**ESSAYS ON THE FISCAL ASPECTS OF TRADE LIBERALISATION**

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# ABSTRACT

This thesis comprises a series of three studies that explore the impact of trade reform on fiscal revenue. Two of the studies use cross-country econometric methods and the third utilizes a partial equilibrium approach to analyse the impact of trade liberalisation on tax revenue and welfare in Jamaica. The first study examines the impact of trade liberalisation on total revenue and trade tax revenue as a share of GDP across countries, explores heterogeneity within the sample (in particular the extent to which a country's level of development influences variations in the effects of trade liberalisation) and utilises alternative indicators of openness to determine if the findings of the model are sensitive to the indicator of openness used. The study finds that, in the case of the openness index used by Khattry and Rao (2002), international trade tax and total tax revenue as a percent of GDP are likely to rise as an economy becomes less open. In contrast, when trade as a percent of GDP is used as the indicator of openness, the results show a positive relationship between openness, and trade and total tax revenue as a share of GDP. The results also suggest that international trade tax revenue tends to fall over time as a country develops. The second study uses events analysis to examine the same issue. There is weak evidence that trade reform has positive revenue effects in the long-run; however, there may be negative impacts within a year of reform. The third study explores the impact of trade liberalisation under the EU-CARIFORUM Economic Partnership Agreement (EPA) on Jamaica by simulating different tariff reform scenarios and comparing the results with the end term EPA as negotiated. It finds that small countries can devise appropriate strategies to mitigate potential negative fiscal effects of trade reform such as scheduling tariff reductions for high revenue items later in the reform process. It also finds that there is often a trade-off between revenue and welfare, which makes welfare increasing and revenue enhancing outcomes difficult to achieve.

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# ACRONYMS

| | |
|---|---|
| CARICOM | Caribbean Community |
| CARIFORUM | CARICOM member countries plus Cuba and the Dominican Republic |
| CET | Common External Tariff |
| CGE | Computable General Equilibrium |
| CREs | Compensated Radial Elasticities |
| EAC | East African Co-operation |
| EPA | Economic Partnership Agreement |
| EU | European Union |
| FTA | Free Trade Area |
| GCT | General Consumption Tax |
| GDP | Gross Domestic Product |
| GMM | Generalised Method of Moments |
| GOJ | Government of Jamaica |
| IMF | International Monetary Fund |
| LDCs | Least Developed Countries |
| MFN | Most Favoured Nation |
| NTBs | Non-Tariff Barriers |
| OECD | Organisation for Economic Cooperation and Development |
| QRs | Quantitative Restrictions |
| ROW | Rest of the World |
| SMART | Single Market Partial Equilibrium Tool |
| SSA | Sub-Saharan Africa |
| TPR | Trade Policy Review |
| TRIST | Trade Impact Simulation Tool |
| VAT | Value Added Tax |
| WIRE | Welfare Increasing and Revenue Enhancing Reforms |
| WITS | World Integrated Trade Solution |
| WTO | World Trade Organisation |

# 1. INTRODUCTION

Studies on the impact of trade liberalisation often focus on its effects on welfare. While this normative perspective is important, it is also necessary to consider the potential impact of trade reform on fiscal revenue. This issue is of primary concern to policymakers, particularly in developing country contexts where sources of fiscal revenue sources may be limited and hence, tariff revenue may be a major source of fiscal revenue. Therefore, although there is widespread recognition and acceptance among economists that tariffs are a second-best method of achieving fiscal policy objectives (Michael et al. (1993)), trade liberalisation is often feared for possible negative fiscal consequences due to the potential for loss of revenue as a result of tariff reform.

Additionally, there are political economy concerns that impact the ability of a government to implement tariff reform as competing interest groups lobby to gain the outcome that is in their best interest. In many instances, the benefits of a tariff tend to be concentrated on certain key interest groups who lobby for their continuation while the costs are often widely dispersed (Bliss (1987)). Therefore, it often proves difficult for governments to push through reforms as there is likely to be an inherent bias for the continuation of tariffs. It is therefore incumbent on policymakers to balance these competing considerations and at the same time ensure that the ultimate trade reform outcome is positive for the country – whether in terms of fiscal revenue, welfare, or both.

A review of available studies on the fiscal and welfare effects of trade reform reveal that there are relatively few on the fiscal aspects and more on the welfare effects of trade reform. In addition, a lot of these studies focus on a theoretical rather than empirical assessment of these issues. This thesis adds to the empirical studies on both these aspects of trade reform, with the fiscal effects being a primary focus of two chapters.

While most studies on the fiscal aspects of trade reform measure trade tax revenue at an aggregate level, it is useful to analyse the impact of trade reform on the different components of trade tax revenue so that reform measures are appropriately structured. An understanding of what drives the change in trade tax revenue – whether mainly import taxes, export taxes, and/or other components - can identify priority areas for reform and inform the order of implementation of reform measures. Conceivably, one may observe a reduction in total trade taxes as a result of tariff reform and yet when the total figure is dissected, there may have been a net increase in import duties, and a reduction in export duties and exchange taxes. This type of analysis is particularly relevant when comparing the aggregate measure of total trade

taxes across countries with varying tax systems as it is likely to be more difficult to determine the principal components impacted by the reform; for example, whether one is likely to observe mainly changes in import duties, and/or changes in export duties. In this context, the specific research questions that this thesis will investigate are:

- How does trade liberalisation affect total tax revenue, and international trade tax revenue in particular?
- Are there variations in the impact of trade liberalisation depending on a country's level of economic development or dependence on specific taxes, such as export taxes?
- Are the findings of the model sensitive to the indicator of openness used?

In addition to consideration of the fiscal effects, the welfare implications are also an important aspect of trade reform, particularly as the gains of liberalisation are often expressed in terms of an improvement in consumer welfare. For policymakers, a primary concern is how to structure trade reforms to obtain the desired outcomes for tariff revenue and welfare; for example, an aim of trade reform may be revenue neutrality and positive welfare effects. Most of the studies on the fiscal and welfare effects are analysed in a stylised first-best framework of full liberalisation that is not particularly realistic for policy makers. This thesis extends the analysis by examining this issue in a second-best framework – where there is partial liberalisation under a free trade agreement but tariffs remain on Rest of the World (ROW) imports. For detail and depth of analysis, it is useful to examine this issue at an individual country level. A suitable case study for consideration is that of a small open economy (Jamaica) in a free trade agreement (EU-CARIFORUM Economic Partnership Agreement (EPA)). In this second-best setting, one can assess various reform scenarios and their likely impact on revenue and welfare. Through a partial equilibrium approach, this thesis will answer the questions:

- How can Jamaica design Rest of the World (ROW) tariffs to minimise possible negative fiscal and welfare impacts of the EU-CARIFORUM EPA?
- Can Jamaica achieve Welfare Increasing and Revenue Enhancing (WIRE) outcomes in this context?

## 1.1 Structure of the thesis

In order to answer these research questions, the thesis starts by examining the question of whether trade liberalisation necessarily results in revenue

depletion and assesses the likelihood that countries will recoup international trade tax revenue losses by changes in other tax sources, such as domestic taxes (Chapter 2). Two equations are estimated, using fixed effects panel regression analysis, with international trade tax revenue as a share of GDP, and total trade tax revenue as a share of GDP as the dependent variables. The regressions include relevant socio-economic indicators, such as the level of urbanisation, per capita income, population size, and the age-dependency ratio. These equations are estimated at an aggregate level and then by country groups based on a country's level of development in order to assess how liberalisation may impact each country differently. Accounting for possible endogeneity issues, the study then goes on to vary the model by using a more traditional indicator of openness, trade as a per cent of GDP.

Chapter 3 continues the analysis within an events framework based on the fact that trade liberalisation is often driven by economic shocks and externally imposed under loan agreements with multilateral lending institutions. We can therefore examine the impact of trade liberalisation through changes in key fiscal variables, such as total tax revenue and trade tax revenue as a share of GDP, in the period before and after liberalisation. This chapter also explores the issue of heterogeneity within the sample, in regard to varying levels of development among countries and the treatment of export taxes by individual countries.

Chapter 4 takes the analysis further and examines the tariff revenue, trade creating, trade diverting and welfare effects of full liberalisation under the EU-CARIFORUM EPA at the product level for Jamaica. It also examines the different effects of utilising statutory tariff rates versus collected tariff rates in the analysis and analyses how Jamaica may adjust Common External Tariffs on ROW imports after implementation of the EPA in order to address concerns about tariff revenue depletion and welfare loss, for example. It then examines the feasibility of achieving welfare increasing and revenue enhancing (WIRE) outcomes for tariff adjustments on ROW imports post-EPA.

The thesis then concludes in Chapter 5 where the main findings and higher-level conclusions, along with their limitations, are identified.

# 2. THE FISCAL IMPLICATIONS OF TRADE LIBERALISATION

## 2.1 Introduction

The impact of trade liberalisation on fiscal revenue has long been a concern for policymakers and researchers. Their main concerns include exploring whether adverse revenue effects necessarily accompany trade liberalisation and possible mitigating measures where adverse effects are observed. In addition, researchers have analysed the factors that are likely to influence the degree of revenue loss such as a country's level of development, the degree of urbanisation and the degree of openness of its economy.

In order to investigate these issues, researchers have utilised various methodologies, ranging from cross-section regression analysis to more recent efforts to take advantage of both time and group variations with the use of panel datasets. Limitations of some of these models, such as cross-country simple linear regression analysis, include the inability to examine changes in the variables over time which is especially important in the context of international trade given that trade liberalisation usually has lagged effects. Additionally, some models (including those that use panel datasets) have undesirable features such as endogeneity, depending on the indicators used to measure variables such as openness and international trade taxes.

This essay examines the question of whether trade liberalisation necessarily results in revenue depletion and the likelihood that countries will recoup international trade tax revenue losses by changes in other tax sources, such as domestic taxes. Using fixed effects panel regression analysis, with international trade tax revenue as a share of GDP, and total tax revenue as a share of GDP as the dependent variables, the study estimates the relationship between openness and international trade tax revenue and total tax revenue as a share of GDP.[1] The regressions include relevant socio-economic indicators, such as the level of urbanisation, per capita income, population size, and the age-dependency ratio. The concept of openness is explored by using alternative measures - an openness index (Khattry and Rao (2002)) and the one-year lag of Trade as a share of GDP). The openness index is endogenous to the model and is therefore unlikely to provide reliable estimates. The lag of trade as a share of GDP does not face this criticism as it is less likely to be contemporaneously correlated over time with trade and total

[1] International trade tax revenue comprise taxies imposed on goods and services entering a customs territory, including import duties, export duties, profits of export or import monopolies, exchange profits, and exchange taxes. Total tax revenue refers to all compulsory transfers to the central government. (IMF Government Financial Statistics Database - 2014)

tax revenue as a share of GDP. In addition, the study explores heterogeneity within the model by estimating the equations by country groups based on a country's level of development in order to assess how liberalisation may impact each country differently. Before delving into the data analysis and regression results, the next section provides a review of key literature on trade liberalisation and its possible impact on fiscal revenue.

## 2.2 Literature Review

The Literature Review first provides an overview of the relevant theoretical underpinnings for tariff formulation and the principles of taxation in general. This section also provides a rationale for the imposition of tariffs and their impact on domestic and global welfare. It then goes on to focus specifically on the factors that influence the level of trade taxes (of which revenue earned from tariffs comprise the vast majority) in total tax revenue and as a percentage of GDP. Following this discussion, it examines the impact of trade liberalisation on tax revenue, taking account of issues such as the impact on domestic tax revenue, and export taxes. It also provides an overview of the methodologies that have been used thus far to investigate the nature of the relationship between trade tax revenue and trade liberalisation. Finally, it concludes by summarising the main findings from the literature review and charts the layout of the rest of the chapter.

### 2.2.1 Theoretical Foundations

In order to have a complete understanding of the issues surrounding the impact of trade liberalisation on trade taxes, this section assesses the factors that influence the amount of trade taxes that a government can raise in order to gauge the final revenue outcome from liberalisation. In this context, there are often conflicting effects at play; for example, some effects of tariff liberalisation depend on the elasticity of substitution between imports and their domestic substitutes and it is therefore difficult to predict the final reform outcome. The section then goes on to trace the likely impact of trade liberalisation on key variables as identified in the economic literature.

*(a) Factors Influencing the Share of Trade Tax Revenue in Total Revenue and in GDP*

The share of trade tax revenue in total government revenue and in GDP varies between countries due to several factors. It may be observed that the share of trade tax revenue in GDP varies with a country's level of economic

development. It is argued that as a country becomes more developed, tax systems mature, administrative experience and efficiencies are gained, and thus other sources of revenue become much more significant than trade tax revenue. Greenaway (1980) attributes this inverse relationship between trade tax revenue and the level of economic development to a country's level of industrialisation which gives rise to greater need for cash transactions; low income elasticity of trade tax revenue; changes in the composition of imports demanded as economies develop, towards intermediate capital goods; the maturity of infant industries which causes less revenue to be earned from their import substitutes; and the general disinclination of industrialised countries to use trade taxes as a source of revenue.

One can also assume that the degree of openness of an economy provides an indication of potential revenue earnings from taxes on trade.[2] One can expect a positive correlation between trade tax revenue and the size of the traded goods sector as, *ceteris paribus,* the more goods that are subjected to import duties and export taxes, for example, the more earnings a government is likely to receive. In a general equilibrium context, however, where there is imperfect competition, the imposition of additional duties and taxes on imports may induce changes in consumer behaviour such as increased spending on domestic substitutes. In this case, even where producers of domestic substitutes take the opportunity to increase product margins, the increase may be less than the full amount of the tariff; hence, the final outcome is unpredictable. Moreover, in many developing countries, there is a difference in the average nominal tariff and the collected tariff rate due to the number of exemptions available.

In its common manifestation, trade liberalisation involves the reduction and/or removal of duties on imports entering into a country. One would therefore expect that the amount of trade tax revenue earned by a government would vary depending on the rates of import duties, export taxes, and stamp duties, for example. Khattry and Rao (2002) posit that the direct effect of tariff liberalisation is dependent on whether or not initial tariffs were relatively high and above their revenue-maximising levels. If they are not above their revenue-maximising levels, tariff liberalisation will increase tariff revenue; if they are, then tariff liberalisation will lead to declining revenue. They also point out that the indirect effects of tariff liberalisation depend on the elasticity of substitution between imports and their domestic substitutes. It is noted that in general the net change cannot be predicted.

[2] For a more intensive discussion, see Greenaway (1980), Greenaway and Milner (1991) and Cole (1992)

Where a country is heavily dependent on primary agricultural products, there may be increased likelihood of the presence of export taxes on products from the traditional export sectors (Burgess and Stern (1993)). As noted by Greenaway and Milner (1991) and Khattry and Rao (2002), the removal of export taxes is expected to reduce tax yield but other export enhancing measures could be pursued such as tax rebates which may encourage increased exports and hence, greater earnings and direct tax yields from sources such as income tax. Export taxes, however, are a negligible source of revenue for the vast majority of countries currently.

Changes in the exchange rate can affect the share of trade taxes in total revenue and GDP. A depreciation of the real exchange rate makes imports more expensive in domestic currency terms and can therefore reduce the quantity of imports demanded and increase demand for domestic import substitutes. The precise effect depends on the relevant price elasticity of demand for imports and the price elasticity of supply for import substitutes. If price elasticity of demand for imports is relatively inelastic then the government would expect to see increased revenue earnings from tariffs. Greenaway and Milner (1991) note that this is often the case for capital goods and intermediates for Less Developed Countries. On the other hand, consumer goods and food items with domestic substitutes tend to have high elasticity. Currency depreciation also has a positive effect on exports which may lead to increased revenue from taxes on income. The net impact therefore depends on these competing considerations (Agbeyegbe et al. (2006)).

Khattry and Rao (2002) point to the structural constraints faced by many developing countries in relation to their level of urbanization and age-dependency ratios. In Lewis' (1954) model of structural change, an economy becomes more urbanised as it develops. This increases its need for and capacity to tax as the urban population demands provision of additional public services and provides a targeted tax base through the economic activity generated. In many developing countries where the rural economy tends to be the dominant sector, economic activity tends to be less concentrated and mostly informal in nature, which makes tax assessment difficult. Therefore, in some cases, governments levy taxes on agricultural exports. In addition, the high age-dependency ratios in many countries mean that the tax base is smaller than in developed countries which tend to have lower age-dependency ratios.

The factors discussed above constitute the explanatory variables that influence changes in trade taxes and total taxes. The age dependency ratio, the level of urbanization, and per capita income account for structural characteristics in the economy that determine a country's taxable base. The inclusion of the exchange rate in the trade tax revenue model accounts for the possible impact

of changes in monetary policy on exports and imports. Additionally, one should be mindful that the final impact of trade liberalisation on fiscal revenue is also dependent on other factors such as a country's existing tariff structure and where tariffs are located in relation to their revenue-maximising levels, the availability of domestic substitutes and their elasticities of supply and demand, and other structural constraints faced by individual economies.

*(b) The Impact of Trade Liberalisation*

The likely impact of trade liberalisation can be assessed in terms of the measures that comprise the reform process. This section sets out the *a priori* expectations of reforms, such as the removal of quantitative restrictions; tariff reform, including liberalisation and reduction in dispersion; domestic tax revenue; and exchange rate adjustment, on fiscal revenue. One of the most frequent components of reform has been the tariffication of quantitative restrictions (QRs). The replacement of quantitative restrictions provides an additional source of tax revenue but the extent to which this happens is dependent on the impact of tariffs on domestic prices and hence on domestic demand for the affected products. It may be the case that the increase in prices reduces demand and hence the volume of trade, thereby affecting the revenue outcome. Ebrill et al. (1999) note that the impact of changes in quantitative restrictions is dependent on the nature of the restriction itself and the administrative capabilities of the countries implementing such reform. For example, removing quotas on imports that are also subject to tariffs may lead to an increase in revenue due to increased import volume.

Another plank of trade reform is tariff liberalisation. As already discussed, if the initial tariff rate is above the revenue maximising rate, then any reduction of the tariff is likely to increase trade tax revenue as the incentive for evasion is lessened by the decrease or removal of the tariff and positive changes in income may be induced. The converse is also true. If the initial tariff rate is below the revenue maximising rate, then tariff reduction or elimination is likely to result in a reduction in government revenue from trade taxes. The final impact of tariff changes will therefore take account of the number of tariffs above and below the tariff maximising rate, the magnitude of tariff changes, and cross price elasticities of demand of imports and supply of import substitutes. (See Greenaway and Milner (1991)).

Domestic tax revenue is also impacted by trade liberalisation. In many developing countries, taxes on imported goods and services are an important source of revenue. Indeed, these taxes are often levied on the tariff-inclusive price. The removal of tariffs is therefore likely to reduce tax yield if the base is eroded. Agbeyegbe et al. (2006) note, however, that the ultimate impact on revenue yield has to take account of possible changes in import demand

(positive) and demand for import substitutes (negative) due to lower prices on imports from removal of the tariff. Moreover, there may be long-term effects on the tax base if liberalisation has a positive effect on economic growth.

Liberalisation measures often comprise a reduction in the dispersion of tariff rates, and simplification of the tariff structure - with significant reduction or removal of tax exemptions. Greenaway and Milner (1991) note that this should be revenue-neutral but may have the positive effect of reducing the incentive for tax evasion and improve administrative efficiencies and this will have a positive effect on the revenue outcome. Ebrill et al. (1999) focus on the relative importance of price elasticities of demand of imports impacted by the reform measure. In this regard, it is argued that if reducing tariff dispersion negatively affects effective rates of protection, then there is likely to be an increase in imports and hence, increased revenue from trade taxes. In addition, higher tariffs tend to be associated with goods that have higher price elasticities of demand and if these tariffs are lowered, then the positive revenue effect is likely to be reinforced through increased demand for these products.

The removal of export taxes – another facet of liberalisation - may lead to a reduction in trade tax revenue, *ceteris paribus*, if export volume is not affected positively. Greenaway and Milner (1991) posit that one can expect an inverse relationship between the significance of export taxes and the share of non-traditional exports in total exports. This follows from the fact that export taxes are applied to traditional exports in most cases and often allow for exemptions so that producers are competitive.

In addition, one can expect some amount of exchange rate adjustment in many trade reform packages. This can be analysed using the standard implications of devaluation in a small open economy. Devaluation will increase the price of imports but the extent to which this affects customs revenue depends on the price elasticity of demand for imports. In addition, devaluation makes non-tradeables more attractive to consumers than tradeables (which are now relatively more expensive). This has a dual effect – there is likely to be a decrease in customs revenue but also an increase in domestic indirect tax revenues. Income taxes from tradeables may also rise as the now lower price of exports in foreign markets should encourage greater demand for these products; once producers respond, they should see increased earnings.

Khattry and Rao (2002) also discuss a terms of trade shock effect of liberalisation. This would result from simultaneous trade liberalisation by several developing countries which could lead to a glut on the market of similar products. It is argued that this would depress the prices of these exports and negatively affect export revenue and also income tax earnings from exporters. This argument fails to take account, however, of the supply constraints and

rigidities faced by many developing countries which makes it very unlikely that a significant number of these countries could increase production to take advantage of the now more open economies simultaneously. Importantly, one also needs to consider the demand for the products in question – more open economies do not necessarily lead to increased demand for particular products.

Agbeyegbe et al. (2006) also explore other impacts of trade liberalisation on income and profit taxes. The short-run channel through which these impacts are transmitted is via the changes in profits of importers and producers of import substitutes. In addition, there may be long-run consequences if trade liberalisation impacts on economic growth – positively or negatively – and therefore on incomes and income tax liabilities. These general equilibrium considerations are not the subject of this study but it is useful to bear in mind that there are other possible indirect effects of trade liberalisation.

In addition to the nature of the trade reforms themselves, timing and sequencing of reforms are also important considerations in determining the final impact of trade liberalisation. Papageorgiou et al. (1990) argue that for liberalisation to succeed it is best to implement reform measures quickly rather than gradually – fast removal of QRs, and real depreciation of the domestic currency. In addition, there should be a stable macroeconomic environment. On the other hand, others such as Toye (2000) object to the "big bang" approach and would rather see more gradual implementation of reform measures with particular attention being paid to the sequencing of reforms with stabilisation policies.

A common thread in the discussion above is that there can be no firm expectation of the final impact of trade reform. Each country's experience depends on the its initial tariff structure before reform, price elasticities of demand and supply for imports and domestic substitutes, the nature of trade reforms, the pace and sequencing of trade reforms, and the extent of exchange rate adjustment, if any. While recognizing that more detailed country-specific analysis is necessary for any country contemplating trade reforms, cross-country and panel analysis is useful to assess general patterns and trends over time as countries have liberalised their economies. The next section examines empirical studies conducted on the subject, with a view to identifying appropriate methodologies for this research and the application of new or different techniques where appropriate.

### 2.2.2 Methodologies

There is no single approach to determining the impact of trade liberalisation on revenue. Most studies of the relationship between trade liberalisation and

changes in tax revenue utilise both correlation and regression analyses. The regression models range from limited three variable cross-country regressions (see Greenaway (1980) and Cole (1992)) to very extensive multi-variable models with panel data (see Greenaway et al. (2002), Baunsgaard and Keen (2005); and Khattry and Rao (2002), for example). One common thread in the approaches taken by the various authors is careful selection of the trade liberalisation variable. Indeed, one finds that in some instances the sensitivity of results depends on the measure of liberalisation used. This section will explore the models that have been used so far to examine the question of how trade liberalisation impacts on growth and what are the best indicators of the factors under consideration. It will also identify the limitations of some of the indicators of trade liberalisation and models used and how researchers have addressed these issues.

*Measures of Trade Liberalisation and Openness*

Researchers have investigated several approaches to measure the degree of openness of an economy. Openness is often seen as being synonymous with the outward orientation of an economy. Wacziarg (2001) lists three categories of openness indicators – outcome measures, policy indicators and deviation measures – in his study on the relationship between trade policy and economic growth.

Outcome measures comprise indicators such as changes in trade volume and composition that show the results of a country's interaction with the global market. The conventional measure of openness is exports plus imports, as a percentage of GDP.[3] However, some researchers have used the collected tariff rate (import duties as a percentage of total imports) to measure openness.[4] A less accepted measure is the ratio of international trade taxes to international trade used by Khattry and Rao (2002). The use of this measure gives rise to issues of endogeneity where the share of international trade taxes in GDP is used as the dependent variable. Moreover, as noted by Agbeyegbe et al. (2006), this measure is limited in its application as a close relationship is not directly observed between changes in one of the components of international trade tax revenue, exports, and trade liberalisation.

More generally, the main drawback of outcome measures is the lack of a strong theoretical framework for analysis as most theoretical papers utilise trade policy measures such as tariffs (see David (2008) and Pritchett (1996)). Wacziarg (2001) rejects the use of outcome measures, citing endogeneity concerns relating to the use of outcome measures and variables such as

[3] See Ebrill et al. (1999), Greenaway and Milner (1991), Greenaway et al. (2002)
[4] For example, Ebrill (1999)

economic growth. He also notes that outcome measures include a gravity component (trading patterns simply based on variations in geographical location and country size) which would not be appropriate for a study that seeks to capture the policy regime and that there are endogeneity concerns. Other researchers such as Chang et al. (2009) have no issues with the use of outcome measures. They use the volume of trade (the ratio of real exports and imports to real GDP) to measure openness in their study on the effect of openness and other variables on economic growth. Chang et al. (2009) highlight that after controlling for country and time specific effects, the trade to GDP ratio is a suitable proxy for trade policy. In addition, when the trade to GDP ratio is replaced with average tariff rates to measure the robustness of the model, the results remain the same.

Policy measures include the scheduled or applied tariff rates, non-tariff barriers, and tariff revenues. Their levels indicate a country's trade orientation – low levels suggest openness to trade; high levels may suggest a protectionist/anti-free trade leaning. Pritchett (1996) classifies these indicators as "incidence" measures where there is direct assessment of the trade policy measure. Wacziarg (2001) states that policy measures are likely to influence outcome measures directly; for example, high tariff rates and the existence of non-tariff barriers directly influence the amount of imports and therefore, trade as a share of GDP. However, their utility may be limited based on data availability and endogeneity concerns, depending on the variables in the regression model.

Finally, deviation measures are based on the divergence of actual trade volume from predicted free-trade levels, pioneered by Leamer (1988). The models are based on gravity equations and factor endowments. The main drawback for these models is the likelihood of omitted variables, including ones that reflect policy stance and are highly correlated with gravity or endowment variables.

Arguing that it is best to combine variations in several measures to obtain an indicator of openness that captures different dimensions of trade policy, Wacziarg (2001) develops a Trade Policy Openness Index by measuring the variation in trade shares attributable to various trade policy measures. The ratio of exports plus imports to GDP is regressed on policy, gravity and endowment variables. The components of the index are:

- The share of import duties in total imports
- The unweighted coverage ratio for the pre-Uruguay Round time period published by UNCTAD
- Dummy variables based on country's liberalization status, using Sachs and Warner (1995)

The regression also includes the log of land area, log of population and the growth rate of GDP per capita. The coefficients from the regression are used as weights to construct a weighted average of these variables – the trade policy openness index, equal to the portion of observed trade shares attributable to the effective impact of trade policy. According to Wacziarg (2001), his methodology avoids the problem of measurement error, as he constructs the difference between potential and observed trade shares, and collinearity between endowment, gravity and policy factors.

Also favouring the use of liberalisation indices, Greenaway et al. (2002) utilise three indicators of liberalisation: indices developed by Dean et al. (1994), Sachs and Warner (1995), and whether the country has a Structural Adjustment Loan (SAL). Dean et al. (1994) derive a composite index of liberalisation to assess when liberalisation occurred in their sample of thirty-two developing countries. Reference is made to changes in tariffs, quotas, export measures, and exchange rates. Sachs and Warner (1995) assess whether an economy is open or closed based upon movements in non-tariff barriers and average tariff levels; whether or not the country is socialist; the existence of state monopolies over key exports; and the difference between the official and black market exchange rates. All three indicators are entered as dummy variables into a dynamic panel setting.

In addition to the measures cited above, there are other methods that assess trade liberalisation and openness by comparing price levels across countries. For example, Dollar (1992) estimates a cross-country index of real exchange rate depreciation to estimate "outward-orientation", using a measure of price levels compiled by Summers and Heston for 121 countries. The measure is similar to comparing purchasing power parities (PPP) across countries. The main drawback of these measures, as noted by Balassa (1964) is the risk of overvaluation of the exchange rate by PPP as developed countries tend to have a comparative advantage in the traded goods sector (leading to higher exchange rates) which imply that non-traded goods cost more in developed countries when compared with less developing countries using the same exchange rate, which is often not the case.

