taxation. In addition to a decrease in trade tax, a free trade agreement is also associated with a drop in domestic taxes both income and consumption taxes. This may cause a problem if these countries choose to liberalize their trade by forming an agreement and plan to mitigate the loss in trade tax by raising any of their domestic taxes.

Table 4.2: Determinants of Tax Revenues; Low Income Countries

	Dependent Variable: ln of Tax Revenues				
	TTR	ITT	PIT	CIT	GST
ln PCGDP	1.579**	-1.154**	1.945**	3.003***	1.743**
	(0.596)	(0.547)	(0.796)	(0.847)	(0.809)
AGR	-0.005	-0.034	-0.012	-0.054**	-0.059**
	(0.027)	(0.045)	(0.031)	(0.026)	(0.023)
ln PCAID	-0.063	-0.314	0.019	-0.157	-0.159
	(0.235)	(0.408)	(0.235)	(0.216)	(0.231)
ln PCDEBT	0.255**	-0.639	0.632**	0.333**	0.277**
	(0.115)	(0.439)	(0.318)	(0.129)	(0.124)
INF	-	-	0.002**	-	-
			(0.001)		
ln EXR	-	-0.440***	-	-	-
		(0.161)			
OPEN	0.025**	0.031**	0.037***	0.023**	0.026**
	(0.013)	(0.013)	(0.013)	(0.010)	(0.013)
ATR	-	0.052**	-	-	-
		(0.025)			
ATR-Squared	-	-0.001**	-	-	-
		(0.000)			
FTA	-0.098***	-0.095**	-0.048**	-0.056**	-0.014***
	(0.021)	(0.048)	(0.023)	(0.023)	(0.005)
R-Squared	0.690	0.733	0.773	0.726	0.671
Adjusted R-Squared	0.616	0.606	0.705	0.653	0.593
Number of Countries	24	22	24	23	24
Number of Observations	301	162	259	271	302
Country Effects	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes

Source: Author's calculation
Notes:
Figures in parenthesis are standard errors
*** indicates that a coefficient is significant at the 1% level
** significant at the 5% level
*   significant at the 10% level

Table 4.3 represents the results of 39 lower-middle income countries. The significance and the signs of coefficients for GDP per capita still support the hypothesis that as countries develop, they make use of more complicated taxes but lower their reliance on trade tax. The significant positive relationship between

agricultural share and trade tax indicates the fact that countries which their economic structure relies on the primary sector tend to use a trade tax as an important source of revenue. Contrary to the results of low income group, the impact of the share of the agricultural sector in GDP on the consumption tax is positive and significant, indicating the importance of the technological matter. A possible explanation is that, in general, most agricultural goods and foodstuffs, which remain in their natural state, are exempt from VAT. Although these countries base their economies on the agricultural sector, they possess technology which is high enough to transform agricultural products into intermediate and final goods, which gives them value added, and hence makes them no longer have exempt status. Thus, an increase in the flow of domestic agricultural processed products is associated with an increase in consumption tax receipts. For countries in this income group, aid tends to reduce tax revenue in recipient countries, especially for personal income and corporate income taxes. There is also evidence indicating that lower income countries usually raise revenue from domestic taxes, both income and consumption taxes, to pay their debt. The coefficient for inflation shows the effect of "bracket creep" and the coefficient for exchange rates has a significant negative sign, which is the same as for low income countries.

The coefficients for the degree of trade openness are all positive and significant with a similar magnitude to those in low income countries, reflecting that tax bases of these countries are highly dependent on international trade sector. The coefficients for average tariff rates show the existence of "Laffer curve" in which the revenue-maximizing rate is approximately at 25%. Although the rate is much lower than that of the low income group, their current average tariff rates have already been lowered below that point since the second half of the 1980s. Thus, again, a reduction in tariff

rates generally leads to a fall in trade tax revenue. The sign on the number of free trade agreements shows negative and significant coefficients for all tax types. Trade liberalization via joining a trade agreement thus appears to lower total taxes, obviously through its effect on both trade tax and domestic taxes.

Table 4.3: Determinants of Tax Revenues; Lower-Middle Income Countries

	Dependent Variable: ln of Tax Revenues				
	TTR	ITT	PIT	CIT	GST
ln PCGDP	0.733***	-0.643***	0.362***	0.403***	0.304***
	(0.123)	(0.157)	(0.129)	(0.135)	(0.112)
AGR	0.019***	0.034***	0.015	0.001	0.017**
	(0.004)	(0.009)	(0.012)	(0.010)	(0.008)
ln PCAID	0.029	-0.040	-0.185**	-0.173***	-0.023
	(0.027)	(0.055)	(0.077)	(0.054)	(0.040)
ln PCDEBT	0.256***	0.208	0.369**	0.473***	0.298***
	(0.058)	(0.166)	(0.143)	(0.139)	(0.085)
INF	-	-	0.003***	-	-
			(0.001)		
ln EXR	-	-0.028**	-	-	-
		(0.014)			
OPEN	0.042***	0.034**	0.010***	0.039**	0.036***
	(0.007)	(0.017)	(0.003)	(0.019)	(0.008)
ATR	-	0.087***	-	-	-
		(0.018)			
ATR-Squared	-	-0.002***	-	-	-
		(0.000)			
FTA	-0.067***	-0.129***	-0.186***	-0.011***	-0.012***
	(0.021)	(0.040)	(0.064)	(0.003)	(0.003)
R-Squared	0.933	0.952	0.805	0.859	0.864
Adjusted R-Squared	0.922	0.938	0.764	0.833	0.842
Number of Countries	36	36	30	34	36
Number of Observations	500	301	374	441	500
Country Effects	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes

Source: Author's calculation
Notes:
Figures in parenthesis are standard errors
*** indicates that a coefficient is significant at the 1% level
** significant at the 5% level
*   significant at the 10% level

In the upper-middle income group of 30 countries (Table 4.4), the level of economic development still has a significant positive influence on all domestic taxes but a significant negative impact on trade tax. Here, the variable "agricultural share" is changed to "industrial share" because it is assumed that the industrial sector plays a

more important role in developed economies. The industrial sector is easier to tax than the agricultural sector since businesses performing in the industrial sector usually keep better accounts and records. In addition, products produced in this sector are rarely exempt from the consumption tax. As expected, the coefficients for the share of the industrial sector in GDP are statistically significant with a positive sign. Aid per capita turns out to be negatively significant not only with income taxes, but also with the consumption tax. This means that as these countries receive more aid, they have less dependency on tax revenue, and hence there is a possibility that they use aid as a domestic tax reduction since tax reduction is a tool that governments use to get more vote and supporters for their next term (see for example Moore, 1998). The result is inline with other studies such as that of Franco-Rodriguez, Morrissey, and McGillivray (1998). The coefficient for debt per capita is positively significant for income and goods and services taxes. This illustrates that upper-middle income countries may choose to use domestic taxes as a mean of their debt payment. Inflation still has a positive impact on personal income tax which illustrates the effect of "bracket creep". The coefficient for the exchange rates is negative and significant, in line with the results of the other two income groups.

Increased trade openness again is observed to have led to an increase in the receipt of all tax types, showing the high influence of the international trade sector in determining tax collection. A potential "Laffer effect" exists for trade tax and the revenue-maximizing rate of trade taxation, estimated to be 25%, is again higher than the actual rate. The coefficients for free trade agreements are negative and significant for all taxes, once again indicating that there is a harmful effect of trade liberalization through trade agreement, not only on trade tax as usual, but also on domestic taxes.

Table 4.4: Determinants of Tax Revenues; Upper-Middle Income Countries

	Dependent Variable: ln of Tax Revenues				
	TTR	ITT	PIT	CIT	GST
ln PCGDP	0.440***	-1.251***	0.661***	0.279***	0.763***
	(0.139)	(0.160)	(0.119)	(0.085)	(0.140)
IND	0.014***	0.001	0.058***	0.037***	0.023***
	(0.004)	(0.018)	(0.023)	(0.008)	(0.007)
ln PCAID	-0.053***	-0.041	-0.098**	-0.114***	-0.040**
	(0.017)	(0.042)	(0.046)	(0.036)	(0.021)
ln PCDEBT	0.163***	-0.165	0.644***	0.093**	0.291***
	(0.065)	(0.182)	(0.148)	(0.048)	(0.055)
INF	-	-	0.008***	-	-
			(0.002)		
ln EXR	-	-0.057***	-	-	-
		(0.022)			
OPEN	0.014***	0.036***	0.020***	0.100**	0.047***
	(0.006)	(0.011)	(0.005)	(0.046)	(0.017)
ATR	-	0.116**	-	-	-
		(0.053)			
ATR-Squared	-	-0.002**	-	-	-
		(0.001)			
FTA	-0.032**	-0.098***	-0.081**	-0.057**	-0.016**
	(0.015)	(0.037)	(0.039)	(0.029)	(0.008)
R-Squared	0.873	0.910	0.786	0.881	0.922
Adjusted R-Squared	0.845	0.871	0.729	0.854	0.904
Number of Countries	30	29	27	28	30
Number of Observations	348	197	295	328	342
Country Effects	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes

Source: Author's calculation
Notes:
Figures in parenthesis are standard errors
*** indicates that a coefficient is significant at the 1% level
** significant at the 5% level
*   significant at the 10% level

For high income countries (Table 4.5), the coefficients for per capita GDP support the
hypothesis that a higher level of economic development is associated with a higher
use of complicated taxes and lower use of trade tax. The tax ratios, except for the
trade tax, are positively related to the share of the industrial sector in GDP, which

again reflects the greater ease of taxing the profits of industry rather than the income from agriculture. The coefficient of inflation indicates that "bracket creep" exists when there is higher inflation. Appreciation of currency leads to higher imports, and hence higher trade tax.

For trade openness, although the coefficients are positive and significant for trade tax, corporate income tax, and consumption tax, it is insignificant in raising total tax to GDP. The level of economic development and the structure of the economy now seem to matter. The result confirms Bahl's (1971) comment that in developed economies, trade tends to be less relevant than per capita income in determining the tax ratio. Average tariff rates do not have a significant impact on trade tax, although the sign shows that "Laffer effect" possibly occurs. Noticeably, while free trade agreements have a significant negative impact on trade tax, similarly to the results of other income groups, the coefficients for this variable are positive and significant for all domestic taxes and total tax. This is interesting since the results indicate that while low and middle income countries have to be careful in signing any trade agreement because it may end up with the loss of tax revenue, high income countries, which usually be the mainstay of urging other less developed countries to sign such agreement, may benefit from trade agreement by gaining more tax revenue.

Table 4.5: Determinants of Tax Revenues; High Income Countries

	Dependent Variable: ln of Tax Revenues				
	TTR	ITT	PIT	CIT	GST
ln PCGDP	0.622***	-0.706***	0.762***	0.723**	0.978***
	(0.222)	(0.268)	(0.308)	(0.346)	(0.367)
IND	0.013**	-0.010	0.052***	0.032***	0.035**
	(0.006)	(0.026)	(0.012)	(0.009)	(0.015)
INF	-	-	0.015**	-	-
			(0.007)		
ln EXR	-	-0.900***	-	-	-
		(0.262)			
OPEN	0.002	0.021***	0.004	0.110**	0.052**
	(0.002)	(0.008)	(0.002)	(0.054)	(0.022)
ATR	-	0.236***	-	-	-
		(0.070)			
ATR-Squared	-	-0.004	-	-	-
		(0.003)			
FTA	0.045**	-0.022***	0.048**	0.121***	0.091***
	(0.020)	(0.008)	(0.024)	(0.021)	(0.022)
R-Squared	0.923	0.982	0.883	0.902	0.927
Adjusted R-Squared	0.914	0.973	0.868	0.891	0.919
Number of Countries	32	14	28	30	32
Number of Observations	632	129	552	588	629
Country Effects	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes

Source: Author's calculation
Notes:
Figures in parenthesis are standard errors
*** indicates that a coefficient is significant at the 1% level
** significant at the 5% level
*   significant at the 10% level

4.6. Conclusions

In research of trade liberalization, a lot of attention has been paid to its impact on export performance, economic growth, employment, income distribution, and wage inequality, but very little to its impact on taxation and government revenue. These are equally important areas of inquiry, because if trade liberalization leads to a reduction

in tax revenues, this can have serious implications for fiscal reform of countries that have a budget constraint. In other words, because trade liberalization is possibly associated with a decrease in international trade tax revenue, if its negative impact is spread on other domestic taxes, the suggesting solution using tax reform by replacing trade tax with income or consumption taxes may be inefficient or even be inapplicable. The sufferings from the loss of tax revenue may be much higher for countries that have constrained government's income sources, especially for most of low and middle income countries which have a high dependency on trade tax revenue. Dividing the estimation into four sub-samples including low, lower-middle, upper-middle, and high income countries, the results of the analysis undertaken are strong and robust to the estimation technique using two-way fixed effects, which means that the conclusion can be presented with some confidence.

First, trade liberalization that leads to higher imports and exports has significantly affected all taxes in low and middle income groups. The estimation has revealed the important of the international trade sector in low and middle income countries' economies. Openness to international trade obviously helps stimulate the collection of income taxes, possibly by increasing employment, wage level, and corporate profits. It also has a contribution to the consumption tax, possibly by spurring flows of goods within the country. The positive relationship between the degree of trade openness and trade tax means that openness possibly is a stimulus to higher volume of trade between countries and consequently increases trade tax receipts at the current level of the tariff rate. The effect of trade openness on both trade tax and domestic taxes emphasizes the fact that, for low and middle income countries, not only is their trade sector highly dependent on international sector, but also their entire economic structure will be affected if there is any change in countries' international trade

system. A change which leads to an increase in trade volume will consequently benefit these countries' taxation. By contrast, trade tends to be less relevant than per capita income in determining tax revenue in high income countries. Thus, although overall results suggest that trade liberalization via increasing trade openness generally has a contribution to taxation in all countries, the degree of its benefit depends on the country's level of economic development and economic structure.

Second, there is an existence of the Laffer effect on trade tax in low and middle income countries. From the estimated results, the actual tariffs are below the revenue-maximizing rate, which in turn illustrates that a further reduction of tariff levels could actually decrease trade tax revenue. This implies that trade liberalization in the form of tariff reduction is harmful to countries where trade tax accounts for a high proportion of their tax revenues.

Third, the impact of trade liberalization in the form of free trade agreements differs according to the level of economic development. While free trade agreements have a strong negative impact on all kind of taxes in low and middle income countries, they seem to have a contribution to taxation in high income countries. The results raise issues concerning agreements which are signed between developed and less developed countries. Generally, many less developed countries are afraid of joining any agreement with developed countries because most parts of their economic sector are not well prepared for freer and higher competition, while developed countries, which usually initiate such agreements, are believed to have a higher ability to take advantages from those agreements. Their fear of trade liberalization is in line with studies which suggest that freer trade may potentially lead to the fall in domestic corporate profit, job loss, or even business shutdown. The negative impact of FTAs on tax revenue may or may not result from the evidence suggested above. However, the

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present results do suggest that the problem on taxation to be faced when entering free trade agreements, especially in low and middle income countries, is a real one. Tax reform suggested by economic theory and international experience by moving away from international trade taxation and compensating the loss of trade tax by raising more revenue from income and consumption taxes may be inapplicable since these taxes also severely suffer from FTAs, not to mention the difficulties in improving domestic tax administration which requires reorganizing along functional lines, modernizing procedures, computerizing systems, and training people.

In conclusion, it should be stressed that because trade liberalization may take many forms, its effects vary greatly in detail of liberalization. The results here do not imply that trade liberalization in the form of FTAs is harmful to taxation since each agreement differs in its detail. However, its negative impact is worth highlighting. One policy conclusion from the results, therefore, would be that countries which need to promote trade liberalization, especially for low and middle income countries, need to take great care in every step of moving toward freer trade. Balancing the advantage and disadvantage of trade liberalization may possibly help countries mitigate their loss of trade tax revenue and achieve successful tax reform.

Appendix 4A: Summary of Previous Studies in Tax Effort

Table 4A1: Summary Table of Previous Studies in Tax Effort

Study	Lotz and Morss (1967)	Shin (1969)	Bahl (1971)	Tanzi (1992)	Piancastelli (2001)	Teera (2002)	Alm, Martinez-Varquez and Schneider (2004)	Bahl (2003)
Sample	Developing and Developed Countries	Developing and Developed Countries	Developing Countries	Developing Countries	Developing and Developed Countries	Developing and Developed Countries	Developing and Developed Countries	Less Developed Economies and OECD
Dependent Variable	Ratio of Tax Revenue to GNP	Tax Ratio	Taxable Capacity	Tax Share	Ratio of Total Tax Revenues to GDP	Tax to GDP Ratio	Ratio of Total Tax Revenues to GDP	Ratio of Tax Revenue to GDP
Independent Variables	GNP per capita	GNP per capita	Income per capita	Income per capita	GNP per capita	GDP per capita	GNP per capita	
Sign	+	+	+	+	+	Mixed Results	-	
Significance	Significant for full sample and low income countries, insignificant for high income countries	Significant for full sample	Insignificant	Generally significant but insignificant for some years	Not always significant	Not always significant	Significant	
Independent Variables	Ratio of imports plus exports to GNP	Foreign Trade Ratio	The Export Ratio	The Share of Imports in GDP	Ratio of Trade to GDP	Ratio of imports plus exports to GDP		Ratio of Openness
Sign	+	+	+	+	+	Both + and -		+
Significance	Significant for full sample and low income countries, insignificant for high income countries	Insignificant	Not always significant	Significant	Significant	Positively significant for low and middle income countries, negative or insignificant for high income countries		Significant
Independent Variables		The Agricultural Income Ratio	The Agricultural Share	The Share of Agricultural sector in GDP	The Share of Agricultural sector in GDP	Ratio of Agriculture to GDP	Ratio of Agriculture to GNP	
Sign		-	-	-	-	Both + and -	-	
Significance		Insignificant	Significant	Significant	Significant	Negatively significant for low income countries, positive and significant in some estimations for middle income countries	Insignificant	
Independent Variables			The Mining Share		The Share of Industrial Sector in GDP	Ratio of Manufacturing to GDP	Ratio of Mining to GDP	The Non-Agricultural Share of GDP
Sign			+		+	-	+	+
Significance			Significant		Significant	Insignificant	Significant	Significant
Independent Variables				Level of Foreign Debt in GDP	The Share of Service Sector in GDP	Shadow Economy	Ratio of Shadow Economy to GDP	
Sign				+	+	+	-	
Significance				Not always significant	Not always significant	Not always significant	Significant	
Independent Variables							Ratio of International Trade Tax to GDP	
Sign							-	
Significance							Insignificant	

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Appendix 4B: Panel Unit Root Test

This study employs the Levin-Lin-Chu (LLC) test which is one of the first unit root tests to be developed for panel data. The results in the table below indicate that there is no presence of unit root. The LLC test rejects the null hypothesis of a unit root, showing that all variables used in the study are stationary at level.

Table 4B1: The Panel Unit Root Test

Variables		Full Sample	Low Income	Lower-Middle Income	Upper-Middle Income	High Income
Taxes	lnTTR	-6.11***	-7.74***	-9.15***	-7.42***	-8.53***
	lnITT	-7.84***	-17.95***	-5.81***	-9.16***	-13.04***
	lnPIT	-8.85***	-7.59***	-3.74***	-10.73***	-13.23***
	lnCIT	-3.96***	-1.97***	-5.07***	-4.50***	-3.31***
	lnGST	-7.87***	-7.02***	-4.75***	-9.71***	-4.35***
Independent Variables	lnPCGDP	-4.35***	-3.29***	-4.94***	-3.91***	-5.08***
	AGR	-2.51***	-2.93***	-2.26***	-	-
	IND	-18.12***	-	-	-18.57***	-17.47***
	lnPCAID	-9.37***	-7.39***	-8.36***	-10.09***	-
	lnPCDEBT	-7.23***	-10.03***	-7.36***	-5.93***	-
	INF	-2.11***	-2.15***	-2.11***	-2.70***	-2.37***
	lnEXR	-5.10***	-4.62***	-2.47***	-7.27***	-4.71***
	OPEN	-3.69***	-3.57***	-4.41***	-2.03***	-3.63***
	ATR	-4.13***	-3.25***	-9.49***	-3.87***	-5.57***
	ATR-Square	-6.97***	-7.36***	-6.77***	-5.62***	-8.68***
	FTA	-2.28***	-1.87***	-2.54***	-4.17***	-7.32***

The number in the table present Levin, Lin and Chu test statistics
*** indicates the significance at 1% level

Chapter 5

The Impact of Trade Liberalization on Revenue Mobilization and Tax Performance

5.1. Introduction

Trade liberalization is always considered as a potential source of fiscal instability because it is usually associated with the decline in international trade tax revenue. One of the critical issues about revenue related trade liberalization is that the boost to international trade tax revenue from higher trade volume, as a consequence of tariff reduction, will be insufficient to outweigh the revenue-dampening effect of tariff rate reduction. Furthermore, in some cases, international trade tax revenue may be driven down as a result of the reduction in international trade tax rates combined with the weak expansion of it tax base. In order for a government to maintain fiscal stability while liberalizing trade, an appropriate domestic tax reform must be performed. In fact, in many programmes supported by the World Trade Organization (WTO), substantial trade liberalization is suggested to be accompanied by comprehensive domestic tax reform. More specifically, the loss of international trade tax revenue should be compensated for by higher revenues from the taxation of domestic goods and services and from direct taxes on income and profits.

The decrease in international trade tax revenue can be matched by an increase in revenue from domestic indirect taxation. Keen and Ligthart (1999) suggest that a combined tariff cut with a point-to-point increase in domestic consumption tax can lead to an increase in public revenue. In particular, most countries have increased reliance on Value-added tax (VAT), in which the VAT is suggested by many authors to reduce the possibility of tax evasion and does not hurt the external competitiveness of domestic producers. Value-added tax has been introduced in ASEAN countries, with varying degree of success. VAT is introduced as part of an overall tax reform during trade liberalization because it is administrated quite effectively and helped boost fiscal revenue. However, in practice, the revenue performance of VAT and its

distributional effects will depend on the tax's specific design and on the quality of its administration. In addition, VAT tends to be less effective in developing countries that have large informal sectors.

Considering the reform of tax administration itself, in the past, the lack of administrative capacity reduces the efficiency of tax collection, while the large size of the informal and subsistence sectors means that a large proportion of transactions cannot be taxed. In addition, the influence of powerful lobbies makes some sectors off-limits to the tax authorities. As a result the domestic tax base is narrow and a government tries to meet its fiscal needs by charging high rates on easy-to-tax sectors such as international trade (Kubota, 2000). Many recent studies suggest that one of the keys to collect higher tax revenue is to improve tax administration. The main problems of tax administration which are needed to be addressed include the lack of financial and material resources, poorly trained staff, ineffective procedures, the absence of effective taxpayer services, and corruption. To resolve these problems, some countries has restructured their tax system, for example, by strengthening tax administration, establishing tax monitoring units, improving audit practices, and computerizing the tax system. Following these reforms, improving tax administration could reduce tax evasion and consequently enhance fiscal revenue.

Generally, tax reform is an important instrument for raising tax yield. Usually, tax productivity should be improved after the country reformed its tax system. However, the effect of trade liberalization on the overall tax system is ambiguous. A positive fiscal effect can arise if trade liberalization is accompanied by 1) a large expansion in international trade volume which results in an increase in international trade tax, 2) economic growth which later increases production, employment, and income level and results in a larger base for personal and corporate income taxes, 3) devaluation of

the exchange rate which raises the domestic value of imports and hence stimulates people to switch consumption from imports goods to domestic products and thus increases goods and services tax base. By contrast, a negative fiscal effect can also happen if trade liberalization is accompanied by shrinking trade volumes, job losses, and deterioration in corporate profit. In addition, in principle, it is difficult to determine the direction of change in tax revenue as a result of trade liberalization because it depends crucially on revenue productivity and tax structure (Suliman, 2005). That is, growth in tax revenues may occur through automatic responses of the tax yield through changes in national income and/or through the imposition of new taxes, revision of the rate-structure of existing taxes, expansion of the tax bases, tax amnesties, and tougher compliance and enforcement measures. Changes in tax yield resulting from the modification of tax parameters (i.e., rates, base) are called "discretionary changes" which stem from legislative action. Generally, tax buoyancy and tax elasticity are the measures used to evaluate the ability of country's tax system to mobilize its revenue (Asher, 1989). Tax buoyancy measures the change in the overall tax yield from changes in GDP whereas tax elasticity measures the change in tax yield resulting from variations in national income with tax parameters held constant (i.e., discretionary changes being removed).

In this chapter, a measure of revenue productivity of the tax system is used to determine whether the responsiveness of tax revenues is high or low in Thailand relative to three of the other founding countries of the ASEAN Free Trade Area (Indonesia, Malaysia, and Philippines). By using the buoyancy and elasticity framework, this chapter applies the concept of tax buoyancy and elasticity to evaluate the implications of the process of trade liberalization on revenue mobilization. The main objective of this chapter is to estimate tax buoyancy and tax elasticity of the tax

system of Thailand, compared to those of its three neighbour countries. The evaluation is done to measure the response of the tax system to trade liberalization by AFTA in 1992. More specifically, in this chapter we address the question of whether Thailand's major trade liberalization by becoming an AFTA member results in the enhancement of the flexibility of the tax system. If there is any change or improvement in Thailand's tax system, which components of the tax structure have been the most responsive, and why? If not, which tax sources have been rigid, and why? What policy implications can be drawn? The results will be used for comparison purpose in order to gain a wider perspective on the impact of AFTA on the tax system among big ASEAN nations.

The rest of this chapter is divided into five sections. Section 2 gives details of taxation choices in revenue from reforming income and consumption taxes discussed from a theoretical perspective. This section also provides an overview of fiscal profiles of Thailand and the other three ASEAN countries as well as the discussion on their fiscal policies in order to identify any policy changes which occurred during the 1990s, especially when countries joined AFTA. Section 3 reviews theoretical and empirical studies on tax buoyancy and tax elasticity. Section 4 summarizes the methodology and the data. Section 5 presents the empirical analysis. The final section gives some summary and concluding remarks.

5.2. The Reform of Taxation in Developing Countries

In most developing countries, the major problem of the fiscal consequences of trade liberalization is how to fit the revenue compensation into revenue loss from liberalization. This area of concern involves domestic tax reform which is associated with broad issues of economic policy, tax administration, and tax structure design.

Among the issues concerning tax reform, the most important and interesting point is how to design the composition of tax structure. More specifically, the critical issue of tax reform is how the government should design the major components of tax structure to cooperate with trade liberalization in order to make the whole tax structure desirable, administratively practicable, and politically feasible. Thus, understanding fiscal backgrounds and fiscal policies of countries is a very necessary step before tax reform is performed and evaluated. In addition, knowing which tax handles should be used for domestic tax reform is crucial since it helps a government to perform the reform efficiently.

Therefore, this section begins with the discussion on the main types of taxes that are generally suggested to be used for tax reform. Then, the fiscal backgrounds and fiscal policies in each of the four countries will be discussed to provide an insight of fiscal movement of these four countries.

5.2.1. The Choice between Income and Consumption taxes: Theoretical Considerations

This section begins with the choice between income tax and consumption tax, as a tool for offsetting revenue shortfall as a consequence of trade liberalization. Although the tax literature has traditionally suggested income tax as a preferred tool in raising revenue, many recent works have emphasized a broad-based consumption tax as a preferred source to mitigate the loss of revenue.[36] The supporters of consumption tax propose that the most attractive reason for using this tax source as a tool for revenue offsetting is because consumption offers a large tax base for developing countries. Moreover, the difficulties that arise with income tax administration are also the cases

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[36] See Auerbach (1996) and Jorgensen (1996) for example.

to avoid income taxes used for mitigation. However, another group has suggested that reforming the tax system by focusing on consumption tax also encounters problems. The modern concern proposed by Keen (2007) suggests that there is a failure in applying the value-added tax (VAT) in some developing countries since the administration of such a tax requires accurate accounting for financial transactions. In general, central considerations in the debate of the reform focusing on income tax or consumption tax are efficiency and equity, especially for developing countries which usually have high inequality of income and wealth. For efficiency issue, the theoretical literature has pointed out that taxing income is less efficient than taxing consumption since it reduces higher welfare. Generally, income tax consists of two broad components, a labour tax and a capital tax. On the part of labour tax, theory suggests that taxing on labour wages causes additional distortions on savings while consumption tax does not. On the part of capital tax, since capital can be divided into physical capital and human capital, theory suggests that, although both taxing on capital and taxing on consumption may have similar consequence by depressing physical capital accumulation, capital tax may also have an additional impact on human capital accumulation, which further lowers social welfare. Thus, when considering efficiency, consumption tax is believed to be a more preferable tool for raising revenue to offset the loss from trade liberalization. Another issue in the choice between raising income tax and raising consumption tax involves the impact on equity. This concern is particularly important in developing countries since there usually is a highly uneven income distribution. The theoretical literature has suggested that consumption tax is inherently more regressive than income taxes. Taxing consumption is suggested to be ineffective in achieving equity objectives because both the rich and the poor consume the same goods that are being taxed at the

same rate (though consuming in different proportions). Therefore, from the equity point of view, raising revenue using income tax is preferable to raising revenue using consumption tax. However, it is found that an application of consumption tax is relatively feasible in practice and hence, is widely adopted by many developing countries.

Since developing countries usually rely heavily on such convenient tax handles as tariffs and import duties and count on these international trade taxes as an important source of government revenue, lowering tariff rates in the process of trade liberalization in order to join the World Trade Organization (WTO), to participate in regional trading agreement such as AFTA or NAFTA, or to reach any bilateral trading agreements with developed countries, could have a the significant impact on economy and the government revenue of these countries. A significant loss in budgetary revenue could possibly occur, at least in the short run before the volume of imports respond to the changes in tariffs. As stated earlier, most developing countries have decided to mitigate the loss under this circumstance by increasing domestic consumption tax rather than increasing income tax since it is the most viable option on grounds of both policy and administration. However, in order to determine precisely the choice between income and consumption taxes, various aspects of these tax handles should be discussed and compared. The following subsection highlights some of the most important aspects of major tax handles used for mitigating the revenue loss.

Personal Income Tax

In most developing countries, personal income tax (PIT) has yielded very little revenue and thus is not counted as the most important tax handle in the tax structure

as it usually is in developed countries. This is mainly because there is a very small number of individuals who are subject to PIT. In addition, administrative capabilities are the major concerns in these countries. Cnossen and Bird (1990) provides a comprehensive discussion on the PIT which highlights many interesting conceptual issues.

Tax Rate

In general, the rate structure of the PIT in developing countries is not the primary concern since many of these countries have maintained the progressivity of the PIT tax rate by applying many rate brackets. Instead, the major concern is on tax deduction, exemption, and credit which could severely affect the progression in the rate structure. Cnossen and Bird (1990) suggest that in many developing countries, the effectiveness of nominal rate progressivity in delivering effective rate progressivity is substantial lowered by the high level of personal exemption. In particular, exemptions and deductions in most cases are commonly found to benefit individuals with high incomes. Such exemptions and deductions include the exemption of capital gain from tax, the high deductions for medical and educational expenses, and the low taxation of financial income. By reducing the number of rate brackets, exemptions, and deductions, the effective rate progressivity of a country could be improved and, therefore, the revenue raising objective together with an equity objective could be achieved. In developing countries, it is also usually found that political constraints impede the restructuring of PIT rates, a substantial improvement in PIT revenue mobilization and in equity objective can also be achieved by replacing PIT deductions with tax credits, which is equally beneficial for all tax payers in all tax brackets. However, the use of tax credits accounts for a very little proportion in developing countries.

Another important issue relating to PIT rate structure is the level of the top marginal PIT rate. In some developing countries, this rate is almost equal or even exceeds the corporate income tax (CIT) rate by a significant margin. This could drive taxpayers from the PIT structure to the CIT form since various expense deductions in the CIT structure provide a strong incentive for those taxpayers, which finally distort the tax structure because the change does not generate from doing business purpose but solely from tax purpose. Therefore, tax policy makers must be careful when choosing to increase the PIT rate to offset the revenue loss from trade liberalization that the top marginal PIT rate must be significantly lower than the CIT rate.

Tax Base

In addition to the problems of the high levels of exemptions and deductions that tend to deteriorate the effective progressivity of a progressive nominal rate structure and narrow the PIT base, most developing countries often encounter the problem of taxing certain groups that have deficiency in coverage. Generally, these hard-to-tax groups include small and medium enterprises, small and medium retail establishments, small traders, professionals, and farmers, which are particularly important compositions in developing countries. There are substantial difficulties in obtaining information on their income. While data on earnings of employees in the public sector and in larger private establishments are widely available, data for these hard-to-tax groups are not. The computation of income tax based on their earnings or profit margins is very difficult and hence requires other treatments than those provided by refined methods of tax administration and provisions in the revenue code. However, the governments of many developing countries are often reluctant to push these hard-to-tax groups into the PIT structure since they do not want to lose political supports, as these groups are accounted for a substantial proportion of the country's population.

Corporate Income Tax

In developing countries, the issues which are related to tax reform by using CIT are numerous and complex. Some of those issues are similar to those found in many developed countries. However, this section focuses on two problematic issues which are still prevalent in most developing countries; multiple CIT rates based on a sectoral differentiation and tax incentives to promote investment.

Tax Rate

Generally, developing countries have a higher tendency to have multiple CIT rates which are differentiated among sectors than that of developed countries. This includes the exemption and deduction from tax of certain sectors. CIT rate differentiation in most of developing countries is a result of past economic regimes which emphasize the state's role in resource allocation. There is an argument that multiple CIT rates may distort the proper function of the market force. To address the distortion in the sectoral allocation of resources, unifying multiple CIT rates across sectors is suggested as an important tax policy in developing countries. However, unifying multiple CIT rates may encounter a serious problem if the government chooses the strategy to offset the revenue shortfall from trade liberalization by raising CIT rates from sectors which reap benefit from the lower tariffs. This difficulty does not include those sectors which have some kind of political power which may impede the strategy to offset revenue shortfalls by using corporate income tax.

Tax Incentives

Although granting tax incentives to promote investment is quite common in countries around the world, evidence suggests that it is particularly high for developing

countries. Investment incentives in developing countries are frequently given to both domestic and foreign-owned businesses. Investment incentives may take various forms, but among all the different forms of tax incentives, tax holidays and reduced tax rates are the most popular among developing countries. There is an argument that the revenue cost of tax incentives in the forms of tax holidays and reduced tax rates are very high. In particular, tax incentives will be very costly if they are given to businesses or sectors which benefit from lower import price as a result of tariff reduction.

Goods and Services Tax

Goods and services tax usually plays a major part in the tax structure of developing countries. The reason is very simple that goods and services tax is easier to impose than income taxes. For collecting goods and services tax, fewer points of tax collection are needed and taxation is concentrated on products either at the very first stage of domestic manufacture or at various stages of production. In developed countries, goods and services tax may be imposed as either a retail sales tax on consumption or a value added tax of the consumption type by exempting capital goods from the base. Where both options are available, the choice between them is a matter of administrative convenience since the covered tax base and the burden distribution will be the same. However, in developing countries, the retail option is usually not available because the retail sector tends to be small, informal, and unstable. The consequences are that sales cannot be determined accurately and enforcement at the retail level is difficult. Therefore, most of developing countries choose to go toward the value added approach since it is more feasible in practice. As a result of its relative simplicity, developing countries usually implement domestic tax reform by introducing the value added tax (VAT). However, it is usually found that

many important sectors in developing countries, including wholesale and service sectors, have been left out of the VAT structure. In addition, the VAT credit mechanism is still very restrictive, especially when it comes to provide tax credit to for the capital goods. These problems greatly reduce the possibility of success when a country chooses to introducing tax reform by focusing on goods and services tax.

5.2.2. Overview of Fiscal Profile

The four countries' fiscal operations for the period 1972 to 2006 are highlighted from Figures 5.1-5.4. All figures show that both government revenue and expenditure maintained consistent growth patterns. In Figure 5.1, the graph shows that Thailand suffered from a long-time deficit until 1988. Then, in the 1990s, revenue exceeded expenditure until 1997, the year of the Asian economic crisis. During the crisis, there was a drop in both revenue and expenditure, but a decrease was much larger for revenue. From 1997, expenditure started to exceed revenue in absolute terms. In addition, over the period 1991 to 2006, government revenue increased by 7.66% on average compared with an increase of 9.80% in expenditure. Revenue started to exceed expenditure again in 2003, although the gap between them was much lower than that in the early 1990s period. Likewise, Indonesia and Malaysia had a huge surplus in the second half of 1980s and the early 1990s. They also experienced a drop in both revenue and expenditure in the Asian crisis period. They were able to maintain a surplus from the second half of 1980s until now although the gap narrowed. By contrast, the Philippines suffered from a deficit for almost the whole period, though there was a little surplus during 1991-1996. From Figure 5.4, the deficit continued to 2006. Obviously, the deficit is can be traced from the economic crisis which occurred in 1997. For most countries which have suffered the Asian financial crisis, including these four countries, it was transformed to a full-blown recession in the real economy

of production. In order for the government to stimulate the domestic economy and moderate economic recession, a large amount of government expenditure was utilized for many years after the recession. Figures 5.1-5.4 point out that all four countries need to boost revenue, especially for the Philippines, in order to prevent a fiscal deficit which may potentially cause a rise in public debt and other fiscal problems in the future.

Figure 5.1: Budgetary Revenues and Expenditures in Thailand, 1972 to 2006
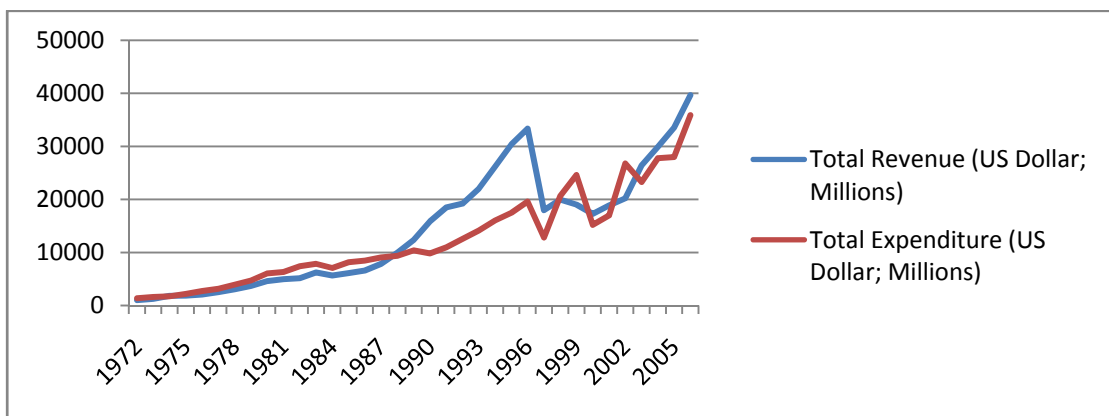
Source: IMF the Government Finance Statistics (GFS); December, 2008

Figure 5.2: Budgetary Revenues and Expenditures in Indonesia, 1972 to 2006
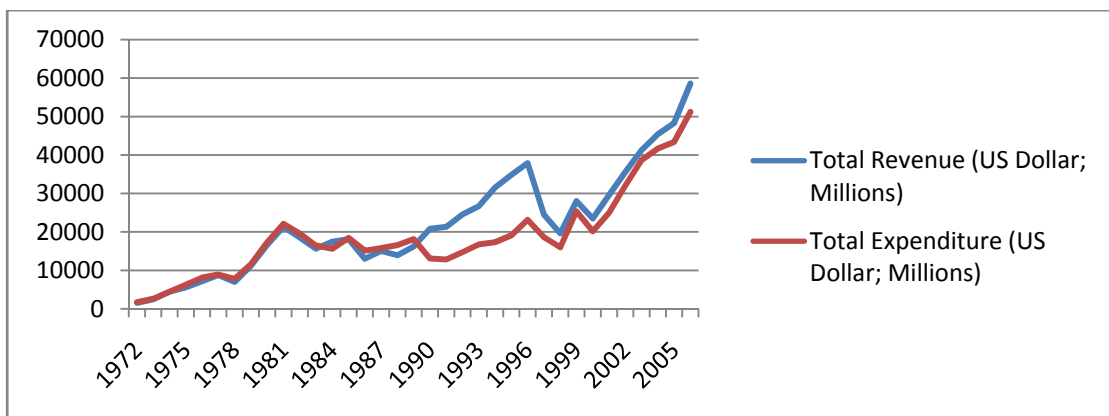
Source: IMF the Government Finance Statistics (GFS); December, 2008

Figure 5.3: Budgetary Revenues and Expenditures in Malaysia, 1972 to 2006
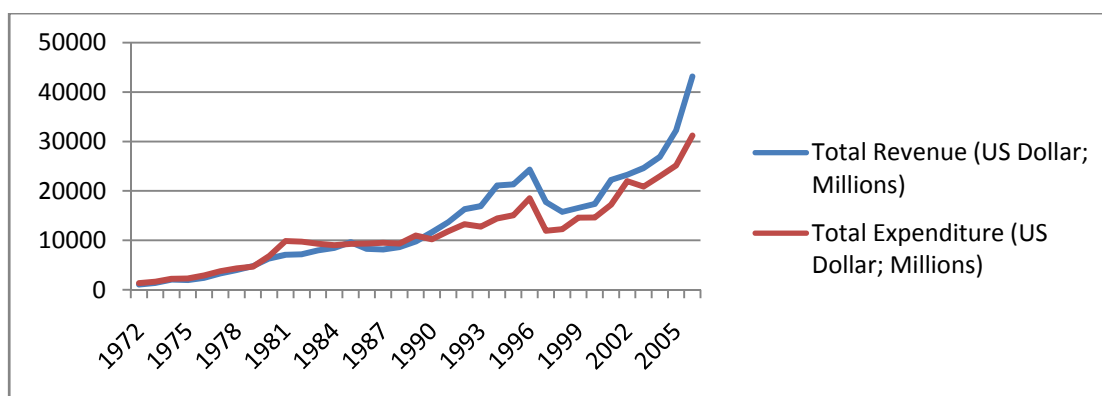
Source: IMF the Government Finance Statistics (GFS); December, 2008

Figure 5.4: Budgetary Revenues and Expenditures in the Philippines, 1972 to 2006
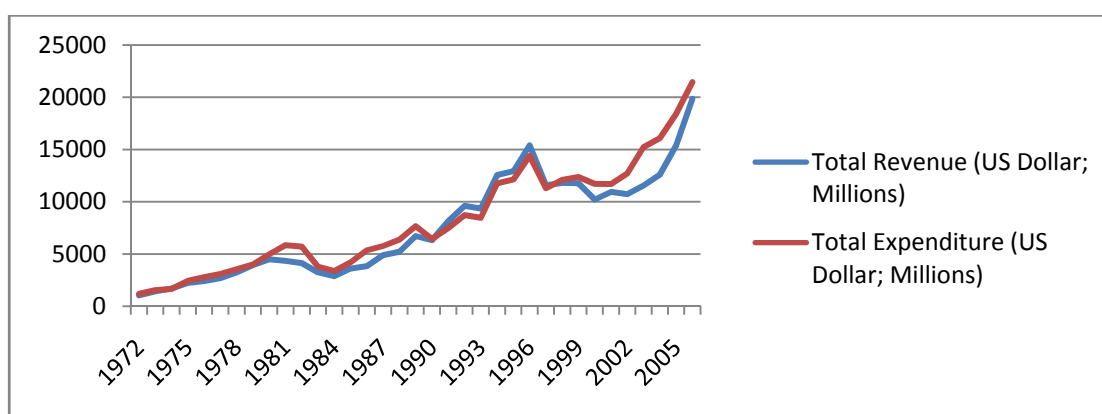
Source: IMF the Government Finance Statistics (GFS); December, 2008

In order to raise revenue, finance the deficit, and obtain a balanced budget, the government may set many fiscal targets; one of those measures is to mobilize tax revenue, since, in general, the major instrument of the government to raise revenue is taxation. Figures 5.5-5.8 show the proportion of tax revenue in total revenue. All figures point out that taxation is the main source of revenue for all countries in our research since it contributes approximately 90% of total revenue for Thailand (Figure 5.5), 80% for Indonesia (Figure 5.6), 70% for Malaysia (Figure 5.7), and 90% for Philippines (Figure 5.8), while the share of non-tax revenue accounted for a small proportion in their total revenue over the period of review. Again, tax revenue shows

a declining trend during the crisis period but it has risen back since the early 2000s to even a higher level than that before crisis, in line with the trend of their total revenue.

Figure 5.5: Share of Tax and Non-Tax Revenue in Total Revenue (US Dollar; Millions); Thailand, 1972-2006
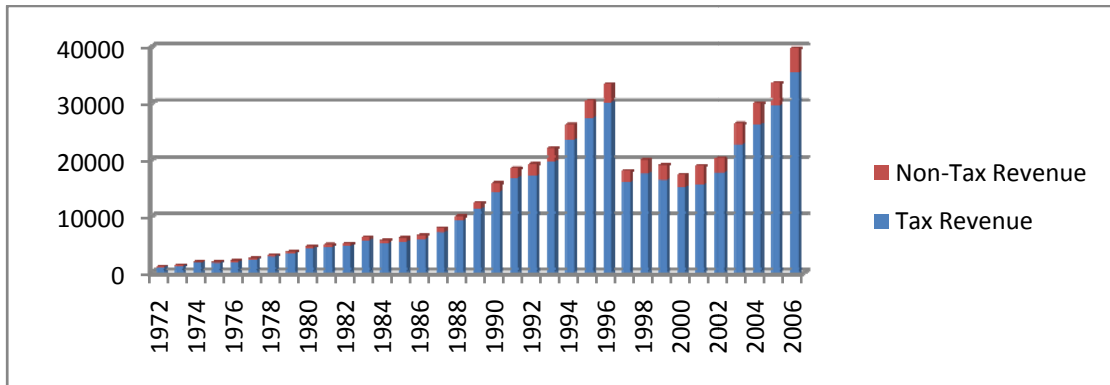
Source: IMF the Government Finance Statistics (GFS); December, 2008

Figure 5.6: Share of Tax and Non-Tax Revenue in Total Revenue (US Dollar; Millions); Indonesia, 1972-2006
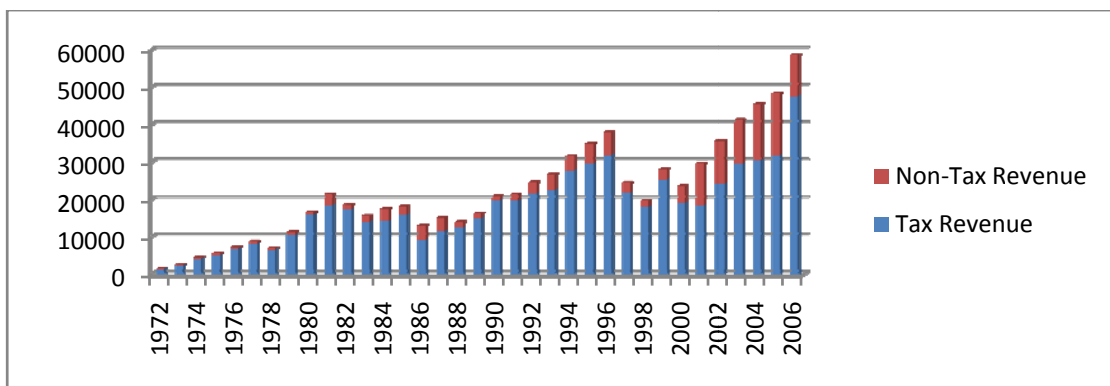
Source: IMF the Government Finance Statistics (GFS); December, 2008

Figure 5.7: Share of Tax and Non-Tax Revenue in Total Revenue (US Dollar; Millions); Malaysia, 1972-2006
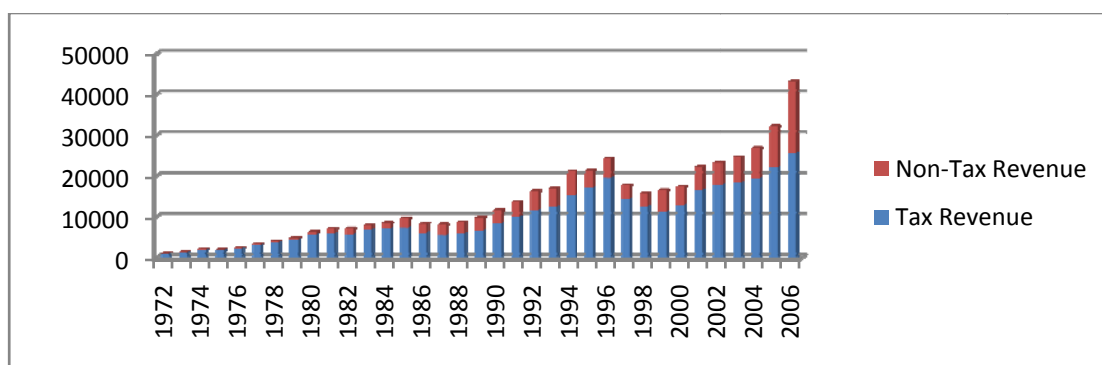
Source: IMF the Government Finance Statistics (GFS); December, 2008

Figure 5.8: Share of Tax and Non-Tax Revenue in Total Revenue (US Dollar; Millions); Philippines, 1972-2006
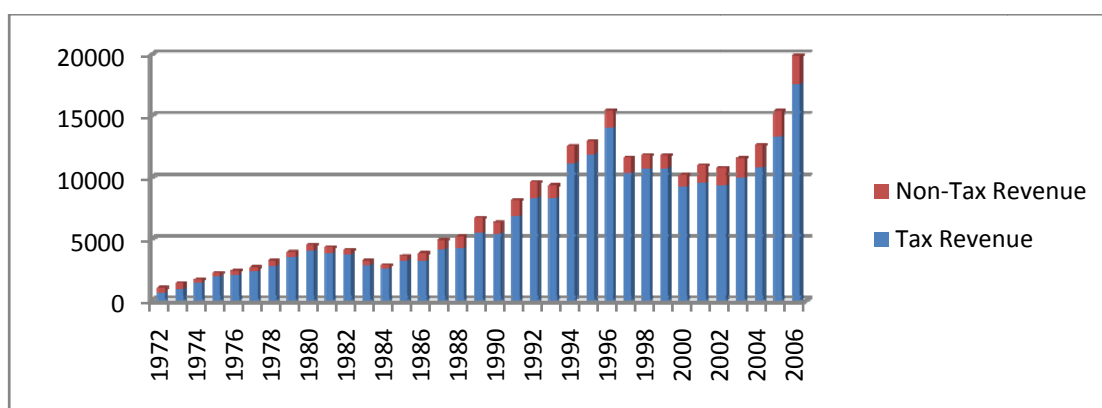
Source: IMF the Government Finance Statistics (GFS); December, 2008

Considering the impact of trade liberalization on tax revenue, Figures 5.9-5.12 show that trade liberalization has been associated with a marked decline in international trade tax revenue for all 4 countries. For Thailand (Figure 5.9), international trade tax accounted for approximately 25% of total tax revenue on average from 1972 to 1990. It ranked as the second most important tax source until 1991. Although international trade tax shows a declining trend over the period of study, it drops very rapidly during 1992 to 1997, the period that the country joined AFTA. In 2006, international trade

tax accounted for only 8% of total tax revenue and ranked the least important among major taxes in the country. Considering other taxes, goods and services tax ranked the most important tax revenue source for Thailand. It accounted for approximately 50% over the review period. Unlike the theory, goods and services tax does not show any increasing trend to mitigate the loss of international trade tax over the liberalization period. Instead, corporate income tax has risen since the late 1980s and become the second most important tax in 2006. In 2006, corporate income tax accounted for more than 30% of total tax revenue. Although the loss of international trade tax in Thailand seems to be successfully mitigated, there are some concerns since corporate income tax base is not as wide as the goods and services tax base. This may cause a problem in raising revenue in the longer term.

Figure 5.9: Trends of Thailand's Major Taxes
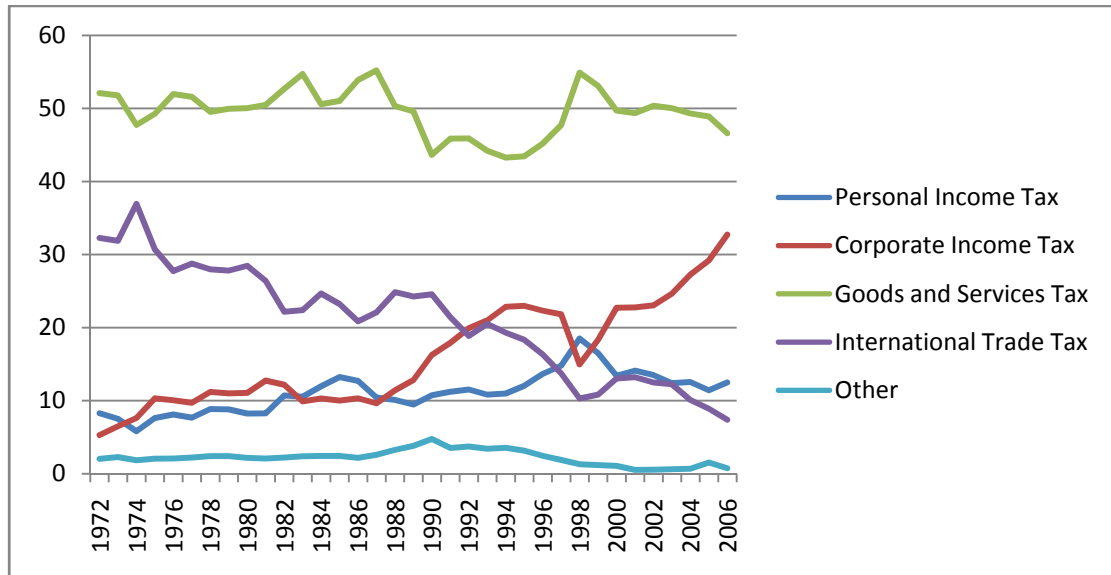
Source: IMF the Government Finance Statistics (GFS); December, 2008

For Indonesia (Figure 5.10), the international trade tax was about 20% of total tax revenue in 1972 and has declined over the period. It accounted for approximately only 6% of total tax revenue in 2006. Like Thailand, the international trade tax was found

to be the least important tax source at the end of the period. Considering other taxes, corporate income tax was considered to be the most important tax revenue source for Indonesia during 1970s and 1980s since it accounted for over 50% of total tax revenue on average. However, corporate income tax dropped rapidly in 1993 and the revenue loss from corporate income tax was compensated by the rise of personal income tax. In 2006, corporate income tax accounted for only about 8% of total tax revenue, while personal income tax accounted for almost 40% of total tax revenue, ranked the second most important tax revenue source for the country. In line with the theory, goods and services tax shows an upward trend over the period of study. In 2006, it comprised almost 50% of total tax revenue and was the most important source of tax revenue for the country.

Figure 5.10: Trends of Indonesia's Major Taxes
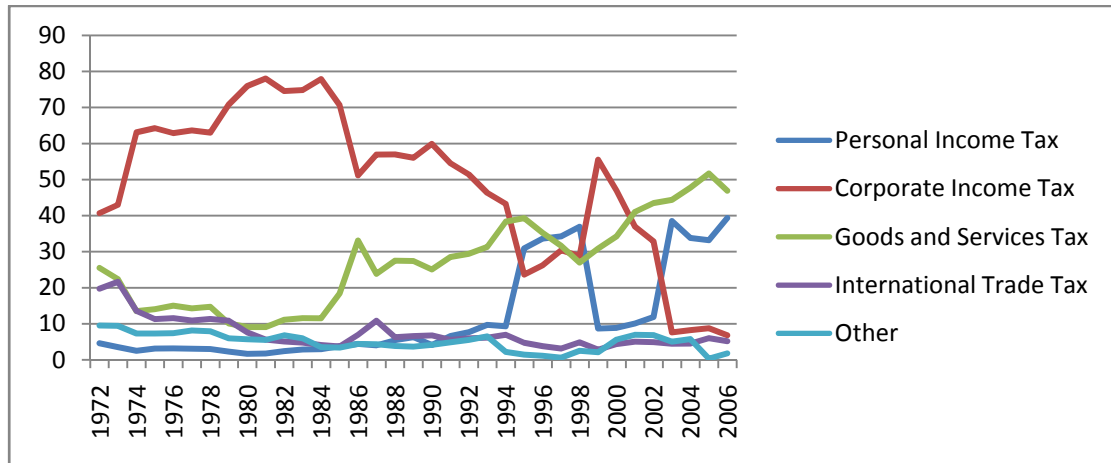
Source: IMF the Government Finance Statistics (GFS); December, 2008

For Malaysia (Figure 5.11), the international trade tax shows a very obvious downward trend over the period. In 1972, it is the most important tax revenue source of the country by accounting for almost 40% of total tax revenue. However, its proportion in total tax revenue dropped to approximately only 8% in 2006. At the end of the study period, corporate income tax seems to play an important role for

government revenue since it made up approximately 50% of total tax revenue. The goods and services tax does not show any increasing trend over the period as it accounted for about 30%, ranked the second most important tax revenue.

Figure 5.11: Trends of Malaysia's Major Taxes
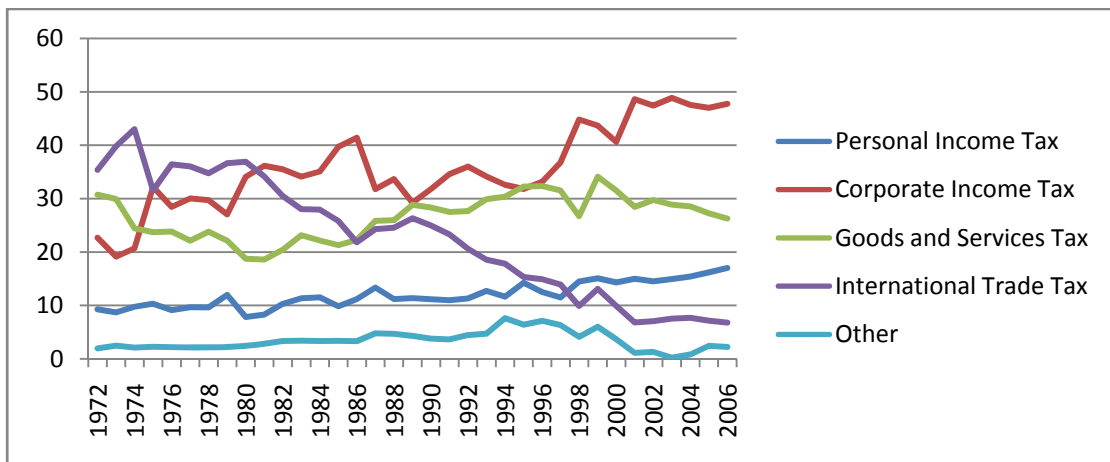
Source: IMF the Government Finance Statistics (GFS); December, 2008

For Philippines (Figure 5.12), although international trade tax dropped rapidly after the country joined AFTA, tax revenue from this source is still important for the country since it was over 20% of total tax revenue in 2006, almost equal to the proportion of corporate income tax and ranked the second most important tax revenue source for the country. Although personal and corporate income taxes show an upward trend, they grew very slowly, compared with other countries. The goods and services tax does not seem to help mitigate the loss of international trade tax revenue since it does not increase over time. From this fact, the Philippines may encounter a severe problem if liberalization causes a significant reduction in international trade tax revenue because there is no other taxes can help mitigate the loss.

Figure 5.12: Trends of Philippines's Major Taxes
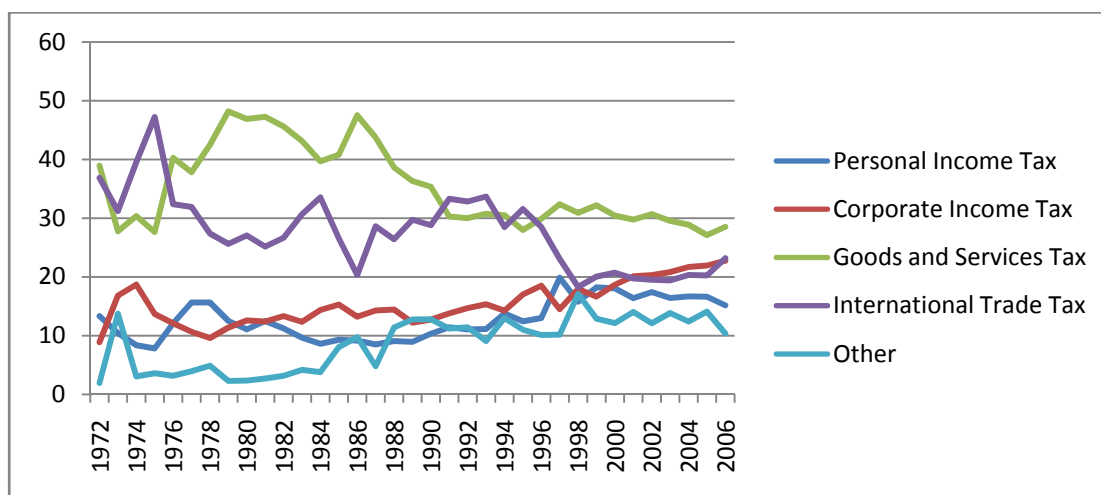
Source: IMF the Government Finance Statistics (GFS); December, 2008

From Figure 5.13 to Figure 5.16, Thailand's data of tax revenues and per capita GDP are plotted on the graph to demonstrate the relationship between them. Figure 5.13 shows that reliance on revenue from international trade tax is inversely related to the country's income levels. This fact is in line with the result in previous chapter. When GDP is low, the country lacks administrative capacity, which reduces the efficiency of tax collection. Government finds that it is difficult to tax the transaction of the informal and subsistence sectors, which accounts for a large share in the country's economy. Additionally, the influence of powerful lobbies makes some sectors off-limits to the tax authorities. As a result, the domestic tax base is narrow and the government tries to meet its fiscal need by placing high rates on easily taxable sectors, and one of those is on international trade (Kubota, 2000). However, as the country grows, it relies less on the international trade tax and depends more on other domestic taxes. While there is a decreasing trend in international trade tax against the income level over the review period, taxes on income and profits increase with the level of income. Figure 5.14 and Figure 5.15 show that taxes on income and profits are positively associated with the country's income level. From these two figures, it

seems that Thailand has tried to recover the loss of international trade tax by collecting more income tax and profit tax, especially corporate income tax. However, tax on goods and services does not show a clear relationship with the change in income level. Figure 5.16 demonstrates that as the income changes, the goods and services tax still remains at around 50% of total tax revenue and shows no increasing trend as income increases.

Figure 5.13: Thailand's reliance on international trade tax measured against income levels, 1972-2006
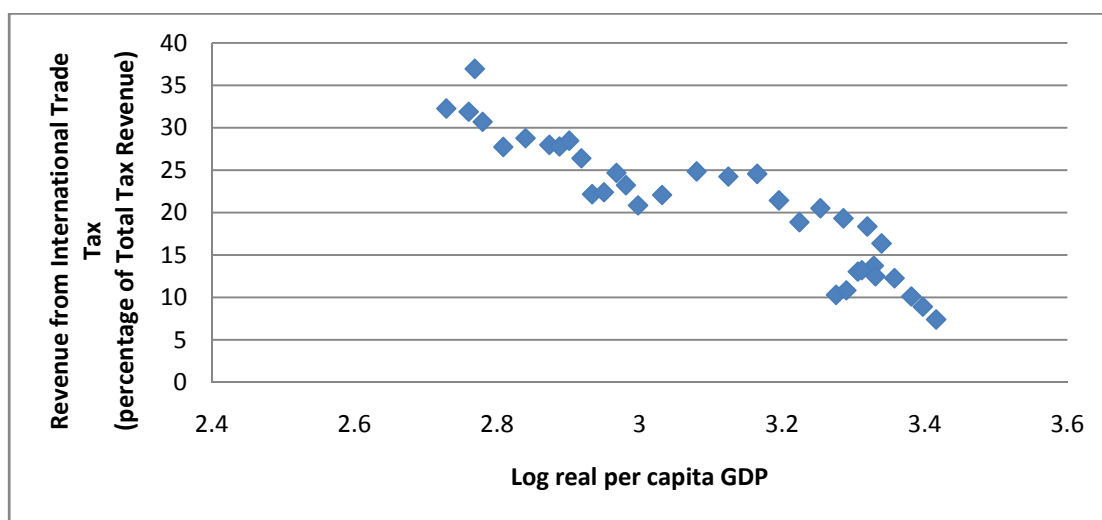
Source: IMF the Government Finance Statistics (GFS); December, 2008 and World Bank, World Development Indicators (WDI); December 2008

Figure 5.14: Thailand's reliance on personal income tax measured against income levels, 1972-2006
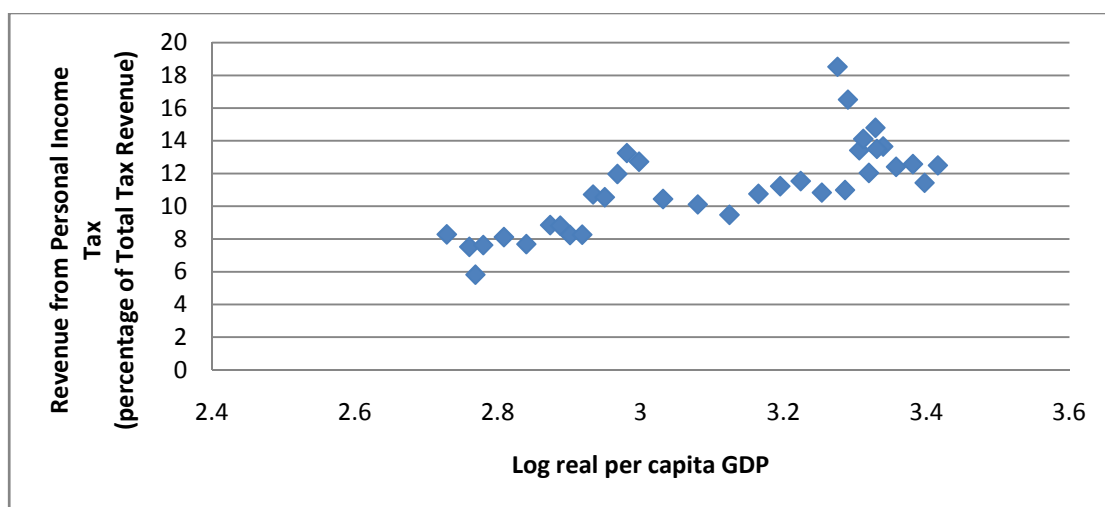
Source: IMF the Government Finance Statistics (GFS); December, 2008 and World Bank, World Development Indicators (WDI); December 2008

Figure 5.15: Thailand's reliance on corporate income tax measured against income levels, 1972-2006
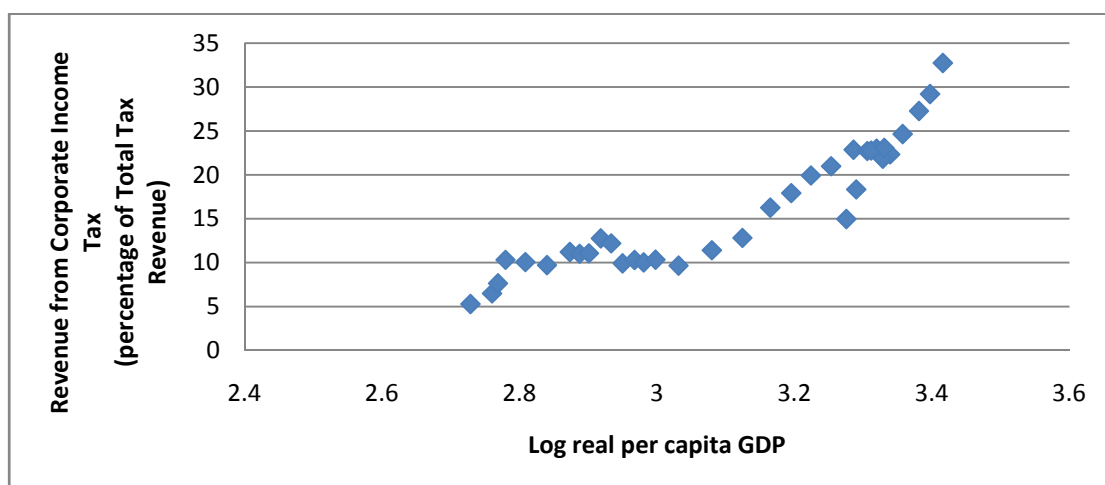
Source: IMF the Government Finance Statistics (GFS); December, 2008 and World Bank, World Development Indicators (WDI); December 2008

Figure 5.16: Thailand's reliance on goods and services tax measured against income levels, 1972-2006
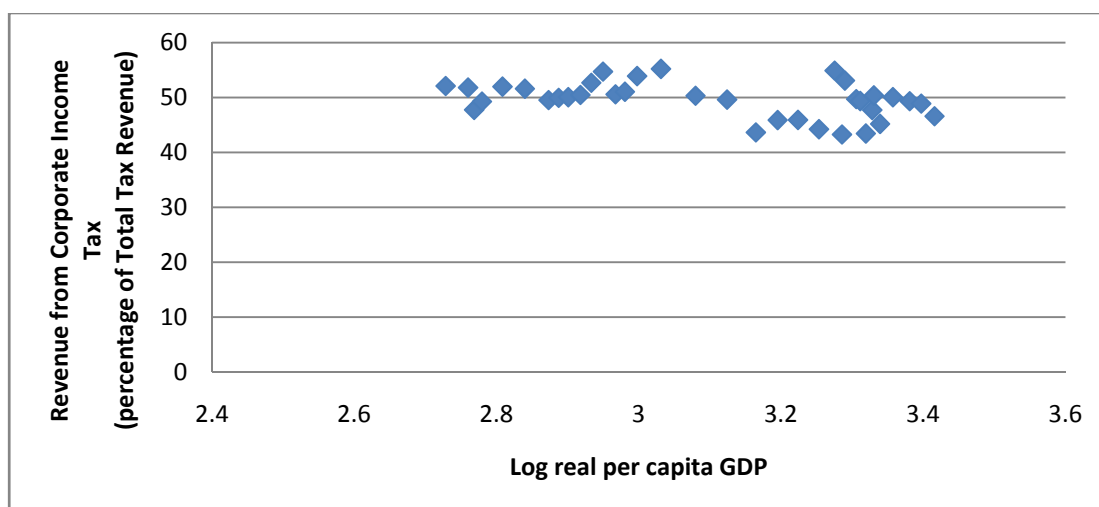
Source: IMF the Government Finance Statistics (GFS); December, 2008 and World Bank, World Development Indicators (WDI); December 2008

Figures 5.17-5.20 show the reliance of Indonesia's major taxes on its income level. Like the case of Thailand, Figure 5.17 shows that international trade tax is inversely related to the country's income level. As a country's income grows, personal income tax gradually increases, although it jumps up in later years when GDP reaches a high level (Figure 5.18). However, unlike that of Thailand, corporate income tax does not seem to mitigate the loss of international trade tax since it does not grow with the country's income (Figure 5.19). Still, there is a good sign for Indonesia since the graph in Figure 5.20 shows that goods and services tax grows along with the country's income level. This implies that what really happens in practice is in line with what the principle that loss of international trade tax revenue could be offset by higher domestic consumption tax revenue. There is a chance to substitute domestic consumption tax for international trade tax while maintaining government revenue for Indonesia.