*Estimation Techniques*

Various techniques have been employed to explore the impact of trade liberalisation on tax revenue. Ebrill et al. (1999) explore the impact of trade liberalisation on revenue using fixed effects panel regression in two models. In the first model, using a dataset of 27 countries over the years 1980-92, import tax revenue as a share of GDP is determined by the import base and dummy variables representing the reduction of tariffs, quantitative restrictions, and

export barriers. Other variables included in the estimating equation are exports as a percentage of GDP, per capita income in 1990 U.S. dollars, dummy variables for whether the country has a VAT, the achievement of Article VIII status with the IMF ( possible indicator of a liberal trading regime as Article VIII refers to the acceptance of the obligations of member states to avoid discriminatory currency practices and restrictions on current payments for international transactions), and the real exchange rate. Article VIII status with the IMF is used as a liberalisation indicator since it is thought to be unrelated to trade tax revenue and thus, uncorrelated with the error term, while at the same time signalling a country's commitment to free trade. The sample used only includes countries that have undertaken liberalisation. Their results show that tariff reductions have not had a significant impact on trade tax revenue while changes in export taxes have had a significantly negative impact on trade revenues. In addition, changes in QRs, using appropriate exchange rate policies to support the reform process, and stimulating imports are likely to have a positive and significant effect on trade tax revenue.

The second equation models trade tax revenue as a function of the collected tariff rate, its square, and the other independent variables included in the first model, excluding the liberalisation dummies, the import base, and exports as a share of GDP. A quadratic form is estimated of the relationship between the collected tariff rate and trade tax revenue to capture the idea of a revenue maximising rate above which the collected tariff may actually decline. The model confirms the existence of a revenue-maximising tariff rate.

Baunsgaard and Keen (2005) use similar fixed effects regressions to assess the impact of trade liberalisation on tax revenue. However, the approach here is different from those outlined previously in that the model seeks to estimate the relationship between the costliness of collecting alternative forms of revenue to trade taxes or the value of public spending, and trade liberalisation. The dependent variable in this case is domestic tax revenue which is regressed against a lagged dependent variable, trade tax revenue as a percentage of GDP and a vector X that includes per capita GDP, openness, inflation, aid per capita, and agriculture as a share of total value added. Similar to Ebrill et al. (1999), Baunsgaard and Keen (2005) include a dummy variable reflecting whether the country has a VAT in place, and have interaction terms of the VAT with openness, and VAT with per capita GDP. In addition, a one-step Generalised Method of Moment (GMM) regression is estimated to deal with issues of endogeneity associated with trade tax revenue and bias from inclusion of the lagged dependent variable. Their findings indicate that some trade tax revenue lost as a result of trade liberalisation is likely to be recovered from other sources and that countries with a VAT recover less revenue than those without.

Agbeyegbe et al. (2006) use GMM estimation with an "orthogonal deviation transformation" based on Arellano and Bover (1995) to estimate the relationship between trade liberalisation and tax revenue for a panel data set of 22 Sub-Saharan African countries over 1980-1996. An orthogonal deviation transformation expresses each observation as the deviation from the average of future observations in a sample for the same unit (for example, country) and weights each deviation to standardise the variance. Where errors are serially uncorrelated and homoskedastic initially, the transformed errors will also have the same properties. The dependent variables are indicators such as total tax revenue, trade taxes, and taxes on goods and services as a share of GDP. These are regressed on the standard variables in the tax literature – per capita GDP, the share of agriculture in GDP, the share of industry in GDP, the terms of trade, inflation, government consumption, the real effective exchange rate, net aid transfer, openness (share of international trade in GDP and share of customs revenue as per cent of total imports), and a dummy variable for CFA franc countries. They find that the openness indicators are not significant in either equations, i.e., trade liberalisation does not have a significant impact on trade tax revenues for this group of countries.

Khattry and Rao (2002) also use regression analysis to determine the factors that influence tax revenue in general and trade tax revenue in particular. The two models use panel data for 80 countries for the period 1970-98. For the first model, the share of tax revenue in GDP is regressed on the natural log of population size, the natural log of real GDP per capita, the age-dependency ratio, the degree of urbanisation, and the index of openness. The second equation looks at the effect of openness on customs revenue, using the same independent variables as in the previous equation and adding the share of domestic indirect taxes/GDP, the exchange rate, and the trade/GDP ratio. Applying the same logic as Ebrill et al. (1999), the second equation includes a quadratic form of the openness index because it is believed that rates of trade taxation above a certain threshold may lead to declining tax revenues. The openness variable selected is endogenous to the model, which limits one's ability to draw inferences from the estimation. Approaches to address endogeneity include using lagged values, instrumental variables,[5] GMM estimation,[6] and event studies.[7] An appropriate approach for this current study is therefore to estimate an alternative specification of the model that includes a lagged value of the traditional indicator of openness (Trade as a share of GDP) to control for endogeneity and test the robustness of results, using an extended data set. In addition, an event study will be done using the liberalisation indicators identified in Greenaway et al. (2002) in a fixed effects

[5] For example, Ebrill et al. (1999)

[6] See Baunsgaard and Keen (2005), Agbeyegbe et al. (2006), and Chang et al. (2009).

[7] Greenaway et al. (2002)

regression framework. The results from these two analyses will then be compared to see if results are consistent across methodologies.

### 2.2.3 Conclusions

The literature on the impact of trade liberalisation on tariff revenue is diverse but provides several starting points for analysis. Common variables that are thought to affect the share of trade tax revenue among the studies researched include GDP per capita, the share of agriculture, and domestic taxes as a percent of GDP. The final effect of trade liberalisation depends on the interplay of these factors, and the relative strength of each. It is accepted that any assessment of the impact of liberalisation should include an analysis of existing tariff levels and their location in relation to the revenue-maximising rates. In addition, trade liberalisation also features less dispersion of tariff rates, and the tariffication of quantitative restrictions. The analysis would therefore need to take account of the impact of relative prices and demand for final and intermediate goods as a result of changes in the price level due to adjustments in the tariff structure.

Other issues that need to be assessed include: the pace of the liberalisation process (rapid vs. gradual); the impact of exchange rate changes, usually depreciation, that often accompany trade liberalisation; and the impact of liberalisation on domestic tax revenues. With respect to the pace of liberalisation, there is disagreement on whether a 'big-bang' approach is best when implementing trade reform as it may speed up the adjustment process; or whether a slower paced reform programme is best to give interest groups time to adjust to incremental changes. For exchange rate changes, the impact of depreciation is dependent on the elasticities of demand for exports and imports and the availability of domestic substitutes. Domestic tax revenues are also likely to be affected by trade liberalisation because most countries levy taxes such as stamp duty on the tariff-inclusive price of the commodity; hence, any reduction in that price is likely to affect revenue, ceteris paribus. Another central question is the extent to which other sources can compensate for lost trade tax revenue. Possible mitigating policies include measures to strengthen the administrative capacity of tax institutions, and concomitant introduction of other indirect taxes such as a consumption tax or a VAT.

Based on the preceding discussion, it is clear that a definitive outcome cannot be predicted for the impact of trade liberalisation on particular countries. However, the likely impacts can be assessed based on the experiences of countries that have undergone liberalisation and any general trends that may be observed. It is generally felt that a panel framework is best suited for this analysis as it allows for the capturing of both cross-country and inter-temporal effects. A key variable in any model estimating the impact of trade liberalisation on fiscal revenue is the indicator of openness. All measures have

advantages and disadvantages, with liberalisation indices arguably being the most recommended. While trade as a share of GDP is an outcome measure and therefore not a direct indicator of trade policy, it can be argued that trade ratios show the manifestation of trade policy. If an economy is inward-looking, one should expect to see lower trade to GDP ratios, ceteris paribus, as consumers and producers respond to high tariffs. Additionally, changes in trade ratios depend on factors such as the structure of the economy, and elasticities of demand and supply, and income elasticities. One criticism of the measure is that in the case of developing countries that are dependent on the exports of commodities, the share of imports in GDP tends to be relatively stable over time but the share of exports in GDP is likely to vary based on changes in the global market. The openness indicator may not fully capture policy changes in this case where changes in trade as a share of GDP are driven by exogenous factors on the global market that affect primary exports.

This research utilises a panel regression framework to analyse the impact of trade reforms on fiscal revenue, similar to Baunsgaard and Keen (2005) and Khattry and Rao (2002) and modifies the model to take into account endogeneity concerns. The next section describes the data that will be used in the model and presents trends in trade tax revenue and total tax revenue as a share of GDP, the exchange rate, the level of urbanization, the age dependency ratio, per capita income, population size, domestic taxes as a share of GDP, the level of urbanization and trade (exports plus imports) as a share of GDP.

## 2.3 Data Analysis

The data for the model are relevant tax and socio-economic indicators for 78 countries (see Appendix 2A) over the period 1970-2006. These include the share of tax revenue in GDP, the share of trade tax revenue in GDP as dependent variables. Independent variables are the exchange rate, the natural log of population size, the dependency ratio, per capita GDP, domestic taxes on goods and services as a share of GDP, the level of urbanisation, and trade as a share of GDP.

### 2.3.1 Definition of key variables

In order to understand fully the composition of the model, it is necessary to define the key variables. These definitions are from the International Monetary Fund's Government Financial Statistics (GFS) database.

**Tax revenue (% of GDP):** Tax revenue refers to compulsory transfers to the central government for public purposes. Certain compulsory transfers such as fines, penalties, and most social security contributions are excluded. Refunds and corrections of erroneously collected tax revenue are treated as negative revenue. The data are sourced from International Monetary Fund, Government Finance Statistics Yearbook and data files, and World Bank and OECD GDP estimates.

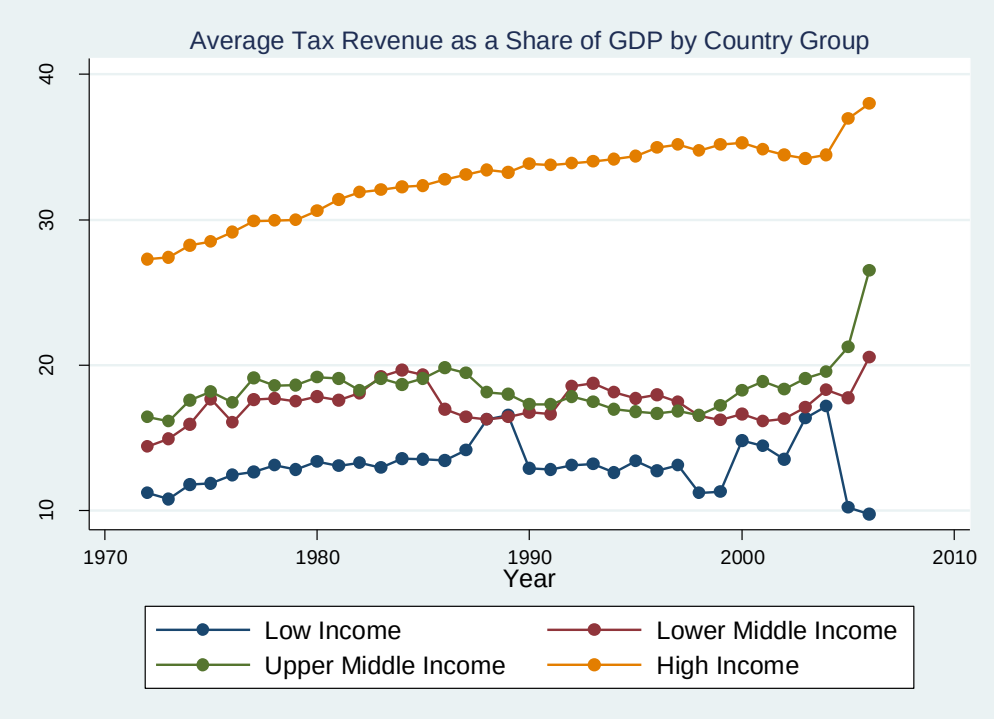
**Taxes on international trade (current LCU):** Taxes on international trade include import duties, export duties, profits of export or import monopolies, exchange profits, and exchange taxes. Data are sourced from International Monetary Fund, Government Finance Statistics Yearbook and data files.

**Trade (% of GDP):** Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. Data are sourced from World Bank national accounts data, and OECD National Accounts data files.

### 2.3.2 Descriptive Analysis

Figures 2-1 to 2-3 show general trends in the key revenue indicators – total tax revenue and trade tax revenue as a share of GDP, and the trade tax to total tax revenue ratio.

**Figure 2-1: Share of Total Tax Revenue in GDP**




Total tax revenue as a percentage of GDP generally increases over the period under study for most country groups, except for low income countries, as shown in Figure 2-1. There is a significant gap in the percentage of tax revenue in GDP (TRgdp) collected by high income countries compared with that collected by other country groups. This may be explained by the fact that high income countries tend to have more highly developed institutional structures for tax collection and thus, are able to collect a higher proportion of tax revenue than less developed countries. For high income countries, TRgdp averaged 29% over 1972-78 and 35% over 2000-06. At the other end of the spectrum, TRgdp was 12% in 1972-78 and increased slightly to 15% for low income countries over the 2000-06 period.

Taxes on international trade as a percentage of GDP (TTgdp) generally trend downwards for lower and upper middle income countries over the period (see Figure 2-2). For high income countries, there was an increase in TTgdp from 2% in the late 1980s to 5% for most of the 1990s, before falling in the late 1990s onwards. TTgdp ranged from 4% to 5% over the period 1972-2006 for

low income countries; and from 4% to 6% over the same period for lower middle income countries. For upper middle income countries, TTgdp averaged a low of 2% for the 2000-2006 period and a high of 4% for 1979-1985.

**Figure 2-2: Share of Trade Tax Revenue in GDP**

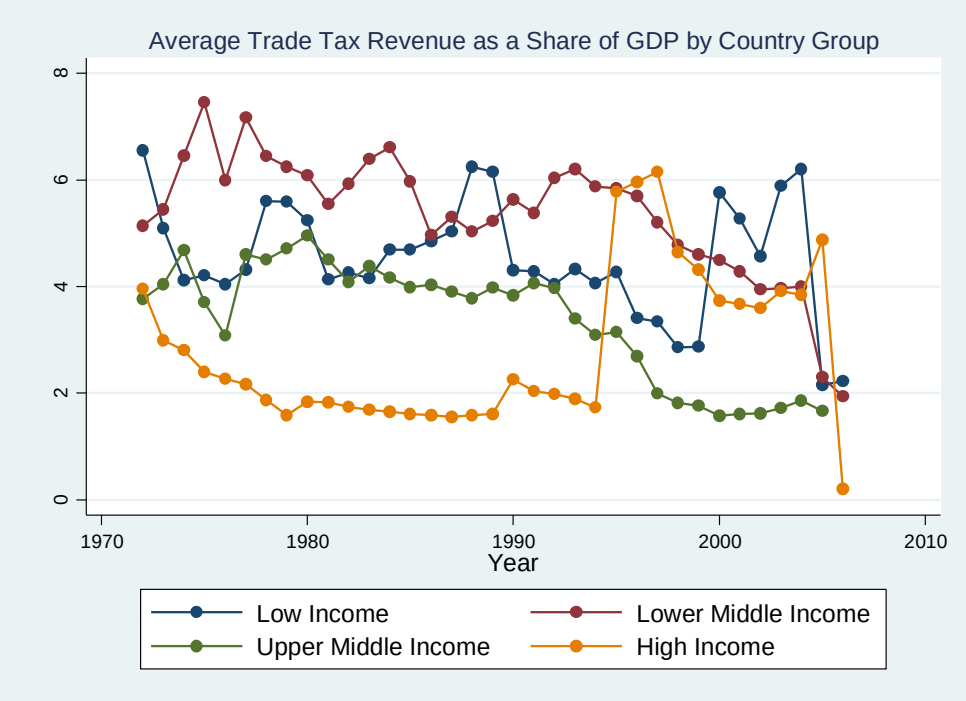



**Figure 2-3: Ratio of Trade Tax Revenue to Total Tax Revenue**

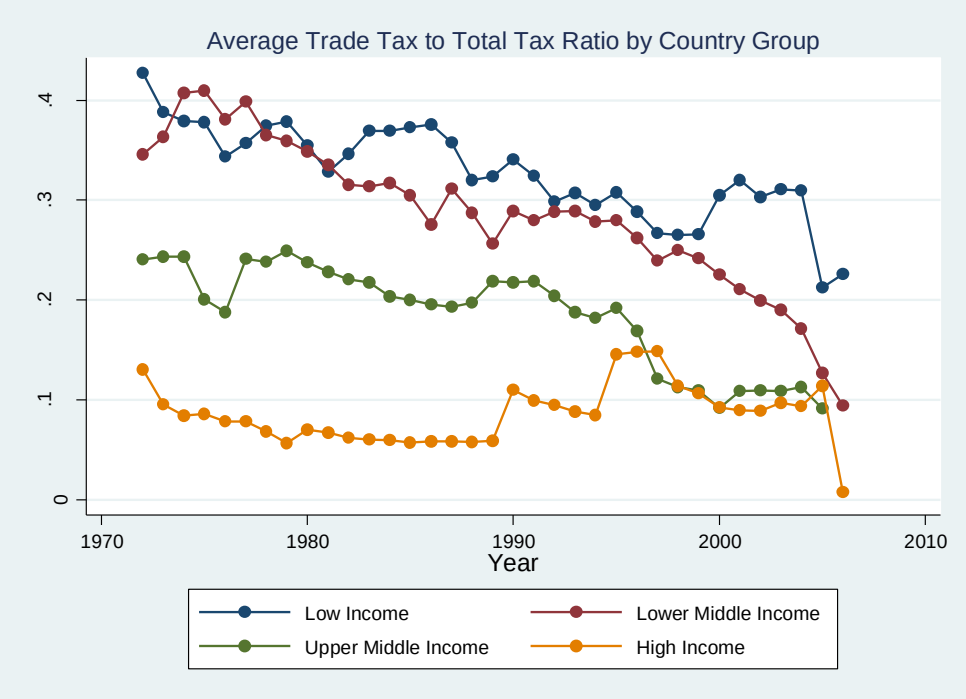


Figure 2-3 shows that high income countries have the lowest proportion of international trade taxes in total taxes while the highest proportion is observed in low income countries. Over time, the trade tax to total tax ratio falls for all country groups, except the high income group. However, high income countries have the lowest rates for most of the time period. This again confirms the theory that as economies develop, the sources of tax revenue are diversified and countries rely less on trade tax revenue.

Average values of the variables for low income to high income countries are broken down into six-year time periods to see any trends in Table 2-1. Tax Revenue as a percentage of GDP is highest in high income countries. This supports Khattry and Rao's (2002) discussion that a country's capacity to tax increases with its level of development due to increased urbanisation and institutional capacities. The level of trade taxes (TT) as a share of GDP is smallest for high income countries at 2.5%; the share for low income to upper middle income countries ranges from 3.5% to 5.6%. This is complemented by the fact that high income countries have the highest average share of domestic taxes as a percent of GDP at 10% compared to low and lower middle income countries with averages of 4.7% and 5.6% respectively. Interestingly, trade measured as per cent of GDP is highest in lower middle income countries and lowest in low income countries. The openness index (tt) is seen to increase with the level of development. On average, the share of taxes on international trade as a per cent of total trade for high income countries is 3% compared to 12% for low income countries and 7% for lower middle income countries.

As is expected, GDP per capita increases as one moves to higher income groups, with average per capita income being $317 in low income countries; $1,191 in lower middle income; $3,677 in upper middle income; and $18,010 in high income countries. Per capita income increases for middle income and high income countries, with the sharpest increase for high income countries over the period. Per capita income in low income countries fluctuated over the time periods and income for the 2000-2006 period was in fact lower than that for the initial 1972-78 time-frame. For all countries, the share of domestic taxes in GDP increases over time – suggesting that the capacity of the state to tax increases over time and with development (higher income levels).

The dependency ratio gets progressively lower as income levels increase – from an average of 0.9 in low income countries to 0.5 in high income countries. The ratio declined for all countries over time - most significantly for lower middle income and upper middle income countries. The level of urbanisation is also highest in high income countries where the urban population as a per cent of the total is 74%. This compares with a rate of 23% for low income countries and 43% for lower middle income ones. Additionally, urbanisation increases, as is expected, over time and with the level of development. This is evidenced by the over 7 percentage point increase in the urban population as

a per cent of a country's total population from 70% in 1972-78 to 77% in 2000-06 for high income countries, compared with a movement from 18.03% to 28.55% for low income countries over similar time periods. For lower middle income and upper middle income countries, the comparable percentages are 36.94% in 1972-78 to 49.25% in 2000-06, and 53.30% to 70.34% for the same years, respectively.

For all country groups, the value of trade as a per cent of GDP increased year on year for all time periods. Low income countries consistently had the lowest share of trade in GDP, ranging from 46.84% in 1972-78 to 57.83% in 2000-2006. Interestingly, lower middle income countries have a higher share of trade in GDP than upper middle income countries, with trade averaging 67.07% and 95.91% of GDP for lower middle income countries over 1972-78 and 2000-2006 respectively. This compares with 47.18% and 84.06% of GDP for upper middle income countries over the same time periods. High income countries had the highest value of trade in GDP at 102.26% for the 2000-2006 time period.

The openness index (tt) was highest (least open) for low income countries but declined over 1972-2006. The values for the other country groups are quite similar, with upper middle income countries being the most open at the end of the period. Lower middle income and high income countries had the same value of the openness index rounded to one decimal place for the 2000-2006 period.

**Table 2-1: Variable Means by Country and Year Groupings (1972-2006)**

| | Variable Means by Country and Year Groupings (1972-2006) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Countries | Years | lnpop | GDPpc (PPP US$) | TRgdp (%) | TTgdp (%) | tt | Trade (%) | Urbpop (%) | Dep | ER | DTaxgdp (%) |
| Low Income | 1972-1978 | 16.12 | 342.68 | 12.12 | 4.75 | 12.71 | 46.84 | 18.03 | 0.92 | 22.55 | 4.18 |
| | 1979-1985 | 16.31 | 321.93 | 13.23 | 4.69 | 11.52 | 47.32 | 20.85 | 0.92 | 31.97 | 4.79 |
| | 1986-1992 | 16.51 | 304.04 | 14.19 | 5.04 | 12.5 | 46.42 | 23.48 | 0.9 | 90.99 | 4.88 |
| | 1993-1999 | 16.68 | 296.56 | 12.54 | 3.59 | 9.72 | 52.54 | 25.96 | 0.88 | 372.51 | 4.35 |
| | 2000-2006 | 16.85 | 312.82 | 14.66 | 5.18 | 10.32 | 57.83 | 28.55 | 0.85 | 1,297.73 | 5.59 |
| | | | | | | | | | | | |
| Lower Middle Income | 1972-1978 | 15.36 | 1,010.49 | 16.41 | 6.36 | 9.12 | 67.07 | 36.94 | 0.91 | 33.25 | 4.34 |
| | 1979-1985 | 15.54 | 1,134.04 | 18.49 | 6.12 | 7.85 | 74.17 | 40.46 | 0.87 | 47.24 | 5.43 |
| | 1986-1992 | 15.7 | 1,150.85 | 16.84 | 5.33 | 6.86 | 78.57 | 43.84 | 0.82 | 103.79 | 5.15 |
| | 1993-1999 | 15.84 | 1,281.75 | 17.59 | 5.49 | 6.36 | 90.55 | 46.7 | 0.75 | 229.66 | 6.41 |
| | 2000-2006 | 15.96 | 1,449.37 | 17.13 | 3.81 | 3.68 | 95.91 | 49.25 | 0.67 | 456.63 | 7.89 |
| | | | | | | | | | | | |
| Upper Middle Income | 1972-1978 | 15.97 | 3,062.65 | 17.71 | 4.08 | 6.6 | 47.18 | 53.3 | 0.82 | 3.81 | 5.24 |
| | 1979-1985 | 16.12 | 3,267.31 | 18.86 | 4.39 | 5.96 | 63.41 | 57.19 | 0.75 | 27.7 | 5.85 |
| | 1986-1992 | 16.26 | 3,440.99 | 18.36 | 3.94 | 5.13 | 69.73 | 62.29 | 0.68 | 255.68 | 5.79 |
| | 1993-1999 | 16.38 | 4,131.39 | 16.95 | 2.63 | 2.97 | 78.68 | 66.71 | 0.62 | 11,952.84 | 6.99 |
| | 2000-2006 | 16.48 | 4,665.01 | 19.45 | 1.67 | 2.1 | 84.06 | 70.34 | 0.57 | 107,906.60 | 9 |
| | | | | | | | | | | | |
| High Income | 1972-1978 | 15.72 | 13,226.08 | 28.66 | 2.61 | 3.62 | 68.6 | 70.02 | 0.59 | 61 | 8.7 |
| | 1979-1985 | 15.78 | 15,173.66 | 31.53 | 1.71 | 2.12 | 77.1 | 72..57 | 0.54 | 97.82 | 9.68 |
| | 1986-1992 | 15.82 | 18,031.14 | 33.41 | 1.66 | 2.1 | 72.88 | 74.45 | 0.51 | 100.32 | 10.23 |
| | 1993-1999 | 15.88 | 20,718.91 | 34.66 | 4.59 | 4.95 | 79.7 | 76.12 | 0.5 | 113.32 | 10.91 |
| | 2000-2006 | 15.93 | 24,694.78 | 35.32 | 3.84 | 3.71 | 102.26 | 77.53 | 0.49 | 51.31 | 11.21 |

## Graphical Representation of Data (1970 – 2006)

**Figure 2-4: Scatterplot TRgdp and Urbpop**

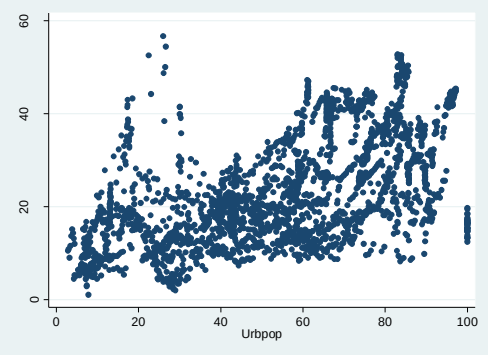



**Figure 2-5: Scatterplot TRgdp and lnpop**

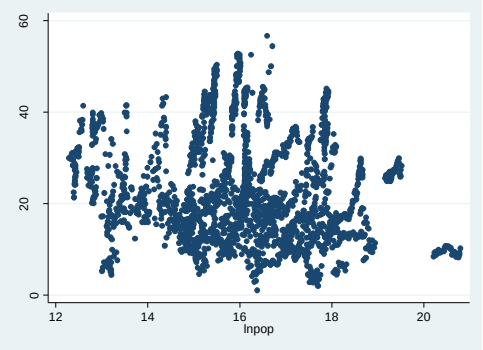



**Figure 2-6: Scatterplot TRgdp and lnGDPpc**

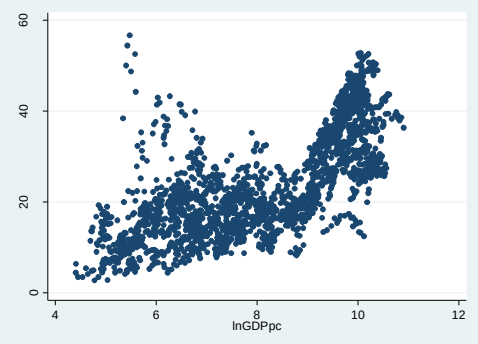



**Figure 2-7: Scatterplot TRgdp and Dep**

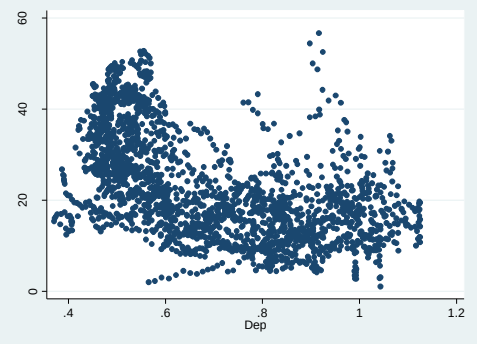
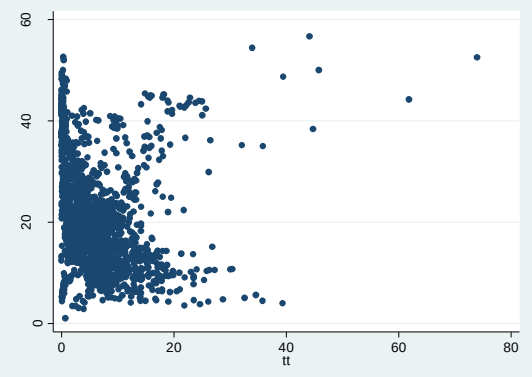



**Figure 2-8: Scatterplot TRgdp and tt**




There appears to be a positive relationship between the share of tax revenue in GDP and the levels of urbanisation and per capita income. From Figure 2-6, it can be seen that higher per capita income levels correspond to higher tax revenue shares. In addition, the relationship between total tax revenue and

the openness index (tt) is not clear, as shown in Figure 2-8. The relationship appears positive; however, if the outliers from Madagascar are removed, then most points are clustered around a ratio of trade taxes to total trade below 15% and a share of total tax revenue in GDP below 25%. Similarly, the relationship shown in Figure 2-6 between the share of total tax revenue in GDP and per capita income suggests that the relationship may be non-linear. Alternatively, there could be two different groups of countries split at around 40% of tax revenue as a share of GDP where a positive relationship is seen for those countries with a ratio below 40% and a negative relationship is observed for countries above 40%. The square of income will be included in the equation to model this relationship to see if there are any impacts on parameter estimates. On the other hand, higher dependency ratios predominantly correspond with lower tax revenue shares in GDP (Figure 2-7). No clear relationship is seen graphically between the Tax Revenue as a per cent of GDP and the country's population size.