Figure 5.17: Indonesia's reliance on international trade tax measured against income
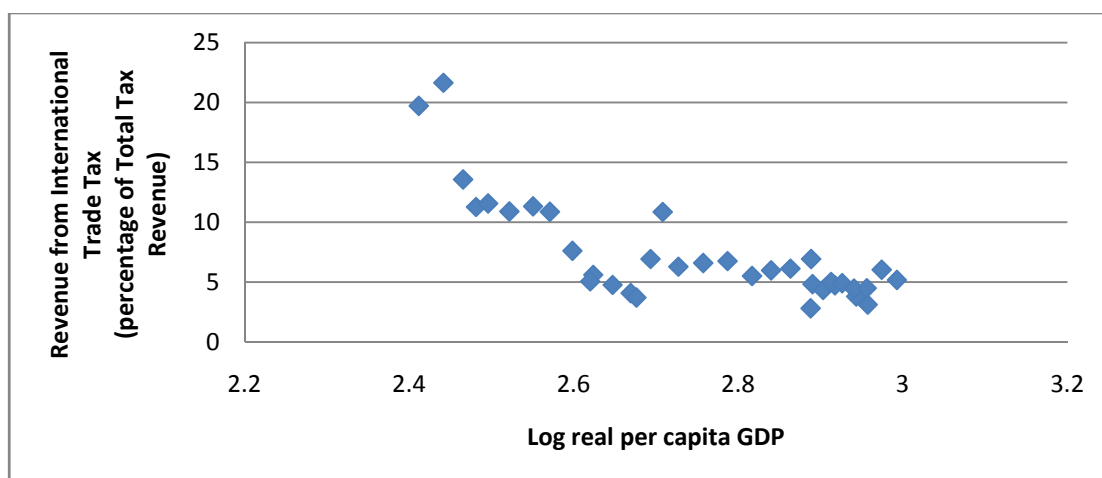
levels, 1972-2006

Source: IMF the Government Finance Statistics (GFS); December, 2008 and World
Bank, World Development Indicators (WDI); December 2008

Figure 5.18: Indonesia's reliance on personal income tax measured against income
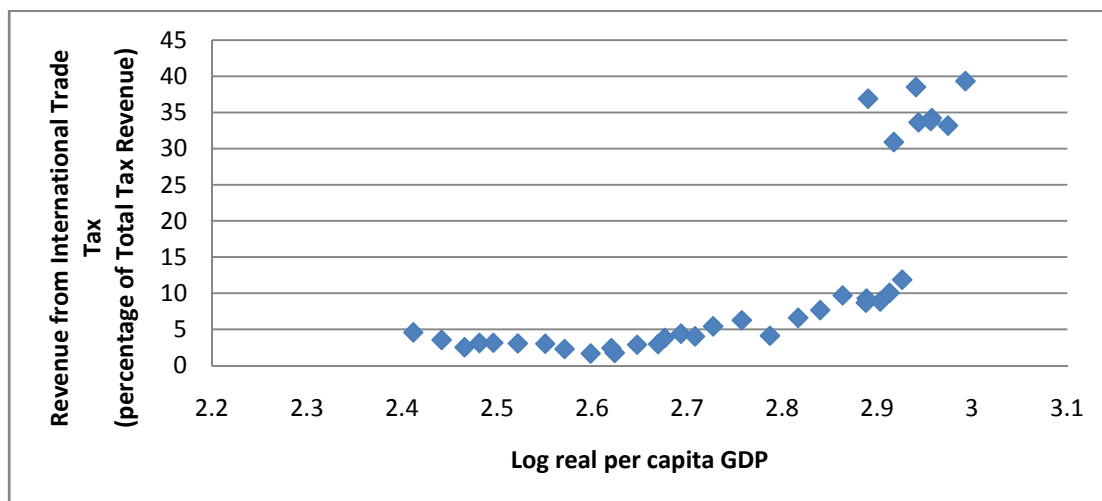
levels, 1972-2006

Source: IMF the Government Finance Statistics (GFS); December, 2008 and World
Bank, World Development Indicators (WDI); December 2008

Figure 5.19: Indonesia's reliance on corporate income tax measured against income
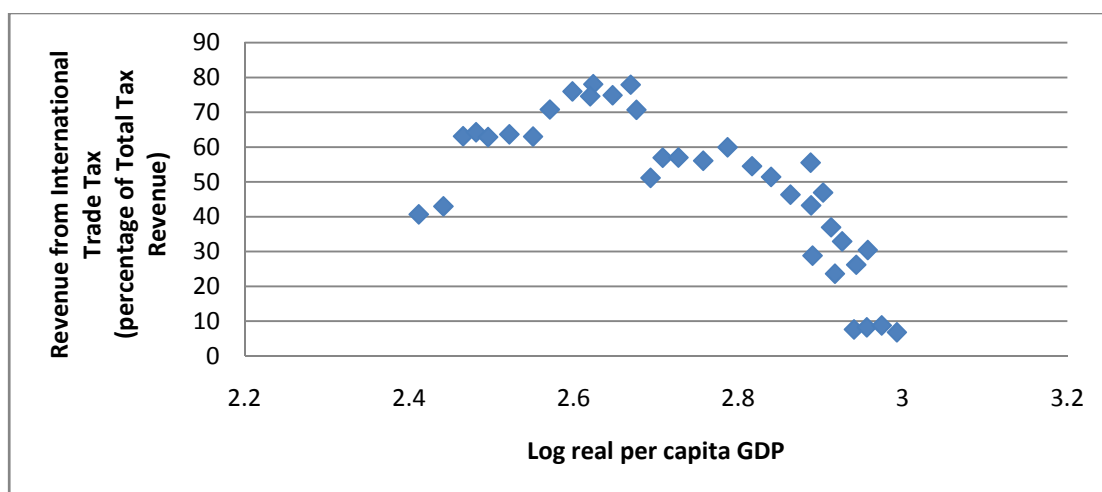
levels, 1972-2006

Figure 5.20: Indonesia's reliance on goods and services tax measured against income
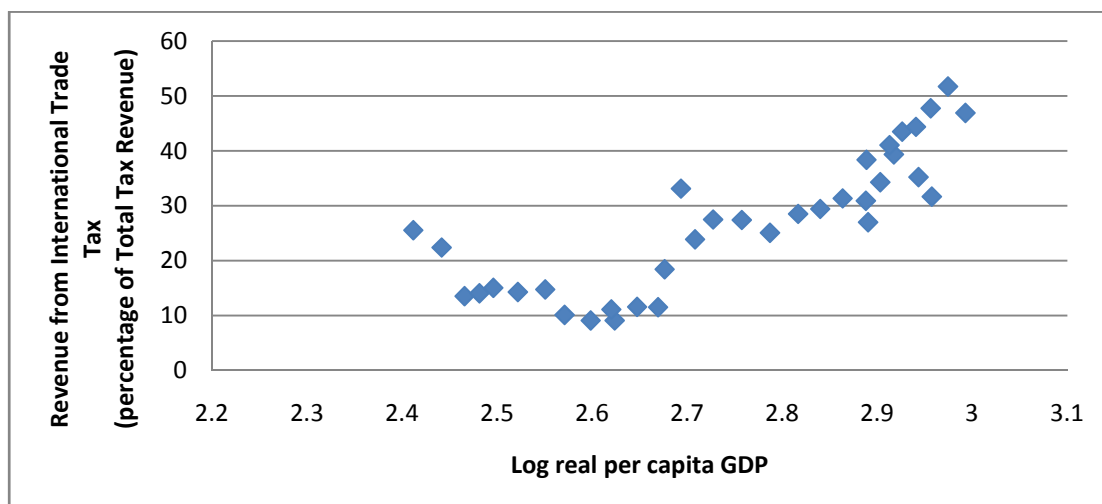
levels, 1972-2006

Figures 5.21-5.24 show the relationship of Malaysia's major taxes and its income

level. As shown by Figure 5.21, international trade tax is, again, negatively related to

the country's income level. For Malaysia, Figures 5.22 and 5.23 show that personal

and corporate income taxes are positively associated with GDP and Malaysia seems to depend on these income taxes as a strategy to substitute these revenue sources from international trade tax. The goods and services tax, on the other hand, do not respond to the growth of GDP, though the proportion in total tax revenue is about two fold higher than the proportion of personal income tax in total tax revenue (Figure 5.22).

Figure 5.21: Malaysia's reliance on international trade tax measured against income levels, 1972-2006
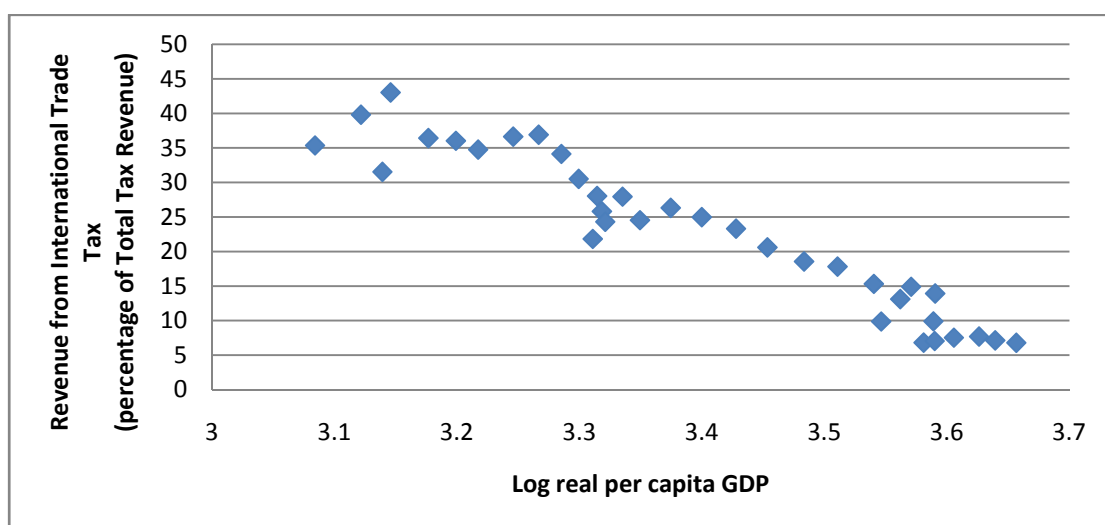
Source: IMF the Government Finance Statistics (GFS); December, 2008 and World Bank, World Development Indicators (WDI); December 2008

Figure 5.22: Malaysia's reliance on personal income tax measured against income
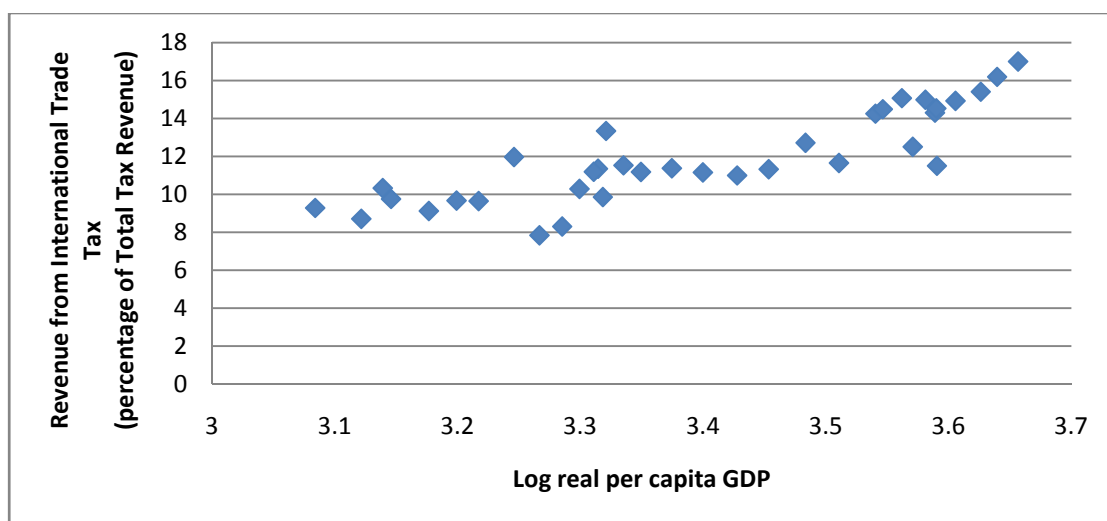
levels, 1972-2006

Source: IMF the Government Finance Statistics (GFS); December, 2008 and World
Bank, World Development Indicators (WDI); December 2008

Figure 5.23: Malaysia's reliance on corporate income tax measured against income
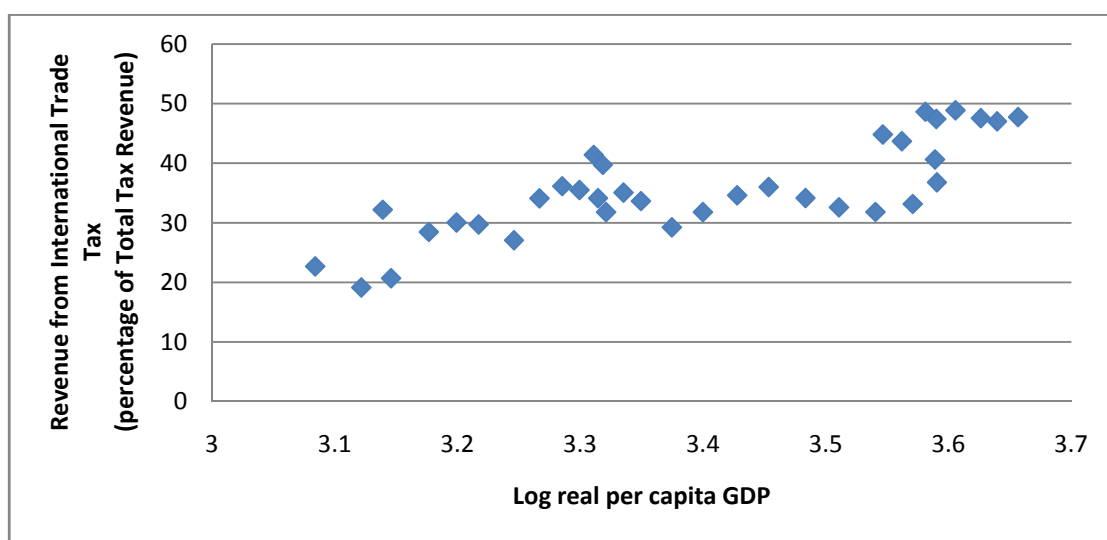
levels, 1972-2006

Source: IMF the Government Finance Statistics (GFS); December, 2008 and World
Bank, World Development Indicators (WDI); December 2008

Figure 5.24: Malaysia's reliance on goods and services tax measured against income levels, 1972-2006
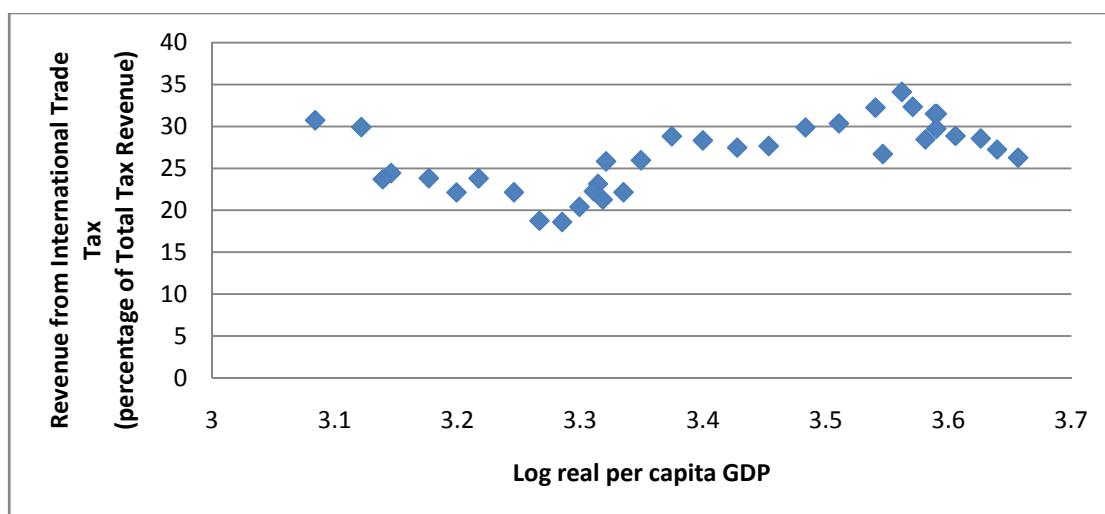
Figures 5.25-5.28 present the reliance of Philippines's major taxes on its income level. Similar to other three countries, international trade tax is inversely related to the income level, as shown in Figure 5.25. However, as presented by Figures 5.26 and 5.28, personal income and goods and services taxes do not increase as income increases. The only major tax of Philippines that grows with its GDP is corporate income tax (Figure 5.27). This may raise concerns of how the Philippines's government will coordinate tariff and tax reform while maintaining government revenue.

Figure 5.25: Philippines's reliance on international trade tax measured against income
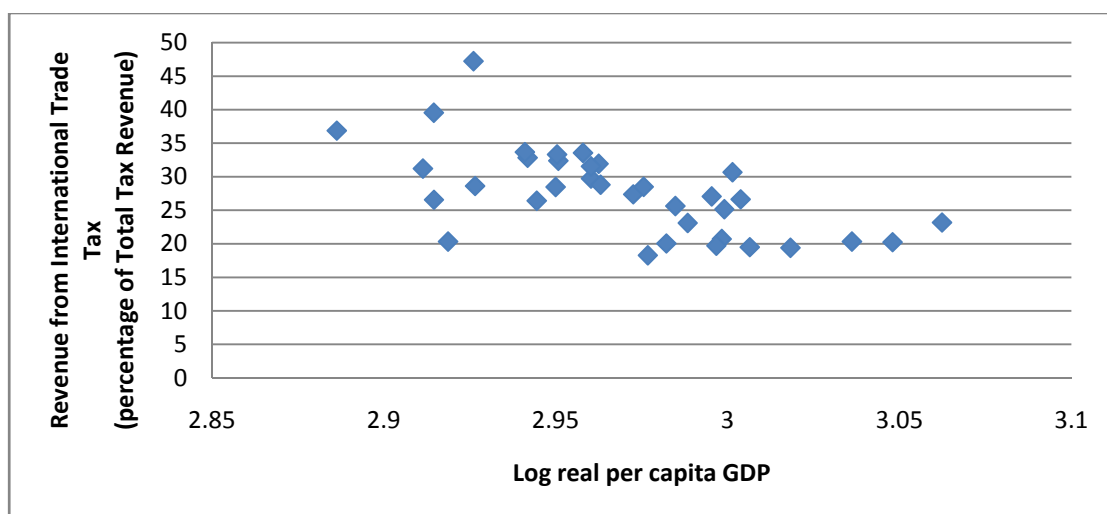
levels, 1972-2006

Source: IMF the Government Finance Statistics (GFS); December, 2008 and World
Bank, World Development Indicators (WDI); December 2008

Figure 5.26: Philippines's reliance on personal income tax measured against income
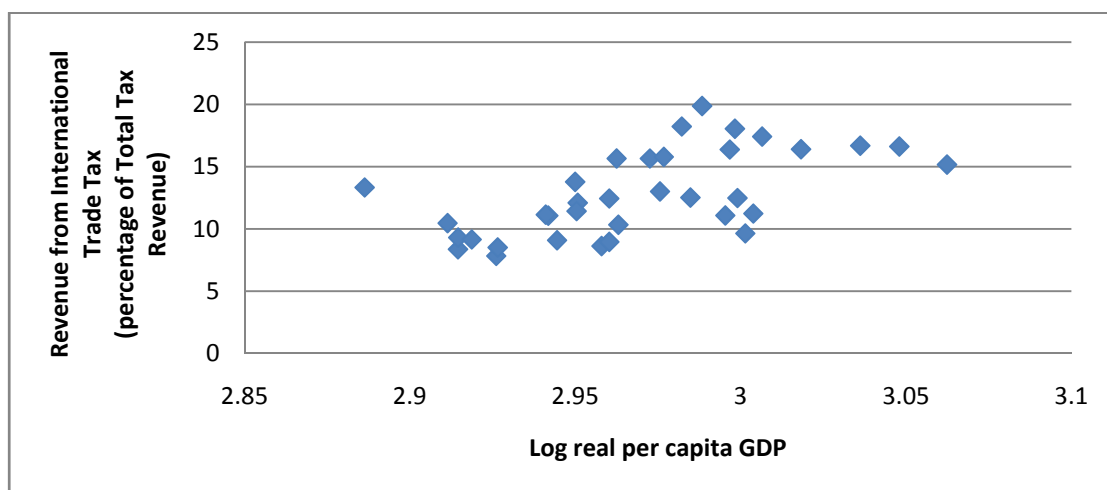
levels, 1972-2006

Source: IMF the Government Finance Statistics (GFS); December, 2008 and World
Bank, World Development Indicators (WDI); December 2008

Figure 5.27: Philippines's reliance on corporate income tax measured against income
levels, 1972-2006
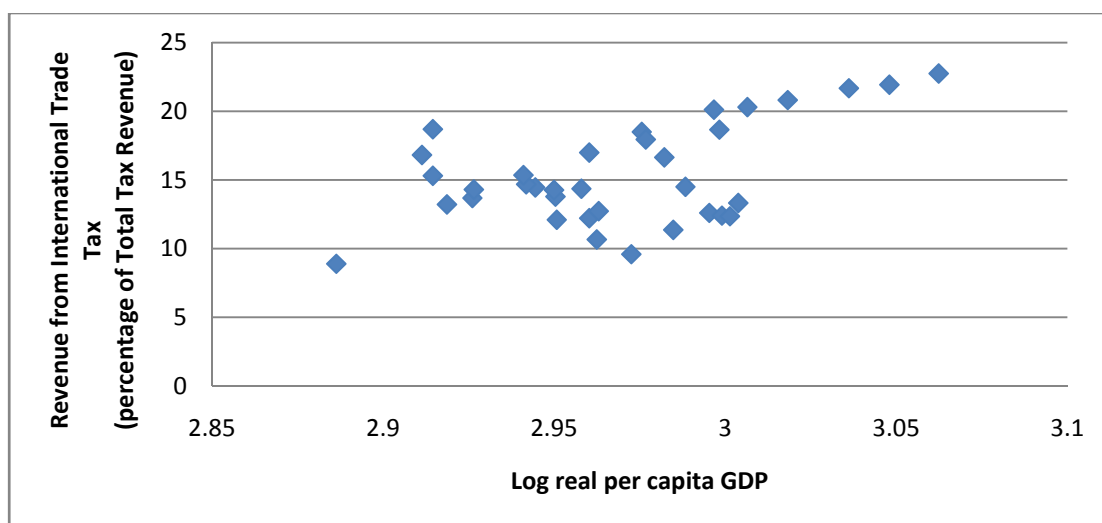
Source: IMF the Government Finance Statistics (GFS); December, 2008 and World
Bank, World Development Indicators (WDI); December 2008

Figure 5.28: Philippines's reliance on goods and services tax measured against
income levels, 1972-2006
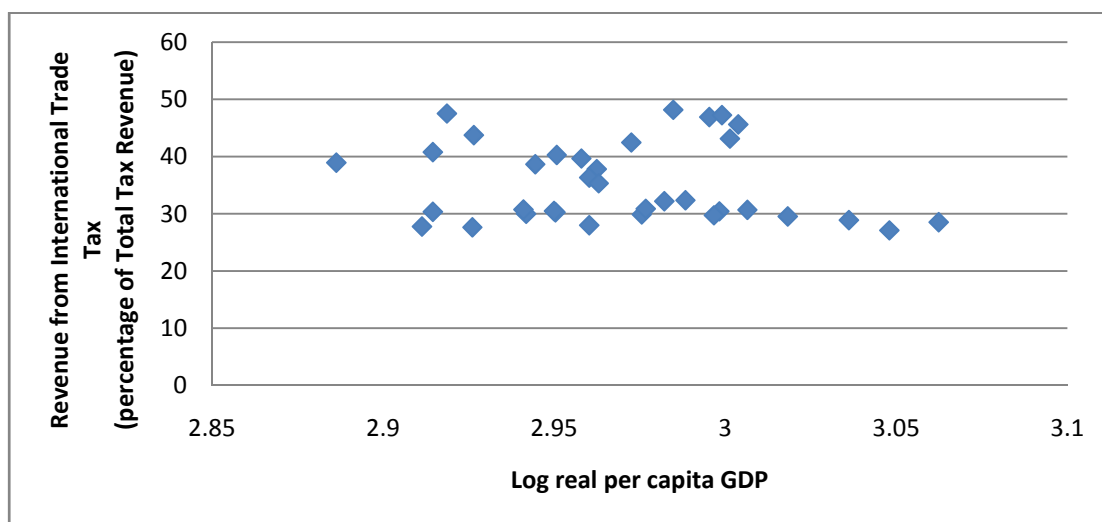
Source: IMF the Government Finance Statistics (GFS); December, 2008 and World
Bank, World Development Indicators (WDI); December 2008

5.2.3. Summary of Fiscal Policies

This section provides direction of fiscal policies and identifies policy changes under the implementation of tax reform following trade liberalization in each of the four countries. Generally, in performing domestic tax reform, the government expects an improvement in the quality of the tax structure by emphasizing the country's tax potential in order to establish fiscal sustainability and increase the level of the country's tax competence both for the transition period of trade liberalization and in the long term. In offsetting the revenue loss from trade liberalization, domestic tax reform increases the opportunity to raise national revenue without increasing rates by either increasing the capacity of tax administration, or expanding tax bases or both. The reason is that, particularly for less developed and developing countries, there is still room for improvement since the utilization of both tax administration and tax bases are far from up to capacity. Therefore, this section is dedicated to discuss fiscal policies in each of the four countries implemented in line with domestic tax reform which is undertaken in the period of trade liberalization (the period of joining AFTA, in particular) in order to investigate how the selected countries have attempted to achieve the objective of revenue loss mitigation.

5.2.3.1. Thailand's Tax Reform

Since the first Economic and Social Development Plan was introduced in 1961 in order to promote industrial development and pursue an import substitution strategy, the tax structure has been simultaneously adjusted and fine-tuned to enhance effectiveness and efficiency of tax administration. However, from the 1960s to 1980s, there was no major change in the country's tax framework. It was not until the early 1990s that the government started thoroughly to review its tax system. The 1990s was

a period of substantial development and there was a dramatic change in global trend. There was a large increase in international trade, investment, and factor mobility. Trade policies have been changed from import substitution to export orientation and protectionism has been gradually reduced. More social and economic cooperation has been established in the region such as Asia-Pacific Economic Cooperation (APEC) and ASEAN Free Trade Area (AFTA) which are mainly aimed to spur trade liberalization in the Asian region. In order to integrate Thailand into the world economy, a trade liberalization policy has been adopted and thus tax reform policies have been used to mitigate the potential revenue loss from tariff reduction and to enhance the productivity of the tax system as a whole.

Since the early 1990s, Thailand has implemented economic reform in various areas including public, financial, and fiscal sectors. As part of overall fiscal reform, the Thai government has implemented major domestic tax reforms, marked by the introduction of the value added tax (VAT) and other tax reform measures starting in 1992. The rationale of domestic tax reform is twofold. Firstly, tax reform is a part of changes in tax structure to offset any revenue loss from tariff reduction. By this means, the Thai government has attempted to substitute revenue sources from tariffs and custom duties to income and consumption taxes, reducing the dependency on international trade tax and focusing to generate more revenue from domestic tax bases. Secondly, tax reform is implemented to increase the efficiency in revenue generation in a reasonably non-distorting, equitable, and sustainable manner.

The major composition of government revenue comprises personal income tax, corporate income tax, value added tax, import duties, and excise tax. In Thailand, tax revenue is collected through three departments, namely the Revenue Department, the Excise Department, and the Custom Department. These three departments work under

the authority of the Ministry of Finance. The Revenue Department is responsible for the collection of personal income tax, corporate income tax, value added tax, special business tax, petroleum tax. The Excise Department is responsible for the collection of tobacco tax, liquor tax, automobile tax, and other selected excise tax. The Custom Department is responsible for the collection of import and export duties. Among the three departments, the Revenue Department is the most important tax collection department since the revenue collected by this department comprises approximately 70% of total tax revenue.

Major tax reforms which have been undertaken since the 1990s focus not only on import duties, income taxes, and consumption tax, but also on tax administration. Detail of the reform are given below.

Comprehensive Reform of the Custom Tariff Structure

In Thailand, custom duties are levied on both imports and selected exports. Duties are levied on either a specific or an *ad valorem* basis depending on which one is higher. In 1985, Thailand's average tariff rate was over than 40%, with the highest rate being for passenger cars in which the rate is over than 80%. However, as the country joined free trade agreement as AFTA and trade liberalization programme provided by the WTO, tariff rates have recently been reduced to the target range of three rates in accordance with the production processes. The target rates are 1% for raw materials and inputs which are not locally produced, 5% for semi-finished products, and 10% for finished products, products requiring extra protection, and luxury goods. Although the reform package has not yet been completed for all products, a number of products in most categories have already adjusted to the new rates. Remaining items are such as petrochemical products in which their tariffs rate will be reduced in line with the

three rate framework in 2010. Recently, as a result of the custom tariff reform, the average tariff rate was reduced to only 10% in 2007.

Comprehensive Reform of Personal Income Tax Structure

In the past, personal income tax rates were set at a relatively high level up to 55% on average. During the reform period, there was a steady reduction in the rate and now it is imposed at progressive rates of between 5 and 37% on net income. Not only have the rates been changed, but expenses and allowances that can be deducted from assessable income have also been reviewed. The major change in deduction categories is on standard expenses which have been increased to 40% but not exceeding 60,000 Baht. There is also an increase in tax allowances of several types, after deducting expenses. For example, personal allowance, spouse allowance, and parent allowance have been increased to 30,000 Baht each. The child allowance has been increased to 15,000 Baht whereas the child's education allowance has been increased to 2,000 Baht. The amount of these allowances has been wider in order to help the middle class population since the average wage and salary in Thailand (and most of developing countries) is relatively low comparing with other developed nations. Recently, the Thai government has promoted private savings by granting allowances for a providence fund or pension fund and retirement mutual fund of 300,000 Baht or not exceeding 15% of net income. As a result of these acts, personal income tax base is automatically lowered.

Comprehensive Reform of Corporate Income Tax Structure

Similarly, the average corporate income tax rate went to 50% in the past. Since then, the corporate income tax rates have been lowered in order to induce more investment and create a greater incentive for domestically economic activities. The reduction in

the corporate income tax rate is in line with the global trend for lowering tax rates. Currently, corporate income tax is set at 30% on net profit for all types of businesses. However, further reduced rates are also applied depending on the type of businesses. These reduced rates have been recently used as policy instruments to promote certain sectors such as Small and Medium Enterprises (SMEs) and listed companies. These acts, on one hand, automatically reduce the collection by lowering the tax rate, but on the other hand, may help improve the corporate income tax base by including more businesses into the tax structure.

Comprehensive Reform of Goods and Services Tax Structure

One of the most important tax reforms in recent Thai history is the introduction of the value added tax (VAT) in 1992 as a replacement for the business tax. After the VAT was implemented, products that were liable for higher tax amount under the business tax such as electrical appliances, automobiles, perfume and cosmetics were taxed at the normal VAT rate and higher excise tax, leaving the tax burden remains unchanged. The VAT is a tax on total consumption expenditure in which the burden is purely on consumers. The VAT is charged at a single rate of 7%.

Comprehensive Reform of Tax Administration

Together with the reform in the structure of taxation, the tax administration has also been substantial improved during the 1990s. The most important reform is the introduction of online processing and the use of web base technology. In the past, the process of tax collection was time consuming. By introducing information and communication technologies, the working process has been largely shortened. The tax database, data processing system, tax supervision system, and supporting system have also been improved. These actions help improving up-to-date taxpayer information,

enhancing voluntary compliance, lowering debt delinquency, increasing taxpayer's cooperation, and consequently increasing the amount of tax collection.

5.2.3.2. Malaysia's Tax Reform

Recently, the Malaysian government has faced the real challenge to assure its fiscal sustainability due to the decline of revenue from tariff reduction. At the same time, the government has attempted to lessen the budget reliance on international trade tax and to depend more on domestic taxes. Besides increasing the efficiency of expenditure, on the revenue side, the Malaysian government has no other choice but effectively to mobilize domestic taxes because they have a great potential to be the main source of government funding. Although there are many way to mobilize tax revenue, including increasing tax rates, expanding tax bases, and improving tax administration, the Malaysian government tends to choose to increase national revenue by the process of tax reform without having to increase tax rates. The major objectives for the reform in Malaysia's tax system are to simplify the tax system, to modernize the tax administration, to introduce various incentives to promote investment, to introduce tax reliefs to reduce the tax burden of the lower income group, to improve the investment climate, to promote domestic consumption, to foster a caring society, and to enhance R&D and skill training.

Unlike many other countries which adopted the reform package that provides major tax changes in the tax reform, Malaysia has also taken the incremental approach which consists of a series of small steps of tax changes. The reform was undertaken gradually and easy to manage by the tax authorities as well as to be withdrawn if unpopular. However, the most notable tax reform of Malaysia's tax system is the introduction of the self-assessment system done in 1992. At that time, the Malaysian

government found that there is an opportunity to mitigate the loss of tariff revenue by increasing capacity in personal income tax. The government has also realized that there should have a better system for tax administration to deal with the increasing number of taxpayers without a proportionate increase in the number of staff of tax authorities. Self assessment is not a new tax but it is a system in which tax payers must determine their own tax liabilities and make a payment accordingly. Along with the self assessment system, there is an enhancement in ICT capabilities in order to capture and update tax payers' information and to improve audit and investigation management.

5.2.3.3. Indonesia's Tax Reform

Tax revenue is a main source of income for Indonesia. The country's tax system is based on personal income tax and value added tax system. The main difference that distinguishes Indonesia's tax system from the others is its relatively small dependence on international trade tax over time. With limited dependence on international trade tax, trade reform under trade liberalization regime has only a moderate impact on government revenue. However, what seems to be a serious problem is the potential of corporate income tax collection, especially once oil and gas revenues have been removed. Since the 1980s, the proportion of oil and natural gas tax revenues has gradually decreased from almost 80% to approximately only 10% in corporate income tax. Since then, corporate income tax has experienced a substantial decrease and thus a reform is needed to improve the efficiency of corporate income tax collection.

Therefore, the need to implement tax reform in Indonesia is not only raised from trade liberalization perspective, but also from a business competitiveness perspective. Therefore, the Indonesian government has set two main objectives for reforming the

country's tax structure. With a more integrated world economy, Indonesia has to walk into the process of trade liberalization, both in regional and world trade. Tax reform must be done to mitigate the loss in tariff revenue, which used to be one of the main sources of the country's revenue. Tax reform must also help improve the investment climate in order to attract more investors, both domestic and foreign ones, to put their portfolio in the country.

Reform of Personal Income Tax

Personal income tax in Indonesia is subject to a five-bracket progressive rate, ranging between 5% and 35%. Most of individual taxpayers are permanent workers and pay their tax by wage withholding. Only a few proportions of taxpayers pay their income tax by self assessment. Since the potential of the personal income tax system has been great for decades, there was no significant personal income tax reform during the 1990s. However, there is an improvement in computer system over time to investigate and assess individual taxpayers.

Comprehensive Reform of Corporate Income Tax

Except for the decrease once gas and oil revenues are removed from its structure, the amount of revenue collected from the corporate income tax is relatively low compared with other taxes. The very low collection is mainly due to Indonesia's corporate structure in which over 90% of Indonesian industry corporate is dominated by small and medium enterprises where most of them are not legal entity and hence are not tax registration companies. In addition, most of these businesses are retailers and agricultural businesses which have a high tendency of tax evasion. The possibility of a tax base expansion, although very difficult, is necessary since these small and medium enterprises largely dominate the corporate structure and make a great contribution to

Indonesian GDP. The reform is aimed to include these companies into the corporate income tax base but the expected time frame to collect majority of revenue from these sources is in the medium term.

Comprehensive Reform of the VAT

In Indonesia, VAT is imposed with a single rate at 10% and is levied on a broad base of goods and services. After implementation of tax reform in the early 1990s, various tax policy measures related to VAT have been changed to improve the revenue productivity of VAT including the reduction of VAT exemptions, the removal of the zero rate VAT except for exports, the abolishment of the exemption on government-borne VAT on certain goods, and the collection on most food products except basic goods consumed by the poor and certain strategic goods including agriculture. The government has also strengthened the VAT structure by expanding the base to, for example, mining and hotels. A substantial improvement in tax administration, particularly by introducing new technologies, was also achieved in the 1990s period.

5.2.3.4. Philippines's Tax Reform

In the past, the Philippines tax system was not very strong and buoyant. The inefficiency of the overall tax structure forced the country to be highly dependent on such international trade tax as import tariffs. As a result of the absence of tax productivity, many infrastructures were not constructed, public utilities deteriorated, and health services remained inadequate. Although the Philippines' government has privatized its assets and borrowed heavily to finance the budget deficit, these measures have provided only a temporary solution in the short and medium terms but could not guaranteed the long-term fiscal stability for the country. Together with globalization and the upward trend of free trade around the world, Philippines has

automatically been forced to reduced its high dependency on international trade tax. Thus, in order to maintain its fiscal position and to create a productive and consistent tax structure, comprehensive tax and tariff reforms were introduced in March 1992, in line with the AFTA membership.

As goods and services tax is the highest performer among all tax types, the Philippines' government has focused tax reform on personal and corporate income taxes. In implementing income tax reform, the Philippines' government has aimed to generate more tax revenue by simplifying the tax system in order to encourage greater compliance from taxpayers, including those in the underground economy, removing areas of discretion which provides avenues for tax avoidance and abuse, broadening the tax base by investigating undeclared revenues and hidden taxpayers, improving the taxation of the hard-to-tax income, reducing exemptions to enhance the amount of revenue, and strengthening the enforcement of laws. The most significant reform in the personal income tax structure is the use of residence instead of citizenship as a basis for taxation. In order to solve the problem of tax avoidance, tax brackets have been broadened so that additional wages or earnings would be subject to the same tax rate and not to a higher marginal tax rate. On the other hand, in order to raise corporate income tax revenue, the Philippines government needs to push more SMEs into the tax structure. In order to achieve this goal, the corporate tax rate has been gradually reduced. The Philippines government has also broadened the base of the tax system by instituting control on deductible expenses which are often subject to the discretion of the taxpayer and tax examiner. Such discretion can potentially lead to abuses and tax avoidance practices which finally result in the leakages and loopholes in the corporate income tax system.

5.3. General Review: Buoyancy and Elasticity of Tax Revenue and Empirical works on Revenue Productivity of the Tax System

In order for a government to plan properly how to mitigate the loss in trade tax revenues by substituting trade taxes to other domestic taxes, it is important to be able to estimate tax buoyancy, built-in tax elasticity, and the impact of discretionary changes on tax revenues. In fact, the estimation of the responsiveness of tax revenues has long been a central empirical issue in applied public economics. The concepts of tax buoyancy and tax elasticity are very important in the study of modern taxation (Mansfield, 1972). Tax buoyancy and tax elasticity are usually used to measure tax productivity. They measure the responsiveness of tax yield to changes in national income. In general, changes in tax revenues are caused by automatic responses of tax yield through national income changes and discretionary changes. Discretionary changes are normally legislative actions done by the government such as the imposition of new taxes, revision of existing tax rates, expansion of tax bases, modification of tax amnesties, and enforcement of new measures. By concepts, tax buoyancy measures the relationship between historical tax revenue and national income in terms of proportional increase in tax revenue following a one percent change in national income. On the other hand, tax elasticity measures relationship between tax revenue at a constant tax structure and national income. If there is no change in tax parameters (i.e., tax rates, tax base) during the reference period, buoyancy will be same as elasticity. In other words, elasticity of tax is the rate of proportionate change in the tax revenue due to change in national income while tax buoyancy is the composite of the change in tax revenue due to change in national income and discretionary tax changes.

However, the estimation of tax elasticity has suffered from a specification bias which results from the unavailability of data. Ehdaie (1990) states that the lack of "an observable quantitative variable" which is capable of reflecting all changes in an individual (or overall) tax system, has a great impact on the accuracy of the estimation. Because such necessary data as the effective tax rates and the changing composition and growth of tax base are usually not available in most countries, the need for a method for adjusting the historical tax series for discretionary changes has arisen. Until recently, there are two widely used adjustment methods in the literature; which are the proportional adjustment method and the dummy variable method. Both methods will be described in the following topics.

Proportional Adjustment Method

The proportional Adjustment (PA) Method is used to eliminate the discretionary effects from the revenue series. This method is usually attributed to many sequential studies including Prest (1962), Mansfield (1972), Bahl (1972), and Chelliah and Chand (1974). Based on the procedure proposed by Mansfield (1972), the proportional adjustment method for computing tax elasticity involves a three-step process. First, a preliminary series of adjusted tax yields is obtained by subtracting the budgetary estimates of the effects of discretionary tax changes from the actual tax yield, that is,

$$T_{t,t} = T_t - D_t \tag{5.1}$$

where;

$T_{t,t}$ is the adjusted or cleaned tax yield in the tth year

T_t is the actual tax revenue yield in the tth year

D_t is the budget estimate of the yield arising out of discretionary tax changes in the tth year

Second, this preliminary series $(T_{t,t})$ is further adjusted to exclude the continuing impact of each discretionary change on all future years' tax yields by multiplying by the ratio of the previous year's adjusted figure to the actual tax receipt. It can be shown that this procedure involves a factor sequence, each element of which represents the effect of the automatic component of tax changes in earlier years. These two steps constitute the 'data cleaning' process, that is,

$$(T')_1 = T_{1,1}$$
$$(T')_2 = \left[\frac{(T')_1}{T_1}\right] \cdot T_{2,2}$$
$$(T')_3 = \left[\frac{(T')_2}{T_2}\right] \cdot T_{3,3}$$
$$\vdots$$
$$(T')_t = \left[\frac{(T')_{t-1}}{T_{t-1}}\right] \cdot T_{t,t}$$

Through sequential substitution, it can be shown that the above formula can be rewritten in terms of $T_t s$ and $D_t s$ as;

$$(T')_t = (T_t - D_t) \prod_{j=1}^{t-1} \left[\frac{T_j - D_j}{T_j}\right] \tag{5.2}$$

which is Mansfield core equation for proportional adjustment data cleaning.

Third, the resulting series of 'cleaned' tax yields is then regressed on some measure of the tax base to obtain the necessary elasticity values.

However, using the proportional adjustment method is likely to cause bias in the estimation. The essential weakness of the proportional adjustment method lies in the data cleaning procedure. It is asserted that this procedure yields a series which is

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systematically biased, and will therefore lead to biased elasticity estimates. Thus, the proportional adjustment method, as commonly used, will almost always yield biased estimates of the tax elasticity.[37]

For example on empirical study done when estimating the tax elasticity by using proportional adjustment approach, Mansfield (1972) estimates tax buoyancy and tax elasticity of Paraguay's tax system from 1962 to 1970 to analyze the growth of revenue. In his study, tax buoyancy and tax elasticity of Paraguay's tax system are calculated to be 1.69 and 1.14, respectively. Both coefficients for buoyancy and elasticity are also estimated and compared for major taxes including income tax, wealth taxes, and import taxes. Then, tax elasticities are decomposed into tax-to-base elasticities and base-to-income elasticities in order to compare the growth rates. From the results, he concludes that discretionary changes in the country's tax system primarily lead to a substantial increase in the tax ratio over the period of study. The improvement of tax-to-base elasticities is necessary for the country to obtain more tax yield. A more recent study, Muriithi and Moyi (2003), analyzed the productivity of Kenya's overall tax system and its major taxes, including direct taxes, import duties, excise duties, and sale tax and VAT, after the tax structure was modernized in 1986. In general, it is assumed that the tax yield or productivity should be improved after a country's tax system is reformed. Taking the analysis over the period 1973 to 1999, the study estimates before- and after-reform buoyancy and elasticity, and then compared the flexibility. They conclude that tax reform improves the response of tax revenue to both the automatic changes in GDP and the discretionary tax measures, and thus the tax reform in Kenya has a positive impact on both overall tax revenue and individual tax types. Ayoki, Obwona, and Ogwapus (2005) investigated the link

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[37] See Feldstein (1972) for example.

between tax reforms and revenue mobilization in Uganda, which took place in the year 1996, over the period 1988 to 2003 by applying the concept of tax elasticity and tax buoyancy to measure the responsiveness of tax revenue to changes in income and excluding the effects of discretionary changes using proportional adjustment method. They conclude that tax reforms have a different impact on individual taxes. The reforms have a positive impact on both direct taxes and VAT/sales tax. The reforms have a bigger impact on direct taxes on indirect taxes. However, similar to the result of Muriithi and Moyi (2003), they find that overall tax structure in Uganda is inelastic. The responses of overall tax revenues are affected by inefficiency of revenue administration, exemption, tax evasion, and inelastic tax bases.

Dummy Variable Method

The dummy variable approach involves using a dummy variable to represent each discretionary change. The dummy variable technique was first developed by Singer (1968) to estimate the income elasticity of the state income tax revenue by introducing a dummy to capture exogenous tax policy changes. Based on Singer (1968) and Choudhry (1979), this method applies dummy variables to adjust for discretionary revenue effects and estimate the tax elasticity. They use a dummy variable as a proxy for each discretionary change which occurs during the period under study and then construct a single-equation econometric model to estimate tax elasticity as follow;

$$\ln T_t = \beta_0 + \beta_1 \ln Y_t + \sum_{i=1}^{n} \beta_{2i} D_i + U_t \qquad (5.3)$$

where;

T_t is tax revenue in the t$^{\text{th}}$ year

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Y_t is GDP in aggregate level in the tth year

D_i is a dummy variable used as a proxy for the ith discretionary change occurring during the period under the study

β_1 is tax elasticity at the aggregate level. The coefficient measures the percentage change in tax revenue resulting from the endogenous change in the tax base caused by a one percent change in GDP

The sign $\sum$ means that if there is more than one discretionary change taking place during the period, the equation will be generalized to include additional dummy variables. However, the use of dummy variables to capture discretionary changes in tax rates and tax structures may be inappropriate if discretionary tax changes have been made frequently in the past. If discretionary changes occur too often, the estimation will confront the problem of insufficient observations. In addition, this will lead to an excessive reduction in the degrees of freedom and cause a problem for the efficiency of the estimators.

The study of the impact of trade liberalization on tax revenues is often related to the use of dummy variable technique. Recent empirical studies on trade liberalization applying tax buoyancy and tax elasticity concepts and using dummy variable as a proxy for liberalization have highlighted the effect of trade liberalization on tax revenue mobilization. A number of attempts have been made to test whether trade liberalization has a negative impact on tax collection, especially trade taxes, since it is believed that reducing trade barriers, particularly by reducing or eliminating tariffs, is a major cause of substantial reduction in trade tax revenues. However, the results are somewhat mix. For example, Chipeta (1998) evaluates the impact of tax reform as a result of trade liberalization in 1980 on Malawi's tax structure during 1970 to 1993.

The study investigates whether tax reform increases the yield of the tax system. From the results, he concluded that tax yield is not buoyant in both pre and post reform. It means that liberalization does not improve the yield of the tax system. Changing other discretionary measures, such as raising tax rates, imposing new taxes, or extending existing taxes to new activities, may also not improve the buoyancy of the tax system. In addition, the analysis of the components of tax elasticities shows that the tax base is very rigid after the reform, which can be implied that the tax base has grown less rapidly than GDP. Moreover, Malawi suffers from many other problems, such as tax evasion, tax exemption, tax allowance, corruption, and underground economy. This results in the more difficulty in raising the country's tax revenue. Matlanyane and Harmse (2002) evaluate the implications of trade liberalization on international trade tax revenue by taking the case of the South African economy over 1974 to 2000. They use the standard method to calculate tax buoyancy and employ a dummy variable method to calculate the effect of trade liberalization, involving using a dummy variable as a proxy for liberalization and regressing trade tax revenue on a liberalization dummy using single equation ordinary least square. Additionally, imports as a percentage of GDP, exchange rate, and the average tariff rate are also included in the equation. They conclude that trade tax revenue in South Africa is highly productive. In addition, the tariff reform dummy variable is significantly different from zero. This implies that liberalization policies in South Africa have been able to increase trade tax revenue. More recent work, Suliman (2005) estimates tax buoyancy and tax elasticity of the Sudanese tax system for the period 1970 to 2002 by placing the question on whether trade liberalization, which takes places in 1992, has an impact on revenue mobilization. The results show that the Sudanese tax system is not buoyant or elastic. The comparison of the performance of the tax system before

and after trade liberalization shows that the buoyancy of import taxes was improved after reform, while the conclusions for all other major taxes cannot be drawn because their estimated values of both coefficients and constants move in the opposite direction. In addition, comparison of buoyancy and elasticity over the sample period indicates that the various discretionary changes improved revenue mobilization from import tax yield. Considering the impact of trade liberalization on tax yield in nominal term, the coefficient on the liberalization dummy is only significant for personal income tax with a negative impact. However, the coefficients of the liberalization dummy, as well as the slope dummy, are significant for almost all taxes when regressing taxes in real term. This implies that inflation has a considerable effect on the growth of Sudanese tax revenues. Brafu-Insaidoo and Obeng (2008) estimate import tax revenue productivity regarding the quantitative effect of import liberalization on tariff revenue in Ghana over the period 1966 to 2003. The results show that tariff revenue in Ghana is neither buoyant nor elastic, there is even an increase in tariff revenue as a result of exchange rate depreciation after trade is liberalized. The study also finds that import liberalization has a negative impact on tariff revenue. The decomposition analysis shows that the degree of responsiveness of the import tax to change in its tax base declines during the liberalization period, compared with the pre-liberalization period. The decomposition analysis also points that the reduction in the official average tariff rate results in the loss of tariff revenue over the period of liberalization.

Other Data Adjustment Methods

Since a complete adjustment of historical tax revenue series is not possible in any of the methods, many authors have tried to apply different techniques to estimate the built-in elasticity of a tax system. Bilquees (2004) examines the buoyancy and

elasticity of the tax system in Pakistan over the period 1974-75 to 2002-03 by using the Divisia Index Approach. By applying the vector autoregressive (VAR) technique to estimate buoyancy and elasticity, he finds that both buoyancy and elasticity of Pakistan's overall tax system are less than unity, which these results confirm the existence of continued exemptions, allowances, and loopholes for evasion. By using the decomposition technique, the results suggest that broadening tax bases of indirect taxes is required in order to increase tax revenues.

5.4. Framework of the Study

5.4.1. Methodology and the Regression Models

In the previous section, we discuss the tax performance estimation technique to be used in this study along with methods of removing the effect of discretionary changes in the tax system. Although there is a number of methodologies for revenue estimation and tax modelling, Ahmed (1994) suggests that the conditional approach using buoyancy and elasticity is the most widely used and practicable approach. This approach has proved to be useful and used by the IMF for evaluating performance and forecasting the revenue of its member countries. Furthermore, Manasen (1981) and Gamboa (2002) confirm that among tax performance evaluating and revenue forecasting methodologies, the tax buoyancy and tax elasticity approach using the regression procedure gives a better fit where the errors of estimation are minimized. Thus, for purposes of this study, the tax buoyancy and tax elasticity approach is used to estimate tax performance and the productivity of tax system in Thailand for the period 1972-2006 relative to 3 other countries, Indonesia, Malaysia, and Philippines, which are founding members of ASEAN and originally signed the AFTA agreement in 1992. These four countries used in this study not only are the original members

which formed ASEAN and the AFTA agreement, but they also have a comparable level of economic development as measured by GDP per capita in purchasing power parity (ppp) terms.[38] Chelliah (1971) suggests that in order for the policymakers to decide the level of taxation, they often make a comparison of their country's tax performance with that of other countries at similar stage of development. The advantage of considering countries which have a similar stage of development is that it gives a better and correct picture when relative productivity is compared. Thus, we use ppp adjusted GDP per capita to compare the level of development of these four ASEAN countries since it provides a better index of living standard than in US dollar term. From GDP data, we found that ppp adjusted GDP per capita of these four countries are quite close to each other. Then, we can conclude that the four countries used in our study have similar economic characteristics, although there might be some geographical and socio-political differences.

Tax revenue may change due to a variety of factors, for example, changes in income, changes in the efficiency of tax assessment and tax collection, and changes in tax rates and tax base. In evaluating the productivity of a tax system, two measures are usually considered. These are the buoyancy and the income elasticity of tax revenue. While the latter measures the changes in tax revenue as a result of the changes in income, the former measures the changes in tax revenue because of the changes not only in income but also other discretionary changes in tax policy.

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[38] In choosing the sample, this study considers the availability of data and GDP per capita ppp as estimated by World Bank, World Development Indicators (2008). Although, at the time AFTA was originally signed, ASEAN had six members, including Brunei, Indonesia, Malaysia, Philippines, Singapore, and Thailand, two members, namely, Brunei and Singapore are restricted by the availability of data so we exclude them from our research. Although AFTA agreement now covers 10 ASEAN countries, this study does not include the four latecomers which compose of Vietnam (joined in 1995), Laos and Myanmar (joined in 1997), and Cambodia (joined in 1999). This is because though these four latecomers were required to sign the AFTA agreement in order to join ASEAN, they were given longer time frames in which to meet AFTA's tariff reduction obligations.

Osoro (1995) indicates that tax buoyancy can be estimated by the following equation;

$$T = \alpha Y^{\beta} \varepsilon \qquad\qquad (5.4)$$

where T is total tax revenue, Y is income (e.g. GDP), and ε is the error term. A log-transform of equation (5.4) enables us to derive the buoyancy coefficient. This can be represented as;

$$\ln T_t = \ln \hat{\alpha} + \hat{\beta} \ln Y_t + \varepsilon_t \qquad\qquad (5.5)$$

where $\hat{\beta}$ provides an estimate of tax buoyancy. It measures the change in total tax revenue due to a change in GDP and the effect of discretionary changes in tax policy in percentage terms. This standard measure of revenue productivity expresses the tax flow in terms of GDP.

Next, in order to estimate the built-in tax elasticity, the historical revenue data need to be adjusted to exclude the effect of discretionary tax changes from tax revenue data. The two common methods adopted to remove the effect of discretionary changes in tax system, including the proportional adjustment method and the dummy variable method, were discussed in an earlier section. Although there is no complete adjustment of historical revenue series for any of the methods, the proportional adjustment requires use of budget estimates of tax yields resulting from discretionary changes in which such data are not available since the data on discretionary revenues provided by government are normally incomplete. Not only the difficulty in obtaining budget estimates, but there also is the question for the reliability of these data since the calculation of these data is based on different models and methods for each country. Alternatively, the dummy variable method does not require the use of such difficult to obtain data as budget estimates. This method is considerably easy to use since all that is needed is a dummy variable to represent important discretionary

changes in the tax system for each year when a policy shift occurred. The dummy variable method is relatively simple to use because the proportional adjustment method is found to be hard to clean the tax data series of the impact of changes to the tax system. Since it is difficult to quantify the effects of any discretionary changes, due to non-availability of the relevant data, the dummy variable technique is considered to be useful. The only disadvantage of the dummy variable method is that it cannot be used properly when discretionary tax changes are quite frequent in the past. However, in the case of Thailand, Indonesia, Malaysia, and Philippines, there have not been any frequent changes in discretionary tax measures over the study period. Therefore, we choose to estimate tax elasticity by applying the dummy variable technique as a method of adjustment.

Thus, in order to adjust the impact of trade liberalization on tax revenue, the dummy variable technique suggested by Singer (1968) has been introduced for the exercise. By using this technique, we introduce a dummy variable into equation (5.5) and it takes value 1 for each year after each country joined the AFTA agreement in 1992, which is the only major tax change for each country. The resulting model is;

$$\ln T_t = \ln \hat{\alpha} + \hat{\beta}_1 \ln Y_t + \hat{\beta}_2 D_i + \varepsilon_t \tag{5.6}$$

where D_i is dummy variable accounting for the AFTA agreement introduced in 1992.

Trade liberalization may also have an impact on GDP. Thus, in this study, we introduce a slope dummy variable into equation (5.6). To derive the slope dummy function, we introduce ($D_i \cdot LogY_t$), equal to the product of GDP and AFTA dummy. The coefficient of ($D_i \cdot LogY_t$) measures the discontinuous effect of changes in

income and trade liberalization. Hence, the final model which includes both the intercept and slope dummy variables can be represented as follow;

$$\ln T_t = \ln \hat{\alpha} + \hat{\beta}_1 \ln Y_t + \hat{\beta}_2 D_i + \hat{\beta}_3 (D_i \cdot \ln Y_t) + \varepsilon_t \qquad (5.7)$$

Where;

T_t is tax revenue

Y_t is Gross Domestic Product (Typically in the empirical studies, the GDP (income) is taken as base)

D_i is dummy variable ($D = 0$ for pre AFTA period and $D = 1$ for the post-AFTA period)

$(D_i \cdot \ln Y_t)$ is an interaction term included to allow for a change in the slope of the tax revenue function over the period of trade liberalization

$\hat{\alpha}$ is the intercept during the pre-AFTA period ($D = 0$)

$\hat{\beta}_2$ is the differential intercept during the post-AFTA period ($D = 1$)

If the regression coefficient of the dummy variable, $\hat{\beta}_2$, is significantly positive then the average tax revenue goes up; If it is significantly negative, then the average tax revenue goes down during the post-AFTA period.

$\hat{\beta}_1$ is the regression coefficient or the magnitude of tax elasticity during the pre-AFTA period ($D = 0$): $\hat{\beta}_1 > 0$

$\hat{\beta}_3$ is the differential coefficient or the magnitude of differential tax elasticity during the post-AFTA period ($D = 1$). It allows a shift (an upward / a downward) in tax elasticity during the post-AFTA period when $D = 1$, $\hat{\beta}_3$ may take any value. The statistical significance of $\hat{\beta}_3$ demonstrate the presence of difference between the magnitude of the tax elasticity during the post-AFTA period and the magnitude of tax elasticity during the pre-AFTA period.

$\hat{\beta}_1 \pm \hat{\beta}_3$ is the magnitude of tax elasticity during the post-AFTA period ($D = 1$). If $\hat{\beta}_1 \pm \hat{\beta}_3$ is more or less than $\hat{\beta}_1$ then there will be an upward or a downward shift in

the degree of tax elasticity during post AFTA period; If $\hat{\beta}_1 \pm \hat{\beta}_3$ is equal to $\hat{\beta}_1$ then the magnitude of tax elasticity remains the same in pre- and post-AFTA periods, implying the absence of shift.

After defining the model for tax buoyancy and tax elasticity, we then perform time series analysis by regressing equations over different period, detailed as follows;

1) In order to compare tax buoyancy and tax elasticity, we regress equation (5.5) and equation (5.7) over the 1972-2006 period to obtain indices of tax buoyancy and tax elasticity, respectively. Buoyancy greater than elasticity means that the discretionary tax measures improve revenue mobilization of tax, while buoyancy less than elasticity implies that revenue mobilization worsens as a result of the introduction of the discretionary tax measures.

2) In order to compare the performance of the tax system and each individual tax handle before and after joining the AFTA agreement, we regress equation (5.5) over two periods; 1972-1991 and 1992-2006. If the estimate of tax buoyancy over the period 1972-1991 is lower than that of the period 1992-2006, it can be implied that tax performance increases after the country joined AFTA member. If tax buoyancy obtained from the 1972-1991 period is higher than that obtained from the 1992-2006 period, it can be implied that tax productivity is worse after the country liberalized its trade to ASEAN countries.

In addition, the analysis is extended to assess the tax performance of both direct and indirect taxes and therefore, in order to obtain tax buoyancy (tax-to-income) and tax elasticity of each tax category, four other models are estimated with the same

specification for the four categories of taxes.[39] Therefore, equation (5.5) and (5.7) will be applied for both total tax revenue and each individual tax handle. The major revenue components to be considered are:

1) International Trade Tax
2) Personal Income Tax
3) Corporate Income Tax
4) Goods and Services Tax

The regression of total tax revenue and its disaggregated sources will be applied to Thailand and 3 other ASEAN countries, including Indonesia, Malaysia, and Philippines, for comparison purpose.

To consider further trends in the individual tax source, we decompose tax buoyancy to obtain the buoyancy of tax revenue with respect to its tax base and the buoyancy of tax base with respect to income. This can be expressed as following;

$$\left[\frac{\Delta T_i}{\Delta Y} \times \frac{Y}{T_i} \right] = \left[\frac{\Delta T_i}{\Delta B_i} \times \frac{B_i}{T_i} \right] \cdot \left[\frac{\Delta B_i}{\Delta Y} \times \frac{Y}{B_i} \right] \tag{5.8}$$

where T_i is tax revenue from the individual ith tax and B_i is the base of the individual ith tax.

The decomposition of buoyancy into tax-to-base and base-to-income is very useful for policy analysis since it tells us which component of growth that is amenable to policy manipulation. Indraratna (1991) suggests that decomposing tax buoyancy is beneficial since the government will be able to identify factors which are responsible for rapid or lagged revenue growth. Generally, factors which affect the tax-to-base buoyancy, such as tax rates, exemptions, and improvement in tax administration are within the

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[39] Direct taxes include personal income and corporate income taxes, while indirect taxes include goods and services tax and international trade tax.

control of tax administration or fiscal authorities and therefore making this measure important for policy purposes. On the other hand, the base-to-income buoyancy reveals the structure of economy changes with economic growth, which is beyond the scope of tax authorities' control. The decomposition of buoyancy will be conducted for both the combined period (1972-2006) and pre- and post-AFTA periods (1972-1991 and 1992-2006, respectively).

For total tax revenue, this study considers GDP as the tax base since Stotsky and WoldeMariam (1997) suggest that the use of GDP as an determinant for tax revenue is more appropriate than the use of GNP because the former includes non-resident income earned locally and excludes income received from abroad by residents, while the latter excludes non-resident income earned locally but includes income received from abroad by residents. Since, in general, local income of non-residents is taxed while remittances from abroad are not, thus GDP produces a more accurate measure of the tax base for total tax revenue.

In the decomposition step, we use different tax bases for each tax category, depending on how each individual tax is levied. Typically, personal income tax is often levied (with some deduction permitted) on the total income of the taxable person, generally including income from employment (personal earnings or wages), income from business, income from basic agriculture or forestry, income from rents and royalties, and income from interest, dividends, capital gains, and other income. Personal income tax is usually collected on a pay-as-you-earn basis and it can be collected at a progressive, proportional or regressive rates. On the other hand, corporate income tax is a generally levied on net profit of a juristic company or partnership at the end of an accounting period. The term "juristic company or partnership" means a limited company, limited partnership or registered partnership and includes any joint venture,

any trading or profit-seeking activity carried on by any revenue producing business. The corporate income tax base is the net profit, normally known as net income, net earnings, and bottom line is ascertained by subtracting all allowed deductible expenses from total sales in an accounting period. The allowed deductible expenses are subjected to conditions commonly found in corporate income tax laws of most countries. Considering two indirect taxes, first, goods and services tax is generally referred to a value added tax (VAT), single business tax, or turnover tax. It is considered to be the broadest-based tax relative to other individual tax handles since it is levied on nearly all supplies of goods and services. Next, the international trade tax, generally includes import and export tariffs. It is usually charged on the movement of goods into and out of the country. Generally, duties are levied on an *ad valorem* basis. In certain cases, however, both *ad valorem* and specific rates are given and the tariff that gives the most revenue will apply.

However, because the legal base of each tax handle is not known with precision, we use the following proxies as bases for each major revenue source. First, merchandise trade as a share of GDP will be used as a proxy for the international trade tax. Second, compensation of employees will be used as a proxy base for personal income tax. Third, the share of industry in GDP will be used as a proxy for corporate income tax since business profit data are difficult to obtain and most of agriculture-based firms either pay very low tax or are exempted from corporate income tax. Last, household final consumption expenditure will be taken as a proxy base for the consumption tax.

The first and very important step in time series analysis is to test the data for stationarity. Each variable in the regression model must be stationary since Granger and Newbold (1974) and Phillips (1986) point out that the regression results may be spurious or nonsense if the estimated variables are non-stationary. Thus, for research

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using time series data, stationarity is vital. For this reason, we have to run the regression with stationary variables, I(0). If a variable is stationary, or it does not have unit root, in level, it is said to be integrated of order zero; I(0). However, if we observe that the order of integration for each series is different, thus we have to transform (i.e. differencing) the variable until stationary. For example, if a variable is not stationary in levels but stationary in its first differenced form, it is said to be integrated of order one; I(1). If the variables are found to be integrated of order one, I(1) process, then we run the regression with the first differenced of the variables. In this study, the presence of a unit root in a time series will be tested by using Augmented Dickey-Fuller (1979 and 1981) and Phillips-Perron (1988) tests before estimating the coefficients of tax buoyancy and tax elasticity.

5.4.2. Variables, Data and Sources

In this study, we estimate the tax buoyancy and tax elasticity of four ASEAN countries by using annual data covering the period from 1972 to 2006. The choice of sample size is mainly determined by the availability of data. Both tax buoyancy and tax elasticity are measured in real terms in which we have to adjust tax revenue, GDP, and other related data for inflation before running the regressions. This is because the use of nominal measures would cause the estimate of tax buoyancy and tax elasticity to be biased towards 1. The real measures of revenue productivity will be obtained by using the Consumer Price Index (CPI) as a deflator. The data set consists of the following items:

1. Total tax revenue, international trade tax revenue, personal income tax revenue, corporate income tax revenue, and goods and services tax revenue –

Unit: US Dollars; Source: IMF, *Government Financial Statistics* (GFS), December 2008.

2. Gross Domestic Product (GDP) – Unit: constant 2000 US Dollars; Source: World Bank, *World Development Indicators* (WDI), December 2008.

3. Merchandise Trade as a share of GDP - the sum of merchandise exports and imports divided by the value of GDP; Unit: Percentage of GDP; Source: World Bank, *World Development Indicators* (WDI), December 2008.

4. Compensation of employees – Compensation of employees consists of all payments in cash to employees in return for services rendered, and government contributions to social insurance schemes such as social security and pensions that provide benefits to employees (the sum of wages, salaries, and employers' social contribution); Unit: US Dollars; Source: National Authorities, International Labour Organization, National Central Banks, National Statistics, and World Bank, *World Development Indicators* (WDI), December 2008.

5. The share of industry in GDP – Unit: Percentage of GDP; Source: The Penn World Table (PWT Version 6.2), World Bank, *World Development Indicators* (WDI), December 2008.

6. Household final consumption expenditure - (formerly known as private consumption) the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. Unit: constant 2000 US Dollars; Source: World Bank, *World Development Indicators* (WDI), December 2008.

7. AFTA dummy variable - The dummy variable takes value of 1 since 1992, when these four countries found the AFTA agreement, and 0 otherwise.

5.5. Empirical Results

In this part, we will estimate the buoyancy and elasticity of the overall tax revenue and individual tax handles. We will provide both before- and after-liberalization as well as combined period for buoyancy estimates. In addition, the decomposed tax-to-base and base-to-income estimates are presented in order to investigate the responsiveness of tax base and tax administration.

Test of Stationarity

In estimating the productivity of tax system and each individual tax handle, the first and very important step is to ascertain the stationarity of the variables under study. Stationarity is an important concept in time series econometrics since the standard regression model makes assumptions which regard the stationarity of the variables and the error term. Therefore, our preliminary task in the estimation procedure is to check for the stationarity of variables by testing for the order of integration. In general, we might need to difference a time series d times in order to induce stationarity and the series is called integrated of order d and is denoted by I(d). In this study, we employ standard unit root tests by applying two asymptotically equivalent tests: the augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. Our observed time series include total tax revenue (TTR), international trade tax revenue (ITT), personal income tax revenue (PIT), corporate income tax revenue (CIT), goods and services tax revenue (GST), gross domestic product (GDP), merchandise trade (MER), compensation of employees (LAB), the share of industry in GDP (IND), and household final consumption expenditure (CONS). All variables have been converted to natural logarithms. The results of the ADF and PP tests with constant and trend for

Thailand are presented from Table 5.1. The test results for other three ASEAN countries are provided in Appendix 5A.