With respect to the graphs of the level of trade taxes and the levels of domestic taxation, income and trade as a per cent of GDP, there appears to be no clear direct relationship which suggests the possibility of a non-linear relationship (see Figures 2-9 to 2-11). Where this is the case, there is the risk that the linear estimators are biased and the regression model may be mis-specified. The fixed effects panel regression framework is fairly standard for this type of analysis and appropriate specification tests are conducted for the model. Khattry and Rao found a negative relationship in their analysis between the ratio of trade taxes to total trade and domestic taxes; a positive but insignificant one with respect to the log of per capita GDP; and a positive relationship for the share of international trade in GDP. The regressions that follow will determine whether the data collected yields similar results.

**Figure 2-9: Scatterplot TTgdp and lnGDPpc**

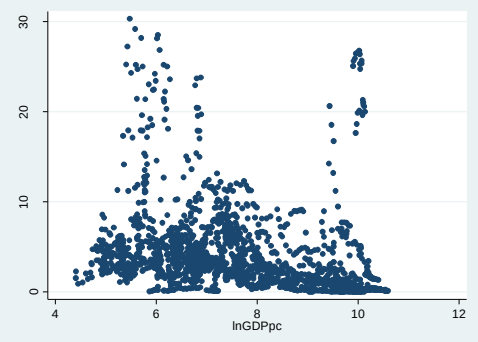



**Figure 2-10: Scatterplot TTgdp and DTaxgdp**

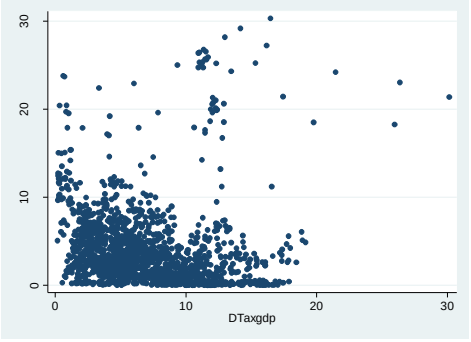
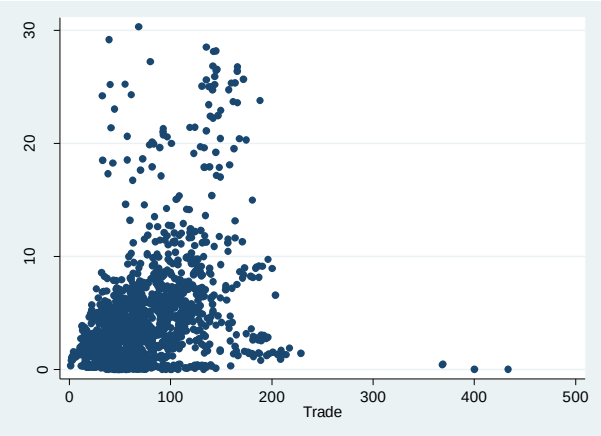


**Figure 2-11: Scatterplot TTgdp and Trade**




Correlation

With respect to Equation 1, Tax Revenue as a percentage of GDP is negatively correlated with population size, the dependency ratio, and the openness index. It is strongly and positively correlated with per capita GDP and the level of urbanisation.

With respect to equation 2, there is small negative correlation between Taxes on International Trade as a percent of GDP (TTgdp), and the share of domestic taxes in GDP and the exchange rate. Larger negative correlations are observed for population size, per capita GDP, and the level of urbanisation. Unsurprisingly, there is large positive correlation between TTgdp and the openness index as the numerator is the same in both measures. There is much smaller correlation between TTgdp, and Trade as a percent of GDP and the dependency ratio (see Appendix 2B).

## 2.4 Methodology

Based on the empirical approaches discussed in the Literature Review, this section uses various methods to analyse the revenue effects of trade liberalisation and notes the extent to which the results obtained are similar or different to earlier findings.

The regression model uses a similar panel regression analysis to Khattry and Rao (2002) in the first instance. The model is then varied by utilising alternative specifications. The openness index is dropped and the traditional indicator of openness – trade as a share of GDP – is incorporated into the model. The time period of the model is also extended from 1972-1998 to

1972-2006. Dummy variables are used for individual countries and years to capture unobservable country and time specific factors.

### 2.4.1 Regression Model

The model for the determinants of **Total Revenue as a Share of GDP** is :

$$TRgdp_{it} = \alpha_0 + \alpha_1 \ln pop_{it} + \alpha_2 \ln GDPpc_{it} + \alpha_3 dep_{it} + \alpha_4 urbpop_{it} + \alpha_5 tt_{it} + \gamma_{FE} + \delta_{FE} + e_{it} \quad (1)$$

where

$TRgdp_{it}$ is the share of tax revenue in GDP

$\ln pop_{it}$ is the natural log of population size

$\ln GDPpc_{it}$ is the natural log of per capita GDP

$dep_{it}$ is the age-dependency ratio

$urbpop_{it}$ is the degree of urbanisation

$tt_{it}$ is the index of openness, measured by the ratio of international trade taxes to the volume of total trade. A fall in this ratio is indicative of greater trade openness.

$\gamma_{FE}$ is the country fixed effect

$\delta_{FE}$ is the time fixed effect

The model for the determinants of **Total Trade Tax as a share of GDP** is as follows:

$$TTgdp_{it} = \alpha_0 + \alpha_1 tt_{it} + \alpha_2 tt_{it}^2 + \alpha_3 ER_{it} + \alpha_4 \ln pop_{it} + \alpha_5 \ln GDPpc_{it} + \alpha_6 dep_{it} + \alpha_7 urbpop_{it} + \alpha_8 trade_{it} + \alpha_9 Dtaxgdp_{it} + \gamma_{FE} + \delta_{FE} + e_{it} \quad (2)$$

where

$TTgdp_{it}$ is the share of trade tax revenue in GDP

$tt_{it}$ is the index of openness, measured by the ratio of international trade taxes to the volume of total trade. A fall in this ratio is indicative of greater trade openness.

$ER_{it}$ is the nominal exchange rate

$\ln pop_{it}$ is the natural log of population size

$\ln GDPpc_{it}$ is the natural log of per capita GDP

$dep_{it}$ is the age-dependency ratio

$urbpop_{it}$ is the degree of urbanisation

$trade_{it}$ is trade as % of GDP

$Dtaxgdp_{it}$ is domestic taxes on goods and services as % of GDP

$\gamma_{FE}$ is the country fixed effect

$\delta_{FE}$ is the time fixed effect

It should be noted that Equation 2 in particular has endogeneity issues as, arguably, it is likely that the error term is not uncorrelated with the independent variable Taxes on International Trade as a percent of Total Trade (tt). Changes in Trade as a share of GDP may influence directly the ratio "tt".

### 2.4.2 Regression Results

Using a fixed effects regression technique, regressions were run for equations 1 and 2 – both for the time period 1972-1998 to compare to Khattry and Rao's (2002) results and for the extended time period 1972-2006. Table 2-2 reports the results and shows that all variables, with the exception of the dependency ratio, were significant in Equation 1 for both time periods. For the extended time period, a negative but insignificant relationship is estimated between Tax Revenue as a per cent of GDP and the dependency ratio. However, for the reduced time period, a positive but insignificant relationship is observed. Positive relationships are seen between the share of tax revenue and the level of urbanization, per capita income, and the index of openness.

As can be seen from Table 2-3, with the exception of the population size variable and the coefficient on the dependency ratio for the reduced time period, all signs of coefficients are similar to those obtained by Khattry and Rao (2002). The difference may be attributed to the slightly smaller sample size in the equations that were run for the time period 1972-1998. For equation 1, with TRgdp as the dependent variable, the countries missing were Barbados, Israel, Myanmar, Paraguay and Singapore.

**Table 2-2: Regression Results, TRgdp and TTgdp**

| All countries | | | | |
|---|---|---|---|---|
| | **Eq (1)** | **Eq (1) 1972-1998** | **Eq (2)** | **Eq (2) 1972-1998** |
| | **TRgdp** | **TRgdp** | **TTgdp** | **TTgdp** |
| lnpop | -2.85** | -3.39* | -0.29 | -0.16 |
| | (1.17) | (1.23) | (0.49) | (0.67) |
| lnGDPpc | 0.92 | 1.09 | -0.50** | -0.47*** |
| | (0.60) | (0.74) | (0.24) | (0.28) |
| Dep | -1.23 | 0.66 | 1.64** | 2.14** |
| | (1.76) | (1.98) | (0.72) | (0.89) |
| Urbpop | 0.06** | 0.06*** | -0.06* | -0.03* |
| | (0.03) | (0.03) | (0.01) | (0.01) |
| tt | 0.25* | 0.30* | 0.88* | 0.81* |
| | (0.03) | (0.04) | (0.05) | (0.06) |
| $tt^2$ | | | -0.008* | -0.006* |
| | | | (0.001) | (0.001) |
| Trade | | | 0.05* | 0.05* |
| | | | (0.004) | (0.005) |
| Dtaxgdp | | | -0.13* | -0.11* |
| | | | (0.03) | (0.03) |
| ER | | | 0.00 | 0.00 |
| | | | (0.00 ) | (0.00) |
| N | 1701 | 1432 | 1709 | 1449 |
| No. countries | 78 | 75 | 78 | 76 |
| Adjusted $R^2$ | 0.93 | 0.93 | 0.91 | 0.93 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

For equation 2, with TTgdp as the dependent variable, the same countries are missing information, except Israel. While a positive and significant relationship is observed at the 95% level between population size and the share of trade revenue in GDP in Khattry and Rao's regression, a negative and significant relationship is found at the 99% and 95% level in both equations run for the reduced and extended time periods respectively. The coefficients on the level of per capita income and the openness index are significant at the 95% and 99% level, respectively, for both time periods. It may also be observed that the relationship between the level of urbanisation and the share of tax revenue in GDP increased in significance from the 90% to the 95% level when the time period is extended to 2006.

**Table 2-3: Comparison of Khattry and Rao Equation 1 Coefficients with Eq. 1 Regression Estimates, TRgdp**

| Variables | Khattry & Rao Coefficients | Regression Coefficients 1972-1998 | Regression Coefficients 1972-2006 |
|---|---|---|---|
| $lnpop_{it}$ | +** | -* | -** |
| $ln\ GDPpc_{it}$ | + | +** | +** |
| $dep_{it}$ | - | + | - |
| $urbpop_{it}$ | +* | +*** | +** |
| $tt_{it}$ | +* | +* | +* |

*- significance at 99% level; **- significance at 95% level; ***-significance at 90% level.

With respect to Equation 2, which has the share of trade taxes in GDP as the dependent variable, when the similar time frame (1972-1998) is applied, domestic taxes as a per cent of GDP has a negative and significant relationship with the share of taxes on international trade in GDP. (See Tables 2-3 and 2-4 for a comparison of regression coefficients.) This concurs with the significant negative relationship that Khattry and Rao estimate in their model and this is also found in the extended model. In addition, the level of urbanisation was estimated to have a significant negative relationship with Taxes on International Trade over the period 1972-1998. Khattry and Rao (2002) found a negative but insignificant relationship for this variable. A positive and significant relationship was found between TTgdp and the dependency ratio at the 95% level of significance for both time periods. The exchange rate variable (ER) was not found to be significant for both time frames.

**Table 2-4: Comparison of Khattry and Rao Equation 2 (TTgdp) Coefficients with Regression Results**

| Variables | Khattry and Rao Coefficients | Regression Coefficients 1972-1998 | Regression Coefficients 1972-2006 |
|---|---|---|---|
| $tt_{it}$ | +* | +* | +* |
| $tt_{it}^2$ | -* | -* | -* |
| $ER_{it}$ | + | + | + |
| $lnpop_{it}$ | +* | - | - |
| $ln\ GDPpc_{it}$ | + | -*** | -** |
| $dep_{it}$ | + | +** | +** |
| $urbpop_{it}$ | - | -* | -* |
| $trade_{it}$ | +* | +* | +* |
| $Dtaxgdp_{it}$ | -* | -* | -* |

*- significance at 99% level; **- significance at 95% level; ***-significance at 90% level

While Khattry and Rao (2002) found a positive but insignificant relationship between GDP per capita and total trade taxes as a share of GDP, the regression coefficient for this variable for both time periods was found to be negative and significant; that is, as per capita income increases, one is likely to observe a decrease in the proportion of international trade taxes in GDP. This result is consistent with economic theory and observed patterns discussed in Section 2.3.2 where countries with higher levels of income tend to have lower proportion of trade tax revenue in GDP due to diversification of sources of taxation and other factors. Additionally, a negative and insignificant relationship was found between population size and taxes on international trade. This result was inconsistent with the positive and significant relationship found by Khattry and Rao (2002). This may be explained by the different samples used. Barbados, Israel, Myanmar, Paraguay and Singapore are missing from the model run for 1972-1998 when compared to Khattry and Rao's sample.

### 2.4.3 Specification Tests

The Hausman test was conducted on both Equations 1 and 2 to see if a random effects estimator would be more appropriate than a fixed effects estimator. The results of the test on Equation 2 show that the coefficients estimated by the efficient random effects estimator are not the same as the ones estimated by the consistent fixed effects estimator. In this case, it is best to use a fixed effects model. The test could not be performed on Equation 1 as the data failed to meet the asymptotic assumptions of the test.

The Wooldridge test for serial autocorrelation in panel data sets revealed that both equations have serial autocorrelation. Heteroskedasticity is also present in both equations and so, robust standard errors are reported for the models.

In addition, tests were conducted for non-linearity in the per capita income variable. As shown in Figure 2-12, the predicted values of the natural log of per capita income (lnGDPpc) in the model are different from the lowess smoothing curve estimate. This suggests that that the relationship is likely to be non-linear. Equations were estimated including the square of per capita income, with results reported in Table 2-5. The square term of per capita GDP is significant in all equations. However, as all the values of the remaining parameters are similar in direction and significance as those observed in models without the squared term, it is clear that the linear estimator does not significantly bias the results. The next section examines the differing effects of the model if countries are grouped by income.

**Figure 2-12: Augmented Component Plus Residual Plot for lnGDPpc, Equation 1**

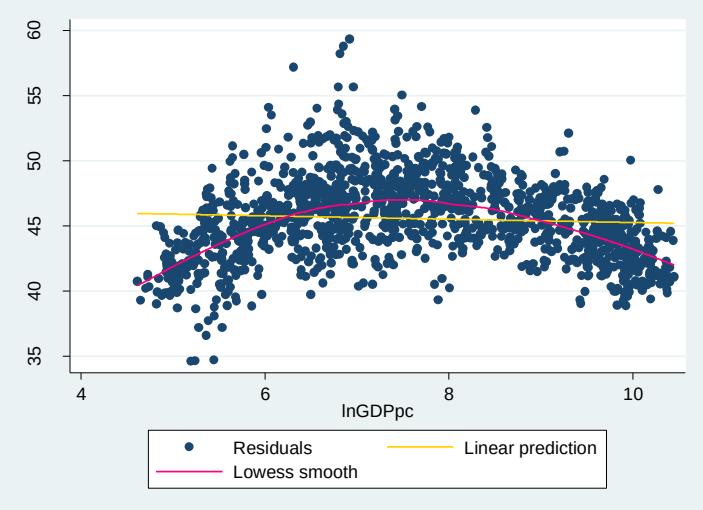



**Table 2-5: Regression Results with the square of Per capita GDP, TRgdp and TTgdp**

| All countries | | | | |
|---|---|---|---|---|
| | **Eq (1)** | **Eq (1) 1972-1998** | **Eq (2)** | **Eq (2) 1972-1998** |
| | **TRgdp** | **TRgdp** | **TTgdp** | **TTgdp** |
| lnpop | -5.95* | -6.92* | -3.27* | -2.02* |
| | (1.43) | (1.54) | (0.60) | (0.75) |
| lnGDPpc | 9.96* | 12.47* | 9.04* | 5.81* |
| | (2.81) | (3.57) | (1.26) | (1.49) |
| $lnGDPpc^2$ | -0.65* | -0.82* | -0.67* | -0.44* |
| | (0.19) | (0.24) | (0.08) | (0.10) |
| Dep | -0.78 | 0.54 | 2.20* | 2.21** |
| | (1.76) | (1.96) | (0.71) | (0.87) |
| Urbpop | 0.10* | 0.10* | -0.03* | -0.01 |
| | (0.03) | (0.04) | (0.01) | (0.01) |
| tt | 0.26* | 0.31* | 0.90* | 0.81* |
| | (0.04) | (0.04) | (0.05) | (0.06) |
| $tt^2$ | | | -0.008* | -0.006* |
| | | | (0.001) | (0.001) |
| Trade | | | 0.05* | 0.05* |
| | | | (0.004) | (0.005) |
| Dtaxgdp | | | -0.13* | -0.10* |
| | | | (0.03) | (0.03) |
| ER | | | 0.00 | 0.00 |
| | | | (0.00) | (0.00) |
| N | 1701 | 1432 | 1709 | 1449 |
| No. countries | 78 | 75 | 78 | 76 |
| Adjusted $R^2$ | 0.93 | 0.93 | 0.92 | 0.93 |

*- significance at 99% level; **- significance at 95% level; ***-significance at 90% level. Robust standard errors in parentheses.

### 2.4.4 Breakdown by Country Group

There are likely to be differences in the relationships between the dependent and independent variables for individual country groups – low income, lower middle income, upper middle income and high income. Tables 2-6 and 2-7 show the results of regression run for Equations 1 and 2 respectively for each country grouping. For Equation 1, the openness index and the level of urbanization are the only variables that exhibit a consistent (positive) relationship with the share of tax revenue in GDP across country groups. With respect to the openness index, the relationship is not significant for the high income group. In contrast, the level of urbanisation is found to be a significant variable for only the low income group. Country size, as indicated by total population, has a positive relationship with TRgdp that is significant for low income countries. At the same time, a negative relationship is observed for the three other categories of countries, with the lower middle income and high income categories showing a significant relationship at the 90% and 99% level, respectively, between population size and the share of trade revenue in GDP.

**Table 2-6: Equation 1 Regression by Country Group, TRgdp**

| **Eq (1) TRgdp 1972-2006** | | | | |
|---|---|---|---|---|
| | **Low Income** | **Lower Middle Income** | **Upper Middle Income** | **High Income** |
| **lnpop** | 17.20* | -5.42*** | -0.87 | -0.75* |
| | (2.62) | (3.08) | (4.75) | (2.57) |
| **lnGDPpc** | 5.53* | 1.80*** | -0.19 | -3.99* |
| | (0.84) | (1.03) | (1.26) | (1.32) |
| **Dep** | 11.01* | -6.09 | -11.16** | -17.35* |
| | (2.42) | (3.98) | (5.12) | (4.27) |
| **Urbpop** | 0.39* | 0.08 | 0.09 | 0.03 |
| | (0.08) | (0.05) | (0.09) | (0.05) |
| **tt** | 0.22* | 0.92* | 0.27** | 0.03 |
| | (0.04) | (0.08) | (0.13) | (0.03) |
| **N** | 390 | 490 | 274 | 547 |
| **No. of countries** | 18 | 21 | 12 | 27 |
| **Adjusted $R^2$** | 0.90 | 0.80 | 0.61 | 0.93 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

The relationship between GDP per capita and TRgdp is positive and significant for low income and lower middle income countries but negative for upper middle income and high income countries, with significance being observed only in the case of the latter group. The dependency ratio shows a negative and significant relationship for upper middle income, and high income groups.

A negative relationship is also seen for lower middle income countries but this is not significant. On the other hand, a significant positive relationship is seen for low income countries.

With respect to Equation 2 which seeks to quantify the relationship between Taxes on international trade as a share of GDP (TTgdp) and variables such as population size, per capita GDP, and Trade as a per cent of GDP (Table 2-7), the variations across income groups observed for equation 1 are also seen. Population size has a positive and insignificant relationship with the share of trade taxes in GDP for low income and high income countries; while the relationship is negative for lower middle income and upper middle income countries. Significance is only observed for the upper middle income category.

**Table 2-7: Equation 2 Regression by Country Group, TTgdp**

| **Eq (2) TTgdp 1972-2006** | | | | |
|---|---|---|---|---|
| | **Low Income** | **Lower Middle Income** | **Upper Middle Income** | **High Income** |
| **lnpop** | 0.25 | -0.66 | -5.49* | 0.27 |
| | (1.35) | (0.99) | (1.36) | (1.14) |
| **lnGDPpc** | 0.16 | -0.37 | -2.85* | -1.09* |
| | (0.40) | (0.32) | (0.52) | (0.39) |
| **Dep** | 0.66 | -2.53** | -3.45** | -0.43 |
| | (1.08) | (1.02) | (1.34) | (1.97) |
| **Urbpop** | -0.10* | -0.03 | 0.01 | -0.03*** |
| | (0.03) | (0.02) | (0.03) | (0.02) |
| **tt** | 0.40* | 0.88* | 0.51* | 1.56* |
| | (0.03) | (0.10) | (0.11) | (0.06) |
| **$tt^2$** | -0.003* | -0.005 | -0.003 | -0.02* |
| | (0.0008) | (0.005) | (0.008) | (0.002) |
| **Trade** | 0.08* | 0.06* | 0.01* | 0.04* |
| | (0.008) | (0.006) | (0.004) | (0.006) |
| **Dtaxgdp** | -0.17* | -0.14* | -0.06 | -0.09* |
| | (0.06) | (0.03) | (0.05) | (0.03) |
| **ER** | 0.00** | 0.00* | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| **N** | 396 | 467 | 274 | 572 |
| **No. of countries** | 18 | 21 | 12 | 27 |
| **Adjusted $R^2$** | 0.95 | 0.95 | 0.94 | 0.97 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

With respect to GDP per capita, lower middle, upper middle and high income country groups show a negative, but significant only for the last two categories, relationship with TTgdp. A positive relationship and insignificant relationship is observed for the low income group.

The dependency ratio varies inversely with the level of international trade taxes for lower middle income, upper middle income and high income

(insignificant) countries. For low income countries, the relationship seen is positive and insignificant.

The level of urbanisation is shown to have a negative relationship with the level of international trade taxes for low, lower middle and high income country groups, with significance at the 99% level for the low income countries and at the 90% level for high income countries; the relationship is not significant for lower middle income and high income countries. For the upper middle income group, the relationship observed is positive but insignificant.

The coefficients on the openness index and trade as a percentage of GDP are positive and significant at the 99% level for all country groups. This implies that regardless of the level of development, increases in exports plus imports as a per cent of GDP generally imply an increase in the level of international trade taxes as a per cent of GDP. However, an increase in the openness index, "tt", means that there is a higher ratio of trade tax revenue to total trade. Therefore as "tt" increases, the economy becomes less open), the positive coefficient on the openness index suggests that international trade tax as a percent of GDP is likely to rise as an economy becomes less open.

Domestic taxes as a per cent of GDP have a negative and significant relationship with TTgdp for low, lower middle, and high income countries. A negative but insignificant relationship is observed for upper middle income countries. Although the estimated coefficient is very small, the Exchange Rate variable is significant for low income and lower middle income countries, at the 95% and 99% level respectively, but insignificant for upper middle income and high income countries.

Table 2-8 shows the results of running both equations for only developing countries, that is, countries in the high income category were left out. These regressions yield results that are generally similar to those obtained by Khattry and Rao (2002) for both models. However, there is now a positive relationship between population size and the share of international trade tax revenue as a percentage of GDP (TTgdp). All other signs remain unchanged. With respect to the Total Revenue equation (TRgdp), the coefficients on the population size and dependency variables have changed to positive, with the other signs remaining unchanged.

**Table 2-8: Regressions without high income countries, TRgdp and TTgdp**

| | Eq (1) | Eq (1) 1972-1998 | | Eq (2) | Eq (2) 1972-1998 |
|---|---|---|---|---|---|
| | **TRgdp** | **TRgdp** | | **TTgdp** | **TTgdp** |
| lnpop | 4.45* | 5.51* | | 0.94 | 1.13*** |
| | (1.70) | (2.04) | | (0.60) | (0.68) |
| lnGDPpc | 1.87* | 2.86* | | -0.84* | -0.72** |
| | (0.67) | (0.81) | | (0.27) | (0.28) |
| Dep | 0.02 | 2.53 | | 2.24* | 1.76** |
| | (1.99) | (2.15) | | (0.67) | (0.81) |
| Urbpop | 0.04 | 0.02 | | -0.06* | -0.05* |
| | (0.04) | (0.05) | | (0.01) | (0.01) |
| tt | 0.35* | 0.42* | | 0.58* | 0.59* |
| | (0.05) | (0.05) | | (0.04) | (0.04) |
| $tt^2$ | | | | -0.005* | -0.004* |
| | | | | (0.0009) | (0.0008) |
| Trade | | | | 0.04* | 0.05* |
| | | | | (0.005) | (0.005) |
| Dtaxgdp | | | | -0.12* | -0.11* |
| | | | | (0.03) | (0.03) |
| ER | | | | 0.00 | 0.00*** |
| | | | | (0.00 ) | (0.00) |
| N | 1154 | 966 | | 1137 | 958 |
| No. of countries | 51 | 50 | | 51 | 50 |
| Adjusted $R^2$ | 0.81 | 0.82 | | 0.92 | 0.93 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

These models have examined fully the effects of liberalisation using the fixed effects model of Khattry and Rao (2002). It has been shown that this model is robust to changes in time periods and has varying effects depending on the country group under study. One consistent finding across all models is that the openness index has a positive relationship with both Total Tax Revenue and Trade Tax Revenue as a share of GDP. Due to its construction, an increase in the index means that the economy is becoming less open and therefore the results in this case suggest that as an economy becomes less open, trade tax revenue and total tax revenue as a share of GDP increases. This finding will be further examined given the challenges with using the openness index (tt) and the next section will present alternative measures that could be used, such as the traditional indicator of openness – trade as a per cent of GDP, and event analysis.

## 2.5 Addressing Endogeneity in the Model

Khattry and Rao (2002) use "tt" as a new measure of openness. This variable is the ratio between total international trade taxes and total trade. For them, a decrease in this ratio means greater openness. This indicator has certain challenges with respect to measuring the concept of openness. In the first instance, Khattry and Rao themselves note that there is the potential criticism that this measure is endogenous with respect to the dependent variable (total trade taxes as a share of GDP). They note the potential solutions such as using instrumental variables (Lee (1993); Frankel and Romer (1999)) but find that findings from these studies are not superior to measures that use tariffs directly. This criticism could be avoided by using the traditional indicator of openness – trade as a percentage of GDP – in their models.

They also note other potential shortcomings of using this "index of openness", including possible underestimation of the Laffer effect of peak tariffs and of the impact of smuggling and other tax evasion efforts. Specifically, the composition of the indicator with total trade as the denominator and taxes on international trade as the numerator does not adequately capture cases where there may be a reduction in the tariff that leads to an increase in international trade tax revenue. This would result in an increase in the openness index, "tt", ceteris paribus. However, the economy in this case did not become less open. Khattry and Rao (2002) counter this criticism by arguing that changes in trade volume (the denominator) reflect the net effect of policy changes and exogenous factors and therefore, the index accommodates instances such as these. This argument should be rejected as the relative effect depends on the extent to which there has been an increase in marginal trade tax revenue vis-á-vis total trade. Agbeyegbe et al. (2006) also point out that this measure is limited in its application as a close relationship is not directly observed between changes in exports and trade liberalisation.

Greenaway and Milner (1991) note that the net effect of a tariff reduction is dependent on the initial tariff and the elasticity of demand for imports over the tariff range in question. Trade tax revenue will increase if the initial tariff is above the revenue maximising rate. They also note external effects of liberalisation such as reducing the incentive for smuggling thereby increasing compliance and the tax base. A reduction in trade tax revenue would result if the initial tariff is below the revenue maximizing rate. For Greenaway and Milner (1991), the net effect of tariff liberalisation is dependent on the location of existing rates in relation to the revenue maximising rate, the shares of the respective imports in total imports, and relevant individual own and cross price elasticities of demand and supply – a very complex issue.

### 2.5.1 Trade as a share of GDP as the indicator of openness

In order to test its usefulness and to address the problem of endogeneity, Equations 1 and 2 were run for both time periods excluding the openness index, "tt", and using the one-year lag of Trade as a per cent of GDP. Trade as a share of GDP itself could be seen as being endogenous to the model as it is also dependent on changes in GDP along with the dependent variables – international trade taxes (TTgdp) and total tax revenue (TRgdp) as shares of GDP. Lagging the variable removes the contemporaneous relationship among the variables and is one way to address this issue. In addition to the one-year lag, regressions were also run with the three-year lag of Trade as a share of GDP to test for sensitivity of the time period chosen.