Table 5.1: ADF and PP Unit Root Tests (Thailand)

Variable	ADF				PP			
	I(0)		I(1)		I(0)		I(1)	
	No trend	With trend	No trend	With trend	No trend	With trend	No trend	With trend
TTR	-1.36	-1.71	-4.79	-4.73	-1.40	-1.98	-4.80	-4.75
ITT	-2.26	-2.09	-4.35	-4.39	-1.81	-1.59	-4.29	-4.33
PIT	-1.30	-1.62	-6.12	-6.19	-1.30	-1.66	-6.12	-6.21
CIT	-1.16	-2.95	-3.12	-4.02	-1.43	-2.29	-3.05	-3.94
GST	-1.43	-1.93	-5.99	-5.95	-1.42	-2.04	-5.99	-5.95
GDP	-0.99	-1.65	-3.16	-3.61	-1.49	-1.14	-3.20	-3.61
MER	-0.30	-2.37	-5.61	-5.54	-0.29	-2.35	-5.61	-5.53
LAB	-1.54	-2.29	-6.02	-6.20	-1.72	-2.29	-6.02	-6.20
IND	-0.77	-2.32	-6.88	-6.79	-0.44	-2.31	-7.16	-7.23
CONS	-0.93	-1.96	-3.55	-3.57	-1.23	-1.55	-3.61	-3.57

Note: The Augmented Dickey-Fuller (ADF) test assumes that the y series follows an AR(p) process and adding p lagged difference terms of the dependent variable y to the right-hand side of the test regression:

$$dy_t = \alpha \, y_{t-1} + x_t{}'\delta + \beta_1 dy_{t-1} + \beta_2 dy_{t-2} + \ldots + \beta_p dy_{t-p} + \upsilon_t$$

The test reported is a t-ratio which it is used to test the null hypothesis that the variable employed in the study has a unit root. 95% critical values are -2.93 (for the case without trend) and -3.51 (for the case with trend).

The Phillips-Perron (PP) test modifies the t-ratio of the α coefficient so that serial correlation does not affect asymptotic distribution of the test statistic. The PP test is based on the statistic:

$$\tilde{t}_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0} \right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2 f_0^{1/2} s}$$

Testing the same null hypothesis that the series are not stationary, 95% critical values are also the same as those for ADF test.
Source; Eviews 6

The results of ADF and PP tests from Table 5.1 and presented in Appendix 5A indicate that each variable is nonstationary in level but they are all found to be stationary in their first differences. From the results we conclude that all variables used for Thailand and other three ASEAN countries are integrated of order 1. Then, the cointegration test using the two-step estimation suggested by Engle and Granger is employed. The cointegration results are provided in Appendix 5D, which it is found that these variables are cointegrated, suggesting that there is a constant long-run linear relationship among them. With this conclusion, we then use ordinary least squares

(OLS) to estimate equation 5.5 and 5.7 in order to obtain tax buoyancy and tax elasticity.

The Estimation of Tax Buoyancy and Tax Elasticity

After the time series log variables are found stationary in first difference, I(1) and it is also found that variables under study are cointegrated, next, this study utilizes a time series regression approach, by fitting a log regression model presented in equation 5.5 and 5.7 to estimate tax buoyancy and tax elasticity for total tax, international trade tax, personal income tax, corporate income tax, and goods and services tax revenues.

Estimates of tax buoyancy and tax elasticity have been derived using the Cochrane-Orcutt iterative procedure, which corrects the problem of autocorrelation. We also perform various diagnostic tests and these tests uniformly suggest that, in all case, our results do not suffer from problems of non-normality, serial correlation, heteroscedasticity, and mis-specification. The following sections provide the estimates of tax buoyancy and tax elasticity for the combined period, as well as tax buoyancy divided into pre- and post-AFTA periods. In addition, the decomposition of tax buoyancy (tax-to-base and base-to-income) over the combined and pre- and post-AFTA periods is provided in later section for further analysis. Full regression results are provided in Appendix 5B and Appendix 5C.

Table 5.2: Tax Buoyancy and Tax Elasticity Estimates; Combined Period (1972-2006)

Country	Tax Category	Tax Buoyancy	Tax Elasticity	Dummy	Slope Dummy	Difference in Coefficient
Thailand	Total Tax Revenue	1.44	1.73	12.72	-0.51	-0.29
	International Trade Tax	0.77	1.34	25.00	-1.00	-0.57
	Personal Income Tax	1.69	2.21	29.20	-1.16	-0.52
	Corporate Income Tax	2.11	1.89	-18.32	0.72	0.22
	Goods and Services Tax	0.71	0.94	11.72	-0.47	-0.23
Indonesia	Total Tax Revenue	0.86	0.65	1.45	0.57	0.21
	International Trade Tax	-1.21	-1.74	-20.85	0.82	0.53
	Personal Income Tax	0.82	0.12	-66.84	2.62	0.70
	Corporate Income Tax	-2.37	-0.87	91.97	-3.60	-1.50
	Goods and Services Tax	2.74	2.04	-25.13	0.98	0.70
Malaysia	Total Tax Revenue	0.60	0.85	14.20	-0.57	-0.25
	International Trade Tax	-0.36	0.33	29.73	-1.21	-0.69
	Personal Income Tax	0.87	0.91	4.02	-0.16	-0.04
	Corporate Income Tax	0.74	0.58	-2.82	0.12	0.16
	Goods and Services Tax	0.83	1.08	18.65	-0.75	-0.25
Philippines	Total Tax Revenue	1.76	1.41	-25.20	1.03	0.35
	International Trade Tax	1.64	2.18	44.89	-1.81	-0.54
	Personal Income Tax	1.93	0.39	-52.67	2.13	1.54
	Corporate Income Tax	2.60	2.86	30.58	-1.21	-0.26
	Goods and Services Tax	1.31	1.62	18.57	-0.74	-0.31

The measures of buoyancy and elasticity of the whole tax system and of its major components are obtained by the estimated regression coefficients and are presented in Table 5.2. As seen the buoyancy of Thailand's total tax revenue is estimated at 1.44, which is well above unity. This means that the tax system yields a 1.44% change in tax revenue for every 1% change in GDP, implying that the tax structure in Thailand is buoyant. A number of other observations can be made on the basis of the figures in

Table 5.2. First, taxes on personal income and corporate income are generally buoyant, while taxes on goods and services and international trade are not. Clearly, the overall buoyancy of the tax system is a consequence of the buoyant income and profit taxes, especially for corporate income tax with the buoyancy estimated at 2.11. However, the low buoyancy of international trade tax adversely affects the overall buoyancy of the total tax. A comparison of the tax handles reveals that corporate income tax has the highest buoyancy coefficient, while the goods and services tax has the lowest. The estimated coefficients also imply that tax on international trade is not buoyant, with the buoyancy calculated at only 0.77. The low buoyancy on international trade tax, in some parts, might be due to its own nature; in principle, it does not grow along with the economic growth. In other parts, it might be due to tax evasion, tax exemptions, corruption in tax administration, and the presence of the underground economy. However, the major concern is on the inflexibility of the goods and services tax, where the buoyancy is less than unity, only 0.71. In principle, the goods and services tax is a broad-based tax which the government usually uses to raise revenue. The strictness of the goods and services tax implies that the Thai government may encounter problems in raising revenue to mitigate the fiscal deficit or to mitigate the loss of international trade tax.

Next, by comparing Thailand's tax buoyancy with that of other countries, it is found that tax systems of Thailand and Philippines are flexible, while tax systems of Indonesia and Malaysia are inflexible. Among our sample countries, the Philippines tax system is the most buoyant but the Malaysian tax system is the most rigid. For Philippines, the estimates of tax buoyancy are buoyant for all tax categories. Like Thailand, the buoyancy of the Philippines tax system is a consequence of income and profit taxes, with the highest buoyancy for corporate income tax. By contrast, for the

Malaysian tax system, the estimated coefficients show that tax buoyancies are inflexible for all major tax handles. Especially for its international trade tax, it is found that the sign of the estimated coefficient is negative, implying that the revenue from international trade decreases as Malaysia's economy grows. Other taxes which are found to be negatively related to income are international trade tax and corporate income tax of Indonesia.

Then, we compare the estimates of tax buoyancy and tax elasticity. The comparison method is very important because it reveals the revenue impact of discretionary policy. The elasticity approach is used to adjust for the effect of trade liberalization after joining AFTA on the productivity of tax system and each tax revenue source. Considering the estimates of the elasticities of total tax revenue and major taxes calculated by using the dummy variable approach developed by Singer (1968), the overall elasticity is 1.73, showing that Thailand's overall tax system is elastic. The results in Table 5.2 indicate that overall tax buoyancy is less than the tax elasticity, implying that the revenue mobilization of Thailand is worse as a result of becoming an AFTA member. For each major category of Thailand's tax, elasticity exceeds buoyancy in all cases, except for corporate income tax, which implies that trade liberalization by joining AFTA is associated with the decline in revenue productivity of almost all taxes. Only corporate income tax is improved after the liberalization period. This can also be seen by considering the estimated coefficient on the dummy and slope dummy. The liberalization dummy and the slope shift dummy are significant for both the overall and individual taxes with different sign and magnitude, which strongly suggests that the tax-income regressions for the two time periods, before and after trade liberalization, are different. From the results present in Table 5.2, the ASEAN Free Trade Agreement leads to a negative change in the slope of the

total tax-income regression, meaning that Thailand's total tax revenue is less elastic in the post-AFTA period. The estimated coefficient of the slope dummy, showing the value equal to -0.51, implies that Thailand's total tax elasticity has declined from 1.73 in the pre-AFTA period to only 1.22 in the post-AFTA period. International trade, personal income, and goods and services taxes show the same pattern as total tax revenue. Their slope dummy are -1.00, -1.16, and -0.47, meaning that tax elasticity of these tax handles have decreased in the post-AFTA period from 1.34, 2.21, and 0.94 to 0.34, 1.05, and 0.47, respectively. Only corporate tax elasticity has increased from 1.89 to 2.61 during the post-AFTA period. The results imply that, after Thailand signed AFTA, although the overall tax system of Thailand is still elastic, the elasticity of the tax system deteriorated, in which international trade tax and goods and services tax have turned out to be very inelastic.

Considering tax elasticities of the other three ASEAN countries, the other country where revenue mobilization worsened during the post-AFTA period is Malaysia, with total tax buoyancy less than total tax elasticity. Total tax elasticity decreases from 0.85 to only 0.28, which is very inelastic. Like Thailand, the inelasticity of Malaysia's total tax revenue results from the fall of international trade tax, personal income tax, and goods and services tax during the post-AFTA period. However, unlike Thailand, there is not much improvement in the elasticity of corporate income tax during the post-AFTA period, and hence makes Malaysia's tax system as a whole very rigid. By contrast, total tax buoyancies of Indonesia and Philippines exceed their total tax elasticities. As seen in the table, the difference between the estimated coefficients of the overall buoyancy and elasticity are positive, suggesting that the growth in tax revenue of these two countries is accounted for by discretionary policy rather automatic changes. This implies that the ASEAN Free Trade Agreement improves

revenue mobilization of the tax system of these countries. The slope dummy of total tax revenue of Indonesia is equal to 0.57, implying that the elasticity of Indonesia's tax system has improved from 0.65 during pre-AFTA period to 1.22 during post-AFTA period, which changes the whole system from inelastic to elastic. Although there is a considerable decline in the elasticity of corporate income tax during the post-AFTA period, there is also a substantial increase in the elasticity of personal income tax and an increase in the elasticity of international trade tax and goods and services tax which are more than enough to offset the fall in the elasticity of corporate income tax, and thus results in a higher elasticity for Indonesia's whole tax system. Likewise, the slope dummy of total tax revenue of the Philippines is equal to 1.03, suggesting that the elasticity of Philippines's tax system has improved from 1.41 during pre-AFTA period to 2.44 during post-AFTA period, changing the whole tax system from fairly elastic to very elastic. However, when consider the individual tax handle, it is found that an improvement in total tax elasticity is a result of an improvement in elasticity only for personal income tax. For the Philippines, personal income tax elasticity improves from 0.39, which is very inelastic during the pre-AFTA period, to 2.52 which is very elastic during the post-AFTA period. The elasticities of international trade tax (2.18), corporate income tax (2.86), and goods and services tax (1.62) have reduced during the post-AFTA period to 0.37, 1.65, and 0.88, respectively.

Table 5.3: Tax Buoyancy Estimates; Pre- and Post-AFTA Period

Country	Tax Category	Overall Tax Buoyancy	Pre-AFTA Tax Buoyancy	Post-AFTA Tax Buoyancy
Thailand	Total Tax Revenue	1.44	1.83	1.77
	International Trade Tax	0.77	1.57	0.79
	Personal Income Tax	1.69	1.36	1.05
	Corporate Income Tax	2.11	2.22	4.14
	Goods and Services Tax	0.71	0.97	0.71
Indonesia	Total Tax Revenue	0.86	0.68	1.44
	International Trade Tax	-1.21	-1.24	1.33
	Personal Income Tax	0.82	0.30	5.08
	Corporate Income Tax	-2.37	-0.90	-6.00
	Goods and Services Tax	2.74	0.31	3.84
Malaysia	Total Tax Revenue	0.60	0.79	0.42
	International Trade Tax	-0.36	0.39	-1.28
	Personal Income Tax	0.87	0.91	0.72
	Corporate Income Tax	0.74	0.46	0.87
	Goods and Services Tax	0.83	1.02	0.24
Philippines	Total Tax Revenue	1.76	0.66	2.32
	International Trade Tax	1.64	1.91	0.47
	Personal Income Tax	1.93	1.40	1.94
	Corporate Income Tax	2.60	2.66	1.35
	Goods and Services Tax	1.31	1.57	0.50

In order to compare the performance of the tax system before and after trade is liberalized, estimated tax buoyancy for different taxes over 1972-1991 and 1992-2006 are reported in Table 5.3. All estimated coefficients are significant, giving us a firm comment on the changes of buoyancies. The results are all in line with the comparison between buoyancy and elasticity and the analysis of elasticity presented in the previous table. As seen, the overall tax buoyancy of Thailand shows a little decrease of approximately 6% after liberalization. The table reveals that the estimated values of coefficients of the major tax handles move in the opposite directions. The only tax handle that has an increase in performance is in the case of corporate income tax. On the other hand, the performance of the other three major tax handles, including international trade tax, personal income tax and goods and services tax, seems to

decline in the period of liberalization. It is notable that the rigidity of the international trade tax and goods and services tax is a result of the decline in their performance during the post-AFTA period. Malaysia is the other country in our sample which shows a decline in tax performance during the post-AFTA period. The difference of buoyancy between pre- and post-AFTA period suggests that the performance of Malaysia's overall tax system drops about 37% in the second half that Malaysia entered into AFTA. Like Thailand, corporate income tax is the only source that shows an increase in performance during the post-AFTA period. However, the other three major taxes shows a decrease in performance during the post-AFTA period and thus results in a drop in its overall tax performance over the whole period. It is important to note that the negative relationship between international trade tax and income is mainly due the change in the post-AFTA period, that the buoyancy changes from positively inflexible value to fairly flexible but negative value.

Indonesia and Philippines show an improvement in overall tax performance during the post-AFTA period. Both countries firstly suffer from the rigidity in the tax system during the first half (the buoyancies are accounted for 0.68 for Indonesia and 0.66 for Philippines in the pre-AFTA period), but their performance has been substantially improved during the second half (1.44 for Indonesia and 2.32 for Philippines). However, there is a big difference between these two countries, that is, Indonesia still suffers from the rigidity of total tax revenue, though gaining benefit from performance improvement in the post-AFTA period, while the Philippines tax system is very buoyant. The reason why Indonesia's tax system is still not buoyant is mainly due to the continually reduction in the performance of corporate income tax, especially in the post-AFTA period. For Philippines, an improvement in overall tax performance is only due to an improvement in personal income tax. Although other

tax handles experience a decline of tax performance, it seems that an improvement in personal income tax performance overwhelms a decline in other tax handles' performance, and hence results in an improvement of overall tax performance.

Table 5.4: Decomposition of Tax Buoyancy

Country	Tax Category	Overall			Pre-AFTA			Post-AFTA		
		Tax Buoyancy	Tax-to-Base	Base-to-Income	Tax Buoyancy	Tax-to-Base	Base-to-Income	Tax Buoyancy	Tax-to-Base	Base-to-Income
Thailand	International Trade Tax	0.77	0.64	0.61	1.57	1.78	0.43	0.79	-0.83	1.41
	Personal Income Tax	1.69	0.54	1.29	1.36	0.30	1.34	1.05	0.96	1.01
	Corporate Income Tax	2.11	3.34	0.27	2.22	1.53	0.29	4.14	3.72	0.26
	Goods and Services Tax	0.71	0.80	0.87	0.97	0.20	0.97	0.71	1.83	0.81
Indonesia	International Trade Tax	-1.21	-0.95	0.21	-1.24	-1.30	0.08	1.33	0.15	2.11
	Personal Income Tax	0.82	0.80	2.10	0.30	0.92	0.78	5.08	0.85	3.17
	Corporate Income Tax	-2.37	-2.47	0.16	-0.90	-2.05	0.10	-6.00	-3.78	0.28
	Goods and Services Tax	2.74	1.50	2.08	0.31	0.37	1.06	3.84	2.12	2.61
Malaysia	International Trade Tax	-0.36	-0.68	0.53	0.39	0.41	1.23	-1.28	-1.11	0.43
	Personal Income Tax	0.87	0.55	0.37	0.91	1.62	0.40	0.72	0.60	1.48
	Corporate Income Tax	0.74	0.77	1.70	0.46	0.66	0.67	0.87	0.96	1.87
	Goods and Services Tax	0.83	0.92	0.88	1.02	1.14	0.88	0.24	0.26	1.21
Philippines	International Trade Tax	1.64	1.89	1.01	1.91	2.08	1.01	0.47	0.62	0.93
	Personal Income Tax	1.93	1.65	1.35	1.40	1.50	1.05	1.94	1.80	1.31
	Corporate Income Tax	2.60	2.51	0.51	2.66	2.25	1.51	1.35	2.58	0.41
	Goods and Services Tax	1.31	1.23	1.33	1.57	1.32	1.40	0.50	0.51	0.72

The decomposed buoyancies can be used to investigate the sources of loopholes in revenue leakages. Table 5.4 gives a decomposition of tax-to-income buoyancy into its

constituent parts (i.e., tax-to-base and base-to-income). It is evident that the buoyancy of the Thailand tax system is mainly due to the high tax-to-base buoyancy of corporate income tax, especially in the post-AFTA period. The higher-than-unity value of tax-to-base index suggests that there is a large improvement in the administration of collection of this tax. However, it is notable that base-to-income estimates of corporate income tax are quite low, indicating that tax bases for corporate income taxes are quite rigid in both pre- and post-AFTA periods. This indicates that trade liberalization does not result in a large expansion of the bases of this tax handle, that it does not play any role in increasing corporate profit, stimulating investment, and setting up of new businesses.

On the other hand, the estimate of base-to-income for personal income tax is quite high, implying that the personal income tax base responds favourably to changes in income. Unfortunately, the growth in personal income tax revenue lags behind the growth in its base. This partly results in the less responsiveness of total tax revenue to changes in GDP than the level that it should be.

For the international trade tax, the low values of tax-to-base and base-to-income buoyancies probably signify not only both tax evasion and inefficient tax administration but also the impact of trade liberalization. In the pre-AFTA period, the value of tax-to-base buoyancy of international trade tax is very high while the value of base-to-income buoyancy is very low, implying that during this period Thailand successfully raised revenue from this tax source because of the nature of this tax. It was easy to collect and the rate was set at very high levels, and was not due to the level of international trade. However, in the post-AFTA period, the value of tax-to-base buoyancy turns out to be very negative while the value of base-to-income buoyancy is very buoyant, implying that, in this period trade liberalization results in a

substantial increase in the volume of international trade but the effect of the reduction in the tariff rate overwhelms the effect of an increase in international trade, and hence results in the reduction in international trade tax revenue. This finding may be explained by the following factors. First, the pre-liberalization period is characterized by a narrow base of international trade tax. It is not until the 1990s that exports and, especially, imports expand considerably with the growth of GDP. Second, there are weaknesses in international trade tax administration since the tax system, information management, skills of tax authorities are poor during this period. Third, the inefficiency of tax system contributes to loopholes for tax evasion and corruption.

For the goods and services tax, which also has the value of tax-to-base and base-to-income estimates lower than unity, the reported values probably signifies tax evasion and inefficient tax administration in the period that the country imposed business tax. The results show tax-to-base estimates of the goods and services tax substantially improves in the liberalization period, which is the same period that the country changes the collection from business tax to value added tax. However, the decline of base-to-income buoyancy from 0.97 to 0.81 reflects a low growth of private consumption, the proxy base of this tax. The contraction of the consumption tax base with respect to GDP implies that the country must be cautious in proceeding tax policy and any policy related since the consumption tax base is the widest base compared with other bases. In fact, both theory and experience in practice suggest that the country should improve the revenue collection from goods and services tax to mitigate the loss in international trade tax revenue. The rigid consumption tax base may further cause the problem in revenue substitution.

Overall, for Thailand, trade liberalization improves the base-to-income buoyancy of only international trade tax (from 0.43 to 1.41), but deteriorates the base-to-income

buoyancy of the other three major taxes; personal income tax (from 1.34 to 1.01), corporate income tax (from 0.29 to 0.26), and goods and services tax (from 0.97 to 0.81). This indicates that trade liberalization, by joining AFTA, impacts on total tax bases and seems to worsen total tax revenue. It causes the expansion of the international trade tax base, it lowers the responsiveness of both direct and indirect domestic tax bases, especially for the goods and services tax base which is the widest tax base of the country. However, tax-to-base indexes of almost all tax handles, except that of international trade tax, increase in the liberalization period, which suggests that the post-AFTA tax structure is generally more flexible. This reflects the improvement of tax administration of the country. The values of tax-to-base indexes of personal income tax, corporate income tax and goods and services tax in the post-liberalization period, which are equal to and higher than unity, suggest revenue leakage is no longer a major problem of these taxes. For income and profit taxes, it can be attributed to the improvement in tax administration, tax investigation, and accounting audit. For goods and services tax, it can be attributed to the relative effectiveness of tax reforms in the goods and services tax, which it does not only make the tax system simpler but also reduce avenues for evasion and corruption. The major reform includes the introduction of VAT, which the new tax reduces the exemptions and shifts the system away from multiple business tax rates to single VAT rate. The improvement in the performance of tax collection relative to the expansion of the tax base is an important issue deriving from the results since it implies that there is a success in tax reform after trade liberalization. However, since the desired goal of tax reform is to make both the whole tax structure and the individual tax handles more buoyant, the more rigidity of tax bases after trade is liberalized are the major concern for the government but it is beyond the control of the tax authorities.

Considering its three neighbouring countries, Indonesia, Malaysia, and Philippines, it is found that the reasons that make each country's tax system rigid or flexible are different. First, considering Indonesia, the rigidity of Indonesia's tax system is mainly due to the reduction in its corporate income tax collection. The negative sign of tax-to-base coefficients means that, as the industry sector grows, Indonesia collects less revenue from this tax. This is because Indonesia has continually cut its corporate income tax rate in order to spur its investment and growth, especially after the monetary crisis in 1997 which the country has experienced significant economic instability. However, it seems that the loss of corporate income tax revenue is more than covered by an increase of two tax sources, personal income and goods and services taxes. For personal income tax, the success of revenue mobilization is mainly due to the high buoyancy of base-to-income, especially in the post-AFTA period. Base-to-income buoyancy of personal income tax substantially increases from only 0.78 to 3.17, implying that as Indonesia's economy grows, more and more taxable persons are included in the tax bracket as a result of substantial increase in wage and salary level. For goods and services tax, both tax-to-base and base-to-income buoyancies considerably increase in the post-AFTA period. This suggests that both tax administration and tax base of goods and services tax have been largely improved after the country entered into AFTA. The international trade tax has also experienced an increase of both tax-to-base and base-to-income during the post-AFTA period, implying that there is an improvement in the performance of tax authorities and improvement in the level of imports and exports. This is a good sign for the country's tax reform since, in the liberalization period, there is no significant decrease in international trade tax because both the tax base and tax authorities seem to have

improved. Furthermore, the tax base and the ability to collect the goods and services tax, which is the broadest-based tax, have also been improved.

For Malaysia, it is found that corporate income tax is the only tax source that has experienced an increase in tax buoyancy during the post-AFTA period. An improvement of buoyancy of corporate income tax results from an increase in both tax-to-base and base-to-income, especially the latter. The decline in tax buoyancy of the international trade tax is rooted from the decrease in both tax-to-base and base-to-income buoyancies, which indicates that not only AFTA may cause a reduction in international trade tax collection via the reduction and elimination of a tariff, but ASEAN Free Trade Agreement may also not have any impact in increasing the level of international trade. On the other hand, the decline in tax buoyancy of personal income and goods and services taxes comes only from the decrease in tax-to-base buoyancy, suggesting that tax reform in the post-AFTA period may not be successful in Malaysia since tax authorities do not show any sign of improvement regarding to an expansion of tax bases.

Last, for Philippines, it is found that personal income tax is the only tax source that has experienced an increase in tax buoyancy during the post-AFTA period, resulting from an improvement in both tax-to-base and base-to-income. Corporate income tax has experienced a little increase in tax-to-base buoyancy but a substantial decline in base-to-income buoyancy, and hence results in the decline in corporate income tax buoyancy during the liberalization period. This indicates that there is a contraction of the corporate income tax base during the liberalization period. On the other hand, the international trade tax and the goods and services tax have experienced a decline in both tax-to-base and base-to-income buoyancies during the post-AFTA period. Although the reduction of international trade tax revenue is an acceptable outcome of

AFTA, the decline of the level of trade is not an expected consequence. In addition, the decline in tax-to-base and base-to-income buoyancies of goods and services tax also indicates the failure of tax reform during the post-AFTA period.

5.6. Conclusion

Thailand and three neighbouring countries, including Indonesia, Malaysia, and Philippines, have developed regional cooperation among Southeast Asian countries by founding ASEAN which aims to accelerate economic growth, economic stability, and other social progress among its members. In order to reach the aim of regional economic development, ASEAN members have established the ASEAN FREE Trade Area (AFTA) in 1992, which is an agreement concerning the elimination of trade impediments. Since then, these member countries have liberalized its trade system and have made significant progress towards a more open trade regime through the reduction and elimination of both tariff and non-tariff barriers and through the simplification of the tax system by conducting domestic tax reform. In principle, trade liberalization may potentially have an impact on tax revenues both on tax productivity and tax bases. Generally, trade liberalization is accompanied with tax reform and one of the major objectives of tax reform is to increase tax productivity. Thus, in general, trade liberalization should be associated with an increase in the country's tax productivity. Trade liberalization may also have an impact on the country's tax bases in many different ways. For example, trade liberalization usually results in an increase in the country's international trade volume, which is the tax base for international trade tax. But trade liberalization itself is related to the reduction and elimination of trade barriers, including tariffs, which directly reduces international trade tax revenue. This leads to an ambiguity in the changes in trade tax revenue after liberalization. In addition, other domestic tax bases may be affected by open trade regime. For instance,

trade liberalization, which is associated with an increase in the volume of trade, may lead to a rise in corporate profit of exporting and importing companies which is an important base for corporate income tax. It may also link with an expansion in the consumption tax base since, in principle, trade liberalization may not only be related to an increase in international trade, but it may also be related to an increase in domestic trade by an increase in import volume. Trade liberalization may also have a role in stimulating employment, especially for businesses in the international trade sector, and hence drive up wages and salaries and consequently improve the personal income tax base. Thus, in this chapter, we have investigated the impact of trade liberalization, specifically AFTA, on revenue mobilization and tax productivity of Thailand compared to those of three other ASEAN nations over the period 1972 to 2006 by applying the concept of tax buoyancy and tax elasticity.

Our results reveal that the tax system of Thailand and Philippines as a whole are buoyant and elastic, while the tax system of Indonesia and Malaysia are not. The buoyancy of Thailand's and the Philippines tax system is mainly due to the high buoyancy of corporate income taxes. By contrast, the rigidity of Indonesia tax system is primarily caused by the inflexibility of the corporate income tax, while the rigidity of Malaysia's tax system is rooted in the inflexibility of all tax handles. Tax buoyancy of pre- and post-AFTA indicates that Thailand and Malaysia have experienced a decline in tax performance, whereas Indonesia and Philippines have experienced an increase in tax performance during the liberalization period. The results are in line with the analysis of tax elasticity which suggests that revenue mobilization of Thailand and Malaysia is worse, while revenue mobilization of Indonesia and Philippines has improved as a result of ASEAN Free Trade Area.

Considering the decomposed buoyancies, it appears that the high buoyancy of Thailand's tax system is particularly due to the high tax-to-base buoyancy of corporate income tax, especially in the post-AFTA period. However, Thailand has experienced a decline in base-to-income buoyancy during the post-AFTA period. An increase in tax-to-base buoyancy can be inferred that the performance of corporate income tax collection has been substantially improved. This is because recently both countries have concentrated more on large companies that have a high potential in paying large amount of tax, i.e. by setting up a large tax office which primarily focuses on auditing these large businesses. However, a decline in base-to-income buoyancy can be inferred that trade liberalization may be harmful to the ability to make a profit of domestic companies. The results show that the Philippines seems to follow the similar pattern that the high overall tax buoyancy resulted from an increase in tax-to-base buoyancy of corporate income tax, though its base-to-income buoyancy is very rigid in the liberalization period.

For Thailand, the other tax handle that is buoyant over the whole period of the study is personal income tax, although the personal income tax buoyancy faces a small decline during the post-AFTA period. The comparison of the decomposed buoyancies of taxes to their respective bases and the bases to income indicates that an increase in buoyancy of personal income tax is a contribution of an improvement in tax administration and tax collection rather than an expansion of its base in the post-liberalization period. This is because in the past decade, there is a large improvement in the technology system that helps both tax authorities to calculate easily individual income tax withholding and employers to withhold the correct amount from their employees. This technology advance is particularly helpful since it correctly withholds tax at source, and hence substantially reduces tax evasion. The other

country used in our study which shows an increase in the performance of personal income tax collection is Philippines. However, the big difference between Thailand and Philippines is that, for Philippines, there is no signal of personal income tax base erosion during the post-AFTA period since there is an increase in both tax-to-base and base-to-income personal income tax buoyancies after Philippines's trade is liberalized.

Two other individual tax handles which are not buoyant over the whole period of study are the international trade tax and the goods and services tax. For the international trade tax, the rigidity of this tax handle is mainly due to a substantial decline in tax buoyancy in the liberalization period. The decline in tax buoyancy in the post-AFTA period is as result of a large decline in tax-to-base buoyancy, not from base-to-income buoyancy since the results show that there is a large increase in the international trade tax base during this period. This suggests that the effect of tariff reduction and the reduction in other related trade tax rates overwhelms an increase in trade volume, and hence results in the reduction of international trade tax revenue. The other two countries which have experienced a decline in the international trade tax buoyancy are Malaysia and Philippines. Unlike Thailand, these two countries have experienced a decrease in both tax-to-base and base-to-income, suggesting that these countries may encounter a fall in trade volume as a result of trade liberalization. Indonesia seems to be the only country which has experienced an increase in international trade tax buoyancy. An increase in buoyancy of this tax handle results from an increase in both tax-to-base and base-to-income, suggesting that trade liberalization for Indonesia does not only have a positive impact on its trade volume, but also has advantage on revenue productivity of this tax handle.

The rigidity of the goods and services tax is mainly due to a low tax-to-base buoyancy in the pre-AFTA period and low base-to-income in the post-AFTA period. Although tax buoyancy of the goods and services tax is quite rigid over the whole period, the results show that this tax handle has a significant improvement in tax administration and tax collection as its tax-to-base index substantially increases in the post-liberalization period. This is mainly due to the VAT introduction in the context of domestic tax reform as a result of liberalization. The introduction of VAT as a replacement for the business tax makes the tax system simpler and reduces avenues for evasion and corruption since it reduces the exemptions and shifts the system away from multiple business tax rates to a single VAT rate. However, it is worth noting that for the goods and services tax with base-to-income buoyancy lower than unity and decreasing considerably from the pre-AFTA period, this indicates a low growth of private consumption and tax authorities have very few options for improving coefficients since the growth of this tax base is a macroeconomic problem outside the control of tax authority. The government must be very careful in proceeding with its macroeconomic policy because the contraction of the goods and services tax base might cause the problem of revenue mobilization in the future. In addition, for Thailand, the results suggest that the revenue mitigation policy by replacing tax sources from international trade tax to broad-base goods and services tax is not very successful. There are two other countries that seem to be faced with a similar problem, Malaysia and Philippines. Indonesia seems to be the only country which is successful in domestic tax reform since it does not have a negative impact on in international trade tax revenue, but it also receives more revenue from goods and services tax since both the tax base and tax administration of this tax handle are improved in the post-AFTA period.