**Table 2-9: Regressions using 1-year lag of Trade, TRgdp and TTgdp**

| All countries | | | | |
|---|---|---|---|---|
| | **Eq. 1 (1972-2006)** | **Eq. 1 (1972-1998)** | **Eq. 2 (1972-2006)** | **Eq. 2 (1972-1998)** |
| | **TRgdp** | **TRgdp** | **TTgdp** | **TTgdp** |
| **lnpop** | -9.16* | -8.25* | -5.68* | -2.44 |
| | (1.02) | (1.12) | (1.06) | (1.56) |
| **lnGDPpc** | -0.92 | -0.42 | -2.82* | -2.16* |
| | (0.58) | (0.73) | (0.35) | (0.40) |
| **Dep** | -2.37 | -0.43 | 3.91* | 1.97 |
| | (1.68) | (1.99) | (1.16) | (1.44) |
| **Urbpop** | 0.08* | 0.05 | -0.02 | -0.01 |
| | (0.03) | (0.03) | (0.02) | (0.02) |
| **$Trade_{t-1}$** | 0.02* | 0.03* | 0.03* | 0.02* |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| **Dtaxgdp** | | | -0.29* | -0.27* |
| | | | (0.04) | (0.05) |
| **ER** | | | 0.00* | 0.00 |
| | | | (0.00) | (0.00) |
| **N** | 2077 | 1681 | 1713 | 1447 |
| **No. of countries** | 78 | 76 | 78 | 76 |
| **Adjusted $R^2$** | 0.93 | 0.93 | 0.74 | 0.76 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

With respect to Equation 1 with Tax Revenue as a percentage of GDP as the dependent variable, the Adjusted R-squared value remains high for the equation without "tt" at 0.93 (see Table 2-9). This suggests that the model does not lose much of its explanatory power if "tt" is dropped and replaced by Trade. The one-year lag of Trade as a share of GDP is shown to have a positive and significant relationship (at the 99% level) with the Tax Revenue as a per

cent of GDP. A negative and significant relationship is found between the share of tax revenue and population size; while a positive and significant relationship is found with respect to the level of urbanisation (at the 99% level of significance). The dependency ratio and the level of per capita income have negative but insignificant relationships with the share of tax revenue in GDP. When the reduced time period is applied to the equation, population size remains a significant variable in the model and the level of urbanisation is no longer a significant variable.

For the extended time period with the one-year lag of Trade as a share of GDP ($Trade_{t-1}$) as the only indicator of openness in Equation 2, significant negative relationships were found between the share of Taxes on International Trade in GDP and population size, the level of per capita income, and the share of domestic taxes on GDP – all at the 99% level. Significant positive relationships were found with respect to the dependency ratio, and Trade as a per cent of GDP. Hence, by this estimate, higher trade means higher taxes on international trade, ceteris paribus. Additionally, when the time period is reduced, two variables lose their significance: population size, and the dependency ratio. The exchange rate is not significant in either time period. The adjusted R-squared falls substantially in the model without "tt", however. This is not surprising, given the significant correlation between TTgdp and "tt" because of the inclusion of the value of taxes on international trade as an element in both variables.

Another variation of the model in Equation 2 was undertaken by excluding the one-year lag of Trade as a per cent of GDP as an independent variable. Thus, "tt" and its square was the only indicator of openness. The results are reported in Table 2-10 and are different from those obtained in earlier estimates with respect to the fact that in this estimation, population size, the level of per capita income, and the dependency ratio do not have a significant relationship with the share of international trade taxes in total trade. The significant variables for both time periods are the level of urbanisation, the openness index and its square, the share of domestic taxes in GDP, and the exchange rate variable.

It should be noted that the removal of the openness variable has a greater impact on Equation 2 than on Equation 1. This is expected given the high degree of correlation between the dependent variable (TTgdp) and the openness index (tt) and the endogeneity issues associated therewith. Importantly, the revised regressions with the one-year lag of the traditional indicator of openness (Trade as a share of GDP) indicate that an increase in international trade increases trade tax revenue and total tax revenue. This is contrary to Khattry and Rao's (2002) finding that an increase in openness

negatively affects trade tax revenue and total tax revenue. The digression suggests that the tt openness index may not be an adequate indicator to capture the effects of liberalisation on tax revenue.

**Table 2-10: Equation 2 without Trade, TTgdp**

| | 1972-2006 | 1972-1998 |
|---|---|---|
| | **TTgdp** | **TTgdp** |
| **lnpop** | -0.62 | -0.21 |
| | (0.55) | (0.73) |
| **lnGDPpc** | -0.07 | 0.001 |
| | (0.27) | (0.32) |
| **Dep** | 1.14 | 1.30 |
| | (0.78) | (0.98) |
| **Urbpop** | -0.04* | -0.03** |
| | (0.01) | (0.01) |
| **tt** | 0.85* | 0.76* |
| | (0.05) | (0.06) |
| **$tt^2$** | -0.007* | -0.005* |
| | (0.001) | (0.001) |
| **Trade** | ------ | ------ |
| | | |
| **Dtaxgdp** | -0.15* | -0.10* |
| | (0.03) | (0.03) |
| **ER** | 0.00* | 0.00** |
| | (0.00) | (0.00) |
| **N** | 1709 | 1449 |
| | | |
| **Adjusted $R^2$** | 0.89 | 0.91 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

In addition, the findings are sensitive to the lag chosen for Trade as a share of GDP (see Table 2-11). The three-year lag of Trade as a share of GDP is significant at the 95% level for Equation 1, with TRgdp as the dependent variable, over the period 1972-2006. However, income as measured by GDP per capita and the dependency ratio are now significant variables. The results for the reduced time period (1972-1998) are not sensitive to a change in the lag of trade as a share of GDP as the results remain the same. Only population size and the three-year lag of Trade as share of GDP are significant for this time period.

With respect to Equation 2, with TTgdp as the dependent variable, the results are not sensitive to a change in lag value of Trade as a share of GDP to three years. Population size, per capita income, the dependency ratio, domestic taxes as a share of GDP and the exchange rate all remain as significant variables with similar directional relationships as the equation with the one-year lag of Trade as a share of GDP. The results are the same when the time period is reduced to 1972-1998.

**Table 2-11: Regressions using 3-year lag of Trade, TRgdp and TTgdp**

| All countries | | | | |
|---|---|---|---|---|
| | **Eq. 1 (1972-2006)** | **Eq. 1 (1972-1998)** | **Eq. 2 (1972-2006)** | **Eq. 2 (1972-1998)** |
| | **TRgdp** | **TRgdp** | **TTgdp** | **TTgdp** |
| **lnpop** | -9.48* | -8.78* | -6.66* | -3.53** |
| | (1.05) | (1.19) | (1.13) | (1.70) |
| **lnGDPpc** | -1.09**** | -0.79 | -2.89* | -2.01* |
| | (0.60) | (0.76) | (0.39) | (0.45) |
| **Dep** | -3.25*** | -2.03 | 3.68* | 1.40 |
| | (1.70) | (2.03) | (1.20) | (1.55) |
| **Urbpop** | 0.08* | 0.04 | -0.03 | -0.02 |
| | (0.03) | (0.03) | (0.02) | (0.02) |
| **$Trade_{t-3}$** | 0.02** | 0.03* | 0.02* | 0.004 |
| | (0.008) | (0.01) | (0.01) | (0.006) |
| **Dtaxgdp** | | | -0.30* | -0.27* |
| | | | (0.04) | (0.05) |
| **ER** | | | 0.00* | 0.00** |
| | | | (0.00) | (0.00) |
| **N** | 2022 | 1618 | 1659 | 1389 |
| **No. of countries** | 78 | 76 | 78 | 76 |
| **Adjusted $R^2$** | 0.93 | 0.94 | 0.73 | 0.76 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

The next chapter will apply one other method - event analysis - to the question of the impact of liberalisation on taxes on tax revenue. This will assist in evaluating the validity of findings of these models.

## 2.6 Conclusions

This chapter has examined two techniques to analyse the fiscal implications of trade liberalisation. Both are set in a fixed effects panel regression model – the difference lies in the measurement of tariff liberalisation (openness). In the first instance, equations 1 and 2, with dependent variables as tax revenue as a share of GDP and international trade tax revenue as a share of GDP, respectively, were run for two time periods (1972-1998 and 1972-2006). The results suggest a negative relationship between trade liberalisation, as measured by the openness index, and international trade tax and total tax revenue. All variables, but for the dependency ratio, are significant in Equation 1 for both time periods. With the exception of the population size variable and the coefficient on the dependency ratio for the reduced time period, all signs of coefficients are similar to those obtained by Khattry and Rao (2002). The results suggest that the share of tax revenue in GDP increases with advances in level of urbanization, per capita income, and a fall in an economy's openness

(an increase in the openness index means an economy is becoming less open). On the other hand, in contrast to Khattry and Rao's (2002) finding, the regression results indicate that the share of tax revenue in GDP is likely to fall as population size increases. With respect to Equation 2, the results show that the share of international trade tax revenue in GDP is likely to fall as domestic taxes as a per cent of GDP, and the level of urbanisation increases. Additionally, it is observed that as per capita income, and the age-dependency ratio increase, one is likely to observe an increase in the proportion of international trade taxes in GDP.

In order to determine any variations due to differing levels of development, these models were then analysed by country group. The results show that the share of tax revenue in GDP is likely to fall as an economy becomes more open. For Equation 1, the openness index is one of two variables (the other being the level of urbanisation) that exhibit a consistent (positive) relationship with the share of tax revenue in GDP across country groups. Importantly, the results suggest that international trade tax revenue tends to fall over time as a country develops (level of per capita income increases). For equation 2, the coefficients on the openness index and trade as a percentage of GDP are positive and significant for all country groups. The positive coefficient on trade as a percentage of GDP implies that regardless of the level of development, increases in exports plus imports as a per cent of GDP generally imply an increase in the level of international trade taxes as a per cent of GDP. However, in contrast, as an increase in the openness index means that an economy is becoming less open, the positive coefficient on the openness index suggests that international trade tax as a percent of GDP is likely to rise as an economy becomes less open. The model also predicts that trade tax revenue is likely to fall as domestic taxes as a per cent of GDP increase. This relationship is significant for low, lower middle, and high income countries and suggests that domestic taxes are one avenue through which countries may recoup lost trade tax revenue as a result of trade liberalisation.

As both models utilised by Khattry and Rao (2002) contain an openness index which presents certain challenges, including the potential for endogeneity within the model, the model was varied to utilise an alternative measure of openness - trade as a per cent of GDP. It should be noted that Trade as a share of GDP is also endogenous within the models as the dependent variables are also conditioned on GDP. The method chosen to address this was to lag Trade as a share of GDP for one and three-year periods. Choosing two different lags allowed for testing for robustness of results to the time period chosen. When the one-year lag of Trade as a percent of GDP is used as the indicator of openness, the results show a positive relationship between openness, and trade and total tax revenue as a share of GDP for both equations; that is, trade

tax revenue and total tax revenue are likely to increase as an economy becomes more open. This suggests that the models are sensitive to the indicator of openness used. In addition, the final effect of trade liberalisation is difficult to predict and is dependent on a variety of factors that may be difficult to capture in one model. Except for Equation 1 with total tax revenue (TRgdp) for the time period, 1972-1998, the results are not sensitive to the lag value chosen. One can therefore use the one-year lag which provides greater degrees of freedom and more power to the results.

Given the findings from these models, it is clear that there is much room for further analysis in this area to find better ways of measuring the net impact of liberalisation on government revenue. The analysis could be extended to examine the impact of lowering tariffs as against eliminating non-tariff barriers, for example. In addition, there could be further breakdown of the different components of trade taxes, by import taxes and export taxes, for example, to see how the liberalisation process impacts each component. There is also room to analyse the net effect of trade liberalisation by using a general equilibrium model that can take account of the impact of relative prices and demand for final and intermediate goods as a result of changes in the price level due to adjustments in the tariff structure.

# APPENDIX 2A - COUNTRIES IN EQUATIONS 1 AND 2

| **Low Income** | **Lower Middle Income** |
|---|---|
| Bangladesh | Bhutan |
| Burkina Faso | Cameroon |
| Burundi | Colombia |
| Congo, Dem. Rep. | Congo, Rep. |
| Gambia, The | Dominican Republic |
| Ghana | Ecuador |
| India | Egypt, Arab Rep. |
| Kenya | Fiji |
| Liberia | Guyana |
| Madagascar | Jordan |
| Malawi | Lesotho |
| Myanmar | Morocco |
| Nepal | Nicaragua |
| Pakistan | Paraguay |
| Papua New Guinea | Peru |
| Sierra Leone | Philippines |
| Uganda | Sri Lanka |
| Zambia | Swaziland |
| Zimbabwe | Syrian Arab Republic |
| | Thailand |
| | Tunisia |

| **Upper Middle Income** | **High Income** | |
|---|---|---|
| Argentina | Australia | Japan |
| Botswana | Austria | Korea, Rep. |
| Brazil | Barbados | Luxembourg |
| Chile | Belgium | Malta |
| Costa Rica | Canada | Netherlands |
| Malaysia | Cyprus | New Zealand |
| Mauritius | Denmark | Norway |
| Mexico | Finland | Portugal |
| Panama | France | Singapore |
| South Africa | Greece | Spain |
| Turkey | Iceland | Sweden |
| Uruguay | Ireland | Switzerland |
| | Israel | United Kingdom |
| | Italy | United States |

# APPENDIX 2B: CORRELATION MATRICES

**Table 2-12: Correlation Matrix for Equation 1**

| | TRgdp | lnpop | lnGDPpc | tt | Dep | Urbpop |
|---|---|---|---|---|---|---|
| **TRgdp** | 1.0000 | | | | | |
| **lnpop** | -0.1369 | 1.0000 | | | | |
| **lnGDPpc** | 0.6729 | -0.0045 | 1.0000 | | | |
| **Tt** | -0.1332 | 0.0121 | -0.5043 | 1.0000 | | |
| **Dep** | -0.4799 | -0.1115 | -0.7801 | 0.4047 | 1.0000 | |
| **Urbpop** | 0.5111 | 0.0258 | 0.8372 | -0.4306 | -0.6787 | 1.0000 |

**Table 2-13: Correlation Matrix for Equation 2**

| | TTgdp | lnpop | lnGDPpc | tt | $tt^2$ | DTaxgdp | Trade | ER | Dep | Urbpop |
|---|---|---|---|---|---|---|---|---|---|---|
| **TTgdp** | 1.00 | | | | | | | | | |
| **lnpop** | -0.32 | 1.00 | | | | | | | | |
| **lnGDPpc** | -0.27 | -0.03 | 1.00 | | | | | | | |
| **tt** | 0.72 | 0.02 | -0.47 | 1.00 | | | | | | |
| **$tt^2$** | 0.52 | 0.04 | -0.21 | 0.83 | 1.00 | | | | | |
| **DTaxgdp** | -0.09 | -0.05 | 0.51 | -0.11 | 0.13 | 1.00 | | | | |
| **Trade** | 0.34 | -0.57 | 0.15 | -0.14 | -0.09 | 0.03 | 1.00 | | | |
| **ER** | -0.04 | 0.06 | 0.005 | -0.04 | -0.01 | 0.07 | -0.01 | 1.00 | | |
| **Dep** | 0.28 | -0.10 | -0.78 | 0.38 | 0.16 | -0.43 | -0.11 | -0.04 | 1.00 | |
| **Urbpop** | -0.25 | -0.01 | 0.84 | -0.41 | -0.20 | 0.47 | 0.15 | 0.02 | -0.67 | 1.00 |

# 3. EVENTS ANALYSIS OF THE IMPACT OF TRADE LIBERALISATION

## 3.1 Introduction

The impact of trade reform on fiscal revenue can be measured in various ways but a key variable to consider is the definition of trade reform itself. Some models have used the degree of openness as an indicator of trade reform. Openness indicators include, for example, a change in exports plus imports as a share of GDP or the openness index (the ratio of total trade tax revenue to the value of total trade as in Khattry and Rao (2002) and Chapter 2), that indicate a country's general orientation towards the world. Researchers utilise an openness variable to examine the impact of trade reform on fiscal revenue, taking into account other variables such as population size and the dependency ratio. The vast majority of these models measure liberalisation over time although trade liberalisation was often driven by economic shocks and externally imposed under loan agreements with multilateral lending institutions. As a condition of the loans, countries (mainly developing) were required to undergo a series of reforms, including trade liberalisation. In these cases, trade liberalisation can be linked to specific periods when these reforms occur.

In this case, one can analyse the impact of trade liberalisation directly by observing the changes in key variables, such as total tax revenue and trade tax revenue as a share of GDP, in the period before and after liberalisation. Events analysis is a valid methodology for conducting this analysis as it takes into account the context within which reforms occurred and how that may have affected the composition, pace and sequencing of reforms. This chapter explores this methodology and applies it to an analysis of the impact of trade liberalisation on total tax revenue and trade tax revenue as a share of GDP. It compares the results from these models to those obtained in Chapter 2 in order to evaluate robustness of findings.

Chapter 3 also explores the issue of heterogeneity within the sample, specifically relating to the varying levels of development among countries and the treatment of export taxes by individual countries over the time period and their impact on the liberalisation experience and fiscal revenue. The fact that developing countries often undertook trade reforms as part of a lending programme with the Fund or the World Bank means that their liberalisation experience is likely to be different from countries that liberalised with no external impetus. For example, the pace of liberalisation may have been more aggressive for those countries in a reform programme when compared to those that liberalised on their own timetable, leaving them vulnerable to

shocks to fiscal revenue. This chapter analyses the models in terms of developing and developed countries in order to explore these issues and to see if there is any empirical basis for these inferences.

In addition, export taxes constitute a relatively small proportion of total trade tax revenue for most countries. However, for those countries where export taxes constitute a large proportion of government revenue, it may be argued that they may seek to implement a reform programme that aims to minimise the impact on export tax revenue. In this case, they may therefore be willing to reduce import taxes at a much faster rate and decrease export taxes more slowly when compared to countries that do not have a high proportion of export tax to total trade tax revenue. Moreover, under IMF and World Bank reform programmes, export taxes were often targeted in the first phase of reform; thus, putting even more pressure on those countries with significant export tax revenue levels. In this context, it would be interesting to see if there are significant differences in fiscal revenue of those countries over time when compared to other countries.

Chapter 3 starts by providing an overview of the events measures that will be used in the study. It then goes on to explore the correlation between the events measures and the fiscal revenue indicators – total tax revenue and trade tax revenue. The results from the regression models are then analysed. The next section goes on to explore heterogeneity within the sample based on the level of income and dependence on export taxes. The chapter then concludes by summarising the main findings and implications for future work.

## 3.2 Measuring Events

There are several approaches to measuring events. Some include composite indices, while others explore specific indicators of a particular event. All of them involve a subjective assessment, to some extent, of the variables to be used as an event indicator and the date the event occurred. An events indicator may be viewed as being exogenous to the model as it is less likely to be correlated over time with trade and total tax revenue as a share of GDP. Indeed, for developing countries, liberalisation events occur oftentimes as part of package of reforms under the International Monetary Fund (IMF) or World Bank. One may therefore be able to use a dummy variable such as the date when a country entered into a structural adjustment loan with the World Bank (Greenaway et al. (2002)). Using indicators related to a specific year or event, however, may present challenges because liberalisation takes place over time and there may be years when an economy is perceived to be open but a change in government or other external factors alter the movement towards liberalisation. Although these issues are recognized, events analysis is still

useful to examine liberalisation through a different lens. This chapter draws upon the work of Sachs and Warner (1995), Dean et al. (1994), and Greenaway et al. (2002) to identify the year of liberalisation events and apply the analysis in an econometric model to assess the impact of these events on government revenue.

With respect to composite indices, the Sachs-Warner index is one of the most often cited work in empirical studies. Sachs and Warner (2005) develop a composite indicator of the degree of openness of thirty-four countries using five criteria. A country is judged to be closed if it had:

1. Nontariff barriers (NTBs) that apply to 40% or more of its trade.

2. Average tariff rates greater than 40%.

3. A black market exchange rate that deviated from the official exchange rate by 20% or more, on average, during the 1970s or 1980s.

4. A socialist economic system.

5. A state monopoly on major exports.

The liberalisation date is set from the year at which the economy is deemed to be continually open until the end of the sample period of the study in 1994. Sachs and Warner (1995) note that there are limitations to the methodology used such as the subjective dating of the liberalisation event and the arbitrary levels of indicator thresholds. In addition, there is the criticism that the Sachs-Warner index ascribes a discrete value (either liberalisation occurred or it did not) to a process that usually lasts several years (David (2008)). Other challenges include the lack of significance and small magnitude of the effect of tariffs and quotas in the index once all its constituents are separated (Harrison and Hanson (1999) and Rodriguez and Rodrik (2001). While the index is an imperfect measure (as are all indicators of openness), it is useful and relevant as it includes features that are typical of a closed economy and can therefore be used to compare and contrast the effect of liberalisation with open economies.

Alternatively, studies such as Dean et al. (1994) evaluate the individual components of trade reform and therefore, do not face criticism on conflating several factors in one index as seen in Sachs-Warner (1995). They assess changes in tariffs, non-tariff barriers, foreign exchange controls, and export impediments in thirty-two countries from 1982 to 1993 in South and East Asia, Latin America, and Africa. Data include changes in the level, range, and dispersion of tariffs, and the extent of quantitative restrictions. Based on the changes in these variables, a year(s) of liberalisation is derived for each

country. As is often the case in studies of this nature, there is some subjectivity in ascribing the year of reform given that there are several indicators that may not be all pointing in the same direction at the same time.

There is also the use of a relatively simple policy proxy dummies, such as the date of signature of a country's Structural Adjustment Loan with the World Bank. Measures such as these do not directly measure the liberalisation experience; however, a structural adjustment loan may be seen as an indicator of a country's intent to liberalise (based on the policy conditionalities of the loan) and thus, provide an indicator that is not directly correlated with trade tax revenue and total tax revenue. Greenaway et al. (2002) utilise such an approach in their analysis of liberalisation events.

The event measures are distinct and are not interchangeable as most provide different estimates of the liberalisation event even for the same countries. In fact, only Venezuela records the same year of liberalization for all three measures and another two countries – Ghana and Costa Rica - have a variance of one year among the event indicators. The analysis in this section treats each event indicator separately and a judgement is not made on the superiority of one measure over the other. This approach is useful as it tests the robustness of these measures across time and may provide an indication of the main factors that influence trade tax and total tax revenue, in general, as the event indicators measure liberalisation differently.

Similar to Greenaway et al. (2002), we include two variations of the Dean et al. and the Sachs-Warner dummies in the regression models – one where the dummies take a value of 1 only in the year the event occurred and the other where the dummy takes the value of 1 in the year of liberalisation and for all subsequent years. The event indicators replace the openness index in both equations estimated by Khattry and Rao (2002). The model also incorporates lagged values of the Dean and Sachs-Warner variables. Appendix 3A provides the list of the predominantly developing countries used in the sample and the date of liberalisation based on the three event indicators over the period 1972-2006. The next section analyses the data that will be used in the regression models.

## 3.3 Data Analysis

Each event dummy is plotted against total trade tax revenue as a share of GDP to see if there is any pattern that can be observed. With respect to the World Bank dummy, there is no clear pattern pre- and post-signature of a World Bank Structural Adjustment loan agreement (see Figure 3-1). There are several

factors that may influence the relationship between a structural adjustment loan and total trade taxes as a share of GDP. In the first instance, a reform programme is multi-faceted and the final impact on trade tax revenue and total tax revenue depends on the execution of the programme and the response of the economy to reforms. For example, there may be a revenue-enhancing component in the form of technical assistance in customs administration and at the same time, there is a requirement to reduce tariff peaks on luxury items which may have a negative effect on fiscal revenue. At the same time, where tariff rates are above the revenue maximising rate, a reduction in rates may lead to increased revenue as consumers are incentivised to increase consumption. The final effect on trade tax revenue depends on the interplay of all these and other factors.

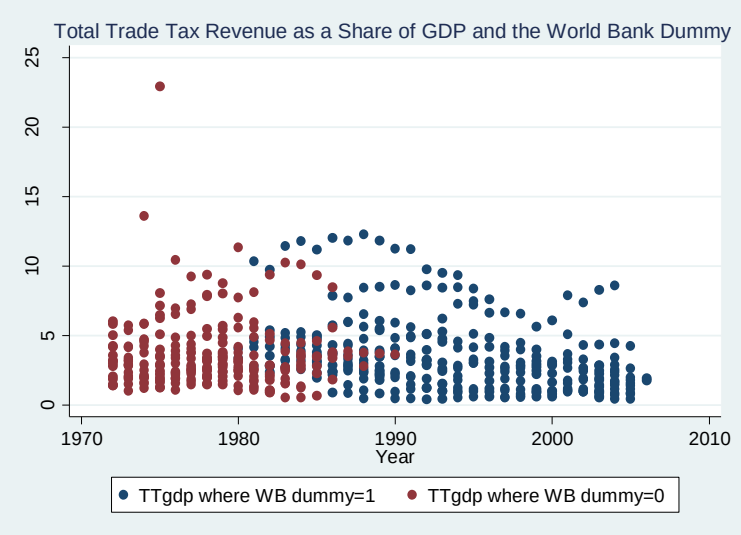



**Figure 3-1: Scatterplot of Total Trade Tax Revenue as a Share of GDP and the World Bank Dummy**

The plot of trade tax revenue in GDP and the first Sachs-Warner dummy (SW1) shows that there appears to be a greater proportion of points below the 5% mark after trade liberalisation. The Sachs-Warner dummy in this case takes the value of 0 before the year of liberalisation and 1 in the year of liberalisation and all the subsequent years. It measures the average post reform effect of trade liberalisation on trade tax revenue as a share of GDP. Although the data points post-liberalisation appear to be lower, it is not clear that total tax revenue as a share of GDP is significantly different after trade liberalisation. From Figure 3-2, it can be seen that trade liberalisation generally took place in the late 1980s and early 1990s.

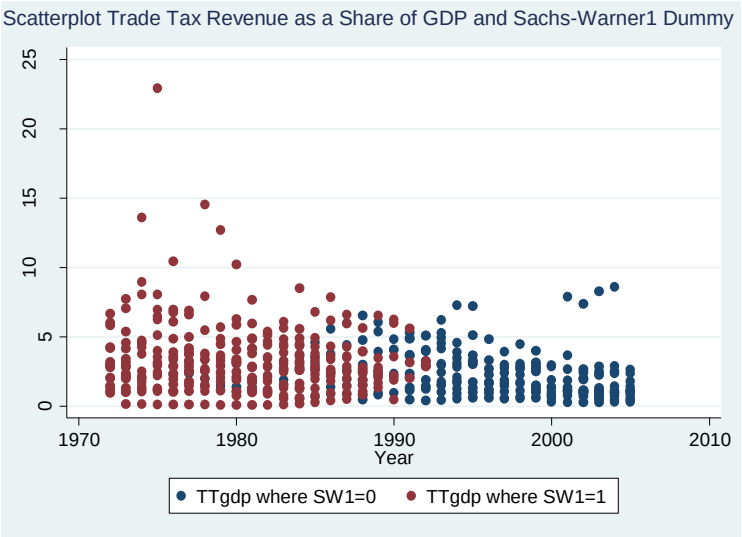



**Figure 3-2: Scatterplot Total Trade Tax Revenue as a Share of GDP and the Sachs-Warner1 Dummy**

For liberalisation to have taken place using the Sachs-Warner measures, there would be less Nontariff barriers (NTBs), a significant reduction (>20%) in the black market exchange rate, a move from a socialist to a free market economy, and a removal of state monopolies on major exports. The extent to which these measures generate positive effects depends on how they are implemented and existing economic structures. For example, a removal or reduction in NTBs could be revenue enhancing if there is a complementary shift in trade facilitation that encourages imports. Depending on individual elasticities of demand and supply of imports, one could see increased trade tax revenue. On the other hand, if NTBs are removed but an anti-import stance remains, then one is not likely to see any positive effects on trade tax revenue.

In addition, if there were taxes on exports that were previously collected by the state monopolies and export taxes are removed under trade reform, then it is likely that there would be a reduction in export taxes, and therefore trade taxes collected post-reform, all things being equal. Another factor to consider is the broader macroeconomic environment. If the rate of GDP growth exceeds that of trade tax revenue, then the share of tax revenue in GDP is likely to fall over time. The Sachs-Warner index takes into account exchange rate changes and movement towards a capitalist economy which have direct impact on the macroeconomy and GDP. One will therefore have to estimate the regression models to see how these factors affected the countries in the sample.

Figure 3-3 plots data points where the second Sachs Warner dummy (SW2) takes a value of 0 in the years before and after trade liberalisation and 1 in the year of liberalisation itself. This dummy seeks to capture the immediate impact of trade liberalisation on trade tax revenue and total revenue as a share

of GDP. There is no clear immediate impact of trade liberalisation on the share of trade tax revenue in GDP. The immediate impact depends on the nature of the reform programme, including factors such as the timing and sequencing of reforms. If there are drastic movements in the exchange rate and immediate implementation of free market reforms, then immediate effects are more likely to be observed. However, if reforms are implemented over time (as is likely the case), then significant immediate effects are less likely to be observed.