Appendix 5A: Tests for Stationarity

Table 5A1: ADF and PP Unit Root Tests (Indonesia)

Variable	ADF				PP			
INDONESIA								
	I(0)		I(1)		I(0)		I(1)	
	No trend	With trend	No trend	With trend	No trend	With trend	No trend	With trend
TTR	-0.90	-2.80	-5.14	-5.04	-1.09	-2.83	-5.12	-5.05
ITT	-0.97	-2.20	-6.03	-5.96	-0.99	-2.43	-6.02	-5.95
PIT	-2.29	-3.02	-4.30	-4.24	-1.85	-2.40	-4.31	-4.26
CIT	0.08	-2.64	-6.66	-7.49	0.20	-2.60	-6.63	-7.71
GST	-2.03	-201	-4.98	-4.89	-2.18	-2.16	-4.94	-4.86
GDP	-2.28	-1.16	-4.09	-4.33	-2.28	-1.30	-4.10	-4.35
MER	-2.64	-3.41	-6.66	-6.56	-2.61	-3.46	-7.56	-7.40
LAB	-1.57	-2.27	-5.70	-5.75	-1.57	-2.34	-5.70	-5.75
IND	-2.16	-2.84	-6.62	-6.28	-2.27	-2.87	-5.24	-5.38
CONS	-1.86	-1.73	-5.65	-6.08	-1.93	-1.71	-5.65	-6.08

Table 5A2: ADF and PP Unit Root Tests (Malaysia)

Variable	ADF				PP			
MALAYSIA								
	I(0)		I(1)		I(0)		I(1)	
	No trend	With trend	No trend	With trend	No trend	With trend	No trend	With trend
TTR	-1.81	-2.90	-4.02	-3.95	-2.55	-2.90	-3.88	-3.75
ITT	-2.20	-2.92	-5.24	-5.29	-2.36	-2.92	-5.24	-5.27
PIT	-1.95	-3.26	-5.05	-5.01	-1.99	-3.07	-5.01	-4.96
CIT	-2.48	-2.86	-4.93	-5.10	-2.48	-2.86	-4.93	-5.10
GST	-1.28	-2.68	-4.28	-4.21	-1.86	-2.24	-4.67	-4.75
GDP	-1.32	-1.65	-4.94	-4.93	-1.28	-1.92	-4.92	-4.93
MER	-1.31	-2.34	-5.10	-5.08	-1.34	-2.20	-5.21	-5.16
LAB	-1.71	-2.62	-6.11	-6.09	-1.84	-2.87	-6.49	-6.66
IND	-0.96	-2.84	-5.19	-5.02	-1.86	-2.82	-5.51	-5.61
CONS	-0.30	-2.41	-4.48	-4.40	-0.51	-2.51	-3.62	-3.51

Table 5A3: ADF and PP Unit Root Tests (Philippines)

Variable	ADF				PP			
PHILIPPINES								
	I(0)		I(1)		I(0)		I(1)	
	No trend	With trend	No trend	With trend	No trend	With trend	No trend	With trend
TTR	-2.47	-3.08	-4.08	-3.95	-1.56	-2.50	-4.08	-3.95
ITT	-1.23	-2.18	-4.94	-4.84	-1.30	-2.45	-4.93	-4.82
PIT	-1.42	-1.42	-3.87	-3.81	-1.89	-1.94	-3.90	-3.84
CIT	-2.48	-2.94	-6.17	-6.02	-1.78	-2.33	-6.26	-6.16
GST	-1.01	-2.12	-4.13	-4.07	-1.28	-2.38	-4.12	-4.07
GDP	-0.38	-2.40	-3.48	-3.61	-0.62	-2.12	-3.24	-4.13
MER	-0.73	-1.38	-4.67	-4.61	-0.80	-1.56	-4.65	-4.58
LAB	-1.71	-0.70	-5.46	-6.00	-1.71	-0.69	-5.48	-6.00
IND	-0.70	-2.48	-4.48	-4.54	-0.98	-2.50	-4.46	-4.52
CONS	0.36	-1.57	-3.80	-3.75	0.01	-1.93	-3.73	-4.45

Appendix 5B: Regression Results – Tax Buoyancy and Tax Elasticity

Tables below present the full regression results of tax buoyancy and tax elasticity computed by the authors using Eviews econometric software. Overall tax system (TTR) composes of four major taxes including international trade tax (ITT), personal income tax (PIT), corporate income tax (CIT), and goods and services tax (GST). Figures in parentheses [ ] below coefficient estimates are t values. R^2 represents the coefficient of determination. SER is the standard error of the regression. DW represents the Durbin-Watson statistic, used to test the autocorrelation in the residuals. JBNORM is the Jarque-Bera statistic for testing normality. The null hypothesis is that errors are normally distributed. Serial LM is the Breusch-Godfrey Lagrange multiplier test for serial correlation. The null hypothesis of the test is that there is no serial correlation in the residuals. ARCH is a Lagrange multiplier (LM) test for autoregressive conditional heteroscedasticity. The null hypothesis is that there is no heteroscedasticity. RESET is Regression Specification Error Test, proposed by Ramsey (1969) for testing functional form misspecification. The null hypothesis is that there is no misspecification.

Tax Buoyancy; Combined Period (1972-2006)

Table 5B1: Thailand Tax Buoyancy of Major Taxes and the Tax System; 1972-2006

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	2.09 [3.74]	0.77 [0.26]	0.92	0.20	1.72	1.95	F(1,30); 0.38	F(1,31); 0.01	F(1,30); 0.86
PIT	-21.41 [-6.75]	1.69 [13.31]	0.98	0.17	2.24	0.49	F(1,30); 0.36	F(1,31); 0.08	F(1,30); 0.46
CIT	-31.55 [-12.05]	2.11 [19.96]	0.99	0.15	1.91	0.30	F(1,30); 0.11	F(1,30); 0.13	F(1,28); 0.69
GST	5.10 [2.14]	0.71 [7.32]	0.92	0.14	2.17	0.56	F(1,30); 0.25	F(1,31); 0.07	F(1,30); 0.19
TTR	-12.95 [-4.48]	1.44 [12.47]	0.98	0.14	2.23	0.03	F(1,30); 0.46	F(1,31); 0.04	F(1,30); 0.16

Table 5B2: Indonesia Tax Buoyancy of Major Taxes and the Tax System; 1972-2006

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	52.43 [6.09]	-1.21 [-3.56]	0.91	0.27	2.03	0.23	F(2,27); 1.36	F(1,30); 1.04	F(1,28); 1.62
PIT	12.35 [2.73]	0.82 [2.41]	0.73	0.40	2.12	0.88	F(2,27); 2.26	F(1,30); 0.39	F(1,28); 0.78
CIT	84.11 [4.83]	-2.37 [-3.48]	0.89	0.41	2.26	1.02	F(2,29); 0.38	F(1,31); 0.08	F(1,30); 1.30
GST	-50.66 [-2.55]	2.74 [2.24]	0.64	0.23	2.05		F(2,29); 2.21	F(1,31); 0.02	F(1,30); 0.62
TTR	10.84 [2.18]	0.86 [4.40]	0.91	0.20	1.92	2.74	F(2,29); 0.31	F(1,31); 0.02	F(2,29); 0.11

Table 5B3: Malaysia Tax Buoyancy of Major Taxes and the Tax System; 1972-2006

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	30.42 [5.39]	-0.36 [-2.85]	0.74	0.20	1.69	1.32	F(2,29); 0.49	F(1,31); 0.13	F(1,30); 1.11
PIT	-3.88 [-13.96]	0.87 [7.76]	0.95	0.14	1.88	2.10	F(2,29); 0.22	F(1,31); 1.16	F(2,29); 0.22
CIT	4.14 [2.24]	0.74 [3.79]	0.94	0.16	2.01	0.50	F(2,29); 0.17	F(1,31); 2.02	F(2,29); 0.36
GST	1.47 [3.53]	0.83 [8.46]	0.96	0.12	1.94	0.87	F(2,27); 0.64	F(1,30); 0.43	F(1,28); 0.32
TTR	8.44 [2.72]	0.60 [4.78]	0.93	0.12	2.03	0.52	F(2,27); 0.04	F(1,30); 1.21	F(2,27); 0.42

Table 5B4: Philippines Tax Buoyancy of Major Taxes and the Tax System; 1972-2006

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-20.93 [-3.21]	1.64 [3.34]	0.84	0.24	2.03	0.84	F(2,29); 0.25	F(1,31); 0.30	F(1,30); 0.44
PIT	-27.28 [-2.80]	1.93 [3.21]	0.96	0.19	2.06	0.93	F(2,27); 0.19	F(1,30); 0.01	F(1,28); 0.63
CIT	-43.71 [-5.98]	2.60 [8.89]	0.93	0.23	2.07	0.71	F(2,27); 0.71	F(1,30); 0.96	F(1,28); 0.23
GST	-10.91 [-2.43]	1.31 [0.38]	0.93	0.16	1.88	0.52	F(2,27); 0.34	F(1,30); 0.15	F(1,28); 0.79
TTR	14.11 [6.02]	1.76 [2.73]	0.95	0.16	1.95	1.10	F(2,27); 1.22	F(1,30); 0.12	F(1,28); 2.68

Tax Elasticity

Table 5B5: Thailand Tax Elasticity of Major Taxes and the Tax System; 1972-2006

	Constant	Elasticity	Dummy	Slope dummy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-11.83 [-2.49]	1.34 [3.41]	25.00 [3.41]	-1.00 [-3.07]	0.93	0.20	1.65	1.22	F(2,27); 1.07	F(1,31); 0.15	F(1,28); 0.33
PIT	-34.17 [-10.28]	2.21 [16.32]	29.20 [2.55]	-1.16 [-2.57]	0.98	0.16	2.07	0.40	F(2,27); 0.82	F(1,31); 7.49	F(1,28); 1.24
CIT	-26.17 [-3.01]	1.89 [5.37]	-18.32 [-2.85]	0.72 [2.87]	0.99	0.16	1.82	0.26	F(2,27); 0.32	F(1,31); 0.25	F(1,28); 0.64
GST	-16.62 [-6.22]	0.94 [8.63]	11.72 [2.33]	-0.47 [-2.65]	0.93	0.14	2.03	0.44	F(2,27); 0.17	F(1,31); 0.19	F(1,28); 0.31
TTR	-20.17 [-5.15]	1.73 [11.01]	12.72 [2.24]	-0.51 [-2.10]	0.98	0.14	2.08	1.36	F(2,27); 0.26	F(1,31); 0.04	F(1,28); 0.67

Table 5B6: Indonesia Tax Elasticity of Major Taxes and the Tax System; 1972-2006

	Constant	Elasticity	Dummy	Slope dummy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	65.96 [3.05]	-1.74 [-2.02]	-20.85 [-4.81]	0.82 [2.05]	0.91	0.28	1.64	0.21	F(2,27); 2.11	F(1,31); 0.32	F(1,28); 1.57
PIT	18.54 [3.59]	0.12 [2.01]	-66.84 [-2.19]	2.62 [2.40]	0.71	0.42	1.64	0.89	F(2,27); 1.20	F(1,31); 0.02	F(1,28); 1.98
CIT	46.37 [4.45]	-0.87 [-2.09]	91.97 [2.35]	-3.60 [-2.36]	0.89	0.41	2.23	1.13	F(2,27); 0.51	F(1,31); 0.02	F(1,28); 2.77
GST	-34.47 [-2.58]	2.04 [3.23]	-25.13 [-2.43]	0.98 [2.05]	0.64	0.23	2.00	1.90	F(2,27); 1.79	F(1,31); 0.01	F(1,28); 0.83
TTR	6.98 [3.37]	0.65 [2.04]	1.45 [2.18]	0.57 [2.96]	0.91	0.21	1.99	3.28	F(2,27); 0.58	F(1,31); 0.05	F(2,27); 0.46

Table 5B7: Malaysia Tax Elasticity of Major Taxes and the Tax System; 1972-2006

	Constant	Elasticity	Dummy	Slope dummy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	13.82 [2.36]	0.33 [3.79]	29.73 [2.25]	-1.21 [-2.16]	0.76	0.20	2.00	0.79	F(2,25); 0.28	F(1,30); 0.01	F(1,26); 0.63
PIT	-1.33 [-2.53]	0.91 [4.23]	4.02 [4.65]	-0.16 [-4.58]	0.95	0.15	1.85	1.82	F(2,27); 0.22	F(1,31); 1.14	F(2,27); 0.21
CIT	7.98 [2.64]	0.58 [3.81]	-2.82 [-2.69]	0.12 [3.89]	0.94	0.16	2.03	0.42	F(2,27); 0.43	F(1,31); 2.06	F(1,28); 0.06
GST	-4.61 [-3.53]	1.08 [8.53]	18.65 [3.50]	-0.75 [-3.49]	0.96	0.11	2.05	0.53	F(2,25); 0.26	F(1,30); 4.01	F(1,26); 1.01
TTR	2.44 [4.01]	0.85 [3.40]	14.20 [2.10]	-0.57 [-2.93]	0.94	0.12	2.03	2.90	F(2,25); 0.07	F(1,30); 0.76	F(1,26); 0.06

Table 5B8: Philippines Tax Elasticity of Major Taxes and the Tax System; 1972-2006

	Constant	Elasticity	Dummy	Slope dummy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-32.85 [-3.03]	2.18 [2.12]	44.89 [2.52]	-1.81 [-5.75]	0.84	0.24	2.10	0.42	F(2,27); 0.23	F(1,31); 1.90	F(1,28); 0.46
PIT	10.46 [2.56]	0.39 [6.33]	-52.67 [-3.10]	2.13 [2.38]	0.96	0.19	2.14	0.65	F(2,25); 1.01	F(1,30); 0.01	F(1,26); 1.31
CIT	-43.01 [-5.27]	2.86 [8.58]	30.58 [2.62]	-1.21 [-2.56]	0.95	0.20	2.07	0.01	F(2,25); 0.83	F(1,30); 001	F(1,26); 1.72
GST	-18.67 [-4.68]	1.62 [5.46]	18.57 [4.68]	-0.74 [-4.62]	0.94	0.16	1.93	0.30	F(2,25); 0.06	F(1,30); 0.54	F(1,26); 0.09
TTR	12.14 [2.71]	1.41 [3.62]	-25.20 [-2.76]	1.03 [2.71]	0.96	0.16	1.95	0.55	F(2,25); 0.87	F(1,30); 0.43	F(1,26); 1.60

Buoyancy; Pre-AFTA (1972-1991)

Table 5B9: Thailand Tax Buoyancy of Major Taxes and the Tax System; 1972-1991

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-17.60 [-6.00]	1.57 [13.22]	0.95	0.15	1.99	1.84	F(2,24); 0.35	F(1,16); 0.01	F(1,15); 0.60
PIT	-12.42 [-2.61]	1.36 [4.43]	0.99	0.10	2.00	0.34	F(2,14); 0.52	F(1,16); 1.35	F(1,15); 0.34
CIT	-34.18 [-8.30]	2.22 [13.18]	0.98	0.12	1.60	0.81	F(2,12); 0.54	F(1,15); 1.57	F(1,13); 1.53
GST	-1.45 [-2.42]	0.97 [23.42]	0.97	0.07	1.92	1.35	F(2,14); 0.05	F(1,16); 1.56	F(1,15); 0.42
TTR	-22.67 [-10.63]	1.83 [21.38]	0.98	0.10	2.21	1.28	F(2,14); 0.73	F(1,16); 1.73	F(1,15); 0.37

Table 5B10: Indonesia Tax Buoyancy of Major Taxes and the Tax System; 1972-1991

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	53.45 [7.18]	-1.24 [-4.14]	0.79	0.26	1.81	0.99	F(2,14); 0.26	F(1,16); 0.06	F(1,15); 0.30
PIT	14.23 [3.27]	0.30 [1.69]	0.25	0.19	1.79	0.35	F(2,14); 0.04	F(1,16); 0.15	F(1,15); 0.03
CIT	47.16 [4.79]	-0.90 [-2.29]	0.61	0.29	1.99	0.82	F(2,14); 0.01	F(1,16); 0.24	F(1,15); 0.05
GST	15.42 [4.10]	0.31 [2.09]	0.35	0.17	1.76	0.94	F(2,14); 2.80	F(1,16); 3.14	F(1,15); 0.23
TTR	6.22 [7.43]	0.68 [2.06]	0.88	0.22	2.07	3.65	F(2,14); 0.09	F(1,16); 0.11	F(2,14); 0.29

Table 5B11: Malaysia Tax Buoyancy of Major Taxes and the Tax System; 1972-1991

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	12.30 [2.37]	0.39 [2.44]	0.56	0.19	1.99	0.49	F(2,12); 0.04	F(1,15); 0.05	F(1,13); 0.19
PIT	-1.21 [-2.15]	0.91 [3.94]	0.91	0.13	2.03	0.56	F(2,14); 0.73	F(1,16); 0.81	F(2,14); 0.38
CIT	10.85 [3.13]	0.46 [8.38]	0.90	0.18	1.97	0.23	F(2,14); 0.32	F(1,16); 1.10	F(2,14); 1.30
GST	-3.19 [-2.88]	1.02 [7.95]	0.93	0.10	2.00	0.31	F(2,12); 0.94	F(1,15); 1.45	F(1,13); 0.35
TTR	3.94 [2.07]	0.79 [2.78]	0.90	0.12	1.99	0.54	F(2,12); 0.05	F(1,15); 1.48	F(1,13); 0.02

Table 5B12: Philippines Tax Buoyancy of Major Taxes and the Tax System; 1972-1991

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-25.52 [-4.95]	1.91 [4.34]	0.74	0.27	2.43	1.32	F(2,14); 0.66	F(1,16); 2.53	F(1,15); 0.51
PIT	38.71 [3.33]	1.40 [4.87]	0.85	0.20	1.95	0.26	F(2,12); 0.14	F(1,15); 0.03	F(1,13); 0.55
CIT	-45.56 [-5.75]	2.66 [8.23]	0.79	0.20	2.03	1.05	F(2,12); 0.43	F(1,15); 0.36	F(1,13); 1.04
GST	-17.43 [-3.20]	1.57 [3.59]	0.89	0.17	1.98	0.83	F(2,12); 0.01	F(1,15); 0.23	F(2,12); 0.15
TTR	6.61 [2.17]	0.66 [2.83]	0.51	0.16	1.96	0.59	F(2,9); 0.84	F(1,12); 0.44	F(1,10); 0.68

Buoyancy; Post-AFTA (1992-2006)

Table 5B13: Thailand Tax Buoyancy of Major Taxes and the Tax System; 1992-2006

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-50.80 [-2.41]	0.79 [4.99]	0.71	0.21	2.43	1.81	F(2,10); 0.93	F(1,12); 0.01	F(1,11); 3.01
PIT	-4.98 [-2.71]	1.05 [3.03]	0.44	0.20	1.97	0.48	F(2,10); 0.06	F(1,12); 0.68	F(1,11); 0.15
CIT	-83.89 [-2.78]	4.14 [3.56]	0.88	0.16	2.37	0.33	F(2,10); 1.53	F(1,12); 0.02	F(1,11); 1.11
GST	4.96 [2.40]	0.71 [8.47]	0.88	0.16	2.38	0.74	F(2,10); 2.59	F(1,12); 0.11	F(1,11); 0.71
TTR	-21.42 [-2.91]	1.77 [2.15]	0.62	0.19	2.40	1.44	F(2,10); 0.34	F(1,12); 0.09	F(1,11); 0.95

Table 5B14: Indonesia Tax Buoyancy of Major Taxes and the Tax System; 1992-2006

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	14.04 [2.37]	1.33 [2.19]	0.86	0.26	1.87	1.40	F(2,10); 2.72	F(1,12); 0.48	F(1,11); 0.83
PIT	-10.95 [-3.22]	5.08 [2.07]	0.59	0.58	1.95	0.13	F(2,10); 0.04	F(1,12); 0.62	F(1,11); 0.14
CIT	177.91 [6.89]	-6.00 [-6.00]	0.79	0.53	2.03	1.00	F(2,10); 0.01	F(1,12); 0.01	F(1,11); 0.20
GST	-77.85 [-3.70]	3.84 [4.87]	0.81	0.24	1.96	0.49	F(2,10); 0.67	F(1,12); 0.27	F(1,11); 2.92
TTR	13.34 [2.33]	1.44 [0.65]	0.49	0.20	1.81	0.89	F(2,10); 1.87	F(1,12); 0.02	F(1,11); 0.11

Table 5B15: Malaysia Tax Buoyancy of Major Taxes and the Tax System; 1992-2006

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-64.28 [-2.10]	-1.28 [-4.64]	0.89	0.16	2.13	3.76	F(2,9); 0.55	F(1,12); 0.23	F(1,10); 2.42
PIT	3.48 [2.44]	0.72 [2.30]	0.61	0.17	1.64	3.36	F(2,10); 0.41	F(1,12); 0.89	F(1,11); 0.51
CIT	0.82 [2.30]	0.87 [3.94]	0.69	0.15	1.90	0.83	F(2,10); 0.04	F(1,12); 0.01	F(1,11); 0.07
GST	16.17 [4.03]	0.24 [4.13]	0.67	0.12	2.11	0.51	F(2,9); 0.81	F(1,12); 1.76	F(1,10); 1.93
TTR	17.90 [3.21]	0.42 [3.48]	0.68	0.12	2.25	1.55	F(2,9); 0.43	F(1,12); 0.13	F(1,10); 0.87

Table 5B16: Philippines Tax Buoyancy of Major Taxes and the Tax System; 1992-2006

	Constant	Buoyancy	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	33.57 [2.05]	0.47 [3.02]	0.85	0.19	1.83	2.94	F(2,9); 1.28	F(1,12); 0.49	F(1,10); 2.34
PIT	-6.11 [-2.57]	1.94 [4.71]	0.75	0.15	2.18	1.27	F(2,10); 0.23	F(1,12); 0.05	F(1,11); 0.50
CIT	-12.27 [-2.24]	1.35 [3.23]	0.66	0.20	1.84	0.22	F(2,9); 0.01	F(1,12); 2.48	F(1,10); 0.07
GST	9.47 [2.88]	0.50 [2.16]	0.42	0.16	1.75	1.09	F(2,9); 0.85	F(1,12); 1.51	F(1,10); 0.89
TTR	-34.93 [-2.50]	2.32 [4.06]	0.86	0.16	1.82	0.47	F(2,12); 0.58	F(1,15); 0.01	F(1,13); 0.85

Appendix 5C: Regression Results – The Decomposition of Tax Buoyancy

Tables below present the full regression results of the decomposition of tax buoyancy computed by the authors using Eviews econometric software. The decomposition is done for all four major taxes including international trade tax (ITT), personal income tax (PIT), corporate income tax (CIT), and goods and services tax (GST). Merchandise trade as a share of GDP is used as a proxy base for international trade tax. Compensation of employees is used as a proxy base for personal income tax. The share of industry in GDP is used as a proxy base for corporate income tax. Household final consumption expenditure is used as a proxy base for consumption tax. Figures in parentheses [ ] below coefficient estimates are t values. R^2 represents the coefficient of determination. SER is the standard error of the regression. DW represents the Durbin-Watson statistic, used to test the autocorrelation in the residuals. JBNORM is the Jarque-Bera statistic for testing normality. The null hypothesis is that errors are normally distributed. Serial LM is the Breusch-Godfrey Lagrange multiplier test for serial correlation. The null hypothesis of the test is that there is no serial correlation in the residuals. ARCH is a Lagrange multiplier (LM) test for autoregressive conditional heteroscedasticity. The null hypothesis is that there is no heteroscedasticity. RESET is Regression Specification Error Test, proposed by Ramsey (1969) for testing functional form misspecification. The null hypothesis is that there is no misspecification.

The Decomposition of Tax Buoyancy; Combined Period (1972-2006)

Table 5C1: Thailand – Tax-to-Base; 1972-2006

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	18.84 [12.98]	0.64 [2.52]	0.92	0.21	1.59	0.52	F(2,29); 0.78	F(1,31); 0.12	F(1,30); 0.99
PIT	10.23 [2.58]	0.54 [2.06]	0.99	0.15	1.91	0.32	F(2,29); 0.03	F(1,31); 0.01	F(2,29); 0.81
CIT	-5.11 [-2.79]	3.34 [6.63]	0.97	0.23	1.86	0.14	F(2,25); 1.47	F(1,29); 0.16	F(1,26); 2.72
GST	-3.11 [-2.70]	0.80 [7.08]	0.92	0.14	2.20	0.53	F(2,29); 0.31	F(1,31); 0.14	F(1,30); 0.26

Table 5C2: Thailand – Base-to-Income; 1972-2006

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-11.04 [-2.77]	0.61 [3.89]	0.96	0.08	1.81	0.66	F(2,29); 0.21	F(1,31); 1.02	F(1,30); 0.32
PIT	15.42 [3.87]	1.29 [8.06]	0.54	0.16	1.92	0.39	F(2,29); 0.04	F(1,31); 0.23	F(1,30); 0.07
CIT	-3.29 [-16.16]	0.27 [34.03]	0.99	0.02	2.05	1.48	F(2,29); 0.22	F(1,31); 0.71	F(1,30); 0.49
GST	2.70 [5.41]	0.87 [44.64]	0.99	0.02	1.91	1.35	F(2,29); 2.18	F(1,31); 0.30	F(1,30); 0.52

Table 5C3: Indonesia – Tax-to-Base; 1972-2006

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	19.94 [13.01]	-0.95 [-25.54]	0.91	0.27	1.86	0.18	F(2,29); 0.58	F(1,31); 0.54	F(1,30); 0.68
PIT	6.02 [2.35]	0.80 [2.94]	0.73	0.39	1.90	0.71	F(2,29); 0.07	F(1,31); 0.23	F(1,30); 0.08
CIT	19.55 [2.27]	-2.47 [-2.49]	0.89	0.40	2.09	0.38	F(2,29); 0.51	F(1,31); 0.41	F(1,30); 0.98
GST	-15.02 [-3.25]	1.50 [8.05]	0.95	0.23	1.75	021	F(2,29); 0.38	F(1,31); 0.01	F(1,30); 1.24

Table 5C4: Indonesia – Base-to-Income; 1972-2006

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-1.42 [-2.76]	0.21 [3.01]	0.55	0.15	1.87	0.14	F(2,29); 0.30	F(1,31); 0.04	F(1,30); 0.34
PIT	-35.44 [-2.65]	2.10 [3.40]	0.94	0.28	2.32	0.82	F(2,29); 1.87	F(1,31); 0.04	F(1,30); 0.56
CIT	-3.74 [-4.03]	0.16 [4.44]	0.86	0.05	1.93	0.38	F(2,29); 0.04	F(1,31); 1.07	F(1,30); 0.41
GST	-2.61 [-2.96]	2.08 [4.15]	0.99	0.06	1.78	0.23	F(2,29); 0.23	F(1,31); 0.13	F(1,30); 0.50

Table 5C5: Malaysia – Tax-to-Base; 1972-2006

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	17.99 [4.92]	-0.68 [-6.95]	0.74	0.20	2.05	0.72	F(2,27); 0.23	F(1,30); 0.60	F(1,28); 0.46
PIT	9.57 [3.65]	0.55 [4.37]	0.95	0.13	2.27	0.14	F(2,29); 0.49	F(1,31); 0.27	F(1,30); 0.32
CIT	19.85 [7.21]	0.77 [2.60]	0.94	0.16	1.96	0.16	F(2,29); 0.01	F(1,31); 0.43	F(1,30); 0.56
GST	-11.29 [-4.22]	0.92 [8.24]	0.96	0.11	1.90	0.51	F(2,27); 0.79	F(1,30); 1.23	F(1,28); 0.41

Table 5C6: Malaysia – Base-to-Income; 1972-2006

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-8.43 [-7.63]	0.53 [12.05]	0.97	0.07	1.81	0.32	F(2,27); 0.01	F(1,30); 0.49	F(2,27); 0.10
PIT	13.28 [8.45]	0.37 [5.63]	0.84	0.14	2.18	0.64	F(2,29); 0.31	F(1,31); 2.49	F(1,30); 0.47
CIT	-4.36 [-5.36]	1.70 [5.15]	0.93	0.03	1.73	0.57	F(2,29); 0.14	F(1,31); 1.82	F(1,30); 0.57
GST	2.11 [3.90]	0.88 [4.04]	0.99	0.03	1.95	0.30	F(2,27); 0.22	F(1,30); 0.09	F(1,28); 0.91

Table 5C7: Philippines – Tax-to-Base; 1972-2006

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	24.00 [10.84]	1.89 [3.55]	0.84	0.25	2.00	0.55	F(2,27); 0.37	F(1,30); 0.36	F(1,28); 0.96
PIT	7.80 [2.55]	1.65 [5.76]	0.96	0.17	1.95	1.67	F(2,27); 0.18	F(1,30); 0.34	F(1,28); 0.63
CIT	-30.71 [-7.79]	2.51 [2.21]	0.94	0.21	2.21	0.42	F(2,27); 1.48	F(1,30); 0.03	F(1.28); 0.38
GST	-8.56 [-2.84]	1.23 [4.32]	0.93	0.16	1.98	0.67	F(2,27); 0.55	F(1,30); 0.10	F(1,28); 0.95

Table 5C8: Philippines – Base-to-Income; 1972-2006

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-21.03 [-2.60]	1.01 [2.27]	0.96	0.09	1.98	1.61	F(2,27); 0.25	F(1,30); 0.36	F(2,27); 0.89
PIT	-12.62 [-3.30]	1.35 [2.57]	0.96	0.16	1.99	0.12	F(2,27); 0.36	F(1,30); 0.22	F(1,28); 0.35
CIT	-9.45 [-7.05]	0.51 [5.15]	0.95	0.02	1.94	0.49	F(2,27); 1.67	F(1,30); 0.03	F(1,28); 0.53
GST	-1.87 [-2.73]	1.33 [2.19]	0.99	0.01	2.32	0.43	F(2,27); 2.02	F(1,30); 0.21	F(1,28); 0.55

The Decomposition of Tax Buoyancy; Pre-AFTA (1972-1991)

Table 5C9: Thailand – Tax-to-Base; 1972-1991

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	14.64 [10.41]	1.78 [6.09]	0.97	0.11	2.37	0.67	F(2,14); 1.40	F(1,16); 0.30	F(1,15); 1.50
PIT	3.39 [3.87]	0.30 [2.08]	0.99	0.11	1.99	0.41	F(2,12); 0.07	F(1,15); 0.74	F(1,13); 0.91
CIT	6.46 [2.45]	1.53 [8.74]	0.97	0.16	1.89	1.26	F(2,12); 0.04	F(1,15); 0.97	F(1,13); 14.52
GST	-6.55 [-5.02]	0.20 [5.92]	0.97	0.07	1.92	0.31	F(2,14); 0.07	F(1,16); 1.84	F(1,15); 0.36

Table 5C10: Thailand – Base-to-Income; 1972-1991

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-6.70 [-2.56]	0.43 [4.06]	0.84	0.08	1.83	0.68	F(2,12); 0.04	F(1,15); 0.27	F(1,13); 1.19
PIT	14.27 [2.93]	1.34 [6.92]	0.57	0.13	1.65	0.55	F(2,14); 0.31	F(1,16); 0.01	F(1,15); 0.57
CIT	-3.69 [-9.28]	0.29 [18.10]	0.96	0.02	2.17	1.18	F(2,14); 0.23	F(1,16); 0.43	F(1,15); 0.94
GST	2.73 [6.20]	0.97 [17.23]	0.99	0.01	1.89	0.16	F(2,10); 1.44	F(1,12); 0.93	F(1,11); 1.62

Table 5C11: Indonesia – Tax-to-Base; 1972-1991

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	17.11 [7.88]	-1.30 [-2.15]	0.80	0.25	2.05	1.21	F(2,14); 0.11	F(1,16); 0.06	F(1,15); 0.84
PIT	41.64 [11.92]	0.92 [6.29]	0.85	0.29	1.88	0.45	F(2,14); 0.41	F(1,16); 1.70	F(1,15); 0.45
CIT	14.51 [3.67]	-2.05 [-2.52]	0.67	0.27	2.33	0.55	F(2,14); 0.92	F(1,16); 0.14	F(1,15); 1.52
GST	-11.99 [-2.73]	0.37 [8.58]	0.92	0.22	1.94	1.45	F(2,14); 0.58	F(1,16); 1.55	F(1,15); 0.72

Table 5C12: Indonesia – Base-to-Income; 1972-1991

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	1.53 [2.48]	0.08 [2.34]	0.33	0.09	1.76	0.47	F(2,10); 0.80	F(1,14); 0.49	F(1,11); 0.82
PIT	68.32 [18.04]	0.78 [11.66]	0.96	0.15	2.08	1.89	F(2,14); 0.42	F(1,16); 0.82	F(1,15); 2.35
CIT	-3.09 [-2.23]	0.10 [2.16]	0.69	0.06	2.07	0.38	F(2,14); 0.25	F(1,16); 0.88	F(1,15); 0.32
GST	-2.25 [-3.10]	1.06 [9.74]	0.97	0.08	1.81	0.44	F(2,14); 0.08	F(1,16); 0.01	F(1,15); 0.14

Table 5C13: Malaysia – Tax-to-Base; 1972-1991

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	17.50 [6.12]	0.41 [2.83]	0.70	0.17	1.52	1.81	F(2,14); 0.53	F(1,16); 0.23	F(1,15); 1.35
PIT	-15.23 [-2.50]	1.62 [5.92]	0.91	0.13	1.83	0.34	F(2,14); 0.13	F(1,16); 0.01	F(1,15); 0.22
CIT	14.57 [3.61]	0.66 [3.38]	0.88	0.17	1.92	1.23	F(2,12); 1.17	F(1,15); 0.75	F(1,13); 0.32
GST	-5.33 [-2.71]	1.14 [13.68]	0.95	0.09	1.93	0.73	F(2,12); 0.20	F(1,15); 0.06	F(2,12); 0.24

Table 5C14: Malaysia – Base-to-Income; 1972-1991

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-25.67 [-3.91]	1.23 [4.77]	0.90	0.06	1.58	0.66	F(2,12); 0.46	F(1,15); 0.98	F(1,13); 2.21
PIT	12.55 [4.24]	0.40 [3.26]	0.93	0.07	1.95	0.74	F(2,14); 1.93	F(1,16); 0.04	F(2,14); 0.91
CIT	15.48 [2.09]	0.67 [2.78]	0.85	0.04	2.00	0.30	F(2,14); 0.40	F(1,16); 2.65	F(1,15); 0.43
GST	2.32 [2.38]	0.88 [21.60]	0.98	0.37	2.06	0.17	F(2,12); 0.32	F(1,15); 0.13	F(1,13); 0.01

Table 5C15: Philippines – Tax-to-Base; 1972-1991

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	13.48 [2.31]	2.08 [3.53]	0.80	0.26	1.90	0.55	F(2,12); 0.26	F(1,15); 0.33	F(1,13); 0.73
PIT	9.53 [3.01]	1.50 [4.38]	0.86	0.19	1.89	1.12	F(2,12); 0.02	F(1,15); 0.28	F(1,13); 1.11
CIT	-31.83 [-4.26]	2.25 [2.19]	0.78	0.21	1.87	0.65	F(2,12); 0.01	F(1,15); 0.35	F(1,13); 0.32
GST	-10.64 [-5.59]	1.32 [2.72]	0.89	0.17	2.08	1.05	F(2,12); 0.06	F(1,15); 0.12	F(1,13); 0.01

Table 5C16: Philippines – Base-to-Income; 1972-1991

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-1.46 [-3.64]	1.01 [3.54]	0.55	0.08	1.75	0.50	F(2,12); 0.36	F(1,15); 0.86	F(1,13); 0.90
PIT	-18.21 [-5.25]	1.05 [3.52]	0.96	0.17	1.88	1.27	F(2,12); 0.13	F(1,15); 0.11	F(1,13); 0.62
CIT	-3.15 [-3.77]	1.51 [10.61]	0.91	0.02	1.85	0.67	F(2,12); 0.28	F(1,15); 0.45	F(1,13); 1.37
GST	-1.61 [-8.18]	1.40 [2.60]	0.99	0.01	2.13	1.22	F(2,12); 1.26	F(1,15); 0.29	F(1,13); 0.32

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Table 5C17: Thailand – Tax-to-Base; 1992-2006

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	25.50 [15.41]	-0.83 [-2.23]	0.72	0.21	2.18	2.66	F(2,9); 0.32	F(1,12); 1.01	F(1,10); 0.42
PIT	6.52 [2.03]	0.96 [6.77]	0.74	0.15	1.98	0.61	F(2,9); 2.05	F(1,12); 0.39	F(1,10); 1.42
CIT	8.45 [2.23]	3.72 [2.04]	0.81	0.21	2.05	0.58	F(2,9); 0.39	F(1,12); 0.33	F(1,10); 1.66
GST	-3.01 [-15.46]	1.83 [2.30]	0.50	0.19	2.28	0.94	F(2,9); 1.15	F(1,12); 0.01	F(1,10); 1.86

Table 5C18: Thailand – Base-to-Income; 1992-2006

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	20.61 [2.47]	1.41 [7.54]	0.93	0.07	2.29	0.28	F(2,10); 2.56	F(1,12); 0.69	F(1,11); 1.31
PIT	20.98 [3.25]	1.01 [2.28]	0.39	0.19	2.29	0.11	F(2,10); 2.01	F(1,12); 0.09	F(1,11); 1.80
CIT	-2.85 [-2.58]	0.26 [5.97]	0.87	0.02	1.67	0.28	F(2,10); 0.44	F(1,12); 0.01	F(1,11); 0.28
GST	4.26 [12.54]	0.81 [5.81]	0.98	0.01	1.85	1.00	F(2,14); 4.06	F(1,16); 1.40	F(1,15); 0.16