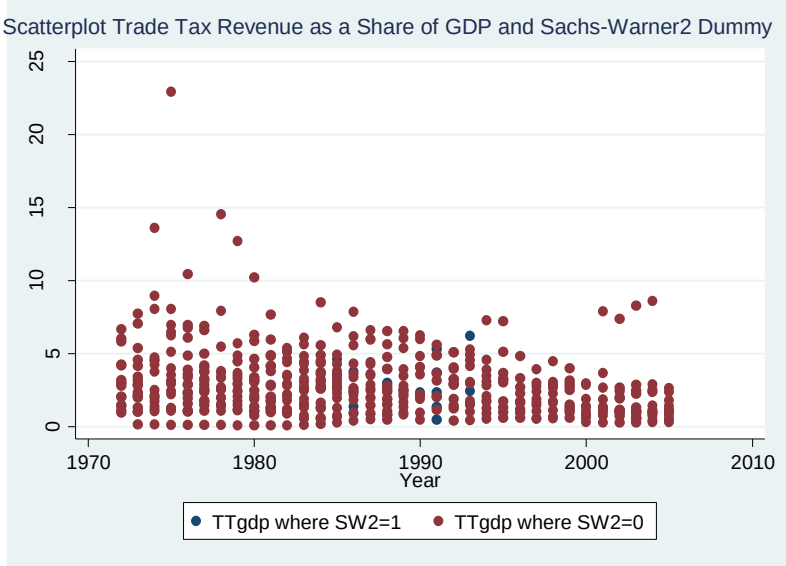



**Figure 3-3: Scatterplot Total Trade Tax Revenue as a Share of GDP and the Sachs-Warner2 Dummy**

Figures 3-4 and 3-5 show a roughly similar picture to the scatterplots of trade tax revenue in GDP and the Sachs-Warner dummies. The first Dean dummy (D1) measures the average effect of trade liberalisation on trade tax revenue and total tax revenue as a share of GDP over time. Figure 3-4 shows that the share of trade tax revenue in GDP appears to be lower post trade reform. The Dean measure is based on changes in tariffs, non-tariff barriers, foreign exchange controls, and export impediments. The average impact of trade liberalisation on trade tax revenue in GDP therefore depends on the components of the trade reform, including timing and sequencing considerations. In addition, one has to take account of the broader economic reform programme which affects GDP.

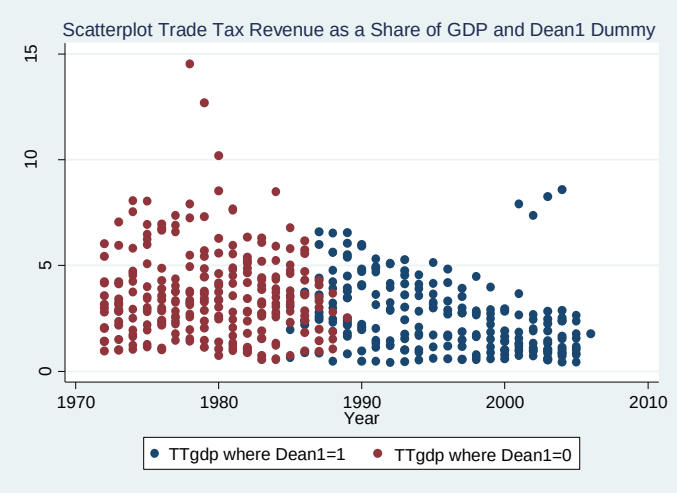



**Figure 3-4: Scatterplot Total Trade Tax Revenue as a Share of GDP and the Dean1 Dummy**

In Figure 3-5, no clear difference is seen between trade tax revenue as a share of GDP in the year of liberalisation, as measured by the second Dean dummy (D2), and the years before and after trade reform. Like the SW2 dummy, D2 estimates the immediate impact of trade reform on trade tax revenue as a share of GDP. The dummy takes a value of 0 in the years before and after trade reform, and 1 in the year of trade liberalisation. The immediate impact of trade reform depends on how aggressive is the reform timetable, the nature of reforms, and the components of the broader economic reform programme, among other factors.

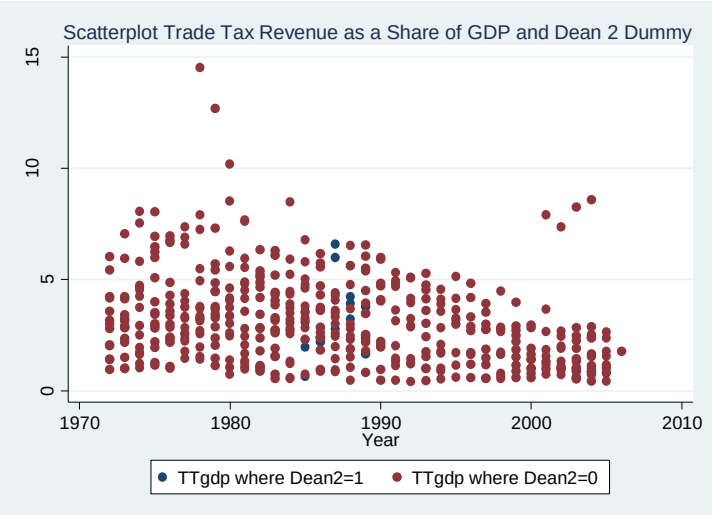



**Figure 3-5: Scatterplot Total Trade Tax Revenue as a Share of GDP and Dean2 Dummy**

## 3.4 Regression Model

This chapter uses an events framework like that employed in Greenaway et al. (2002) to assess if there is any discernible impact of trade liberalisation on total tax revenue and trade tax revenue as a share of GDP before and after trade liberalisation. The three dummy variables used to measure the liberalisation event are indices developed by Dean et al. (1994), and Sachs and Warner (1995), and a World Bank dummy which is based on the date that a country signed a Structural Adjustment Loan (SAL) with the World Bank. The Dean et al. (1994) measure is based on a subjective assessment of the timing of liberalisation taking into account changes in tariffs, quotas, export measures, and exchange rates which assesses when liberalisation occurred in their sample of thirty-two developing countries. The Sachs and Warner index, developed for thirty-four countries, assesses whether an economy is open or closed based upon movements in non-tariff barriers and average tariff levels; whether or not the country is socialist; the existence of state monopolies over key exports; and the difference between the official and black market exchange rates.

These event dummies are included in a model with other independent variables that are shown to have influence total tax revenue and trade tax revenue as a share of GDP. These variables include population size, the level of urbanisation, per capita income and the dependency ratio.

The model explaining **Total Revenue as a share of GDP** is:

$$TRgdp_{it} = a_0 + a_1 \ln pop_{it} + a_2 \ln GDPpc_{it} + a_3 dep_{it} + a_4 urbpop_{it} + a_5 D_{it} + \gamma_{FE} + \delta_{FE} + e_{it} \quad (3)$$

where

$TRgdp_{it}$ is the share of tax revenue in GDP

$\ln pop_{it}$ is the natural log of population size

$\ln GDPpc_{it}$ is the natural log of per capita GDP

$dep_{it}$ is the age-dependency ratio

$urbpop_{it}$ is the degree of urbanisation

$D_{it}$ is a dummy variable indicating a liberalisation event, either using the Sachs-Warner (SW), Dean et al. (D), or World Bank Structural Adjustment Loan (WB) indicator

$\gamma_{FE}$ is the fixed effect estimate that captures unobservable country effects

$\delta_{FE}$ is the time fixed effect that captures unobservable changes that occur over time

In addition, the model for **Total Trade Tax Revenue** as a share of GDP is given below:

$$TTgdp_{it} = a_0 + a_1 lnpop_{it} + a_2 lnGDPpc_{it} + a_3 dep_{it} + a_4 urbpop_{it} + a_5 D_{it} + a_6 Dtaxgdp_{it} + a_8 ER_{it} + \gamma_{FE} + \delta_{FE} + e_{it} \quad (4)$$

where

$TTgdp_{it}$ is the share of trade tax revenue in GDP

$lnpop_{it}$ is the natural log of population size

$ln\ GDPpc_{it}$ is the natural log of per capita GDP

$dep_{it}$ is the age-dependency ratio

$urbpop_{it}$ is the degree of urbanisation

$D_{it}$ is a dummy variable indicating a liberalisation event, either using the Sachs-Warner (SW), Dean et al. (D), or World Bank Structural Adjustment Loan (WB) indicator

$Dtaxgdp_{it}$ is domestic taxes on goods and services as % of GDP

$ER_{it}$ is the exchange rate

$\gamma_{FE}$ is the fixed effect estimate that captures unobservable country effects

$\delta_{FE}$ is the time fixed effect that captures unobservable changes that occur over time

The dummy variables in the model take two variations. In the first variation, the dummies take the value of 0 in the years preceding trade liberalisation and 1 for the year of liberalisation and all subsequent years ($SW_1$, $D_1$, $WB_1$). The coefficient on these dummy variables therefore captures the average post-reform effect of trade liberalisation on the share of total tax revenue and trade tax revenue. The second variation of the dummy variable only takes a value of 1 in the year of liberalisation itself ($SW_2$, $D_2$, $WB_2$), thus capturing the immediate impact on the share of trade tax and total tax revenue in GDP. The dummies are also lagged by one and two years to assess if there are any short-

term effects on trade tax and total tax revenue related to the liberalisation event.

Robust standard errors are used as heteroskedasticity is present in both equations.

### *A Priori* Expectations

There are many competing factors at play that affect the impact of tariff liberalisation on fiscal revenue, in large part due to the varying forms that trade reform can be implemented. Reform can comprise the removal of tariffs and quantitative restrictions up front or over a phased period. Quantitative restrictions may also be changed to tariffs. Trade reform often comprises multiple facets that are implemented simultaneously or sequentially. It is therefore difficult to predict the final impact; however, the analysis of a priori expectations can be framed in the context of the likely impacts of the measure.

One can predict that the share of trade tax revenue in GDP is likely to have an inverse relationship with a country's level of economic development. As a country becomes more developed, tax systems mature, administrative experience and efficiencies are gained, and thus other sources of revenue become much more significant than trade tax revenue. In addition, there may be greater need for cash transactions and a change in the composition of imports needed for production as an economy develops leading to a movement away from trade taxes to domestic import taxes (Greenaway (1980). As country develops, it is also less likely to be heavily dependent on primary agricultural products. At the early stages of development, countries are more likely to impose export taxes on primary products. Under trade liberalisation, the removal of export taxes is expected to reduce tax yield but there may be positive effects on tax revenue as other export enhancing measures such as export credits are implemented as part of the reform package.

It is also likely that there will be positive revenue effects of tariff liberalisation if the initial tariff rate is above the revenue maximising rate. In this case, any reduction of the tariff is likely to increase trade tax revenue as the incentive for evasion is lessened by the decrease or removal of the tariff and positive changes in income may be induced. Conversely, if the initial tariff rate is below the revenue maximising rate, then tariff reduction or elimination is likely to result in a reduction in government revenue from trade taxes as no positive changes in income are likely to be induced in this case (Khattry and Rao (2002)). The net impact of tariff changes will therefore depend on the location of tariffs relative to the tariff maximising rate, the magnitude of tariff changes, and cross price elasticities of demand of imports and supply of import substitutes.

In addition, the tariff liberalisation programme often simplifies the tariff structure, reduces the dispersion of tariff rates, and significantly lessens discretionary tax waivers. Greenaway and Milner (1991) state that this should be revenue-neutral but there is the potential for positive revenue effects if the reform induces greater tax compliance. An alternative framework to analyse this issue is to look at effective rates of protection (Ebrill et al. (1999)). If reducing tariff dispersion negatively affects effective rates of protection, then there is likely to be an increase in imports and hence, increased revenue from trade taxes. In addition, higher tariffs tend to be associated with goods that have higher price elasticities of demand and if these tariffs are lowered, then the positive revenue effect is likely to be reinforced through increased demand for these products.

Another component of trade reform is the replacement of quantitative restrictions with tariffs, which may have positive revenue effects. The extent to which this occurs depends on the impact of these tariffs on domestic prices and hence on domestic demand for the affected products. The change to tariffs may result in lower consumer prices as supply is no longer restricted, which may lead to increased demand for the product. Once supply is able to meet demand, there is likely to be increased revenue from additional imports, ceteris paribus. As noted by Ebrill et al. (1999), other factors that influence the final income include the nature of the restriction itself and the administrative capabilities of the executing agencies of the reform.

Domestic tax revenue is also impacted by trade liberalisation. In many developing countries, taxes on imported goods and services are an important source of revenue. Indeed, these taxes are often levied on the tariff-inclusive price. The removal of tariffs is therefore likely to reduce tax yield if the base is eroded. Agbeyegbe et al. (2006) note, however, that the ultimate impact on revenue yield has to take account of possible changes in import demand (positive) and demand for import substitutes (negative) due to lower prices on imports from removal of the tariff.

In addition, one often sees some amount of exchange rate adjustment in trade reform packages. Devaluation is likely to increase the price of imports but the extent to which this affects customs revenue depends on the price elasticity of demand for imports. In addition, devaluation makes tradeables more expensive than non-tradeables. This may have two divergent effects – a negative impact on customs revenue but a positive impact on domestic indirect tax revenues. The precise effect depends on the relevant price elasticity of demand for imports and the price elasticity of supply for import substitutes. If price elasticity of demand for imports is relatively inelastic then the government would expect to see increased revenue earnings from tariffs.

On the other hand, consumer goods and food items with domestic substitutes tend to have high elasticity. Currency depreciation also has a positive effect on exports which may lead to increased revenue from taxes on income. The net impact therefore depends on these competing considerations (Agbeyegbe et al. (2006)).

A country's level of urbanization and age-dependency ratio also may influence the share of total tax revenue in GDP. In Lewis' (1954) model of structural change, an economy becomes more urbanised as it develops. This increases its revenue need and capacity to tax as the urban population demands provision of additional public services and provides a focused tax base. In many developing countries where the rural economy tends to be the dominant sector, economic activity tends to be less concentrated and mostly informal in nature, which limits tax administration and collection. Therefore, in some cases, governments levy taxes on agricultural exports. In addition, the high age-dependency ratios in many countries mean that the tax base is smaller than in developed countries which tend to have lower age-dependency ratios.

Finally, the sign on the dummy variable that captures the liberalisation event can be either positive or negative, depending on the combination of factors operating during the trade reform process. If there is a positive effect on trade tax revenue and total tax revenue, one can expect the sign on the dummy variable coefficient ($a_5$) to be positive, that is, revenue will be higher on average after the liberalization event relative to the pre-liberalization period. On the other hand, if trade tax revenue and total tax revenue are adversely impacted by trade liberalisation, then one can expect a negative sign on $a_5$, that is, revenue is less on average for the period after liberalisation.

Other impacts of trade liberalisation may also be seen on income and taxes on profits which are not explicitly explored in these models and may be explored in a CGE-type setting. Agbeyegbe et al. (2006) note that short-run impacts can be observed through changes in profits of importers and producers of import substitutes. Long-run impacts of trade liberalisation may be seen if there are changes in economic growth and by extension, incomes and income tax liabilities that may be attributed to the reform programme.

To conclude, it is clear that the final impact of trade reform on fiscal revenue cannot be predicted with any great degree of certainty. Factors such as the age dependency ratio, the level of urbanization, and per capita income account for structural characteristics in the economy that determine a country's taxable base. The inclusion of the exchange rate in the trade tax revenue model accounts for the possible impact of changes in monetary policy on exports and imports. In addition, there are other factors that influence the

final reform outcome, such as the initial tariff structure, price elasticities of demand and supply for imports and domestic substitutes and the nature of trade reforms. The next section formally outlines the model that will be used to analyse the impact of trade liberalisation on fiscal revenue within the framework of the variables discussed.

Trade as a share of GDP is not included in these models as it likely to be collinear with the liberalisation event; ceteris paribus, trade liberalisation should lead to increased trade as a share of GDP.

## 3.5 Regression Results

**Total Tax Revenue as a Share of GDP**

The level of urbanisation is shown to have a positive and significant relationship with total tax revenue as a share of GDP for all models that measure the average post-reform of effect of trade liberalisation over time (see Table 3-1). This is consistent with Lewis' (1954) argument that urbanisation provides a centralised population for taxation which is easier to manage than dispersed rural populations. The Sachs-Warner event dummy itself ($SW_1$) is significant at a 90% level and estimates that the share of total tax revenue in GDP is 0.87 percentage points more on average in the years after liberalisation. Hence in this sample, liberalisation has a positive effect on total tax revenue. In the vast majority of cases, trade liberalisation is a component of a broader reform program that may include structural changes in the economy that spur economic activity and leads to increased tax revenue. The average post-reform effect as measured by the Dean et al. (1994) and World Bank dummies, although having a negative sign, is not significant.

The dependency ratio is shown to have a negative relationship with total tax revenue as a share of GDP, significant in the case of the models with the Dean and World Bank dummies. As the dependency ratio increases, there is likely to be a reduction on the tax base and this may lead to reduced tax collection, all things being equal. Population size is not significant for all models with the liberalisation event, with no consistent sign. Per capita income is significant for the model with the WB dummy where it is estimated that as per capita income rises, the share of total tax revenue in GDP is likely to rise. The majority of the sample of countries for the World Bank dummy is upper middle income and so the difference in the income level of these countries, and their capacity to tax, with the few low-income countries is especially stark.

**Table 3-1: The Determinants of Tax Revenue as a Share of GDP (TRgdp) – Average Post Reform Effect**

| All countries (1972 – 2006) | | | |
|---|---|---|---|
| lnpop | -1.67 | -0.32 | 0.52 |
| | (2.03) | (2.88) | (2.33) |
| lnGDPpc | -0.32 | 0.37 | 1.96** |
| | (0.87) | (0.76) | (0.82) |
| Dep | -0.17 | -5.09** | -4.91** |
| | (2.27) | (2.50) | (2.43) |
| Urbpop | 0.20* | 0.14* | 0.14* |
| | (0.05) | (0.04) | (0.04) |
| $SW_1$ | 0.87*** | --- | |
| | (0.51) | --- | |
| $D_1$ | | -0.86 | |
| | | (0.55) | |
| WB | | | -0.02 |
| | | | (0.42) |
| N | 738 | 489 | 551 |
| No. of countries | 29 | 18 | 21 |
| Adjusted $R^2$ | 0.79 | 0.63 | 0.79 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors.

With respect to the models that capture the immediate and lagged impact of the liberalisation event (that is, in the year of liberalisation itself the dummy takes a value of 1), consistent relationships are found between the level of urbanisation and the dependency ratio, and total tax revenue as a share of GDP (see Table 3-2). The level of urbanisation is found to have a significant positive impact of tax revenue as a share of GDP for all models – again confirming empirical findings and economic theory that urbanisation increases the need for and facilitates tax collection. In addition, the dependency ratio is shown to vary inversely with tax revenue as a share of GDP for all models, being significant in models with the Dean and WB dummies.

As the dependency ratio rises, one is likely to see a fall of almost five percentage points in total tax revenue as a share of GDP in these models. Per capita income is found to be a significant variable only for the model with the WB dummy where total tax revenue as a share of GDP is estimated to vary positively with level of income. The sign on the per capita income is similar, but not significant, for the other models. Population size is not estimated to be a significant variable in determining the share of total tax revenue in GDP in all models.

The immediate impact of the liberalisation event itself is significant in the case of the Sachs-Warner dummy. It should be recalled that this measure takes a

value of 1 only in the year of liberalisation. By the Sachs-Warner measure, total tax revenue as a share of GDP is on average 1.72 percentage points less in the year of liberalisation. A smaller negative effect is seen for the Dean dummy; however, it is not significant. There is a small positive coefficient on the World Bank dummy; which is not significant. In addition to estimating the immediate impact of the liberalisation event, lagged values are also used for a year and two years following liberalisation to assess if there are any significant delayed impacts on total tax revenue as a share of GDP. None of these lagged values was found to be significant which suggests that there are no large effects on the share of total tax revenue within one to two years of the liberalisation event.

The findings of the models are sensitive to the measure of trade liberalisation used and in particular, the dating of the liberalisation event and the sample chosen. There is a significant average positive effect on total tax revenue as a share of GDP over time from trade liberalisation as measured by the Sachs and Warner dummy. However, the immediate effect is estimated to be negative by that same measure, suggesting that there may be a negative impact in the very short-term but in the long-run the average effect is likely to be positive. In addition, trade liberalisation is often a part of a reform package where there may be broader economic and systemic reforms that have a positive effect on the economy and indirectly on total tax revenue.

**Table 3-2: The Determinants of Tax Revenue as a Share of GDP (TRgdp) – Immediate Reform Impact**

| **All countries (1972-2006)** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| lnpop | -1.58 | -1.68 | -1.70 | -0.22 | -0.20 | -0.26 | 0.54 | 0.53 | 0.50 |
| | (2.02) | (2.03) | (2.03) | (2.88) | (2.88) | (2.88) | (2.34) | (2.33) | (2.33) |
| lnGDPpc | -0.46 | -0.41 | -0.36 | 0.43 | 0.42 | 0.42 | 1.97** | 1.96** | 1.95** |
| | (0.87) | (0.87) | (0.88) | (0.76) | (0.76) | (0.76) | (0.83) | (0.83) | (0.83) |
| Dep | -0.25 | -0.31 | -0.32 | -4.88** | -4.87** | -4.89** | -4.92** | -4.91** | -4.91** |
| | (2.27) | (2.27) | (2.28) | (2.49) | (2.49) | (2.49) | (2.44) | (2.44) | (2.44) |
| Urbpop | 0.20* | 0.20* | 0.21* | 0.14* | 0.14* | 0.14* | 0.14* | 0.14* | 0.14* |
| | (0.05) | (0.05) | (0.05) | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) | (0.04) |
| $SW_2$ | -1.72* | --- | --- | --- | --- | --- | | | |
| | (0.59) | --- | --- | --- | --- | --- | | | |
| $SW_{2,t-1}$ | | -0.45 | --- | --- | --- | --- | | | |
| | | (0.57) | --- | --- | --- | --- | | | |
| $SW_{2,t-2}$ | | | 0.43 | --- | --- | --- | | | |
| | | | (0.56) | --- | --- | --- | | | |
| $D_2$ | | | | -0.18 | --- | --- | | | |
| | | | | (0.62) | --- | --- | | | |
| $D_{2,t-1}$ | | | | | -0.47 | | | | |
| | | | | | (0.58) | | | | |
| $D_{2,t-2}$ | | | | | | -0.38 | | | |
| | | | | | | (0.64) | | | |
| $WB_2$ | | | | | | --- | 0.43 | | |
| | | | | | | --- | (0.43) | | |
| $WB_{2,t-1}$ | | | | | | --- | | 0.04 | |
| | | | | | | --- | | (0.50) | |
| $WB_{2,t-2}$ | | | | | | --- | | | -0.16 |
| | | | | | | | | | (0.55) |
| N | 738 | 738 | 738 | 489 | 489 | 489 | 551 | 551 | 551 |
| No. of countries | 29 | 29 | 29 | 18 | 18 | 18 | 21 | 21 | 21 |
| Adjusted $R^2$ | 0.80 | 0.80 | 0.80 | 0.62 | 0.62 | 0.62 | 0.79 | 0.79 | 0.79 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

### Total Trade Tax Revenue as a Share of GDP

With respect to the models predicting the determinants of total trade tax revenue, per capita income has a consistent negative and significant relationship with the share of total trade tax revenue in GDP for all models estimating the average post-reform impact of the liberalisation event (see Table 3-3). As per capita income rises, there is an estimated fall in trade tax revenue as a share of GDP of between 0.84 and 2.12 percentage points. Domestic taxes as a share of GDP is also shown to vary inversely with the share of total trade tax revenue in GDP – falling by between 0.08 and 0.39 percentage points, with significance for models with the Sachs-Warner and World Bank dummies. This finding is supported by the empirical literature where it is observed that countries tend to increase the collection of domestic taxes and reduce the share of trade tax revenue as they grow due to an increase in administrative capacity over time and urbanisation, among other factors.

**Table 3-3: The Determinants of Trade Tax Revenue as a Share of GDP (TTgdp) – Average Post Reform Effect**

| **All countries** | | | |
|---|---|---|---|
| lnpop | 0.36 | -2.79** | -0.12 |
| | (0.97) | (1.30) | (1.24) |
| lnGDPpc | -1.78* | -2.12* | -0.84*** |
| | (0.44) | (0.37) | (0.47) |
| DTaxgdp | -0.22* | -0.08 | -0.39* |
| | (0.05) | (0.05) | (0.06) |
| ER | 0.00** | 0.00* | 0.00* |
| | (0.00) | (0.00) | (0.00) |
| Dep | 4.07* | -1.23 | 1.53 |
| | (1.32) | (1.28) | (1.39) |
| Urbpop | 0.02 | 0.05* | 0.02 |
| | (0.03) | (0.02) | (0.02) |
| $SW_1$ | -0.08 | --- | |
| | (0.23) | --- | |
| $D_1$ | | 0.10 | |
| | | (0.24) | |
| WB | | | 0.16 |
| | | | (0.23) |
| N | 680 | 469 | 532 |
| No. of countries | 29 | 18 | 21 |
| Adjusted $R^2$ | 0.71 | 0.70 | 0.70 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

In addition, the level of urbanisation has a consistent positive sign across all models; however, it is significant only for the model with the Dean dummy. The exchange rate has a consistent positive relationship with total trade tax revenue as a share of GDP; however, it is miniscule though significant. The share of total trade tax revenue in GDP is likely to rise with an increase in the

dependency ratio for the models with the Sachs-Warner (significant) and World Bank dummies. A negative but insignificant relationship is observed for the Dean dummy model. Population size is only significant for Dean dummy model where it is estimated that total trade tax revenue as a share of GDP is likely to fall as population size increases.

The liberalisation event dummies are not significant for any of the models. This suggests that trade liberalisation did not have any effect on total trade tax revenue as a share of GDP on average post-reform on the basis of the measures used.

With respect to the models that capture the immediate and lagged impact of the liberalisation event (that is, in the year of liberalisation itself the dummy takes a value of 1), consistent positive relationships are found between the level of urbanisation and the exchange rate, and total trade tax revenue as a share of GDP (see Table 3-4). In the case of the level of urbanisation, the relationship is significant only for the model with the Dean dummy. Although the coefficient on the exchange rate is significant for all models, the magnitude of the effect is extremely small.

Per capita income is shown to vary inversely with total trade tax revenue as a share of GDP; the relationship is only significant for the model with the Dean dummy. In addition, Total Trade Tax revenue as a share of GDP is also shown to vary inversely with Domestic taxes as a share of GDP for all models, being significant for models with the Sachs-Warner and World Bank dummies. This is consistent with empirical findings that developed countries have a larger proportion of total tax revenue from domestic sources than less developed countries. It is also consistent with the finding of no effect on total tax revenue as domestic taxes are likely to replace lost trade tax revenue to some extent and therefore offset any negative impact on total revenue.

The dependency ratio is also shown to vary positively with trade tax revenue as a share of GDP for the models with the Sachs-Warner (significant) and World Bank dummies. For the model with the Dean dummy, the coefficient is positive and not significant. Population size is estimated to be a significant variable only in the model with the Dean dummy, where it varies inversely with the share of trade tax revenue in GDP. Although not significant, a similar sign is also seen in the model with the World Bank dummy.

Similar to the model which estimates the average effect of trade liberalisation over time, the event dummies are not significant in the models estimating the immediate impact of the liberalisation event itself. The one and two-year lags of the dummies are also not significant, which suggests that there is no

discernible impact of the share of trade tax revenue in GDP as a result of trade liberalisation using the event indicators under study.

It is clear that the findings of the models are sensitive to the measure of trade liberalisation used and in particular, the dating of the liberalisation event and the associated sample. However, the consistent finding of a lack of significance for all event indicators for the total trade tax revenue as a share of GDP model is noteworthy.

**Table 3-4: The Determinants of Trade Tax Revenue as a Share of GDP (TTgdp) – Immediate Reform Impact**

| | All countries (1972 – 2006) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| lnpop | 0.37 | 0.37 | 0.38 | -2.81** | -2.81** | -2.83** | -0.18 | -0.17 | -0.17 |
| | (0.96) | (0.96) | (0.96) | (1.30) | (1.30) | (1.30) | (1.25) | (1.25) | (1.25) |
| lnGDPpc | -1.79* | -1.77* | -1.75* | -2.13* | -2.14* | -2.13* | -0.87*** | -0.87*** | -0.87*** |
| | (0.44) | (0.44) | (0.43) | (0.37) | (0.37) | (0.37) | (0.48) | (0.48) | (0.48) |
| DTaxgdp | -0.23* | -0.22* | -0.22* | -0.08 | -0.08 | -0.08 | -0.39* | -0.39* | -0.39* |
| | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) | (0.05) | (0.06) | (0.06) | (0.06) |
| ER | 0.00** | 0.00** | 0.00** | 0.00* | 0.00* | 0.00* | 0.00* | 0.00* | 0.00* |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Dep | 4.09* | 4.07* | 4.06* | -1.25 | -1.23 | -1.25 | 1.51 | 1.51 | 1.51 |
| | (1.32) | (1.32) | (1.32) | (1.28) | (1.27) | (1.28) | (1.40) | (1.40) | (1.40) |
| Urbpop | 0.02 | 0.02 | 0.02 | 0.06* | 0.06* | 0.06* | 0.02 | 0.02 | 0.02 |
| | (0.03) | (0.03) | (0.03) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| $SW_2$ | -0.27 | --- | | --- | --- | | | | |
| | (0.26) | --- | | --- | --- | | | | |
| $SW_{2,t-1}$ | | 0.05 | | --- | --- | | | | |
| | | (0.29) | | --- | --- | | | | |
| $SW_{2,t-2}$ | | | 0.47 | --- | | | | | |
| | | | (0.30) | --- | | | | | |
| $D_2$ | | | | -0.15 | | | | | |
| | | | | (0.30) | | | | | |
| $D_{2,t-1}$ | | | | | -0.24 | | | | |
| | | | | | (0.24) | | | | |
| $D_{2,t-2}$ | | | | | | -0.13 | | | |
| | | | | | | (0.35) | | | |
| $WB_2$ | | | | | | | -0.03 | | |
| | | | | | | | (0.23) | | |
| $WB_{2,t-1}$ | | | | | | | | 0.004 | |
| | | | | | | | | (0.32 | |
| $WB_{2,t-2}$ | | | | | | | | | 0.04 |
| | | | | | | | | | (0.27 |
| N | 680 | 680 | 680 | 680 | 469 | 469 | 532 | 532 | 532 |
| No. of countries | 29 | 29 | 29 | 29 | 18 | 18 | 21 | 21 | 21 |
| Adjusted $R^2$ | 0.72 | 0.72 | 0.72 | 0.54 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

When one compares the findings of the events analysis with those obtained from the models in Chapter 2 and by Khattry and Rao (2002) for the share of total tax revenue in GDP, it may be seen that a consistent relationship is not observed for any variable in all models (see Table 3-5). The events analysis found a consistently positive and significant relationship between the level of urbanisation and total tax revenue in GDP; while a negative relationship was found in Khattry and Rao's (2002) model with the openness index. In addition, the dependency ratio was found to have a negative relationship with total tax revenue in GDP for the events analysis; the opposite was found in Khattry and Rao's (2002) model. This may be explained by the difference in the liberalisation measure used and sample size and composition. The openness index used by Khattry and Rao (2002) measures the total trade taxes as a share of GDP as a share of total trade. The sample covers a diverse array of countries with varying income levels. In contrast, the events analysis focussed on developing countries that reformed (had a liberalisation event) between 1972 to 2006 and would therefore have different characteristics from the Khattry and Rao's (2002).

**Table 3-5: Comparison of Regression Results across Models for the Share of Total Tax Revenue in GDP**

| Variables | Khattry and Rao Coefficients | Extended Regression Coefficients 1972-2006 | WB regression coefficients | $WB_2$ regression coefficients | $SW_1$ regression coefficients | $SW_2$ regression coefficients | $D_1$ regression coefficients | $D_2$ regression coefficients |
|---|---|---|---|---|---|---|---|---|
| $tt_{it}$ | +* | +* | --- | --- | --- | --- | --- | --- |
| $lnpop_{it}$ | +* | +* | + | + | - | - | - | - |
| ln $GDPpc_{it}$ | + | +** | +** | +** | - | - | + | + |
| $dep_{it}$ | + | + | -** | -** | - | - | -** | -** |
| $urbpop_{it}$ | - | -* | +* | +* | +* | +* | +* | +* |
| WB | --- | --- | - | --- | --- | --- | --- | --- |
| $WB_2$ | | | | - | | | | |
| $SW_1$ | --- | --- | --- | | +*** | --- | --- | --- |
| $SW_2$ | | | --- | | | -* | --- | --- |
| $D_1$ | | | --- | | | | - | --- |
| D2 | | | --- | | | | | - |

Table 3-6 compares the results obtained from the events analysis with those found by Khattry and Rao (2002) for the determinants of total trade tax as a share of GDP. It can be seen that consistent relationships among all the models are found between the share of domestic taxes in GDP and the exchange rate, and the share of international trade taxes in GDP. In the case of the exchange rate, a positive relationship is found while in the case of domestic taxes as a share of GDP, a negative relationship is observed. The

income variable while found to have a positive relationship with the share of trade taxes in GDP in Khattry and Rao's (2002) model, has a negative relationship for all the models with event dummies. As the equations with event dummies reflect a limited sample of developing countries, it may be the case that these countries import less with higher incomes due to an increased ability to produce import substitutes and hence, this may be reflected in a lower share of trade tax revenue in GDP. Moreover, the results suggest that countries generally move away from trade taxes as a significant source of fiscal revenue as they develop over time.

**Table 3-6: Comparison of Regression Results across Models for the Share of Total Trade Tax Revenue in GDP**

| Variables | Khattry and Rao Coefficients | Extended Regression Coefficients 1972-2006 | WB regression coefficients | $WB_2$ regression coefficients | $SW_1$ regression coefficients | $SW_2$ regression coefficients | $D_1$ regression coefficients | $D_2$ regression coefficients |
|---|---|---|---|---|---|---|---|---|
| $tt_{it}$ | +* | +* | --- | | --- | --- | --- | --- |
| $tt_{it}^2$ | -* | -* | --- | | --- | --- | --- | --- |
| $lnpop_{it}$ | +* | +* | - | - | + | + | -** | -** |
| ln $GDPpc_{it}$ | + | +** | -*** | -*** | -* | -* | -* | -* |
| $Dtaxgdp_{it}$ | -* | -* | -* | -* | -* | -* | - | - |
| $ER_{it}$ | + | + | +* | +* | +* | +* | +* | +* |
| $dep_{it}$ | + | + | + | + | +* | +* | - | - |
| $urbpop_{it}$ | - | -* | + | + | + | + | +* | +* |
| WB | --- | --- | + | | --- | --- | --- | --- |
| $WB_2$ | | | | - | | | | |
| $SW_1$ | --- | --- | --- | | - | --- | --- | --- |
| $SW_2$ | | | --- | | | - | --- | --- |
| $D_1$ | | | --- | | | | + | --- |
| D2 | | | --- | | | | | - |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level.

Additionally, the level of urbanisation has a negative relationship with trade taxes in GDP in Khattry and Rao's (2002) model but a positive relationship is found for all models with liberalisation dummies. The dependency ratio has a positive relationship with the share of international trade taxes in GDP for all models with the exception of the model with the Dean et al. (1994) dummies.

Importantly, the liberalisation dummy itself is found to be significant only in the case of the Sachs-Warner dummy for the model estimating the determinants of total tax revenue as a share of GDP. There is an average increase of 0.87 percentage points in total tax revenue as a share of GDP in the years after liberalisation. The immediate impact as measured by the Sachs-Warner dummy is negative with total tax revenue in GDP estimated to fall by -

1.72 in the year of liberalisation. For their part, Khattry and Rao (2002) found a positive relationship between their openness index and total tax revenue in GDP; that is, as the economy becomes less open (an increase in the openness index), total taxes in GDP is likely to rise.

In addition, it is important to remember that trade liberalisation is often a part of a reform package that covers broader economic and systemic reforms that may have a net positive or negative effect on the economy and indirectly on total tax revenue. Indeed, it may be the case that the Sachs-Warner picks up this average effect on total tax revenue over time while there is no significant impact on trade tax revenue itself. Countries may find different means to adapt; for example, by adjusting domestic taxes (a significant variable in the trade tax revenue equation), which will be reflected in the average revenue picture. The study also shows that the findings are sensitive to the sample used, the measure of openness and the liberalisation event.

### Specification Tests

The Hausman test was conducted on both models and found that there was no systematic difference in coefficients between the fixed effects and random effects estimators. The choice of a fixed effects estimator is therefore appropriate.

Heteroskedasticity is present in both models; hence, robust standard errors are used. The Wooldridge test for serial autocorrelation in panel data sets revealed that both equations have serial autocorrelation.

Given the diversity in the sample by development level and tax composition, the next section goes on to do further analysis on the models focussing on the developed vs developing country distinction and the use of export taxes in the pre-reform to see how these factors impacted total tax revenue and trade tax revenue as a share of GDP.

## 3.6 Heterogeneity within the model

The findings reported in the previous section masks differences in a country's level of development. As espoused by Lewis (1954), a country's level of development is a key determinant of the capacity to tax. In addition, the relationship between the dependency ratio, domestic taxes as a share of GDP, and the level of urbanization and tax revenue and trade tax revenue as a share of GDP is likely to be different for countries at varying income levels. For example, high income countries are likely to have a much different tax structure than developing countries.

The sample for the events analysis mainly comprises developing countries that would have liberalized within the period 1972-2006. Most developed countries liberalized before that time period and therefore could not be included in the analysis. The Sachs-Warner index was the only event measure that was significant. The twenty-nine countries for this model comprise a majority of low income and lower middle income countries (62%). Thirty-one per cent are upper middle income countries and a further 7% are high income countries that liberalized over the period.

In addition to diversity with respect to income levels within the sample, there are also differences with respect to the treatment of different tax types. Import taxes are the traditional indicators used for assessing trade liberalisation impacts. However, particularly in the context of developing countries, export taxes may also influence the structure and characteristics of the trade reform programme. Countries with relatively higher rates of export tax dependence may have a different trade reform experience; for example, by reducing import taxes up front and slowing the pace of reduction of export taxes in the reform process when compared to other countries.

This section first begins by further dissecting the models, specifically with respect to the Sachs-Warner indicator to see what income groups were affected by the liberalisation event. Both models on the determinants of tax and trade tax revenue as a share of GDP will be broken down into two groups – high income and upper middle income countries, and low and lower middle income countries. It should be noted that the sample sizes are small, with 13 and 12 countries in the high income and upper middle income groups, and low and lower middle income groups, respectively. The results therefore do not have as much power as models that utilise larger samples.

It then goes on to assess how the structure of export taxes may influence trade reform and subsequently, total tax and trade tax revenue as a share of GDP. This is done by examining the ratio of export taxes to total trade taxes over the period 1972-1989, which is when most trade reforms occurred for developing countries under IMF and World Bank lending programmes. The section then

explores the dependence on export taxes by assessing the ratio of export tax to total trade tax revenue over 1972-1975. Finally, the regression models are run for these groups and findings discussed.

### 3.6.1 Events Analysis by Income Group

Table 3-7 assesses the determinants of Tax Revenue as a Share of GDP for two separate country groups: low income and lower middle income countries, and high income and upper middle income countries. The relationship between population size and the level of urbanization, and the share of tax revenue in GDP is similar for both income groups. In the case of population size, a negative relationship is observed; that is, as population size increases the share of tax revenue in GDP is likely to fall. Many different factors could be driving this finding. It could be that countries with larger populations tend to have higher GDP and so, the proportion of taxes is lower than countries with smaller populations although the absolute value of tax revenue is higher. The level of urbanization has a positive relationship with the share of tax revenue in GDP further supporting Lewis' theory that urban centres provide a target population from which taxes can be collected.

**Table 3-7: The Determinants of Tax Revenue as a Share of GDP by Income Group – Average Post Reform Effect**

| | Low Income and Lower Middle Income Countries | High Income and Upper Middle Income Countries |
|---|---|---|
| lnpop | -1.97 | -11.39** |
| | (3.85) | (5.37) |
| lnGDPpc | 0.80 | -3.46*** |
| | (1.23) | (1.84) |
| Dep | 9.27* | -16.92* |
| | (2.73) | (4.67) |
| Urbpop | 0.19* | 0.33* |
| | (0.05) | (0.11) |
| $SW_1$ | -0.14 | 1.63*** |
| | (0.64) | (0.91) |
| N | 455 | 283 |
| No. of countries | 18 | 11 |
| Adjusted $R^2$ | 0.76 | 0.78 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

Per capita income is shown to have an inverse relationship with tax revenue in GDP for high income and upper middle income countries but a positive relationship for low and lower middle income ones. For the high and upper middle income country groups the share of tax revenue in GDP is likely to fall as per capita income rises and the converse is true of low and lower middle income countries. This suggests that there may be a threshold effect where the share of tax revenue in GDP begins to fall at a certain level of income – as

GDP exceeds a certain point. The dependency ratio also has opposite signs for both country groups. As the dependency ratio rises, the share of tax revenue in GDP is likely to fall for high income and upper middle income countries and rise for low income and lower middle income countries. This finding is related to the different demographic profiles of countries in both groups and its impact on the taxable base. A higher dependency ratio may mean a fall in the tax base for high income and upper middle income countries and hence lower trade tax revenue in GDP over time, all things being equal. For low income and lower income countries, a fall in the dependency ratio may be related to external factors such as the infant mortality rate and food provision, that may have an adverse effect on the tax base. If there are these negative external events, then a fall in the dependency ratio may lead to a reduction in the share of tax revenue in GDP for these countries.

The Sachs-Warner event dummy is only significant for the high income and upper middle income country group where the average post-reform effect of trade liberalisation is positive. Tax revenue as a share of GDP is estimated to increase by 1.63 percentage points on average after liberalisation.

**Table 3-8: The Determinants of Tax Revenue as a Share of GDP by Income Group –Immediate Reform Impact**

| | Low Income and Lower Middle Income Countries | | | High Income and Upper Middle Countries | | |
|---|---|---|---|---|---|---|
| lnpop | -1.89 | -1.99 | -1.94 | -12.29* | -12.16 | -12.11 |
| | (3.80) | (3.84) | (3.85) | (5.33) | (3.84) | (3.85) |
| lnGDPpc | 0.77 | 0.77 | 0.81 | -4.42** | -4.19** | -4.12** |
| | (1.22) | (1.23) | (1.23) | (1.87) | (1.86) | (1.87) |
| Dep | 9.31* | 9.31* | 9.21* | -17.49* | -17.52* | -17.50* |
| | (2.68) | (2.68) | (2.69) | (4.62) | (4.63) | (4.63) |
| Urbpop | 0.19* | 0.19* | 0.19* | 0.36* | 0.35* | 0.35* |
| | (0.05) | (0.05) | (0.05) | (0.12) | (0.12) | (0.12) |
| $SW_2$ | -2.12* | --- | --- | -2.22** | --- | --- |
| | (0.72) | --- | --- | (1.11) | --- | --- |
| $SW_{2,t-1}$ | | -0.99 | --- | | -0.65 | --- |
| | | (0.74) | --- | | (1.04) | --- |
| $SW_{2,t-2}$ | | | 0.53 | | | -0.06 |
| | | | (0.83) | | | (0.92) |
| N | 455 | 455 | 455 | 283 | 283 | 283 |
| No. of countries | 18 | 18 | 18 | 11 | 11 | 11 |
| Adjusted $R^2$ | 0.76 | 0.76 | 0.76 | 0.78 | 0.78 | 0.78 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

In terms of the immediate reform impact on tax revenue as a share of GDP, the liberalisation dummy has a negative coefficient for both country groups (see Table 3-8). This finding suggests that trade liberalisation has a negative immediate short-term impact. The lags of the dummy are not significant; however, when considered with the finding that there are positive revenue effects of trade liberalisation over time (SW1), one may conclude that although

trade tax revenue may decline initially, other sources, such as domestic taxes, will eventually be substituted to replace lost revenue.

Similar to the average effects model in Table 3-7, the model also predicts that as the level of urbanization increases so will the share of tax revenue in GDP. Population size is shown to have a negative relationship with the share of tax revenue in GDP. The dependency ratio has a positive relationship with the dependent variable for low income and lower middle income countries and a negative relationship for high and upper middle income countries. Finally, per capita income is shown to vary inversely with tax revenue as a share of GDP for high and upper middle income countries and positively for low income and lower middle income countries.

**Table 3-9: The Determinants of Trade Tax Revenue as a Share of GDP by Income Group – Average Post Reform Effect**

| | Low and Lower Middle Income Countries | High and Upper Middle Income Countries |
|---|---|---|
| lnpop | 5.49** | -6.46* |
| | (2.15) | (1.46) |
| lnGDPpc | -0.14* | -2.16* |
| | (0.58) | (0.64) |
| DTaxgdp | -0.24* | -0.14** |
| | (0.06) | (0.06) |
| ER | 0.00** | 0.00 |
| | (0.00) | (0.00) |
| Dep | 3.26*** | -7.18* |
| | (1.87) | (1.92) |
| Urbpop | 0.06** | -0.02 |
| | (0.03) | (0.03) |
| $SW_1$ | -0.15 | 0.06 |
| | (0.33) | (0.39) |
| N | 434 | 246 |
| No. of countries | 18 | 11 |
| Adjusted $R^2$ | 0.67 | 0.85 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

For the model estimating the determinants of trade tax revenue as a share of GDP over time (see Table 3-9), per capita income and the share of domestic taxes in GDP are shown to have a negative relationship with the dependent variable for both income groups. This is consistent with the a priori expectation that at higher income levels, countries show a preference for domestic taxes over border taxes due to ease of administration. In addition, a fall in the exchange rate is likely to reduce the share of trade tax revenue in GDP as ceteris paribus, a fall in the exchange rate makes imports more expensive and exports less so. The final effect depends on which effect dominates and elasticities of demand and supply. It should be noted, however, that the coefficient on the exchange rate is very small and so, this effect is minimal.

Population size is shown to have a positive relationship with the share of trade tax revenue in GDP for low and lower middle income countries. In contrast, trade tax revenue is likely fall as population size increases for high and upper middle income countries. Although population size is a used as a rough indicator of the taxable base, it is clear that there is an interplay with a country's level development which may determine the extent to which trade tax revenue can be collected. The dependency ratio also has opposite signs for both income groups. For low and lower middle income countries, the share of trade tax revenue in GDP is expected to fall as the dependency ratio falls; the converse is true for high and upper middle income countries.

The level of urbanisation has a positive and significant relationship with trade tax revenue as a share of GDP for low and lower middle income countries while a positive, but insignificant relationship, is seen for high and upper middle income countries. The liberalisation event dummies are not significant for both income groups, which suggests that there is no significant effect on trade tax revenue as a share of GDP, in the years after trade reform.

**Table 3-10: The Determinants of Trade Tax Revenue as a Share of GDP by Income Group - Immediate Reform Impact**

| | Low Income and Lower Middle Income Countries | | | High Income and Upper Middle Countries | | |
|---|---|---|---|---|---|---|
| lnpop | 5.46** | 5.49** | 5.54** | -6.47* | -6.47* | -6.47* |
| | (2.15) | (2.15) | (2.15) | (1.45) | (1.45) | (1.45) |
| lnGDPpc | -0.15 | -0.13 | -0.11 | -2.15* | -2.16* | -2.16* |
| | (0.58) | (0.58) | (0.58) | (0.59) | (0.59) | (0.58) |
| DTaxgdp | -0.24* | -0.24* | -0.24* | -0.14** | -0.14** | -0.14** |
| | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) |
| ER | 0.00* | 0.00* | 0.00* | 0.00 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Dep | 3.24*** | 3.21*** | 3.17*** | -7.20* | -7.18* | -7.19* |
| | (1.87) | (1.87) | (1.87) | (1.91) | (1.91) | (1.91) |
| Urbpop | 0.06** | 0.06** | 0.06** | -0.02 | -0.02 | -0.02 |
| | (0.03) | (0.03) | (0.03) | (0.04) | (0.04) | (0.04) |
| $SW_2$ | -0.56 | --- | --- | 0.28 | --- | --- |
| | (0.36) | --- | --- | (0.35) | --- | --- |
| $SW_{2,t-1}$ | | -0.07 | --- | | 0.23 | --- |
| | | (0.44) | --- | | (0.38) | --- |
| $SW_{2,t-2}$ | | | 0.55 | | | 0.24 |
| | | | (0.44) | | | (0.45) |
| N | 434 | 434 | 434 | 246 | 246 | 246 |
| No. of countries | 18 | 18 | 18 | 11 | 11 | 11 |
| Adjusted $R^2$ | 0.67 | 0.67 | 0.67 | 0.85 | 0.85 | 0.85 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

With respect to the immediate impact of trade liberalisation on trade tax revenue as a share of GDP (see Table 3-10), the event dummies are also not

significant. In the model, no evidence was found of a significant impact in the year of liberalisation and in the one to two-year period following liberalisation. However, recall that the model found a negative and significant relationship between share of total tax revenue in GDP and trade liberalisation on average post-reform for the high income and upper middle income country group (mainly upper middle income countries). As trade liberalisation is part of an integrated process of broader economic reform, high and upper middle income countries may find it easier to incorporate changes to their tax system (such as increased use of domestic taxes) given that they have more advanced tax systems than their less developed counterparts. In addition, over the long term, the effect of trade liberalisation on total tax revenue was found to be positive in the years after liberalisation. This may be due to an increased ability of high and upper middle income countries to take advantage of the economic opportunities brought about by trade liberalisation.

Similar to the model that assesses the average effect of trade liberalisation over time, domestic taxes as a share of GDP and per capita income are shown to vary inversely with the share of trade tax revenue in GDP for both country groups. As the share of domestic taxes in GDP rises, the model predicts that the share of trade tax revenue will fall. This suggests that countries do replace trade taxes with domestic taxes over time due to ease of collection and distributional concerns, among other factors. In addition, as per capita income increases, the share of trade tax revenue is GDP is likely to fall. As an indicator of the level of development, a rise in per capita income means that countries are becoming more developed and therefore, better able to diversify the tax base, in particular, extend the coverage of domestic taxes. Also, another factor that may explain this relationship is that industries that may have benefitted from high tariffs on imports in the early stages of development may see those protective measures removed as they mature.

In addition, the exchange rate has a positive relationship with the share of trade tax revenue in GDP. An increase in the exchange rate (appreciation) makes imports less expensive and exports costlier. The effect in the model is estimated to be extremely small, however, and to not be significant for high and upper middle income countries. Population size is shown to have a negative relationship with the share of trade tax revenue in GDP for high and upper middle income but a positive one for low and lower middle income countries. It may be the case that as population size increases for upper and middle income countries, there is an increase in the taxable base for alternative taxes, such as consumption taxes, which further reduce the trade tax revenue share in GDP. The converse may occur in low income and lower middle countries that still have trade tax revenue as a major source of income and so, an increase in the population may mean increased consumption of imported products and therefore, an increase in trade tax revenue at a lower rate than the rate of GDP growth.

The level of urbanisation is found to vary positively with the share of trade tax revenue is GDP for low and lower middle income countries, suggesting that as these countries become more urbanised the share of trade tax revenue was likely to rise by about 0.06%. In this case, the countries at this level of development are not likely to have a sufficiently developed tax system to replace trade taxes with domestic taxes; however, with urbanisation, they may be better able to centrally locate customs services, etc. and thus, improve the collection of trade tax revenue. On the other hand, for high and upper middle income countries that are at a different level of development, a significant relationship is not found between the level of urbanisation and trade tax revenue as a share of GDP. Arguably, most of these countries would have already been urban throughout the sample period and one would therefore not expect any significant change in trade tax revenue as a result of changes in the level of urbanisation.

In addition, the model predicts that a fall in the dependency ratio is likely to lead to a reduction in the share of trade tax revenue in GDP for low and lower middle income countries. On the other hand, as the dependency ratio rises, it is likely to lead to a fall in trade tax revenue as a share of GDP in high income and upper middle income countries. The variation in findings may be due to the different demographic characteristics of both income groups and its impact on the taxable base. For high income and upper middle income countries, a higher dependency ratio may mean a fall in the tax base and hence lower trade tax revenue in GDP over time, all things being equal. Health, social and environmental facts may influence a reduction in the dependency ratio in low income and lower income countries. They may also have an adverse effect on the tax base and by extension, the share of tax revenue in GDP for these countries.

The results of the events analysis suggest that there are significant differences between high income and upper middle income, and low income and lower middle income countries with respect to the interaction of key variables and the total tax and trade tax revenue as a share of GDP. Importantly, the results suggest that the impact of trade liberalisation is at the aggregate tax revenue level. While the overall average effect is estimated to be positive and significant for only high income and upper middle income countries, the short-term impact (within a year of the liberalisation event) is negative for both country income groups. There is also no evidence that there are significant lagged effects of trade liberalisation within one and two years of the reform date.

In addition to the variation in the sample by country size, there are also likely to be differences in the implementation of the reforms themselves which are likely to be influenced by the existing trade tax structure. The majority of analyses tend to concentrate on how the structure of import taxes affects the

trade reform process. An equally interesting line of inquiry is how the existence of export taxes may have influenced the impact of reform on total tax revenue and trade tax revenue. Did countries with higher export to total trade tax revenue ratios have lower total trade tax revenue as a share of GDP after trade liberalisation when compared with countries with lower ratios? The next section seeks to answer this question and begins by exploring the export tax to total tax ratios in the events study and their behaviour over time. It then goes on to analyse the determinants of total tax and trade tax revenue as a share of GDP splitting the sample according to the share of export tax in total tax revenue.

### 3.6.2 Export Taxes to Total Trade Taxes (1972-1989)

Figure 3-6 provides a graphic description of the trend of export taxes to total trade taxes over the period 1972-1990 which is the period within which the majority of liberalisation took place using the events measures. As can be seen, the minimum ratio of export taxes to total trade taxes has fallen over the period. Lower values of the ratio are seen in the latter half of the period. Figure 3-7 also confirms that the export tax ratio is lower at the end of the period than at the beginning in 1972. In 1972, the five countries with the highest ratios are: Ghana, the Democratic Republic of the Congo, Uganda, Uruguay, and the Philippines.

**Figure 3-6: Minimum Ratio of Export to Total Trade Taxes (1972-1990)**

**Figure 3-7: Ratio of Export Taxes to Total Trade Taxes (1972 and 1989)**


Table 3-11 ranks countries by the highest value of the export tax to total tax ratio over the period 1972-1975. The highest value is 0.84, which belongs to Ghana. A little less than fifty percent of countries (12) in the sample have an export tax to total tax ratio below 0.081. The countries with export taxes mainly comprise developing countries, ranging from low income to upper middle income countries. The rankings show broad heterogeneity across income groups.

**Table 3-11: Ratio of Export Taxes to Total Trade Taxes in Descending Order of the Highest Value over 1972-1975 – Top 15 in Sample**

| Country | Highest value over 1972-1975 | Average over 1972-1975 |
|---|---|---|
| **Guyana** | 0.84 | 0.44 |
| **Uruguay** | 0.78 | 0.49 |
| **Ghana** | 0.67 | 0.65 |
| **Malaysia** | 0.51 | 0.40 |
| **Mauritius** | 0.41 | 0.29 |
| **Pakistan** | 0.39 | 0.32 |
| **Nicaragua** | 0.38 | 0.17 |
| **Ecuador** | 0.36 | 0.29 |
| **Sri Lanka** | 0.35 | 0.30 |
| **Thailand** | 0.34 | 0.18 |
| **Philippines** | 0.29 | 0.25 |
| **The Gambia** | 0.22 | 0.17 |
| **Mexico** | 0.21 | 0.17 |
| **Morocco** | 0.19 | 0.13 |
| **Tunisia** | 0.17 | 0.07 |

Of the twenty-nine countries in the events study, twenty-two imposed export taxes over the period. It would be instructive to note if there is a significant difference in the impact of trade liberalisation (as denoted by the Sachs-

Warner liberalisation event) on total tax and trade tax revenue when export taxes are above and below the median point of 8% of Total Trade Tax revenue. Although the median ratio appears relatively low, it sets a base of comparison for countries with respect to the extent to which they would need to replace export tax revenue in the reform process. It also allows one to assess if there is any difference in the impact of liberalisation on total tax revenue and trade tax revenue between the two groups.

The regression models for the determinants of trade tax and total tax revenue as a share of GDP continue to be used for this section. The models are run for countries with export tax to total trade tax revenue ratios above and below the median level.

### 3.6.3 Events Analysis by Share of Export Tax to Total Trade Tax

For the determinants of tax revenue as a share of GDP, there are clear differences in the results for countries above and below the median ratio. For countries with export to total trade tax ratios below 0.08 in the initial five years of the study (1972-1975), an inverse and significant relationship is found between population size and the level of urbanization, and the share of total tax revenue in GDP (see Table 3-12). A significant positive relationship is also found between per capita income and total tax revenue as a share of GDP.

**Table 3-12: The Determinants of Tax Revenue as a Share of GDP by Export Tax Revenue to Total Trade Tax Revenue Ratio – Average Post Reform Effect**

| | Export Tax to Total Trade Tax Revenue Ratio<0.08 | Export Tax to Total Trade Tax Revenue Ratio>0.08 |
|---|---|---|
| lnpop | -5.88* | 8.58* |
| | (1.98) | (3.22) |
| lnGDPpc | 6.33* | -0.76 |
| | (1.02) | (1.41) |
| Dep | 3.02 | -1.88 |
| | (3.01) | (2.65) |
| Urbpop | -0.14* | 0.15* |
| | (0.06) | (0.06) |
| $SW_1$ | 2.37* | -2.49* |
| | (0.69) | (0.80) |
| N | 289 | 349 |
| No. of countries | 12 | 13 |
| Adjusted $R^2$ | 0.91 | 0.76 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

On the other hand, a positive and significant relationship is found between population size and the level of urbanization, and the share of total tax revenue in GDP for countries with export to total trade tax ratios above the median level. Per capita income is not found to be a significant variable for these countries. For both groups, the dependency ratio is not a significant variable. These findings are likely driven by the diverse characteristics of countries in

both groups. Both groups included countries from all income levels; for example, the group above the median export to total tax ratio, included South Africa, Mexico and The Gambia. It would appear that more high and upper middle income groups appear to be in the group above the median total tax ratio and the result reported with respect to per capita income is consistent with the sign to obtained for the model with high income countries.