Table 5C19: Indonesia – Tax-to-Base; 1992-2006

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	20.36 [14.89]	0.15 [4.17]	0.86	0.27	2.08	0.56	F(2,9); 0.87	F(1,12); 0.54	F(1,10); 0.56
PIT	3.83 [2.23]	0.85 [3.15]	0.65	0.54	1.71	1.45	F(2,10); 0.18	F(1,12); 0.50	F(1,11); 0.15
CIT	36.79 [3.27]	-3.78 [-4.17]	0.47	0.47	1.98	0.93	F(2,10); 0.05	F(1,12); 0.22	F(1,11); 0.03
GST	-3.58 [-5.65]	2.12 [4.96]	0.65	0.27	1.56	1.98	F(2,10); 0.33	F(1,12); 0.01	F(1,11); 0.92

Table 5C20: Indonesia – Base-to-Income; 1992-2006

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	58.98 [2.30]	2.11 [3.67]	0.46	0.18	2.06	0.38	F(2,9); 0.19	F(1,12); 0.34	F(1,10); 0.45
PIT	-61.18 [-2.82]	3.17 [3.73]	0.77	0.36	2.24	0.11	F(2,10); 1.64	F(1,12); 0.61	F(1,11); 1.71
CIT	-3.52 [-2.28]	0.28 [2.88]	0.73	0.03	1.86	0.27	F(2,9); 0.27	F(1,12); 0.71	F(1,10); 0.23
GST	9.66 [7.79]	2.61 [2.50]	0.99	0.02	1.84	0.30	F(2,10); 0.63	F(1,12); 0.25	F(1,11); 1.11

Table 5C21: Malaysia – Tax-to-Base; 1992-2006

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	26.98 [5.09]	-1.11 [-10.81]	0.83	0.19	1.90	0.14	F(2,9); 0.36	F(1,12); 0.05	F(1,10); 2.25
PIT	8.21 [2.39]	0.60 [3.89]	0.79	0.12	2.29	0.21	F(2,10); 1.12	F(1,12); 0.45	F(1,11); 3.19
CIT	34.30 [2.24]	0.96 [3.27]	0.72	0.15	2.02	0.05	F(2,9); 0.16	F(1,12); 0.01	F(1,10); 2.13
GST	16.06 [4.35]	0.26 [2.70]	0.68	0.12	2.15	0.40	F(2,9); 0.99	F(1,12); 2.39	F(1,10); 2.14

Table 5C22: Malaysia – Base-to-Income; 1992-2006

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	-5.76 [-3.24]	0.43 [6.14]	0.76	0.06	1.56	0.56	F(2,9); 0.58	F(1,12); 0.32	F(1,10); 0.37
PIT	-13.19 [-2.09]	1.48 [3.19]	0.29	0.19	2.03	0.12	F(2,9); 0.44	F(1,12); 0.40	F(1,10); 1.05
CIT	-5.24 [-4.46]	1.87 [3.45]	0.92	0.03	2.18	0.20	F(2,9); 0.89	F(1,12); 0.77	F(1,10); 0.50
GST	-6.16 [-3.38]	1.21 [16.77]	0.99	0.02	1.91	0.88	F(2,9); 0.47	F(1,12); 0.06	F(1,10); 1.37

Table 5C23: Philippines – Tax-to-Base; 1992-2006

	Constant	Tax-to-Base	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	31.71 [9.09]	0.62 [8.45]	0.92	0.14	1.87	0.38	F(2,9); 0.38	F(1,12); 0.10	F(1,10); 2.72
PIT	12.56 [2.16]	1.80 [5.05]	0.75	0.16	1.86	1.10	F(2,9); 0.19	F(1,12); 0.09	F(1,10); 0.34
CIT	-30.89 [-4.06]	2.58 [2.22]	0.58	0.22	1.80	0.57	F(2,9); 0.10	F(1,12); 0.01	F(1,10); 0.21
GST	9.32 [2.03]	0.51 [2.62]	0.42	0.16	1.77	1.27	F(2,9); 0.85	F(1,12); 1.40	F(1,10); 0.97

Table 5C24: Philippines – Base-to-Income; 1992-2006

	Constant	Base-to-Income	R^2	SER	DW	JBNORM	Serial LM	ARCH	RESET
ITT	14.82 [2.05]	0.93 [2.90]	0.92	0.08	2.18	0.78	F(2,9); 4.01	F(1,12); 0.25	F(1,10); 1.30
PIT	-30.13 [-6.14]	1.31 [6.70]	0.93	0.14	1.99	0.77	F(2,9); 0.12	F(1,12); 0.34	F(1,10); 0.26
CIT	-3.69 [-3.66]	0.41 [10.27]	0.97	0.02	2.29	1.16	F(2,9); 0.84	F(1,12); 1.29	F(1,10); 1.54
GST	-8.83 [-3.97]	0.72 [3.44]	0.99	0.01	2.35	0.33	F(2,9); 2.00	F(1,12); 1.32	F(1,10); 1.12

Appendix 5D: Cointegration Test – Tax Buoyancy and Tax Elasticity

Tables below present the cointegration test for variable used to calculate tax buoyancy and tax elasticity computed by the authors using Eviews econometric software. In this study, the Engle-Granger (EG) approach is applied to test for cointegration. The concept of the EG approach is that if cointegration genuinely exists between variables, the error term should remain roughly constant over time, i.e. it should be stationary. However, if the error term is tending to increase over time, this implies that the variables are not cointegrated. There are two steps in performing the EG cointegration test. After it is found that all variables in all countries are I(1) in the stationary test using ADF and PP approaches, the first step here is to run a standard OLS regression on the variables. The residuals obtained from the first step will be used to test for unit root by using the ADF and PP procedure. If a unit root does not exist, the residuals are stationary and we can conclude that the variables under investigation are cointegrated, and therefore buoyancy, elasticity, and decomposition results are meaningful.

Figures in parentheses [ ] below coefficient estimates are t values. The residual tests using both ADF and PP methods report a t-ratio which is used to test the null hypothesis that the residual has a unit root.

Cointegration test for variables used for computing tax buoyancy; Combined period (1972-2006)

For combined period (1972-2006), the critical values for both the ADF and the PP tests are as follows; 90% critical value is -1.61, 95% critical value is -1.95, and 99% critical value is -2.64.

Table 5D1: Thailand

	C	lnGDP	Unit Root Test for Residual	
			ADF	PP
lnITT	2.09 [3.74]	0.77 [0.26]	-4.92	-4.92
lnPIT	-21.41 [-6.75]	1.69 [13.31]	-7.56	-7.59
lnCIT	-31.55 [-12.05]	2.11 [19.96]	-5.64	-5.64
lnGST	5.10 [2.14]	0.71 [7.32]	-6.20	-6.18
lnTTR	-12.95 [-4.48]	1.44 [12.47]	-6.53	-6.47

Table 5D2: Indonesia

	C	lnGDP	Unit Root Test for Residual	
			ADF	PP
lnITT	52.43 [6.09]	-1.21 [-3.56]	-5.73	-5.76
lnPIT	12.35 [2.73]	0.82 [2.41]	-5.93	-5.93
lnCIT	84.11 [4.83]	-2.37 [-3.48]	-6.49	-6.44
lnGST	-50.66 [-2.55]	2.74 [2.24]	-5.83	-6.10
lnTTR	10.84 [2.18]	0.86 [4.40]	-5.54	-5.55

Table 5D3: Malaysia

	C	lnGDP	Unit Root Test for Residual	
			ADF	PP
lnITT	30.42 [5.39]	-0.36 [-2.85]	-4.78	-4.78
lnPIT	-3.88 [-13.96]	0.87 [7.76]	-5.45	-5.46
lnCIT	4.14 [2.24]	0.74 [3.79]	-6.16	-6.17
lnGST	1.47 [3.53]	0.83 [8.46]	-5.58	-5.58
lnTTR	8.44 [2.72]	0.60 [4.78]	-5.55	-5.57

Table 5D4: Philippines

	C	lnGDP	Unit Root Test for Residual	
			ADF	PP
lnITT	-20.93 [-3.21]	1.64 [3.34]	-5.74	-5.74
lnPIT	-27.28 [-2.80]	1.93 [3.21]	-5.73	-5.74
lnCIT	-43.71 [-5.98]	2.60 [8.89]	-6.04	-6.02
lnGST	-10.91 [-2.43]	1.31 [0.38]	-5.27	-5.27
lnTTR	14.11 [6.02]	1.76 [2.73]	-5.68	-5.70

Cointegration test for variables used for computing tax elasticity

D is a dummy variable for trade liberalization by joining AFTA. It takes value 1 between 1992 and 2006, and 0 elsewhere.

D*LogGDP is a slope dummy.

The critical values for both the ADF and the PP tests are as follows; 90% critical value is -1.61, 95% critical value is -1.95, and 99% critical value is -2.64.

Table 5D5: Thailand

	C	lnGDP	D	D*lnGDP	Unit Root Test for Residual	
					ADF	PP
lnITT	-11.83 [-2.49]	1.34 [3.41]	25.00 [3.41]	-1.00 [-3.07]	-4.76	-4.77
lnPIT	-34.17 [-10.28]	2.21 [16.32]	29.20 [2.55]	-1.16 [-2.57]	-6.19	-6.18
lnCIT	-26.17 [-3.01]	1.89 [5.37]	-18.32 [-2.85]	0.72 [2.87]	-3.88	-3.88
lnGST	-16.62 [-6.22]	0.94 [8.63]	11.72 [2.33]	-0.47 [-2.65]	-5.77	-5.78
lnTTR	-20.17 [-5.15]	1.73 [11.01]	12.72 [2.24]	-0.51 [-2.10]	-6.03	-6.03

Table 5D6: Indonesia

	C	lnGDP	D	D*lnGDP	Unit Root Test for Residual	
					ADF	PP
lnITT	65.96 [3.05]	-1.74 [-2.02]	-20.85 [-4.81]	0.82 [2.05]	-4.83	-4.88
lnPIT	18.54 [3.59]	0.12 [2.01]	-66.84 [-2.19]	2.62 [2.40]	-4.63	-4.63
lnCIT	46.37 [4.45]	-0.87 [-2.09]	91.97 [2.35]	-3.60 [-2.36]	-6.36	-6.32
lnGST	-34.47 [-2.58]	2.04 [3.23]	-25.13 [-2.43]	0.98 [2.05]	-5.60	-5.64
lnTTR	6.98 [3.37]	0.65 [2.04]	1.45 [2.18]	0.57 [2.96]	-5.66	-5.66

Table 5D7: Malaysia

	C	lnGDP	D	D*lnGDP	Unit Root Test for Residual	
					ADF	PP
lnITT	13.82 [2.36]	0.33 [3.79]	29.73 [2.25]	-1.21 [-2.16]	-5.62	-5.63
lnPIT	-1.33 [-2.53]	0.91 [4.23]	4.02 [4.65]	-0.16 [-4.58]	-5.35	-5.34
lnCIT	7.98 [2.64]	0.58 [3.81]	-2.82 [-2.69]	0.12 [3.89]	-6.23	-6.26
lnGST	-4.61 [-3.53]	1.08 [8.53]	18.65 [3.50]	-0.75 [-3.49]	-5.80	-5.80
lnTTR	2.44 [4.01]	0.85 [3.40]	14.20 [2.10]	-0.57 [-2.93]	-5.67	-5.67

Table 5D8: Philippines

	C	lnGDP	D	D*lnGDP	Unit Root Test for Residual	
					ADF	PP
lnITT	-32.85 [-3.03]	2.18 [2.12]	44.89 [2.52]	-1.81 [-5.75]	-5.98	-5.98
lnPIT	10.46 [2.56]	0.39 [6.33]	-52.67 [-3.10]	2.13 [2.38]	-6.01	-6.00
lnCIT	-43.01 [-5.27]	2.86 [8.58]	30.58 [2.62]	-1.21 [-2.56]	-5.90	-5.90
lnGST	-18.67 [-4.68]	1.62 [5.46]	18.57 [4.68]	-0.74 [-4.62]	-5.38	-5.35
lnTTR	12.14 [2.71]	1.41 [3.62]	-25.20 [-2.76]	1.03 [2.71]	-5.52	-5.55

Cointegration test for variables used for computing tax buoyancy; Pre- and Post-AFTA periods

For Pre-AFTA period (1972-1991), the critical values for both the ADF and the PP tests are as follows; 90% critical value is -1.61, 95% critical value is -1.96, and 99% critical value is -2.70.

For Post-AFTA period (1992-2006), the critical values for both the ADF and the PP tests are as follows; 90% critical value is -1.60, 95% critical value is -1.97, and 99% critical value is -2.74.

Table 5D9: Thailand

| | Pre-AFTA (1972-1991) | | | | Post-AFTA (1992-2006) | | | |
| | C | lnGDP | Unit Root Test for Residual | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP			ADF	PP
lnITT	-17.60 [-6.00]	1.57 [13.22]	-4.46	-4.44	-50.80 [-2.41]	0.79 [4.99]	-4.53	-4.53
lnPIT	-12.42 [-2.61]	1.36 [4.43]	-4.59	-4.64	-4.98 [-2.71]	1.05 [3.03]	-3.57	-3.57
lnCIT	-34.18 [-8.30]	2.22 [13.18]	-3.60	-3.65	-83.89 [-2.78]	4.14 [3.56]	-4.46	-4.51
lnGST	-1.45 [-2.42]	0.97 [23.42]	-4.00	-4.00	4.96 [2.40]	0.71 [8.47]	-4.16	-4.17
lnTTR	-22.67 [-10.63]	1.83 [21.38]	-5.36	-5.36	-21.42 [-2.91]	1.77 [2.15]	-4.46	-4.46

Table 5D10: Indonesia

| | Pre-AFTA (1972-1991) | | | | Post-AFTA (1992-2006) | | | |
| | C | lnGDP | Unit Root Test for Residual | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP			ADF	PP
lnITT	53.45 [7.18]	-1.24 [-4.14]	-3.90	-3.90	14.04 [2.37]	1.33 [2.19]	-2.81	-2.87
lnPIT	14.23 [3.27]	0.30 [1.69]	-3.65	-3.66	-10.95 [-3.22]	5.08 [2.07]	-3.54	-3.54
lnCIT	47.16 [4.79]	-0.90 [-2.29]	-4.27	-4.27	177.91 [6.89]	-6.00 [-6.00]	-3.68	-3.68
lnGST	15.42 [4.10]	0.31 [2.09]	-4.13	-4.23	-77.85 [-3.70]	3.84 [4.87]	-3.46	-3.46
lnTTR	6.22 [7.43]	0.68 [2.06]	-4.39	-4.39	13.34 [2.33]	1.44 [0.65]	-3.36	-3.36

Table 5D11: Malaysia

| | Pre-AFTA (1972-1991) | | | | Post-AFTA (1992-2006) | | | |
| | C | lnGDP | Unit Root Test for Residual | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP			ADF	PP
lnITT	12.30 [2.37]	0.39 [2.44]	-4.11	-4.11	-64.28 [-2.10]	-1.28 [-4.64]	-4.03	-4.06
lnPIT	-1.21 [-2.15]	0.91 [3.94]	-4.38	-4.51	3.48 [2.44]	0.72 [2.30]	-2.98	-2.99
lnCIT	10.85 [3.13]	0.46 [8.38]	-4.52	-4.53	0.82 [2.30]	0.87 [3.94]	-3.57	-3.57
lnGST	-3.19 [-2.88]	1.02 [7.95]	-4.10	-4.10	16.17 [4.03]	0.24 [4.13]	-3.85	-3.87
lnTTR	3.94 [2.07]	0.79 [2.78]	-3.87	-3.87	17.90 [3.21]	0.42 [3.48]	-3.96	-3.96

Table 5D12: Philippines

| | Pre-AFTA (1972-1991) | | | | Post-AFTA (1992-2006) | | | |
| | C | lnGDP | Unit Root Test for Residual | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP			ADF	PP
lnITT	-25.52 [-4.95]	1.91 [4.34]	-5.18	-5.17	33.57 [2.05]	0.47 [3.02]	-3.30	-3.22
lnPIT	38.71 [3.33]	1.40 [4.87]	-4.03	-4.03	-6.11 [-2.57]	1.94 [4.71]	-3.58	-3.59
lnCIT	-45.56 [-5.75]	2.66 [8.23]	-4.19	-4.19	-12.27 [-2.24]	1.35 [3.23]	-3.31	-3.31
lnGST	-17.43 [-3.20]	1.57 [3.59]	-3.96	-3.96	9.47 [2.88]	0.50 [2.16]	-3.12	-3.13
lnTTR	6.61 [2.17]	0.66 [2.83]	-3.65	-3.72	-34.93 [-2.50]	2.32 [4.06]	-3.55	-3.56

Cointegration test for variables used for the Decomposition of tax buoyancy; Combined period (1972-2006)

For combined period (1972-2006), the critical values for both the ADF and the PP tests are as follows; 90% critical value is -1.61, 95% critical value is -1.95, and 99% critical value is -2.64.

Table 5D13: Thailand

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | | |
| | C | ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | | |
			ADF	PP				ADF	PP
lnITT	18.84 [12.98]	0.64 [2.52]	-4.60	-4.60	lnMER	-11.04 [-2.77]	0.61 [3.89]	-5.15	-5.14
lnPIT	10.23 [2.58]	0.54 [2.06]	-5.61	-5.61	lnLAB	15.42 [3.87]	1.29 [8.06]	-5.55	-5.56
lnCIT	-5.11 [-2.79]	3.34 [6.63]	-5.17	-5.17	lnIND	-3.29 [-16.16]	0.27 [34.03]	-4.48	-4.49
lnGST	-3.11 [-2.70]	0.80 [7.08]	-6.30	-6.27	lnCONS	2.70 [5.41]	0.87 [44.64]	-5.42	-5.42

Table 5D14: Indonesia

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | | |
| | C | ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | | |
			ADF	PP				ADF	PP
lnITT	19.94 [13.01]	-0.95 [-25.54]	-5.65	-5.65	lnMER	-1.42 [-2.76]	0.21 [3.01]	-5.33	-5.33
lnPIT	6.02 [2.35]	0.80 [2.94]	-5.39	-5.39	lnLAB	-35.44 [-2.65]	2.10 [3.40]	-6.67	-6.69
lnCIT	19.55 [2.27]	-2.47 [-2.49]	-8.78	-8.83	lnIND	-3.74 [-4.03]	0.16 [4.44]	-5.94	-5.94
lnGST	-15.02 [-3.25]	1.50 [8.05]	-5.01	-4.99	lnCONS	-2.61 [-2.96]	2.08 [4.15]	-5.27	-5.28

Table 5D15: Malaysia

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | | |
| | C | ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | | |
			ADF	PP				ADF	PP
lnITT	17.99 [4.92]	-0.68 [-6.95]	-5.84	-5.84	lnMER	-8.43 [-7.63]	0.53 [12.05]	-6.12	-6.12
lnPIT	9.57 [3.65]	0.55 [4.37]	-6.57	-6.61	lnLAB	13.28 [8.45]	0.37 [5.63]	-6.35	-6.35
lnCIT	19.85 [7.21]	0.77 [2.60]	-5.64	-5.64	lnIND	-4.36 [-5.36]	1.70 [5.15]	-5.71	-5.71
lnGST	-11.29 [-4.22]	0.92 [8.24]	-5.46	-5.46	lnCONS	2.11 [3.90]	0.88 [4.04]	-5.45	-5.45

Table 5D16: Philippines

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | | |
| | C | ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | | |
			ADF	PP				ADF	PP
lnITT	24.00 [10.84]	1.89 [3.55]	-6.41	-6.41	lnMER	-21.03 [-2.60]	1.01 [2.27]	-6.50	-6.48
lnPIT	7.80 [2.55]	1.65 [5.76]	-5.45	-5.46	lnLAB	-12.62 [-3.30]	1.35 [2.57]	-5.54	-5.54
lnCIT	-30.71 [-7.79]	2.51 [2.21]	-6.61	-6.58	lnIND	-9.45 [-7.05]	0.51 [5.15]	-5.55	-5.57
lnGST	-8.56 [-2.84]	1.23 [4.32]	-5.52	-5.52	lnCONS	-1.87 [-2.73]	1.33 [2.19]	-6.12	-6.15

Cointegration test for variables used for the Decomposition of tax buoyancy; Pre-AFTA period (1972-1991)

For Pre-AFTA period (1972-1991), the critical values for both the ADF and the PP tests are as follows; 90% critical value is -1.61, 95% critical value is -1.96, and 99% critical value is -2.70.

Table 5D17: Thailand

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | |
| | C | ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP				ADF	PP
lnITT	14.64 [10.41]	1.78 [6.09]	-5.02	-5.01	lnMER	-6.70 [-2.56]	0.43 [4.06]	-4.54	-4.48
lnPIT	3.39 [3.87]	0.30 [2.08]	-3.99	-3.99	lnLAB	14.27 [2.93]	1.34 [6.92]	-3.64	-3.64
lnCIT	6.46 [2.45]	1.53 [8.74]	-4.60	-4.52	lnIND	-3.69 [-9.28]	0.29 [18.10]	-4.57	-4.57
lnGST	-6.55 [-5.02]	0.20 [5.92]	-3.95	-3.96	lnCONS	2.73 [6.20]	0.97 [17.23]	-4.59	-5.00

Table 5D18: Indonesia

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | |
| | C | ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP				ADF	PP
lnITT	17.11 [7.88]	-1.30 [-2.15]	-4.51	-4.51	lnMER	1.53 [2.48]	0.08 [2.34]	-3.48	-3.46
lnPIT	41.64 [11.92]	0.92 [6.29]	-4.06	-4.05	lnLAB	68.32 [18.04]	0.78 [11.66]	-4.39	-4.39
lnCIT	14.51 [3.67]	-2.05 [-2.52]	-5.13	-5.13	lnIND	-3.09 [-2.23]	0.10 [2.16]	-4.97	-4.97
lnGST	-11.99 [-2.73]	0.37 [8.58]	-4.02	-4.02	lnCONS	-2.25 [-3.10]	1.06 [9.74]	-3.95	-3.95

Table 5D19: Malaysia

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | |
| | C | Ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP				ADF	PP
lnITT	17.50 [6.12]	0.41 [2.83]	-3.35	-3.35	lnMER	-25.67 [-3.91]	1.23 [4.77]	-5.82	-5.84
lnPIT	-15.23 [-2.50]	1.62 [5.92]	-3.84	-3.84	lnLAB	12.55 [4.24]	0.40 [3.26]	-4.22	-4.26
lnCIT	14.57 [3.61]	0.66 [3.38]	-4.17	-4.18	lnIND	15.48 [2.09]	0.67 [2.78]	-5.79	-5.74
lnGST	-5.33 [-2.71]	1.14 [13.68]	-4.04	-4.04	lnCONS	2.32 [2.38]	0.88 [21.60]	-4.13	-4.13

Table 5D20: Philippines

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | |
| | C | ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP				ADF	PP
lnITT	13.48 [2.31]	2.08 [3.53]	-3.81	-3.81	lnMER	-1.46 [-3.64]	1.01 [3.54]	-4.21	-4.21
lnPIT	9.53 [3.01]	1.50 [4.38]	-3.79	-3.79	lnLAB	-18.21 [-5.25]	1.05 [3.52]	-3.78	-3.78
lnCIT	-31.83 [-4.26]	2.25 [2.19]	-3.82	-3.82	lnIND	-3.15 [-3.77]	1.51 [10.61]	-3.82	-3.84
lnGST	-10.64 [-5.59]	1.32 [2.72]	-4.16	-4.16	lnCONS	-1.61 [-8.18]	1.40 [2.60]	-4.54	-4.51

Cointegration test for variables used for the Decomposition of tax buoyancy; Post-AFTA period (1992-2006)

For Post-AFTA period (1992-2006), the critical values for both the ADF and the PP tests are as follows; 90% critical value is -1.60, 95% critical value is -1.97, and 99% critical value is -2.74.

Table 5D21: Thailand

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | |
| | C | ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP				ADF	PP
lnITT	25.50 [15.41]	-0.83 [-2.23]	-4.12	-4.10	lnMER	20.61 [2.47]	1.41 [7.54]	-4.63	-4.68
lnPIT	6.52 [2.03]	0.96 [6.77]	-4.24	-4.29	lnLAB	20.98 [3.25]	1.01 [2.28]	-4.61	-4.61
lnCIT	8.45 [2.23]	3.72 [2.04]	-3.75	-3.75	lnIND	-2.85 [-2.58]	0.26 [5.97]	-3.41	-3.44
lnGST	-3.01 [-15.46]	1.83 [2.30]	-4.21	-4.23	lnCONS	4.26 [12.54]	0.81 [5.81]	-4.41	-4.48

Table 5D22: Indonesia

| Tax | Tax-to-Base | | | | Base | Base-to-Income | | | |
| | C | ln of Tax Base | Unit Root Test for Residual | | | C | lnGDP | Unit Root Test for Residual | |
			ADF	PP				ADF	PP
lnITT	20.36 [14.89]	0.15 [4.17]	-2.83	-2.82	lnMER	58.98 [2.30]	2.11 [3.67]	-3.73	-3.75
lnPIT	3.83 [2.23]	0.85 [3.15]	-3.98	-3.92	lnLAB	-61.18 [-2.82]	3.17 [3.73]	-4.34	-4.28
lnCIT	36.79 [3.27]	-3.78 [-4.17]	-4.17	-4.15	lnIND	-3.52 [-2.28]	0.28 [2.88]	-3.60	-3.60
lnGST	-3.58 [-5.65]	2.12 [4.96]	-2.94	-2.91	lnCONS	9.66 [7.79]	2.61 [2.50]	-5.91	-5.89

Table 5D23: Malaysia

Tax	Tax-to-Base				Base	Base-to-Income			
	C	Ln of Tax Base	Unit Root Test for Residual			C	lnGDP	Unit Root Test for Residual	
			ADF	PP				ADF	PP
lnITT	26.98 [5.09]	-1.11 [-10.81]	-3.44	-3.43	lnMER	-5.76 [-3.24]	0.43 [6.14]	-3.15	-3.15
lnPIT	8.21 [2.39]	0.60 [3.89]	-4.49	-4.49	lnLAB	-13.19 [-2.09]	1.48 [3.19]	-3.58	-3.58
lnCIT	34.30 [2.24]	0.96 [3.27]	-3.66	-3.66	lnIND	-5.24 [-4.46]	1.87 [3.45]	-4.09	-4.11
lnGST	16.06 [4.35]	0.26 [2.70]	-3.94	-3.97	lnCONS	-6.16 [-3.38]	1.21 [16.77]	-3.45	-3.44

Table 5D24: Philippines

Tax	Tax-to-Base				Base	Base-to-Income			
	C	ln of Tax Base	Unit Root Test for Residual			C	lnGDP	Unit Root Test for Residual	
			ADF	PP				ADF	PP
lnITT	31.71 [9.09]	0.62 [8.45]	-3.85	-3.85	lnMER	14.82 [2.05]	0.93 [2.90]	-4.81	-4.86
lnPIT	12.56 [2.16]	1.80 [5.05]	-3.36	-3.36	lnLAB	-30.13 [-6.14]	1.31 [6.70]	-3.59	-3.59
lnCIT	-30.89 [-4.06]	2.58 [2.22]	-3.23	-3.23	lnIND	-3.69 [-3.66]	0.41 [10.27]	-4.17	-4.17
lnGST	9.32 [2.03]	0.51 [2.62]	-3.17	-3.18	lnCONS	-8.83 [-3.97]	0.72 [3.44]	-4.53	-4.47

Chapter 6

GENERAL CONCLUSION

6.1. Summary and Conclusions

As a growth strategy, trade liberalization has been encouraged by most countries around the world for over two decades. It has also been formally introduced into Thailand when it became an AFTA member in 1992 and a WTO member in 1995. This thesis has examined the relationships between the special features of trade liberalization and revenue performance of countries with different levels of development. The study has also provided in-depth analysis of how trade liberalization affects trade and tax productivity of Thailand at the aggregate level. This concluding chapter highlights the main results found in this thesis, offers some general conclusions, draws policy implications, and suggests some areas for future research.

6.1.1. Qualifications

Before we summarize the main findings of this thesis, it is important to clarify its boundaries and specify some qualifications. In the estimation of the short-run and long-run elasticities by using Thailand's import and export demand functions (Chapter 3), relative import and export prices, which are used for calculating import and export price elasticities, are based on unit-value indices. The use of these unit-value indices are subject to well-recognized bias. Since unit-value indices are derived from customs data, which measure the change in price or volume of an aggregate over different items, or items of different quality, changes in the mix of the heterogeneous items mainly cause bias in unit-value indices. The bias is also caused by the poor quality of recorded data on quantities. As mentioned in many previous studies, such bias possibly lowers the estimates of import and export price elasticities.

In examining the effect of trade liberalization on taxation of countries with different level of development (Chapter 4), a new measure of trade liberalization has been introduced by applying the summation of the number of agreements which country entries into force. However, types of agreements may take many forms such as custom unions, preferential arrangement, service agreement, and free trade agreement. Effects on taxation may vary greatly in detail of liberalization, and hence the conclusion of those results should be considered with care that all types of trade liberalization are not harmful to taxation since they differ in their detail.

In investigating the responsiveness of the tax system (Chapter 5), non-availability of required data have limited the extent of the analysis performed, especially for the quality of tax-related data and data for discretionary and non-discretionary tax changes. Also, the ability to assess accurately the productivity of some tax sources requires more reliable tax base data, i.e. data on company profits.

Another concern is on the use of a partial equilibrium analysis. A partial equilibrium approach has been adopted in all chapters in order to investigate trade and tax performance under a liberalization policy. Therefore, some aspects of interactions between government policy toward trade liberalization and trade and tax reactions, as well as revenue consequences, may not be fully captured in our models.

6.1.2. The Main Findings

Since this study aims to investigate whether trade liberalization has a dual impact on the trade balance and fiscal balance, Chapter 3 starts by proposing import and export demand functions to assess empirically the major determinants of imports and exports of Thailand, as an example of a developing country. Then, the study adds liberalization factors to the classical formulation of the import and export demand

functions in order to ascertain the impact of trade liberalization on the volume of imports and exports in both short run and long run. From the results, we have found that the aggregate import volume is cointegrated with Thailand's GDP, Thailand's relative import price, and Thailand's average tariff rate, while the aggregate export volume is cointegrated with world's GDP, Thailand's relative export price, and world's average tariff rate. Thus, a long-run equilibrium relationship could be established among variables of our interest. Results of the estimated dynamic specification of the functions also present their short-run relationship. In the estimation of coefficients, it is found that, for Thailand's imports, Thailand's import demand is largely explained by domestic GDP. As domestic income increases, Thailand imports expand more than proportionately. The short-run income elasticity is much larger than the long-run elasticity, suggesting that income change has a potentially comtemporaneous effect on change in the volume of imports. However, prices seem to have very little effect on imports. The price elasticity does not appear to be significant in the short run, though it is significant in the long run but the estimated value is a rather low. The result that prices seem to have very little effect on imports reflects the nature of the import pattern in the country. Thailand is highly dependent on the imports of raw materials, intermediate goods, and capital goods such as mineral and metal products, chemicals and plastic materials, electronic parts, and industrial machinery, industrial tools and parts, which are required in most of the production processes (also the production for exports), rather than consumer goods and a substitution for domestic production.

For Thailand's exports, the result seems to be very similar since Thailand's export demand is largely dependent on world GDP, rather than on relative export price. However, the long-run income elasticity of demand for exports is quite high, while

the short-run income elasticity of demand for exports is rather low, suggesting that the income impact seems to be larger in the long run than in the short run. The result that the impact of change in domestic GDP on imports seems to overwhelm the impact of change in the world's GDP on exports in the short run, raises concern about the problem in trade balance in the short run.

The impact of trade liberalization on trade volume is also analyzed by introducing two measures of liberalization; average tariff rates and trade liberalization dummy. Considering average tariff rates, for import demand, it is found that the effect of a change in Thailand's average tariff rates on the volume of imports is negative, with the short-run elasticity being a little larger than that in the long run. By contrast, although the effect of change in World's average tariff rates on the volume of exports is also found to be negative, the impact is much larger in the long-run. In addition, the impact of the reduction of average tariff rates is much higher on export demand than on import demand. This suggests that the reduction of overall average tariff rates (including those of Thailand) seems to increase both imports and exports, with the impact on exports larger than on imports. Thus, it can be inferred that trade liberalization by tariff reduction is beneficial for Thailand. However, the coefficient on the trade liberalization dummy appears to be insignificant for both import and export demands.

These results indicate that, for Thailand, trade liberalization does not lead to the deterioration in the trade balance. Instead, it helps improve Thailand's export performance. Although trade liberalization in the form of tariff reduction is associated with an increase in imports, it leads to the expansion of exports in higher proportion. However, a trade deficit may still occur in the short run and it will lead to further current account problems. This is because of the very high short-run income elasticity

of demand for imports. For Thailand, the short-term trade deficit is hard to avoid since the problem is rooted in its trade structure rather than from its trade policies. However, in the long run, Thailand is likely to gain more from freer trade, partly as a contribution from the liberalization policy. The problem of trade balance, and thus current account problem, should also be improved in longer term.

Although trade liberalization is not found to be associated with the problem of the trade deficit, the problem of fiscal deficit may still persist since it is widely accepted that trade liberalization potentially leads to a substantial reduction of tariff revenue. A reduction of the tariff, even though it may be partially offset by an increase in the volume of trade transaction, often leads to a loss in the country's tax revenue and consequently threatens the fiscal balance. In order to deal with the fiscal imbalance problem, governments have to implement domestic tax reform at the same time as trade is liberalized. Fiscal reform is normally done by raising the revenues from domestic taxes, especially the broad-based consumption tax, to mitigate the highly possible loss of international trade tax, as a result of such liberalization as tariffs reduction. However, fiscal reform is not always successful, especially for most of the less developed and developing countries. While tax structures of developed economies are very similar to a certain extent, tax structures of less developed and developing economies vary widely. The restrictions of these countries may be due to the low level of economic and social development, the political instability, the constrained institutional capacities, and the limitation of a country's geography. Fiscal problem is worsened if trade liberalization has passed any negative impact on to tax revenues. Therefore, Chapter 4 is dedicated to examine the effect of trade liberalization on both international trade and domestic taxes, by applying tax effort model and employing a two-way fixed effect approach. Besides the study of a full

sample of 134 countries, the study categorizes countries into four groups; low income, lower-middle income, upper-middle income, and high income countries, depending on their level of income. In the full sample, the results indicate that the level of economic development is the most important determinant of overall tax revenues. It appears that when countries grow, they tend to lower their dependency on such an easy-to-collect tax as international trade tax and collect more revenues from more complicated domestic taxes. The results are in line with many other studies.[40] High income countries tend to have a relatively high level of development and thus, are usually associated with higher capacity of taxpayers to pay taxes as well as a greater capacity of governments to collect taxes. High income countries also tend to have a higher degree of monetization of the economy and better tax administration. As a consequence, high income countries tend to have higher capacity to collect revenues from hard-to-collect or complicated taxes such as the goods and services tax and corporate income tax. By contrast, low and middle income countries normally lack capacity of tax administration, which finally results in the high dependence on easy-to-collect tax such as international trade tax.