With respect to the liberalisation event, the results show that there was a positive effect on total tax revenue for countries below the median ratio. However, countries with export tax to total trade tax ratios above the median level, were likely to see negative effects of the share of total tax revenue in GDP, falling by 2.49 percentage points on average in the period after trade liberalisation, as denoted by the Sachs-Warner event dummy.

**Table 3-13: The Determinants of Tax Revenue as a Share of GDP by Export Tax Revenue to Total Trade Tax Revenue –Immediate Reform Impact**

| | Export Tax to Total Tax Revenue Ratio<0.08 | | | Export Tax to Total Tax Revenue Ratio>0.08 | | |
|---|---|---|---|---|---|---|
| lnpop | -5.74* | -5.94* | -6.03* | 8.00** | 8.00** | 8.04** |
| | (1.99) | (2.01) | (2.01) | (3.24) | (3.26) | (3.26) |
| lnGDPpc | 6.58* | 6.62* | 6.69* | -0.99 | -0.96 | -0.95 |
| | (1.05) | (1.05) | (1.06) | (1.43) | (1.43) | (1.43) |
| Dep | 2.47 | 2.53 | 2.52 | -2.02 | -2.09 | -2.11 |
| | (3.10) | (3.12) | (3.12) | (2.66) | (2.67) | (2.67) |
| Urbpop | -0.17* | -0.16* | -0.16* | 0.14** | 0.14** | 0.14** |
| | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) |
| $SW_2$ | -1.91 | --- | --- | -2.28* | --- | --- |
| | (0.73) | --- | --- | (0.75) | --- | --- |
| $SW_{2,t-1}$ | | -0.01 | --- | | -1.13 | --- |
| | | (0.72) | --- | | (0.76) | --- |
| $SW_{2,t-2}$ | | | 1.15 | | | -0.38 |
| | | | (0.81) | | | (0.67) |
| N | 289 | 289 | 289 | 349 | 349 | 349 |
| No. of countries | 12 | 12 | 12 | 13 | 13 | 13 |
| Adjusted $R^2$ | 0.91 | 0.91 | 0.91 | 0.76 | 0.76 | 0.76 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

Regarding the immediate reform impact on tax revenue as a share of GDP (see Table 3-13), the liberalisation dummy is not significant for countries below the median export tax to trade tax ratio. However, there is a significant negative effect on the share of total tax revenue in GDP within the first year of liberalisation for countries with trade tax revenue above the median ratio. There is no significant lagged effect on the share of total tax revenue in GDP within one and two years of liberalisation for countries in both groups.

As found in the average effects model in Table 3-12, significant negative relationships are found between the population size and the level of urbanization and the share of total revenue in GDP for countries below the median export to total trade tax ratio. For countries above the median ratio,

a positive relationship is observed for these variables. The dependency ratio is not significant for either group of countries. The share of total tax revenue in GDP is also predicted to increase as per capita income increases for countries below the median export to total tax ratio. For countries above the median ratio, per capita income is not a significant variable, although a negative coefficient is observed.

**Table 3-14: The Determinants of Trade Tax Revenue as a Share of GDP by Export Tax Revenue to Total Trade Tax Revenue – Average Post Reform Effect**

| | Export Tax to Total Tax Revenue Ratio<0.08 | Export Tax to Total Tax Revenue Ratio>0.08 |
|---|---|---|
| lnpop | -2.65** | 2.20 |
| | (1.05) | (2.00) |
| lnGDPpc | -0.74 | -0.28 |
| | (0.51) | (0.73) |
| DTaxgdp | -0.28* | -0.14** |
| | (0.06) | (0.06) |
| ER | 0.00 | 0.00* |
| | 0.00 | (0.00) |
| Dep | 0.80 | 6.96* |
| | (2.04) | (1.80) |
| Urbpop | -0.11* | 0.14* |
| | (0.03) | (0.04) |
| $SW_1$ | 0.29 | -0.46 |
| | (0.42) | (0.35) |
| N | 274 | 339 |
| No. of countries | 12 | 13 |
| Adjusted $R^2$ | 0.77 | 0.73 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

For the model estimating the determinants of trade tax revenue as a share of GDP (see Table 3-14), domestic taxes as a share of GDP is shown to vary inversely with the share of trade tax revenue in GDP for countries above and below the median ratio of export tax revenue to total tax revenue. This is consistent with the finding that as countries develop over time, they tend to replace trade taxes with domestic taxes. As part of the reform process, some countries may also rename export taxes and collect "charges" through commodity boards. These new "charges" would now fall under the domestic tax category. Population size and the level of urbanization have a negative and significant relationship with the share of trade tax revenue in GDP for countries below the median export tax revenue to trade tax revenue ratio. For countries above the median ratio, the share of total trade tax revenue is predicted to rise as the level of urbanization increases.

The dependency ratio is also shown to vary positively (and significantly) with trade tax revenue for countries above the median ratio. This means that as the proportion of children and the elderly fall, the share of trade tax revenue in GDP is likely to rise. This may be due to an increase in the taxable base that comprises the working population who can make consumption choices of

traded goods. However, the dependency ratio is not significant for countries above the median export tax to trade tax revenue ratio.

Per capita income is not a significant variable for either country group. It should also be noted that the exchange rate is shown to have a positive relationship with trade tax revenue in GDP, which is significant for countries above the median export tax to total trade tax revenue. A reduction in the exchange rate is likely to reduce the share of trade tax revenue in GDP as ceteris paribus, a fall in the exchange rate makes imports more expensive and exports less so. The final effect depends on which effect dominates and elasticities of demand and supply. However, the effect on trade tax revenue as a share of GDP is minimal in the model. With respect to the trade liberalisation event, there is no significant effect on trade tax revenue as a share of GDP on average in the years after liberalisation for either country group.

**Table 3-15: The Determinants of Trade Tax Revenue as a Share of GDP by Export Tax Revenue to Total Trade Tax Revenue - Immediate Reform Impact**

| | Export to Total Tax Ratio<0.08 | | | Export to Total Tax Ratio>0.08 | | |
|---|---|---|---|---|---|---|
| lnpop | -2.71* | -2.69* | -2.64** | 2.06 | 2.08 | 2.10 |
| | (1.03) | (1.04) | (1.04) | (1.99) | (1.99) | (1.98) |
| lnGDPpc | -0.72 | -0.70 | -0.66 | -0.31 | -0.30 | -0.30 |
| | (0.53) | (0.53) | (0.53) | (0.73) | (0.73) | (0.73) |
| DTaxgdp | -0.29* | -0.29* | -0.28* | -0.14** | -0.13** | -0.13** |
| | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) |
| ER | 0.00 | 0.00 | 0.00 | 0.00* | 0.00* | 0.00* |
| | 0.00 | 0.00 | 0.00 | (0.00) | (0.00) | (0.00) |
| Dep | 0.77 | 0.80 | 0.76 | 6.91* | 6.90* | 6.91* |
| | (2.04) | (2.05) | (2.06) | (1.81) | (1.80) | (1.80) |
| Urbpop | -0.11* | -0.11* | -0.11* | 0.14* | 0.14* | 0.14* |
| | (0.03) | (0.03) | (0.03) | (0.04) | (0.04) | (0.04) |
| $SW_2$ | -0.52 | --- | --- | -0.22 | --- | --- |
| | (0.46) | --- | --- | (0.28) | --- | --- |
| $SW_{2,t-1}$ | | 0.04 | --- | | 0.12 | --- |
| | | (0.52) | --- | | (0.32) | --- |
| $SW_{2,t-2}$ | | | 0.83*** | | | 0.42 |
| | | | (0.43) | | | (0.41) |
| N | 274 | 274 | 274 | 339 | 339 | 339 |
| No. of countries | 12 | 12 | 12 | 13 | 13 | 13 |
| Adjusted $R^2$ | 0.77 | 0.77 | 0.77 | 0.73 | 0.73 | 0.73 |

*- significance at 99% level; **- significance at 95% level; ***- significance at 90% level. Robust standard errors in parentheses.

With respect to the immediate impact of trade liberalisation on trade tax revenue as a share of GDP (see Table 3-15), the results of the model show that trade liberalisation had no immediate impact on trade tax revenue as a share of GDP within the year of the liberalisation for countries below the median export tax to total tax ratio. There also is no impact on trade tax revenue seen within a year of liberalisation; however, there is some impact within two years

of liberalisation for these countries. Trade tax revenue is predicted to fall by -0.83 percentage points two years after trade liberalisation. For countries above the median ratio, no immediate impact is seen in the year of liberalisation, nor within one and two years of the liberalisation event. However, it should be recalled that effects at the aggregate level on total tax revenue were seen. This supports the theory that trade liberalisation often forms part of a comprehensive macroeconomic reform programme that may include reforms to domestic taxes and incentive structures. The overall impact of this process may therefore be more likely to be observed at the aggregate level rather than on trade tax revenue itself.

Domestic taxes as a share of GDP is shown to have a negative relationship with the share of trade tax revenue in GDP for both country groups. As the share of domestic taxes in GDP increases, the model predicts that the share of trade tax revenue will decrease. This suggests that there may be some replacement of trade taxes with domestic taxes over time due to administrative efficiencies, among other factors. In addition, the exchange rate has a positive relationship with the share of trade tax revenue in GDP, which is significant for countries above the median ratio of export tax to total trade tax revenue. An appreciation of the exchange rate makes imports less expensive and exports more so; the final effect being determined by demand and supply elasticities. Again, the effect in the model is estimated to be extremely small.

Population size and the level of urbanization are shown to vary inversely and significantly with the share of trade tax revenue in GDP for countries below the median export tax revenue to trade tax revenue ratio. On the other hand, a significant relationship is not seen for countries above the median ratio with respect to population size. The share of trade tax revenue in GDP is likely to increase with an increase in the level of urbanization for countries below the median ratio.

The dependency ratio is also shown to vary positively with the share of trade tax revenue in GDP for countries both country groups, with a significant relationship for countries above the median ratio. This may be due to an increase in the taxable base that comprises the working population who can make consumption choices of traded goods. Per capita income is not a significant variable for either country group.

The results of the events analysis by export tax ratio suggest that there are significant differences among countries when split into groups by the ratio of export tax to total tax revenue. The findings reaffirm that there are tangible differences between countries that require a tailored approach to liberalisation. In addition, with respect to the question of whether there was any difference in the impact of trade liberalisation on countries based on their initial export tax to total tax ratio, countries above the median ratio were

predicted to see an average negative effect on the share of total tax revenue in GDP over time while those below the median ratio were likely to see a positive effect on total tax revenue as a share of GDP. The short-term effect of trade liberalisation on total tax and trade tax revenue itself is not significant, with the exception of a two-year lag for countries that was found to be significant for countries with export tax to trade tax revenue ratios above the median level. The effect of trade liberalisation, as denoted by the Sachs-Warner event are therefore manifested over time at an aggregate level and therefore depend on the interplay of the entire economic reform programme, of which trade liberalisation is often just one component.

## 3.7 Conclusions

This chapter explored an alternative framework to examine the impact of trade reform on total tax revenue and trade tax revenue as a share of GDP. Trade liberalisation is often driven by external events and shocks such as a severe decline in the balance of payments and lack of access to global financial markets. Countries (mainly developing) facing these constraints turned to multilateral lending institutions, such as the IMF and World Bank, for assistance. In most cases, trade reform was included as part of a comprehensive economic reform programme with strict conditionalities for continued financing under these loan agreements. Since these "events" are the driving force behind reforms, it makes sense to utilise an events framework to analyse the impact of trade reform on total tax and trade tax revenue. Three events measures were used based on work by Sachs-Warner (1995), Dean et al. (1994) and Greenaway et al. (2005). In the first scenario, the setup of the event dummies sought to capture the average effect of trade reform on total tax revenue as a share of GDP. The second variation of the event dummies captured the immediate impact of liberalisation on the dependent fiscal revenue variables. The models were also run with lags of the event dummies to see if there are impacts within one and two years of liberalisation.

In general, trade liberalisation as captured by events was not a significant determinant of changes in total or trade tax revenues; in the vast majority of cases the dummy variable was insignificant. There is weak evidence that trade liberalisation, as denoted by the Sachs-Warner dummy, was associated with an increase in the share of total tax revenue in GDP (by 0.87 percentage points on average in the years after liberalisation). The average post-reform effect as measured by the Dean et al. (1994) and World Bank dummies, although having a negative sign, is not significant. The immediate impact of the liberalisation is a reduction in total tax revenue as a share of GDP by 1.72 percentage points in the year of liberalisation event, as measured by the Sachs-Warner dummy. The other event dummies are not significant; although, there

is a small negative coefficient for the Dean dummy and a small positive coefficient on the World Bank dummy. The lagged values of the event dummies are not significant which suggests that there are no significant effects on the share of total tax revenue within one to two years of the liberalisation event.

The results also suggest that there may be a negative impact on total tax revenue as a share of GDP within the year of liberalisation but the long-run average effect is likely to be positive. This is not surprising as trade liberalisation is often a part of a comprehensive reform programme that includes other components such as exchange rate adjustment and broader tax reform. If, for example, there are changes to domestic taxes and exchange rate adjustments, then the final impact will be shown at the aggregate tax revenue level after the reforms have worked through the economy, taking into account factors such as supply and demand of imports and domestic substitutes and the administrative capacity of the state to collect taxes. Since the other event measures are not significant in the models, it is clear that the findings are sensitive to the measure of trade liberalisation used and in particular, the dating of the liberalisation event and the sample chosen.

With respect to the share of trade tax revenue in GDP, none of the liberalisation event dummies is significant for any of the models. This suggests that trade liberalisation did not have any significant effect on total trade tax revenue as a share of GDP on average in the years following liberalisation. The effect on trade tax revenue as a share of GDP depends on the nature of reforms and timing and sequencing, among other factors. A gradual reduction in tariffs and replacement with indirect taxes are less likely to lead to significant changes in the share of trade tax revenue in GDP. Another consideration is the pace of GDP growth. Once a country's rate of GDP growth exceeds growth in trade tax revenue as a share of GDP, one can expect that the trade tax revenue as a share of GDO will fall.

Trade liberalisation does not have an immediate impact on the share of total trade taxes as a share of GDP as the event dummies are not significant. The one and two-year lags of the dummies are also not significant, which suggests that there is no discernible impact of the share of trade tax revenue in GDP as a result of trade liberalisation using the event indicators under study.

When the models are assessed based on country groups – high and upper middle income countries, and low and lower middle income countries, there are significant differences in the impact of trade liberalisation on total tax and trade tax revenue. Trade liberalisation is shown to have an average positive effect on total tax revenue as a share of for the high income and upper middle income country group GDP, by the Sachs-Warner measure. However, the immediate reform impact on tax revenue as a share of GDP is negative and

significant for both country groups. The lags of the dummy are not significant, which means that the effect is not carried forward into subsequent years. These findings support the conclusion that while there may be a negative effect initially of trade reform on total tax revenue as a share of GDP on both country groups, the average effect is likely to be positive for high and upper middle income countries in the long run. High and upper middle income countries have more developed economies and administrative systems that may make it easier to replace any income lost from liberalisation with revenue from other sources. In addition, the composition and execution of a wider reform programme is likely to influence the final effect on total tax revenue as a share of GDP. The study found no evidence that trade liberalisation impacts trade tax revenue as a share of GDP on average in the years after reform or in the short-term in both country groups.

The results of the analysis by the share of export tax revenue in total tax revenue show that the impact of trade liberalisation on total tax and trade tax revenue as a share of GDP is different for those countries above and below the median threshold. Countries with ratios above the median level were likely to see negative effects of the share of total tax revenue in GDP, as denoted by the Sachs-Warner event dummy. No significant short-term impact is found for countries below the median export tax to trade tax ratio. However, there is a significant negative effect on the share of total tax revenue in GDP within the first year of liberalisation for countries with trade tax revenue above the median ratio. There is no significant lagged effect on the share of total tax revenue in GDP within one and two years of liberalisation for countries in both groups.

There is no significant effect on trade tax revenue as a share of GDP on average in the years after liberalisation for either country group. The results also show that trade liberalisation has no immediate impact on trade tax revenue as a share of GDP within the year of the liberalisation for countries below the median export tax to total tax ratio. There also is no impact on trade tax revenue seen within a year of liberalisation; however, there is some impact within two years of liberalisation for these countries.

The overall impact of trade liberalisation on fiscal revenue is therefore more likely to be observed at the aggregate level rather than on trade tax revenue itself. Trade liberalisation usually forms part of a reform programme that covers broader economic and systemic reforms that may have a net positive or negative effect on the economy and indirectly on total tax revenue. The Sachs-Warner index captures some of these reforms and the average effect of trade liberalisation on total tax revenue as a share of GDP over time is shown to be positive and significant.

It is clear that the findings of the models are sensitive to the measure of trade liberalisation used and in particular, the dating of the liberalisation event and the associated sample. There is much room for further analysis in this area to find better ways of measuring the net impact of liberalisation on government revenue. In addition, other methods for events analysis could be explored that are applicable to a larger number of countries. As the revenue effects observed are at the aggregate level, it would be useful to analyse the net effect of trade liberalisation by using a general equilibrium model that can take account of the complex relationships in the domestic economy, the adjustment of indirect taxes, and the impact of relative prices and demand for final and intermediate goods as a result of changes in the price level due to trade reform.

# APPENDIX 3A - COUNTRIES AND YEAR OF LIBERALISATION EVENT IN EVENTS ANALYSIS

| | Year of Liberalisation Event | | |
|---|---|---|---|
| **Country** | **World Bank** | **Dean** | **Sachs-Warner** |
| Algeria | 1989 | | |
| Argentina | 1987 | 1989 | 1991 |
| Bangladesh | 1989 | | |
| Botswana | | | 1979 |
| Brazil | 1983 | 1987 | 1991 |
| Cameroon | 1989 | 1989 | 1993 |
| Chile | 1985 | 1985 | 1976 |
| Colombia | 1985 | 1985 | 1991 |
| Costa Rica | 1985 | 1985 | 1986 |
| Ecuador | | | 1991 |
| Ghana | 1987 | 1987 | 1985 |
| Guyana | 1981 | | 1988 |
| India | 1991 | | 1994 |
| Israel | | | 1985 |
| Kenya | 1980 | 1988 | 1993 |
| Korea | 1982 | 1987 | 1968 |
| Malawi | 1981 | 1988 | |
| Malaysia | | 1988 | 1963 |
| Mauritius | 1981 | | 1968 |
| Mexico | 1986 | 1985 | 1986 |
| Morocco | | | 1984 |
| Nepal | | | 1991 |
| Nicaragua | | | 1991 |
| Pakistan | 1982 | 1988 | |
| Paraguay | | | 1989 |
| Peru | | 1989 | 1991 |
| Philippines | 1980 | 1986 | 1988 |
| South Africa | | 1990 | 1991 |
| Sri Lanka | | 1987 | 1991 |
| Thailand | 1982 | 1989 | |
| Tunisia | 1987 | | 1989 |
| The Gambia | | | 1985 |
| Uruguay | 1987 | | 1990 |
| Zambia | 1985 | | 1993 |

# 4. REVENUE AND WELFARE EFFECTS OF THE EU-CARIFORUM EPA ON JAMAICA AND THE DESIGN OF WIRE TARIFF REFORM OUTCOMES

## 4.1 Introduction

In October 2008, Jamaica signed the Economic Partnership Agreement (EPA) as a member of the CARIFORUM[1] group – CARICOM plus Dominican Republic and Cuba. The EPA succeeded the Cotonou Agreement (2000) which provided non-reciprocal market access for African, Caribbean, and Pacific states to the EU[2] market on more favourable terms than those granted to other countries. The Cotonou Agreement required a waiver from the World Trade Organization (WTO) as it was contrary to Article 1 of the GATT, which guaranteed most favoured nation (MFN) treatment to all members, with exceptions for regional free trade agreements or economic integration agreements that meet the substantive criteria of Article XXIV of the GATT or Article V of the General Agreement on Trade in Services (GATS). In order to secure the waiver, EU and ACP states agreed to replace the Cotonou agreement with a WTO-compatible one by the end of 2007.

The EU-CARIFORUM EPA is the first EPA to be completed between Europe and one of the six sub-regions of the ACP. The Agreement is divided into six parts, with annexes and protocols:

- Part I: Trade Partnership for Sustainable Development
- Part II: Trade and Trade-related matters
    - Title I. Trade in Goods
    - Title II. investment, Trade in Services and E-commerce
    - Title III. Current Payments and Capital movements
    - Title IV. Trade-related issues
- Part III: Dispute avoidance and Settlement
- Part IV: General Exceptions
- Part V: institutional Provisions

[1] CARIFORUM comprises CARICOM plus The Dominican Republic and Cuba. The members of CARICOM are: Antigua and Barbuda; The Bahamas; Barbados; Belize; Dominica; Grenada; Guyana; Haiti; Jamaica; Montserrat; St. Kitts and Nevis; St. Lucia; St. Vincent and the Grenadines; Suriname; Trinidad and Tobago.

[2] EU comprises Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

- Part VI: General and final Provisions

Under the EU-CARIFORUM EPA, the tariff liberalization regime was as follows:

- 2009 - CARIFORUM would remove tariffs on 52.8 % of tariff lines (most already at 0% or near 0%).
- 2013 - five years from the date of signature of the EPA (2013), CARIFORUM would remove tariffs on 56% of tariff lines;
- 2018 – 61.1 % will be liberalised
- 2023 - 82.7% will be liberalised;
- 2028 – 84.6% will be liberalised
- 2033 - 86.9% will be liberalised

According to the Caribbean Regional Negotiating Machinery (2009), the objectives of the Agreement from CARIFORUM's perspective were to remove the barriers to trade between the EU and CARIFORUM and to improve the competitiveness of CARIFORUM goods and services. The expected end result was an increase in employment and business opportunities for CARIFORUM countries.

The EPA had its detractors, such as Girvan (2008), who argued that CARICOM states in particular made too many concessions under the agreement and that the benefits of the agreement would mainly accrue to the European Union. Girvan (2008) argued that CARIFORUM negotiated market access which was very different from "market presence", in reference to capacity and technical barriers to trade which may limit the actual penetration of the EU market by CARIFORUM firms.

In the current context, regional governments have expressed dissatisfaction that the promised benefits of the EPA have not materialised so far.[3] The former Head of the Delegation to the EU, Paola Amedi also expressed her disappointment with the seeming inability of the Jamaican private sector to take advantage of the EPA.[4] While noting that the problem is not market access as Jamaica has access to other foreign markets through the CSME (Caribbean Single Market Economy) and from the Caribbean Basin Initiative, she stated that the EU was providing over €7 million to work on NTB issues such as sanitary and phytosanitary measures and other trade related assistance.

[3] "Caribbean countries not fully satisfied with EPA accord", Jamaica Observer, 21 March 2016.

[4] "EU Laments Jamaica's Failure to Maximise EPA Benefits", Jamaica Gleaner, 23 October 2014.

**Revenue Considerations of Tariff Liberalisation**

Whilst it is clear from Girvan and others that there were other concerns with the EPA mainly arising from the asymmetrical nature of the partnership with the two groups at different level of development, the primary focus of this essay is the revenue concerns of CARIFORUM, mainly the CARICOM grouping. As with other ACP regions that were, and are still, negotiating EPAs, one of the main concerns for CARICOM, and Jamaica, was the revenue impact of the agreement.

In general, this is a concern that is not limited to the small island states of the Caribbean. Kowalski (2005) note that trade tax revenues as a percent of GDP was 4% for low and middle income countries between 1995 and 2000 as against less than 1% percent for high income countries. In the case of LDCs in Africa, import duties constituted approximately 34% of total government revenue over the period 1999-2001. The picture has improved somewhat over the years. Data from Chapter 2 show that Taxes on international trade as a percentage of GDP generally trend downwards for lower and upper middle income countries over the period 1972-2006. For high income countries, there was an increase in the share of trade taxes in GDP from 2% in the late 1980s to 5% for most of the 1990s, before falling in the late 1990s onwards.

Bilal et al. (2012) note that average applied tariff rates in ACP countries were between one-third to one-half of 1980 levels in 2006/7. Despite this progress, trade tax revenue as a share of total tax revenue was over 30% for 15 out of 43 Sub-Saharan Africa countries in their sample. Therefore, any drastic fall in trade tax revenues would have serious implications for social expenditure and the broader functioning of the state. In the context of the small island states of the Caribbean, customs revenue as a percentage of total fiscal revenue ranges from a high of 25% and 18% for The Bahamas and Belize, respectively, to a low of 5% for Trinidad and Tobago. For Jamaica specifically, customs revenue as a percentage of total taxes was approximately 8% in 2011 and 2012, rising to 9% in 2013.[5]

Singh et al. (2014) highlight that revenue considerations have been one of the factors in the reluctance for countries to enter into Economic Partnership Agreements with the EU. In the case of CARIFORUM countries, implementation of the EPA has stalled in many countries partly due to the effects of the 2007/2008 global financial crisis which led to slowed economic activity in these countries. Where tariff revenue constitutes a significant

[5] IMF Government Financial Statistics Database. Available Online: http://data.imf.org/?sk=A0867067-D23C-4EBC-AD23-D3B015045405. Date accessed: May 24, 2016

portion of fiscal revenue and governments are contemplating tariff liberalisation, there has to be some consideration of measures that would offset lost revenue from tariff reform with alternative sources. Notably, for Jamaica where there is a high rate of discretionary waivers, revenue considerations may not necessarily be driven by the EPA. In 2011, the trade weighted average MFN tariff rate (in the tariff schedule) was 9.8% and the collected tariff rate (what is actually collected at the border weighted by the amount of imports per tariff line) is 3.6%. This suggests that the government collected less than half of the value of statutory tariffs. Concerns about revenue fall-off post-EPA could therefore be addressed by reducing the amount of duty waivers and exemptions.

Building on the analyses in Chapters 2 and 3, Chapter 4 explores issues of trade liberalisation, fiscal revenue and welfare for a small open economy, Jamaica, in the context of the EU-CARIFORUM Economic Partnership Agreement (EPA). The EU-CARIFORUM EPA provides for, inter alia, the liberalisation of trade in goods across participant countries over a maximum period of 25 years. This chapter explores the tariff revenue, trade creating, trade diverting and welfare effects of full liberalisation under the EU-CARIFORUM EPA at the product level for Jamaica. It also examines the different effects of utilising statutory tariff rates versus collected tariff rates in the analysis, which is especially relevant where a country has a high level of exemptions or discretionary waivers. In addition, this chapter analyses how Jamaica may apply statutory tariffs on ROW imports after implementation of the EPA in order to address concerns about tariff revenue depletion and welfare loss, for example. It also examines the extent to which revenue considerations influenced the phasing schedule and exclusions list of the EPA, with particular reference to Jamaica's schedule of commitments. It then examines the feasibility of achieving welfare increasing and revenue enhancing (WIRE) outcomes for tariff adjustments on ROW imports post-EPA.

The chapter starts by reviewing the literature on varying approaches to trade liberalisation and the theories that have been developed to try to understand the effects of liberalisation with a focus on Hatta (1977) as a basis for analysis. The literature review also examines empirical studies on the welfare and revenue effects of trade reform. It then goes on to assess the different methodological tools that are available to assess the impact of tariff reforms and analyses the 2011 trade and tariff data for Jamaica that will be used in the reform scenarios. Then utilising the welfare increasing and revenue enhancing concept discussed in Falvey (1994), various tariff liberalisation scenarios will be conducted for Jamaica to assess the conditions under which tariff reforms will and will not enhance tariff revenue and welfare within the context of the EU-CARIFORUM EPA.

The next section presents the theoretical and empirical issues in the analysis of the tariff revenue and welfare impacts of tariff reform.

## 4.2 Literature Review

There is extensive research and analysis of the effects of trade liberalisation on revenue as this issue is of prime concern to governments, especially those from developing countries that are contemplating trade reform. Much of the discussion surrounds how reform measures can be structured to have positive revenue and welfare effects and where that is not possible, to promote overall revenue and welfare neutral outcomes. In this regard, issues that present for deeper analysis include appropriate timing and sequencing of reforms (see Falvey and Kim (1992)), the coverage of reforms, and the impact of interest groups on the reform process. In addition, there is the question of how governments can make up for lost revenue through consumption taxes, for example, in both perfectly competitive as well as imperfectly competitive markets, and in asymmetrical trading arrangements. In this context, Abe and Naito (2008) find that even in imperfectly competitive markets, trade liberalisation when combined with consumption taxes can increase revenue and welfare. Similarly, Conway et al. (1989) find that under some conditions entering into preferential trading arrangements yield superior welfare gains, particularly when the union is with "non-competitive" countries.