In order to investigate the impact of trade liberalization, Chapter 4 introduces three different measures of trade liberalization including openness, average tariff rates and the number of free trade agreements. Considering trade openness, the results show that the degree of international trade has significantly affected all major taxes in low and middle income countries. The results suggest that an increase in total tax revenues as a result of an increase in the proportion of international trade in GDP strongly supports the hypothesis that tax revenues of low income and most of middle income countries have a high dependency on trading with other nations. The more these

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[40] See Agbeyegbe et al. (2004) for example

countries open themselves to trade with the world, the more the benefits they have for taxation. For countries at every level of development, openness is found to be positively related to international trade and goods and services taxes. Openness possibly is a stimulus to higher volumes of trade between countries and consequently increases international trade tax receipts at the current level of tariff rate. The contribution of trade openness toward goods and services tax is possibly by spurring flows of goods within the country. The results also show that openness to international trade helps stimulate the collection of personal income taxes in low and middle income countries, possibly by stimulating growth which in turn, increasing employment and the wage level. It is notable that while trade openness increases revenues from each tax in very similar proportion for low and lower-middle income countries, it increases revenue from corporate income tax for upper-middle and high income countries in an outstanding proportion. This result suggests that openness may be linked with higher corporate profits. It is possible that firms in developed economies have a higher capability to make profits from international trade than firms in less developed and developing countries. Although overall results suggest that trade openness has a contribution to taxation in all countries, the degree of its benefit is still dependent upon the country's level of economic development and economic structure.

Considering the second measure of trade liberalization, average tariff rates, this measure is introduced into our analysis in order to investigate the impact of tariff reduction on international trade tax since it is suggested that the initial tariff levels, their coverage, and the extent to which they are reduced, play a significant role in determining the impact on international trade tax revenue. If the initial tariff rates are high, tariff reduction may lead to an increase in international trade tax revenue. This effect can be illustrated by a Laffer curve, which demonstrates the relationship

between international trade tax revenue and tariff rates. When the initial tariff rate is prohibitively high, trade volumes are likely to be severely limited and international trade tax revenue will be very low. Reducing a tariff will decrease an incentive of tax evasion and will lead to a substantial increase in trade volumes. These combination effects will more than compensate the lower tariff rates and hence result in higher tariff revenue. However, a further reduction to a tariff lower than the revenue maximizing rate will result in the loss of international trade tax revenue since the increase in trade volumes will not be large enough to offset the lower tariffs. The results show that there exists a Laffer effect on international trade tax in low and middle income countries. The revenue-maximizing tariff rate of international trade taxation of low income countries is estimated to be approximately 43% while, from average tariff rates data, the peak was at 44.2% in 1983 and 43.2% in 1991. Thus, it is clear that the effective rate of tariff has already been reduced below this rate in all low income countries. A potential Laffer effect also exists for the international trade tax in middle income countries and the revenue-maximizing rate is estimated to be 25%. However, the highest average tariff rate of middle income countries was 32% in 1983, and thus again, the revenue-maximizing rate is higher than the actual rate. Since the actual tariffs are below the revenue-maximizing rate for both low income and middle income countries, the results illustrate that a further reduction of tariff levels could actually decrease international trade tax revenue in these countries. This implies that trade liberalization in the form of tariff reduction is considerably harmful to countries where international trade tax is accounted for a high proportion of their tax revenues. The results suggest that the reduction of average tariff rates in high income countries does not have a significant impact on their international trade tax, though Laffer effect possibly occurs.

The last measure of trade liberalization included in the study of Chapter 4 is the summation of the number of agreements which a country has in force. Types of agreements include custom unions, preferential arrangement, service agreement, and free trade agreement. The results show that trade liberalization in the form of free trade agreements is associated with the decrease in the international trade tax revenue in all countries, especially those with low and middle income. It is also found that the impact of trade liberalization in the form of free trade agreements on domestic taxes differs according to the level of economic development. While free trade agreements have a strong negative impact on all kind of domestic taxes in low and middle income countries, they seem to have a contribution to domestic taxation in high income countries. The results raise issues concerning agreements which are signed between developed and less developed countries. Generally, many less developed countries are afraid of joining any agreement with developed countries because most parts of their economic sector are not well prepared for freer and higher competition, while developed countries, which usually initiate such agreements, are believed to have a higher ability to take advantages from those agreements. However, many less developed and developing countries are usually forced by developed countries to sign trade agreement even though such an agreement is disadvantageous, in exchange for avoiding non-trade barriers used by developed countries (e.g. environmental concerns or intellectual properties). The fear of trade liberalization in less developed and developing countries is in line with evidence and studies which suggest that freer trade may potentially lead to the fall in domestic corporate profits, job losses, or even business shutdown. The negative impact of FTAs on domestic tax revenues may or may not result from evidence suggested above. However, the results from Chapter 4 do suggest that the problem of domestic taxation to be faced in taking forward free

trade agreements in low and middle income countries is a real one. By contrast, most FTAs give privilege and opportunities for developed economies to enter new markets in less developed countries, and hence leading to higher profit for companies, especially those related to international trade, in developed countries. From the results, it can be concluded that trade liberalization in terms of the number of agreements which a country signs may be harmful to taxation in less developed and developing countries but may be beneficial to taxation in developed countries.

The results from Chapter 4 suggest that tax reform in less developed and developing countries recommended by economic theory and international experience by moving away from international trade taxation and compensating the loss of international trade tax by utilizing other domestic sources, such as income and consumption taxes, may be inapplicable since their domestic taxes may also severely suffer from trade liberalization, not to mention the difficulties in improving domestic tax administration which requires reorganizing along functional lines, modernizing procedures, computerizing systems, and training people. However, domestic tax reform is still necessary since it is one of a few instruments for raising revenues to mitigate the loss of an international trade tax. Generally, tax reform is implemented at the same time as trade liberalization as an important mechanism for raising tax yield because a government realizes that the loss of revenue from an international trade tax may potentially cause further fiscal problems. Tax reform always includes restructuring a country's tax system, for example, by strengthening tax administration, establishing tax monitoring units, improving audit practices, and computerizing tax system. Following these reforms, improving tax administration could reduce tax evasion and consequently enhance fiscal revenue. In general, tax productivity should be improved after the country reformed its tax system. However, trade liberalization makes the

consequences of the reform of the overall tax system ambiguous since it has various impacts on a country's tax bases. Chapter 5 applies the concept of tax buoyancy and tax elasticity in order to evaluate the ability of country's tax system to mobilize its revenue since the performance of the tax system crucially depends on tax bases and tax administration.

In Chapter 5, tax buoyancy and tax elasticity are used as measures of revenue productivity of the tax system to determine whether the responsiveness of tax revenues is high or low in Thailand relative to three other founding countries of the ASEAN Free Trade Area (Indonesia, Malaysia, and Philippines). All of these countries are categorized as developing countries or middle income countries so the negative impact of trade liberalization found in previous chapters may exist, and the impact on their revenue performance is worth investigated. The aim of Chapter 5 is to estimate tax buoyancy and tax elasticity of Thailand's tax system, compared to those of its three neighbouring countries. The evaluation is done to measure the response of the tax system to trade liberalization by AFTA in 1992. Tax buoyancy and elasticity are estimated in order to address the question of whether Thailand's major trade liberalization by becoming an AFTA member results in the enhancement of the flexibility of the tax system. Tax buoyancy is also decomposed to obtain the buoyancy of tax revenue with respect to its tax base and the buoyancy of tax base with respect to income. The decomposition of buoyancy into tax-to-base and base-to-income is very useful for policy analysis since it tells us which component of growth that is amenable to policy manipulation. It also tells us which components of the tax structure have been the most responsive or most rigid and which parts of tax system should be improved.

The results reveal that the tax system of Thailand and Philippines as a whole is buoyant and elastic, while the tax system of Indonesia and Malaysia is not. The buoyancy of Thailand's and the Philippines tax system is mainly due to the high buoyancy of corporate income taxes. By contrast, the rigidity of Indonesia's tax system is primarily caused by the inflexibility of corporate income tax, while the rigidity of Malaysia's tax system is due to the inflexibility of all tax sources. Tax buoyancy of pre- and post-AFTA indicates that Thailand and Malaysia have experienced a decline in tax performance, whereas Indonesia and the Philippines have experienced an increase in tax performance during the liberalization period. The analysis of tax buoyancy of pre- and post-AFTA period are in line with the analysis of tax elasticity.

Considering Thailand's tax system, the decomposition of tax buoyancy shows that the high buoyancy of its tax system is particularly due to the high tax-to-base buoyancy of corporate income tax, especially in the post-AFTA period. An increase in tax-to-base buoyancy can be inferred that the performance of corporate income tax collection has been substantially improved. This is because recently Thailand concentrated more on large companies that have high a potential to pay a large amount of tax, i.e. by setting up a large tax office which primarily focuses on auditing these large businesses. However, Thailand has experienced a decline in base-to-income buoyancy during the post-AFTA period. A decline in base-to-income buoyancy can be inferred that trade liberalization may harm the ability of domestic companies to make a profit. This result is in line with that presented in previous chapters where trade liberalization may deteriorate the corporate tax base of low and middle income countries. Fortunately, in the case of Thailand, corporate tax administration has been largely improved so it does not result in the decline of corporate tax revenue.

Similarly, an increase in buoyancy of personal income tax is a contribution to an improvement in tax administration and tax collection rather than an expansion of its base in the post-liberalization period. This is because in the past decade, there is a large improvement in the technology system that help both tax authorities to calculate easily individual income tax and employers to withhold the correct amount from their employees. This technology advance is particularly helpful since it correctly withholds tax at source, and hence substantially reduces tax evasion. Like corporate income tax, the result shows that base-to-income buoyancy of a personal income tax faces a decline during post-liberalization period, suggesting that Thailand's trade liberalization may be associated with such negative impacts on the personal income tax base as job losses, unemployment, or wage cut. This result is also in line with the result presented in the previous chapter that there is possibility that trade liberalization will be harmful to personal income tax in less developed and developing countries.

The results show that the international trade tax is not buoyant over the whole period of study. The rigidity of this tax source is mainly due to a substantial decline in tax buoyancy in the liberalization period. The decline in tax buoyancy in the post-AFTA period is a result of a large decline in tax-to-base buoyancy, not from base-to-income buoyancy since the results show that there is a large increase in international trade tax base during this period. The result is in line with the study in Chapter 3 which shows that trade liberalization helps stimulate the trade performance of Thailand. It leads to an increase in both imports and exports, though not at the same proportion. This result suggests that the effect of tariff reduction and the reduction in other related trade tax rates overwhelms an increase in trade volume, and hence results in the reduction of international trade tax revenue.

The results also show that the goods and services tax is not buoyant in both the pre- and post-liberalization period. The rigidity of the goods and services tax is mainly due to low tax-to-base buoyancy in the pre-AFTA period and low base-to-income in the post-AFTA period. Although tax buoyancy of the goods and services tax is quite rigid over the whole period of study, the results show that this tax source has a significant improvement in tax administration and tax collection as its tax-to-base index substantially increases in the post-liberalization period. This is mainly due to VAT introduction in the context of domestic tax reform as a result of liberalization. The introduction of VAT as a replacement for a business tax makes the tax system simpler and reduces avenues for evasion and corruption since it reduces the exemptions and shifts the system away from multiple business tax rates to a single VAT rate. However, it is found that base-to-income buoyancy of goods and services tax is lower than unity and decreasing considerably from the pre-AFTA period. Referring to the results from previous chapters, trade liberalization may be harmful to the goods and services tax in low and middle income countries. In the case of Thailand, trade liberalization may be related to the deterioration of goods and services tax base since the lower value of base-to-income buoyancy points in this direction. This may be due to slower growth of private consumption during post-liberalization period. However, the certain effect of trade liberalization on the goods and services tax base is somewhat complicated and further analysis is needed to indicate its precise impact.

In conclusion, in the case of Thailand, it is found that although tax administration has been improved for all individual taxes, most of the tax bases have deteriorated during the post-liberalization period. As a consequence, overall tax revenue cannot be raised to the expected level. However, the deterioration in many domestic tax bases is beyond the control of tax authorities. Tax authorities have very few options for

improving tax bases since this is a macroeconomic problem outside the control of tax authority. The results give a warning to the government that it must be very careful in proceeding macroeconomic policy because the contraction of the domestic tax bases causes the failure in revenue substitution from international trade tax to domestic taxes and also causes further problem in revenue mobilization in the future.

The main contribution of this thesis to the literature is quite significant in three aspects. First, it represents an attempt to explore the relationship between the current policy towards trade liberalization and trade and revenue performance. It contributes to the growing literature not only by considering trade effects of trade liberalization, but also by providing empirical analysis of tax revenue effects, in which trade liberalization may have a different impact when implemented on countries with different level of development. In addition, it contributes to the study of tax revenue productivity as a result of tax reform which is implemented in cooperation with trade liberalization policy.

Second, this study is the first attempt to examine the relationship between imports, exports, income, relative prices, and average tariff rates in Thailand by using import and export demand functions within the cointegration and the ECM framework. This study provides important insights on how trade liberalization affects trade performance of a developing economy.

Third, buoyancy and elasticity concepts are initially employed for Thailand's tax system, since it is crucial to investigate the productivity of the overall tax system before and after trade is liberalized in order to detect changes in revenue productivity and examine which parts of the tax system have experienced an improvement or rigidity as a consequence of trade liberalization. The findings from the study generate

important policy implications which do not appear from the analysis using other approaches.

6.2. Clarifications and Conclusions Derived from the Econometrics

6.2.1. The Impact of Trade Liberalization on the Tariff Structure of Thailand

As in other developing countries, Thailand has implemented both tariff and quantitative restrictions as trade policy instruments, but historically, there has been greater reliance on tariffs rather than quantitative restrictions. However, Thailand has made significant progress in trade liberalization over the past three decades. Since the 1980s, the Thai Government has been significantly shifting its trade policy in order to promote more efficient industrial development, reduce protectionism and improve the overall tariff structure. Part of Thailand's structural adjustment has been progression of import tariff adjustments, aimed at reductions in compliance with ASEAN Free Trade Area (AFTA) and the World Trade Organization (WTO) principles. As a result, Thailand does not prohibit imports in any category and continues to liberalize its trade accordingly.

Tariff restructuring has received renewed emphasis as an essential part of overall economic reforms aimed at strengthening efficiency and competitiveness. From 1985 to 1995, import custom duty rates have been changed several times in line with economic considerations and government policy. Before 1 January 1995, the tariff for imported goods was relatively high using up to 39 rates from 0-100 percent with an average percentage of 31.15. On 1 January 1995, the government reduced import tariff rates to only 6 bands (excluding motor vehicles) as follows;

- 0 percent: exempted duty goods, including instruments and appliances used in dental, medical, surgical or veterinary sciences

- 1 percent: raw materials

- 5 percent: primary and fundamental products

- 10 percent: secondary products

- 20 percent: finished products

- 30 percent: special protection products

In mid-1997, the reform process was temporarily interrupted by the financial crisis. Tariffs on a number of luxury imports were temporarily raised in 1997 to increase tax revenue in order to meet the budget surplus of one percent of GDP agreed to with the International Monetary Fund (IMF) in late 1997. Table 6.1 provides selected items that had tariff rate cuts between 2002 and 2005 according to the magnitude of the cuts. Changes in tariff rates between 2006 and 2008 are minor, compared to the 2005 tariff structure. All in all, over the past three decades, there have been significant reductions in nominal tariff rates. Currently, the average import tariff rates is approximately 10 percent in 2009.

Table 6.1: Average Tariff of Top 10 Items Under Tariff Restructuring in Thailand, 2002 - 2005

	Average Tariff Rates				Tariff Difference 2000 -2005
	2002	2003	2004	2005	
Rubber	23.3	23.3	15.0	8.6	14.7
Glass and Glassware	18.0	10.1	10.1	10.1	7.9
Knitted Fabrics	20.0	20.0	12.5	5.0	15.0
Base Metals	9.4	3.2	2.5	2.5	6.9
Woven Fabrics, Lace, etc.	20.0	20.0	13.2	6.1	13.9
Man-Made Staple Fibre	15.9	15.9	9.4	4.8	11.1
Wadding Yarns	17.7	17.7	11.4	6.1	11.5
Cotton Miscellaneous	15.5	15.5	9.2	4.8	10.7
Silk	14.9	14.9	8.9	5.1	9.8
Metals	19.1	13.6	13.6	10.1	9.0

Source: The Custom Department, Minister of Finance.

At the sectoral level, industries producing intermediate goods (such as chemicals, fertilizer, construction material, and metal products) have relatively low rate of tariff protection. By contrast, final-goods producing sectors (such as food and drinks, pharmaceuticals, and garments), with the exception of non-electrical machinery and electrical machinery and equipment, have relatively high rates of protection. In addition, tariff rates are generally higher for manufacturing, compared with agriculture and other primary product sectors. This is indicated in Table 6.2 by the fact that the average applied tariff rates (without the various exemptions) for the manufacturing sector were higher than those for the overall economy between 1980 and 2003. This is consistent with patterns observed in other developing countries and reflects the belief in industrialization as the path to economic growth.

Table 6.2: Nominal and Effective Rates of Protection in Thailand 1908-2003 (percent)

	Rates of Protection							
	1980		1985		2002		2003	
	NRP	ERP	NRP	ERP	NRP	ERP	NRP	ERP
Process Foods	34.4	58.1	30.9	135.2	22.7	37.4	20.3	32.4
Textile Products	41.0	74.5	27.8	118.4	18.9	36.4	18.6	36.2
Leather and Footwear Products	54.1	87.8	26.8	152.7	18.8	20.8	18.5	23.8
Wood Products	31.6	65.4	28.2	62.0	13.7	26.6	13.5	26.9
Paper and Pulp	24.0	20.4	17.8	53.5	14.4	47.8	10.5	32.2
Chemical and Petroleum Products	32.8	43.0	21.4	44.5	9.4	16.7	8.4	14.2
Rubber Products	29.1	42.1	26.8	42.0	23.2	58.5	23.2	58.8
Other Non-Metal Products	36.7	72.1	23.0	108.5	15.0	32.8	10.0	19.3
Metal Products	25.2	35.6	16.6	70.9	13.2	25.1	10.7	20.0
Machinery	22.4	27.1	14.3	29.3	6.2	-0.5	6.2	0.9
Consumer Goods and Motor Vehicles	31.2	48.4	19.7	45.6	11.4	18.8	10.6	19.8
Total Manufacturing	32.9	51.7	23.8	78.4	16.4	27.8	15.4	24.4

Note: NRP = Nominal Rates of Protection, ERP = Effective Rates of Protection
Source: The Custom Department, Minister of Finance.

As a consequence of the cascading tariff structure, nominal protection does not provide a precise picture of protection in a particular industry. Since the protection of a domestic industry depends not only on the tariff rate on its competitive import, but also on the tariffs paid on its intermediate inputs, the concept of effective rates of protection have been proposed because it depends not only on the tariff rate applicable to that sector, but also on tariffs of all other sectors which provide production input (intermediate and capital goods) to that sector.

From Table 6.2, a broad comparison provides useful information in understanding the evolution of the protection structure in Thailand. Two major inferences can be drawn. First, from 1980 to 2003, the estimates of effective rates of protection presented a downward trend in all industries. The average ERP in the manufacturing fell from 51.7% in 1980 to 27.8% and 24.4% in 2002 and 2003, respectively. Second, the pattern of ERP estimates across industries did not change significantly between 1980 and 2003. As a consequence of the cascading tariff structure, ERP estimates for finished goods such as agro-processing products, textiles, and leather products are likely to be higher than those for intermediate products (e.g. chemical and petroleum products, machinery, and metal products). Generally, in Thailand, protection tends to be granted to industries that have high level of industry concentration and are experiencing increased import competition. The relatively open foreign investment policy regime in Thailand means that the government is more responsive to requests made by foreign investors, including requests for tariff cuts. The decision to grant protection to Thai industries is justified by the ability of industries to generate employment and income to the country.

6.2.2. The Composition of Thailand GDP

From 2000, Thailand's economy has grown steadily by approximately 8 percent. There is a wide base for growth, with each sector contributing to the development of the country. Starting from an agrarian economy, Thailand has gradually changed for industrialization which strengthens its industry sector, while the boom in the tourism industry since the past decade has strengthened the service sector. Nowadays, manufacturing and tourism are the two largest contributors to GDP.

Agriculture has been the traditional backbone of the country, since Thailand is ranked among the top five producers of food in the world. It is also the world's largest supplier of rice and flowers, particularly orchids, which it exports mainly to Japan and Europe. In addition, it is the world's largest producer of rubber and continues to be the leading exporter of tapioca and frozen shrimp. Despite its output, the agricultural sector is on the decline, and is slowly being overtaken by the industry and service sectors in terms of contribution to GDP. As shown in Table 6.3, in 2008, agricultural sector was accounted for only 11.64 percent of GDP, whereas non-agricultural sectors were accounted for 88.36 percent of GDP.

With the re-orientation of production from import substitution to export promotion, the country has been driven toward industrialization and the manufacturing industry has grown steadily until it exceeded agriculture in terms of contribution to GDP. The country's first step into manufacturing was food processing, which effectively built on its strong agricultural sector. Nowadays, it is the world's largest exporter of canned pineapple, canned tuna, computer and computer appliances, and electrical parts.

Table 6.3: Thailand GDP by Sector, 2000 - 2008 (percent)

	Year								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Agriculture	**9.02**	**9.13**	**9.43**	**10.41**	**10.31**	**10.33**	**10.74**	**10.68**	**11.64**
Agriculture, Hunting and Forestry	6.63	6.97	7.46	8.56	8.66	8.79	9.29	9.48	10.48
Fishing	2.39	2.16	1.97	1.85	1.65	1.54	1.45	1.20	1.17
Non-Agriculture	**90.98**	**90.87**	**90.57**	**89.59**	**89.69**	**89.67**	**89.26**	**89.32**	**88.36**
Mining and Quarrying	2.37	2.46	2.49	2.61	2.70	3.14	3.28	3.27	3.47
Manufacturing	33.59	33.43	33.69	34.84	34.45	34.70	35.10	35.57	34.93
Electricity, Gas and Water Supply	2.97	3.25	3.22	3.23	3.25	3.11	3.05	2.91	2.89
Construction	3.06	3.01	3.04	2.95	3.00	3.05	3.00	2.92	2.87
Wholesale and Retail Trade	17.22	16.68	15.89	15.01	14.96	14.65	14.18	14.23	14.14
Hotels and Restaurants	5.59	5.63	5.68	5.06	5.15	4.89	4.93	4.89	4.82
Transport, Storage and Communications	8.04	8.32	8.24	7.73	7.59	7.32	7.24	7.34	7.09
Financial Intermediation	2.96	2.95	3.12	3.42	3.60	3.69	3.62	3.62	3.86
Real Estate, Renting and Business Activities	3.29	3.19	3.15	3.01	2.90	2.80	2.67	2.52	2.39
Public Administration and Defence	4.29	4.33	4.49	4.43	4.56	4.59	4.47	4.38	4.41
Education	3.99	3.94	3.88	3.74	3.84	3.96	4.04	4.23	4.16
Health and Social Work	1.96	2.04	1.98	1.81	1.80	1.91	1.92	1.92	1.87
Other Community, Social and Personal Service Activities	1.50	1.50	1.56	1.63	1.77	1.74	1.65	1.40	1.36
Private Households with Employed Persons	0.14	0.14	0.14	0.13	0.13	0.12	0.11	0.11	0.11
Gross Domestic Product (GDP)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: National Economic and Social Development Board (NESDB)

The country's service sector is experiencing steady growth, with the boom in the tourism industry. The table below shows that expenditure by tourists has risen steadily. As a percentage of GDP, in 2008, tourism is accounted for approximately 10 percent of the GDP, with over 14 million international tourists and over 3 million

domestic tourists for the year, spending an average of 5,000 Baht per person per day.

There is no doubt that tourism is a significant contributor to the Thailand economy.

From Table 6.4, the revenue from tourism shows a continually increasing trend. The

total revenue from tourism the revenue has risen from 495,788 million Baht in 2000,

and hit 867,700 million Baht in 2008. This amount is almost equal to 50 percent of the

country's total exports.

Table 6.4: Revenue from Tourism, 2000 – 2008

Year	International		Domestic		Total	
	Million (Baht)	Change (%)	Million (Baht)	Change (%)	Million (Baht)	Change (%)
2000	285,272	12.75	210,516	3.61	495,788	8.68
2001	299,047	4.83	223,732	6.28	522,779	5.44
2002	323,484	8.17	235,337	5.19	558,821	6.89
2003	309,269	-4.39	289,987	23.22	599,256	7.24
2004	384,360	24.28	317,225	9.39	701,585	17.08
2005	367,380	-4.42	334,717	5.51	702,097	0.07
2006	482,319	31.29	322,534	-3.64	804,853	14.64
2007	500,013	3.67	337,893	4.76	837,906	4.11
2008	515,822	3.16	351,878	4.14	867,700	3.56

Source: Tourism Authority of Thailand

Although actual tax receipts from the tourism could not be obtained, it is assumed by

the Revenue Department that, currently, 20 percent of all tourism receipts is collected

in taxes (both consumption tax and income taxes paid by tourism sector workers). By

using this assumption, tourism has made a great contribution to total tax revenue in

more recent years. Despite high receipts from tourism, this sector has a relatively low

contribution on consumption tax revenue. Like many other countries, Thailand allows

tourists to claim back the VAT that is paid on goods that are bought in the country.

Table 6.5 presents that although Thailand has experienced an increase in the VAT,

theVAT refund has increased in higher percentage. In addition, the amount of refund

in recent years is showing an increasing trend. In 2000, it was accounted for

approximately 31%, while it was 37% in 2008. The high proportion of tax refund finally results in a low consumption tax receipt. This gives a warning to the government that overall tax structure may be significantly affected if the amount of tax refund continues to increase.

Table 6.5: Tax on Consumption and Tax Refund, 2000 – 2008

Year	Value Added Tax		Tax Refund	
	Millions of Baht	Change (%)	Millions of Baht	Change (%)
2000	139,167	4.26	43910	2.17
2001	126,803	-8.88	40,113	-8.65
2002	147,228	16.11	49,926	24.46
2003	150,457	2.19	51,046	2.24
2004	154,682	2.81	53,947	5.68
2005	159,395	3.05	56,008	3.82
2006	163,188	2.38	58,163	3.85
2007	168,911	3.51	60,147	3.41
2008	170,895	1.17	63,283	5.21

Source: The Revenue Department, Minister of Finance

6.2.3. The Problem Associated With Quantifying the Impact of Trade Liberalization on Tax Revenues

The difficulties in quantifying the impact of trade liberalization on taxation and government revenues arise because the effects depend significantly on the form of liberalization and the circumstances under which it occurs. Consider first the impact of trade liberalization on tariff revenue; although trade liberalization is presumed to reduce trade tax revenues, the impact is in fact ambiguous. This is because the impact depends crucially on the nature of a country's trade barriers and its strategy of trade reform. Since Thailand has applied a mixed strategy in order to mitigate any negative impact of trade liberalization, many institution and policy variables are related with liberalization. Thus, it is somewhat difficult to separate the impact of those factors in order to obtain a "pure" impact of trade liberalization. Furthermore, it is difficult to

assess the size and direction of the impact of trade liberalization on government revenues because custom duty and international trade tax rates have continually declined prior to its accession to AFTA and the WTO, and continued to decrease afterwards. This is also happened during Asian financial crisis, with a depreciating currency, in which expectations were driving importers to change their purchasing decisions, and thus the volume of imports in aggregate.

Indirect effects are more difficult to assess. There is also an issue that trade liberalization may have indirect and interactive effects on domestic tax revenues. Trade liberalization can interact with the domestic tax system indirectly through the impact on the macroeconomic environment and economic growth. If trade liberalization is linked to higher rate of economic growth, it will lead to both a better static allocation of resources and to a higher rate of output growth. This consequently leads to expansion of tax bases and also the expansion of revenue potential. However, if trade liberalization is associated with job losses, shrink in corporate profits, and contraction in consumption of domestic goods, the revenue consequences will be different. The analysis of the impact on tax revenue of trade liberalization needs a more complicated structural model and a tool such as computable general equilibrium (CGE) model in order to give a more accurate picture of the consequence of trade liberalization.

In addition, trade liberalization may have various forms such as bilateral agreement, regional agreement or multilateral agreement. Each form of liberalization varies greatly in its detail. The difference in details of liberalization, as a result, leads to an ambiguous outcome on taxation and government revenue. Thus, this raises the question of how precisely it is to assess the impact of the "whole process" of

liberalization. To be more specific, one should consider on the effect of each agreement.

6.2.4. The Issue of Income Distribution and Profitability of Corporations in Thailand

Although there are expected gains from trade liberalization for the economy in various aspects, one of the critical questions is whether trade liberalization leads to disproportionate increased in income, especially for the poor. Economists expect that trade liberalization will help developing countries reduce poverty. Trade liberalization is expected to increase demand for goods produced by developing countries' poor and low-skilled workers, leading to higher wages for unskilled workers and improving poverty. Trade liberalization is also expected to raise the prices of the agricultural products produced by the poor and to reduce prices of goods that the poor consume. If opening up to trade is associated with higher growth, it may be associated with a decline in poverty as well. However, in some developing countries including Thailand, economic growth seems to be followed by a widening income gap between the poor and the rich, and between skilled and unskilled workers. It seems to have the positive association between rising income inequality and high economic growth over time. While the GDP grew at an average rate of 5% in the 1980s and 1990s, income inequality increased steadily during the same period. For Thailand, the role of agricultural sector has a great influence on the country's income distribution. Recently, while the share of the agricultural sector in GDP has decreased, the labour force in the agricultural sector is still accounted for more than half of the total labour force in the country. However, income level in the agricultural sector is lower than that of other sectors. Moreover, income level is very volatile because farm prices and harvest directly affect the value of agricultural output. This fact is in line with the

result presented in Chapter 5 that there is no significant expansion of personal income tax base. The high income inequality and relatively low level of income in agricultural sector explains why personal income tax base in Thailand is quite rigid.

Another interesting issue is the association between trade liberalization and corporate profits. For Thailand, trade liberalization appears to have a significant effect on profitability. Declining import tariffs are associated with falling profits as firms are subject to increasing import competition. This effect is strongest for the firms with the highest levels of import competition. Export-oriented industries do not seem to benefit from declining export tariffs, since the rates are very low, as a result of export-oriented policy that was introduced in 1980s. As a consequence, corporate income tax base is quite rigid in post-liberalization period. Fortunately, there has been a lot improvement in the country's tax administration, i.e. improvement in the technology system that helps tax authorities to monitor and audit firms' profits more accurately. The improvement is particularly aimed at the collection from large businesses. This is because large companies normally have a high potential in paying large amount of tax. There is also the set up of a large tax office which primarily focuses on auditing these large businesses. All of these help maintain corporate income tax receipt at a high level, even though its tax base is experiencing a large contraction.

6.3. Policy Implications

When jointly considered, the three main chapters of this thesis bear important policy implications. In general, a country will agree to reduce or eliminate its trade barriers when it reaches agreement that other trading partners will also reduce or eliminate their trade barriers. That is, in order to implement a trade liberalization policy, a country must ensure that the loss from opening its market is overwhelmed by the gain

from freer trade. The results in Chapter 3, by suggesting that trade liberalization by means of tariff reduction has a significant impact on Thailand's trade volume, provide empirical underpinnings for the increased interest of the government in pursuing trade liberalization. Since the results in the chapter show that the impact of the world's tariff reduction on exports is much higher than the impact of Thailand's tariff reduction on its imports, this implies that, in order to promote exports, the government should support the proliferation of global trade liberalization, especially in terms of tariff reduction. The strategy to promote world free trade has been obviously followed as it can be seen that Thailand has supported Mr.Supachai Panitchpakdi, a former deputy prime minister and minister of commerce of Thailand, who played a vital role in promoting trade liberalization in the Southeast Asia region through what has become the ASEAN Free Trade Area (AFTA), to be elected as a Director General of World Trade Organization (WTO) and he took office from 2002 to 2005. At present, he has taken office of United Nations Conference on Trade and Development (UNCTAD) as a Secretary-General of UNCTAD and continued his work on free trade policy. However, the results in Chapter 3 show that Thailand's international trade structure is highly dependent on the imports of raw materials, intermediate goods, and capital goods which are required in most of the production process, particularly production for exports. In order to prevent a trade deficit or other negative impacts caused by world economic fluctuation, the government should strengthen its domestic economy, especially manufacturing sector.

Freer trade does not only seem to be beneficial when considering trade performance perspective, but it may also help improving the performance if considering the revenue perspective. The main results from Chapter 4 imply that Thailand's overall taxation will benefit from an increase in the proportion of trade to GDP. Therefore,

creating a favorable environment and infrastructure with a stable trade policy and effective trade regulation is a significant task facing most of low and middle income countries, including Thailand. However, trade liberalization varies widely in its forms and details. As also shown by the results in Chapter 4, trade liberalization in terms of the number of free trade agreements may be harmful to taxation of less developed and developing countries. This result warns the governments, particularly for those of less developed and developing countries, when negotiating any trade agreement with developed countries, to be very careful in details of each agreement.

Since the results in Chapter 5 reveal that many tax bases of Thailand's domestic tax sources deteriorated after trade is liberalized, the government should implement policies to alleviate the pain which these tax bases suffer in order to improve revenue productivity and prevent political issues since liberalization policy is also induced by the government.

6.4. Option for Further Study

In this study, we have found that there are a number of directions which could be explored in future research. First, there is still room to examine the impact of trade liberalization on trade performance by applying import and export demand functions using disaggregated data. The disaggregated import and export demand models will provide a more complete picture of how trade liberalization affects trade at the sector level. The disaggregated model can be used by Thai policy makers to draw more accurate liberalization policies on specific sectors.

Second, individual tax sources may be affected by a range of factors that are not captured by the variables used in traditional tax effort model. Recently, many observers have drawn the conclusion that changes in tax revenues are caused by

intangible factors. Therefore, other explanatory variables, particularly structural variables, such as institutional variables, and other policy variables should also be included into the model in further study. When data are available, we would like to test how these variables affect countries' tax revenues. By including institutional and policy factors, we will be able to perform an in-depth examination of how institutions and policies affect the pattern of taxation. This is of importance since institutions are closely related to liberalization policy.

Third, although the tax administration of Thailand is likely to be substantially improved after trade is liberalized, tax evasion associated with the underground economy is still a major problem facing tax administration in Thailand and many other less developed and developing countries. In many cases, tax reform induced by trade liberalization does not play a significant role in solving the evaded tax problem and the black market activities since it is found that the underground economy remains sizable and growing. Further research which includes checking of tax evasion, tax compliance, and black market activities will help improve accountability of tax authorities.

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