One can therefore analyse varying approaches to trade liberalisation, and in particular tariff reform; for example, the concertina approach, and "one-off", immediate tariff reductions which can either be applied across the board or selectively, and their impact on welfare and revenue. The Literature Review summarises the theoretical approaches that have evolved in an effort to understand the effects of liberalisation on welfare and revenue as well as empirical research in the area.

### 4.2.1. Theoretical Issues

This section outlines one of the main models utilised to analyse the impact of tariff reform on welfare – Hatta (1977) – and the main variations of this model. It then broadens the discussion to include the utility of domestic tax reform to mitigate some of the negative welfare and revenue effects of tariff reform. Finally, the review concludes by summarising the empirical studies on the welfare and revenue effects of trade reform, with special emphasis on the Caribbean region, and identifying knowledge gaps where the essay can make a contribution to the economic literature.

The theoretical research on welfare and revenue effects of trade liberalisation, and tariff reform specifically, includes analyses for markets with varying levels of competition – perfectly competitive markets, and imperfectly competitive markets such as oligopolies and monopolies – as well as for traded and non-traded goods. As expected, the theoretical conclusions are sensitive to the underlying set of assumptions of the model. The focus of most theories in this field is on the conditions under which tariff reforms improve welfare in single-good and multi-good settings. Contributors to this literature include Hatta (1977), Hatta and Fukushima (1979) and Fukushima and Kim (1989). The basic model assumes a two-commodity multi-country world where:

I. Each country faces a strictly concave production possibility curve.

II. There is only one consumer who has well-behaved compensated demand functions for both goods in each country.

III. Producer prices are maximised with prices as given.

IV. Consumers and producers face the same prices.

V. Each country is small and is a price taker of the two goods.

VI. No country imports or exports both goods, has only tariffs as trade barriers, and where there is no inferior good.

VII. An ad valorem tariff is place on each imported good by each country.

Under these conditions, global welfare is judged to improve if the utility possibility set of the world grows. Hatta (1977) and Hatta and Fukushima (1979) find that tariff reform that reduces the highest tariffs to the level of the second highest will increase welfare if there are no inferior goods, the good on which the highest tariffs is imposed is a substitute for all other goods and non-traded goods are substitutes for all other goods. In addition, unilateral trade liberalisation improves welfare if the country with the highest tariff unilaterally reduces its tariff to that of the second highest or if all countries reduce their tariffs proportionately. Fukushima and Kim (1989) extend the analysis above by generalising to a multi-good framework where each country now has specific tariffs as well as subsidies on each good. In this setting, a proportional reduction in tariffs/subsidies increases global welfare, noting that international lump-sum transfers need to occur for the Pareto improvement to be realised.

The framework outlined above may be modified to allow for greater generalisation of findings as well as to include alternate measures of welfare

effects. In this regard, building on the work of Fane (1991), Falvey (1994) uses the basic framework developed by Hatta and combines that framework with the concept of compensated radial elasticities (CREs) to assess the conditions under which a welfare improving and revenue enhancing (WIRE) reform will exist, with the underlying proposition that these types of reform are more likely to be sustained after the reform. CREs measure the proportionate reduction in the tax base due to a proportionate radial increase in all tax rates. Falvey (1994) finds that WIRE reforms exist where CREs of tariffs under reform are different and, where CREs are the same, there may still be welfare improvement if taxes are above their revenue maximum. In the case of single tax reform, reforms that increase taxes at their lowest level or reduce subsidies at their highest will have positive effects on welfare and revenue.

There are also models that take into account domestic distortions and non-traded commodities in a multi-household framework by extending the Hatta (1977) framework. The results of these models vary from those which are focussed on single households with no distortions. For example, Diewert et al. (1991) propose that strict Pareto improvements will occur from tariff reform if: (i) the reform leads to prices that are closer to world prices, (ii) if all tariffs are reduced proportionally or linearly and the gains are transferred to households by a lump sum, (iii) if a tariff on a single good is reduced, provided that the good has the highest tariff rate, domestic commodities are zero and traded goods are net substitutes. Welfare improvement in this instance is judged on the basis of Pareto optimal changes achieved through lump sum transfers to households of gains realised from tariff reform. It should be noted that as the analytical assumptions are relaxed and domestic distortions are allowed in the models, the findings are not easily generalizable. For example, Anderson and Neary (1992) use the concept of "implicit separability" to derive sufficient conditions for welfare enhancing tariff reforms under specific assumptions. However, their findings are quite sensitive to the assumptions made. More recently, Anderson and Neary (2016) utilise Hatta's (1977) framework to propose conditions under which tariff reform leads to a rise in welfare with no loss of tariff revenue. They posit that trade reform that comprises a mean-preserving reduction in tariff dispersion and convex combinations of uniform absolute tariff reductions is beneficial to an economy when the marginal cost of revenue from the tariff is exceeds the marginal cost of revenue from alternative sources. In addition, they show that when households have different preferences for the same set of goods, tariff dispersion within different groups is not efficient.

Hatta and Ogawa (2007) also show that the optimal tariff in a revenue constrained environment is close to uniformity when the goods imported are close substitutes. In the context of non-traded commodities, there can be specific focus on public production. In this case, the publicly produced good is substituted for the non-traded private goods in Hatta's model and it is

assumed that the non-traded publicly produced good is complementary to some traded private goods in order for welfare to improve as a result of tariff reform and that the government utilises the revenue gained from levying specific tariffs on private goods to produce a non-market provided good rather than transferring the revenue as a lump-sum payment to consumers. A key contributor to this literature is Abe (1992) who finds that the reduction of the highest tariffs will improve welfare if the publicly produced good is oversupplied initially; the highest tariff rate is applied to private goods that are complements to the publicly produced good; no private goods are inferior; and the private goods on which the highest tariffs are applied are net substitutes for all the other private goods. Conversely, a uniform change of all tariffs will reduce welfare if the publicly produced good is initially undersupplied, there is no substitutability among private goods, there is no inferior good, the market is in stable local equilibrium, and the price of the publicly produced good is less than the world price of private goods. If the publicly produced good is initially oversupplied and the other conditions hold, a uniform change of all tariffs toward any target will improve welfare. Abe (1992) posits that tariff reform may be harmful to the small economy where tariff revenue limits the production of the publicly produced good and renders it scarce and where price elasticities of demand and supply are relatively inelastic.

The preceding analyses are based in a partial equilibrium setting. Other models, such as Heady and Mittra (1986), use a general equilibrium approach to analyse the welfare and revenue effects of tariff reform. Heady and Mittra (1986) point to the critical role of the characteristics of the social welfare function (which includes the elasticity of substitution between factors and the taxation power of the government) in determining optimal tariffs. However, as this essay will utilise a partial equilibrium approach, the literature review will focus on this line of research.

The analyses above provide insight into how trade liberalisation, and in most instances tariff reform, affects welfare and revenue. The rules suggest that unilaterally lowering the highest tariff to the next level can increase welfare. However, as expected, the welfare and revenue effects are dependent on the characteristics of the market and the nature of the goods in question (for example, whether they are privately or publicly produced; or finished or intermediate goods). While most studies show analytical rigour in the development of the theory, there is a dearth of empirical verification of the rules suggested. This essay explores the potential to apply these theories and verify their propositions. Specifically, there is room to extend Falvey's use of compensated radial elasticities to empirical application where data is available. In addition, one can further explore the significance of assumptions relating to the degree of homogeneity of goods being traded on the analysis of the welfare effects of unilateral tariff liberalisation.

The literature cited above focuses on mainly the welfare effects of trade reform but there is complementary analysis of the interplay between trade liberalisation and domestic tax reform and specifically, how domestic taxes can limit the impact of a reduction in trade tax revenue on the fiscal account. The next section delves further into this issue and reviews studies that have analysed welfare and revenue effects of combined tariff and domestic tax reform.

*Tariff and Domestic Tax Reform*

Empirical studies have analysed how trade liberalisation and domestic tax reform interact. Hatzipanayotou et al. (1994) show how a uniform decrease in trade taxes plus an increase in consumption taxes can improve welfare and increase government revenue. In this case, a general equilibrium model is developed for a small open economy with trade and consumption taxes and limited factor mobility internationally. A uniform decrease in tariffs plus a simultaneous increase in consumption taxes are welfare and revenue-raising if either all tariffs and consumption taxes are harmonised or the consumption tax is equal to the tariff on each good. Additionally, they propose that if the country's initial position subsidises producers then holding consumer prices constant by reducing the tariff but increasing the consumption tax by the same amount will improve welfare and increase government revenue.

Erbil (2004) also uses a CGE model to examine whether trade taxes or output taxes are costlier in welfare terms. The comparison is based on the "marginal cost of funds" as the welfare defining tool, where countries with higher marginal cost of funds for tariffs than output taxes would be better off after tariff reform. They find that tariffs are the more expensive distortion for most countries in their study (26 out of 32 countries) and posit that these countries would be better off reducing tariffs and replacing them with indirect taxes. However, Kreickemeier and Raimondos-Møller (2008) argue that the replacement of tariffs with indirect taxes such as consumption taxes does not necessarily lead to increased access of imports to the market of the country undertaking the reform. In addition, they show that the welfare effect of reforming only tariffs is greater than when the reform package also increases consumption taxes.

In contrast, Keen and Ligthart (2005) explore the same theme but in the context of imperfect competition and find that matching tariff reductions with proportional increases in consumption taxes reduces domestic welfare. Abe and Naito (2008) also analyse welfare effects under imperfect competition but for a country that imports final and intermediate goods. They find that trade liberalisation and domestic tax reform can still enhance welfare in this context but the inclusion of the intermediate good in the analysis is crucial to this result.

Konan and Maskus (2000) assert that the benefits of trade liberalisation depend on the current tax structure and the extent to which other taxes are reformed. Applying a similar general equilibrium framework to Egypt, they examine the welfare effects of various scenarios, including unilateral tariff elimination, tariff unification, and removal of the consumption tax. They conclude that the replacement tax imposed by the government is important in determining welfare effects and that it is important to consider joint trade and domestic policy reform in the face of economic distortions.

Domestic tax revenue is also impacted directly by trade liberalisation. In many developing countries, taxes on imported goods and services are an important source of revenue and are levied on the tariff-inclusive price. The removal of tariffs is therefore likely to reduce tax yield if the base is eroded. Agbeyegbe et al. (2006) note, however, that the ultimate impact on revenue yield has to take account of possible changes in import demand (positive) and demand for import substitutes (negative) due to lower prices on imports from removal of the tariff. Moreover, there may be long-term effects on the tax base if liberalisation has a positive effect on economic growth.

In addition to the revenue and welfare effects of trade liberalisation, there are also issues relating to the timing and sequencing of reforms that in and of themselves may impact welfare and revenue gains/losses. Kubota (2000) argues that trade reform should occur after governments undertake "efficiency-enhancing and revenue-increasing" tax reform The issue may also be assessed in the context of overall market liberalisation reforms; for example, Papageorgiou et al. (1990) find that liberalisation tends to be less successful in cases where capital market liberalisation precedes trade liberalisation. It is argued that reforms in the capital market are likely to be felt immediately while trade reforms tend to take longer to have an effect. Therefore, in order to synchronise the re-allocation effects of reforms, it may be best to implement trade reforms first. Falvey and Kim (1992) provide a rich assessment of the various issues surrounding timing and sequencing, ranging from the place of tariffication of quantitative restrictions in the reform programme to the appropriate speed of reform.

There is therefore room to marry analyses of welfare effects of trade liberalisation with an analysis of the feasibility of replacing lost revenue with a VAT, for example. Additionally, one can analyse the role that timing and sequencing plays in determining welfare and revenue effects and, for countries with high dependence on trade tax revenue, the conditions under which the proposed reform can be welfare improving and revenue enhancing if revenue replacement by consumption taxes is not possible.

This essay will explore these issues empirically and report on best practices or possible rules that may be applicable in a small country context. However, before launching into the empirical analysis, it is necessary to review other

studies that have sought to quantify the welfare and revenue effects of trade reform. The next section assesses these studies and outlines the main modelling approaches used and their findings with a view to develop and refine the approach to be used in this study.

### 4.2.2. Empirical Studies on Quantifying Welfare and Revenue Effects

Several researchers have quantified the welfare and fiscal effects of trade liberalisation in the context of multilateral trade negotiations in the World Trade Organisation, bilateral trade agreements, unilateral trade liberalisation and regional trade agreements. It should be noted that the number of theoretical papers on the welfare effects of trade reform far exceed the number of empirical papers - which leaves much room for further empirical research in this field. This section reviews existing research on assessing welfare and revenue effects, particularly with respect to the Caribbean.

There are two main approaches to modelling the welfare and revenue effects – a general equilibrium framework (normally a computable general equilibrium (CGE) model) or a partial equilibrium framework. While the general equilibrium framework assesses the impact of liberalisation on the economy as a whole and allows the linkages across sectors to be incorporated, the analysis is conducted at a very high level of aggregation which limits the applicability of findings to specific goods or services. The partial equilibrium approach, on the other hand, allows detailed analysis at a fairly disaggregated level; however, it does not capture effects on the economy as a whole and cannot be used to explore inter-sector linkages (see Busse and Lüehje (2007), Busse and Grossmann (2007) and Milner et al. (2005)). As this essay will focus on the impact of trade liberalisation at the highest level of detail available for Jamaica and CARICOM and given the paucity of data that would do justice to a CGE framework, a partial equilibrium approach will be used to assess how liberalisation ought to occur to maximise welfare and minimise revenue loss.

In the context of the Caribbean, the most recent studies on the impact of trade liberalisation on fiscal revenue and welfare refer to the Economic Partnership Agreements. Singh et al. (2014) assess the impact of the EU-CARIFORUM EPA five years after the agreement was signed in 2008. Their assessment covers all the aspects of the EPA, including trade in goods, services, trade facilitation and development cooperation. Of particular interest to this study is the methodology used to assess the trade in goods and revenue impact of the EPA. Singh et al. (2014) assess three scenarios:

1. An “EPA Review” scenario that estimates the impact of the tariff reduction commitments made by both the EU and CARIFORUM countries during the review period (2008-2013);

2. A “full EPA” scenario that estimates the impact of tariff reduction commitments over the full implementation period of the EPA; and
3. A “no-EPA” counterfactual scenario where there is no EPA and CARIRIFOUM states maintain pre-EPA tariffs on imports from the EU and CARIOFORUM imports are subject to GSP preferences by the EU.

They utilise a partial equilibrium framework in the form of the World Bank’s TRIST, with elasticity estimates based on World Bank data, their own judgement and assumptions to simplify the model. Import elasticity of demand estimates are based on World Bank data and their judgement. Supply elasticity is assumed to be infinitely elastic and elasticities of substitution are assumed at various levels based on expert judgement. In the model, they specify an importer and a set of exporters. The simulation involves tariff changes by the importer which then lead to a change in the pattern of trade and the quantities demanded for individual products. They find that in the early years of implementation of the EU-CARIFORUM EPA over the period 2008 to 2013, customs revenue fell by 2% for CSME countries (-US$30.7 million) compared with a projected loss of -13.27% when the full EPA is implemented. This is not surprising as Singh et al. (2014) note that CARIFORUM countries scheduled the high revenue products for later phases of liberalisation and so the revenue impact of the EPA on CARIFORUM states is ‘muted’ in the short-term.

Additionally, Milner et al. (2005); Morrissey et al. (2007); Busse and Lüehje (2007); and Gasiorek and Winters (2004) have also conducted studied on the impact of the EU-CARIFORUM EPA. Most of these studies are also set in a partial equilibrium framework which allows for analysis at a relatively detailed level. Greenaway and Milner (2006) apply this framework to examine the welfare and revenue effects for CARICOM states of an EPA between the European Union (EU) and CARIFORUM, reciprocal liberalisation with both the EU and the United States (US), and multilateral liberalisation. The model allows for different assumptions about the degree of substitutability between locally produced goods and imports – perfect substitution and imperfect substitution with increasing costs for local producers. In the perfect substitution case, Greenaway and Milner (2006) note three effects of introducing a discriminatory tariff in a regional trade agreement where EU prices are higher than those in the rest of the world:

I. A trade creation effect as a result of increased consumption (due to price reduction from high cost local/CARIFORUM suppliers to lower cost EU suppliers).

II. An extra-regional trade diversion effect where goods that were previously imported from suppliers in the rest of the world (ROW) are now imported from less-efficient EU suppliers. It should be noted that this cost also includes tariff revenue foregone from ROW suppliers.

III. A trade creation effect caused by the replacement of intra-regional suppliers with more efficient EU suppliers. EU suppliers may not be more efficient than ROW suppliers; however, to the extent that they have replaced less efficient regional suppliers, there is a positive "source substitution effect" of the EPA.

The net welfare effect depends on the relative strength of the trade creation and diversion effects which are also dependent on the shape of the EU supply curve. In the case of imperfect substitution, there are similar trade creation and diversion effects; however, the net welfare effect is even more difficult to predict. Using imperfect substitution in their model, Greenaway and Milner (2006) find that overall welfare effects represent only a small percentage of GDP but there is substantial redistribution of rents from producers and governments to consumers. As expected, they find that multilateral trade liberalisation yields the greatest welfare gains for CARICOM states, followed by reciprocal free trade agreements with both the EU and the US, and then an EPA. Using a general equilibrium framework, Bussolo (2002) finds a similar ordering of policy options for Jamaica. It therefore appears that though the models have differing uses and applicability, the core conclusions are the same – unilateral trade liberalisation yields the greatest improvement in welfare; however, the adjustment costs are significant. This conclusion is also supported by Busse and Lüehje (2007) who find that although there will be significant gains from the EPA, the adjustment effects require a gradual approach to liberalisation, providing adequate time for governments to reform their tax systems, for example.

Other studies such as Gasiorek and Winters (2004) highlight that it is the degree to which the EU price is below the ROW tariff-inclusive price that determines the magnitude of trade creation effects. They also note that the welfare effects ultimately depend on the group that is the main supplier of goods to the market (EU or ROW), demand and supply elasticities, the level of the tariff, and the extent to which tariff reductions are passed on to consumers.

Similar analyses have been conducted for African countries. Bilal et al. (2012) conduct a review of studies undertaken on trade liberalisation and fiscal adjustments for African countries in the process of negotiating an EPA. While finding that there is much variation of the findings of different studies, depending on the assumptions made in the model, Bilal et al. (2012) note that there are some common factors that seem to influence the fiscal impact of an EPA. These factors include the country's trade structure (for example, whether domestic production mainly comprises finished goods that compete with imports or is reliant on imports as inputs into the production process), demand for imports from the EU, the effective tariff rate, and the price elasticity of demand and substitution. In addition, e that the implementation schedule of

the agreement is also very important in assessing the fiscal impacts of an EPA as an extended period for implementation may mitigate potential negative fiscal effects as the impact will be spread over time. Indeed, the EU-CARIFORUM EPA adopted this approach and high revenue items were scheduled for liberalisation during the last phase. It is also noted that a country's ability to identify alternative sources of financing is a key determinant of the fiscal impact of an EPA. They also note that most studies tended to overestimate the fiscal impact of an EPA due to methodological errors as well as a lack of information on the commitments made for the agreement.

Vollmer et al. (2009) apply the same model developed by Greenaway and Milner (2006) to assess the effects of interim agreements between the EU and nine Sub-Saharan African (SSA) countries, using the actual tariff rates that were negotiated based on the agreement's phasing schedule. Here, the comparison is between the short-run and long-run welfare effects of an EPA and full liberalisation. They find that four countries - Botswana, Cameroon, Mozambique and Namibia - seem likely to have net positive welfare effects from the agreement while the other five countries are predicted to have minimal trade effects. Vollmer et al. (2009) estimate that the EPA is likely to have high trade creation and low trade diversion effects for these countries. Of interest, they estimate bilateral elasticities of import demand from disaggregated trade data and input them into the import demand function. Busse and Grossmann (2005) also use a partial equilibrium framework to analyse the impact of an EPA on West African countries and conclude that the adjustment costs associated with the EPA require a gradualist approach to trade liberalisation. This point is supported by Morrissey et al. (2007) in their theoretical and empirical analysis of the trade and welfare implications of EPAs for ACP countries, and the specific case of an EPA between the East African Co-operation (EAC) and the EU. They conclude that the net welfare effects of an EAC-EU EPA are not consistent across sectors and depend on the costs of producing imports between the EU, and ROW and domestic sources. Their analysis also suggests that it is more likely that the static effects of an EPA will be negative for ACP countries and that LDCs especially are not likely to have additional gains from an EPA by virtue of the fact that they would enjoy preferential access by virtue of the Everything But Arms initiative under the EU Generalised System of Preferences.

Common themes in the empirical literature are the role of appropriate timing and sequencing in trade liberalisation, particularly where trade tax revenue constitutes an important source of fiscal revenue. Additionally, there is the impact of dislocation of local and/or regional suppliers on the economy through job losses and also a loss of domestic tax revenue previously garnered from these suppliers. The net welfare effect of trade liberalisation within the context of a Free Trade Agreement (FTA) is the result of three phenomena – a

change in consumption, trade diversion, and trade creation. The first effect is the direct result of price changes on consumers and the trade diversion effect is the welfare loss realised from diverting trade from more efficient ROW suppliers to less efficient intra-regional suppliers (in the case of a Free Trade Agreement, for example). On the other hand, trade creation occurs where domestic production is replaced by more efficient products from suppliers within the FTA. Most studies suggest that the net welfare effects are small as a percentage of GDP in the long run. However, in the short run, there are likely to be significant adjustment costs, and there may even be a welfare loss, as less efficient producers are forced to exit from the market resulting in job losses and reduced fiscal revenue for the government. These short term effects prove especially challenging politically and present the greatest threat to the sustainability of reforms.

This essay analyses the possibility of achieving WIRE reform outcomes within the context of full liberalisation of EU imports into Jamaica under a CARIFORUM-EU EPA under various scenarios. These scenarios include the application of statutory tariff rates vis-à-vis the collected tariff rate on ROW imports; and the introduction of different tariff reform measures, for example, a linear cut in the collected tariff rate and a reduction of maximum tariff rates. In order to conduct the analysis, the study will utilise tools that have already been developed to analyse the impact of tariff reform scenarios – notably, work by the World Bank. Before delving into the methodology of the study, the next section describes Jamaica's trade and tariff structure in order to provide the context for the tariff reform scenarios that will be conducted.

## 4.3 Jamaica – Trade and Tariff Profile

With an estimated population of 2.8 million, the Jamaican economy is very open and its trading pattern mirrors both its geographic location as well as its colonial past. Data from the World Bank show that, in 2011, GDP amounted to $14.4 billion (current US$).[6] In that same year, total merchandise exports amounted to US$1.5 billion while imports totalled US$6.4 billion; therefore, the economy had a merchandise trade deficit of almost $5 billion.

The World Trade Organisation (WTO) Trade Policy Review (TPR) 2010 notes that Jamaica imposes no restrictions or taxes on exports. While exports are not taxed, the revenue generated from exports and the multiplier effect of increased income and production in the economy is usually reflected in higher total tax earnings from all tax categories. Trade tax revenue constitutes a significant portion of overall fiscal revenue (amounting to between 27% - 28% of total revenue (WTO TPR (2010)), with the majority earned from General Consumption Tax and Special Consumption Tax on imports and customs duties. The figure would be higher but for the large number of discretionary waivers and exemptions that are granted. Given the economic difficulties that the country is facing and its current unsustainable level of public debt (at 142% of GDP for FY 2011/2012[7]), trade tax revenue is seen as critical in supporting the government's fiscal consolidation efforts. Additionally, as one of the structural benchmarks under the IMF Extended Fund Facility (EFF) signed in May 2013, the Jamaican Government committed to reducing the number of discretionary waivers in an effort to increase treasury inflows.

### 4.3.1. Trade Structure

Data reported by the World Bank show that, in 2011, over 92% of Jamaica's exports went to high-income economies while these economies accounted for 61% of the country's total merchandise imports. As Jamaica does not maintain any export taxes or charges, there are no direct fiscal implications of further liberalisation that can be analysed with respect to exports. The analysis here will therefore focus on Jamaica's imports in 2011. From UN COMTRADE data Jamaica's main imports (goods) in 2011 were oil (accounting for over 36% of total imports), boilers and machinery, beverages and vehicles (Figure 4-1). The country's main source of imports in 2011 was the United States (see Figure 4-

[6] World Bank World Development Indicators database. http://databank.worldbank.org/data/views/reports/tableview.aspx. Date accessed: August 21, 2013.

[7] See IMF Country Report No. 13/126, 'Jamaica Request for an Extended Arrangement Under the Extended Fund Facility'.

2), comprising 34% of total imports, followed by Venezuela at 15% of total imports. In both these cases, the main import is petroleum and petroleum by-products. CARICOM partner Trinidad and Tobago is third with 13% of total imports and is followed by Brazil, China, Mexico and Japan. It is thus evident that the EU is not a major source of imports and the net welfare effect of an EPA is not likely to be positive. Trade diversion is likely to exceed trade creation in this case as the EU is unlikely to displace petroleum imports from the United States and Venezuela.

**Figure 4-1: Jamaica's Top Ten Imports in 2011**

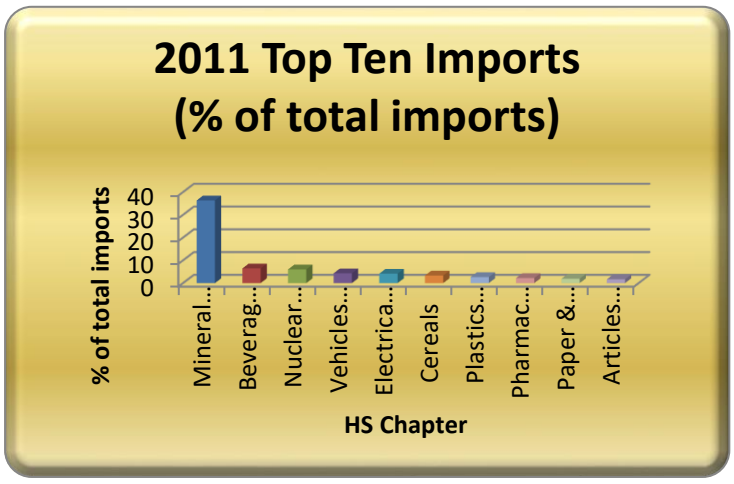
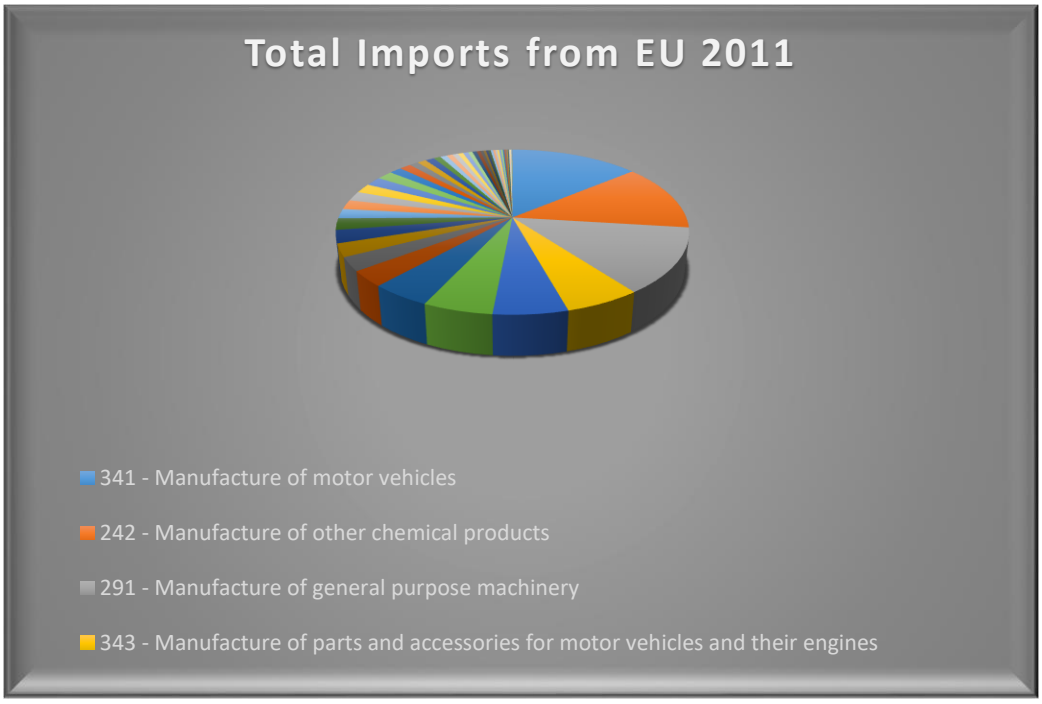



**Figure 4-2: Jamaica's Main Trading Partners in 2011**

*Trade with the EU*

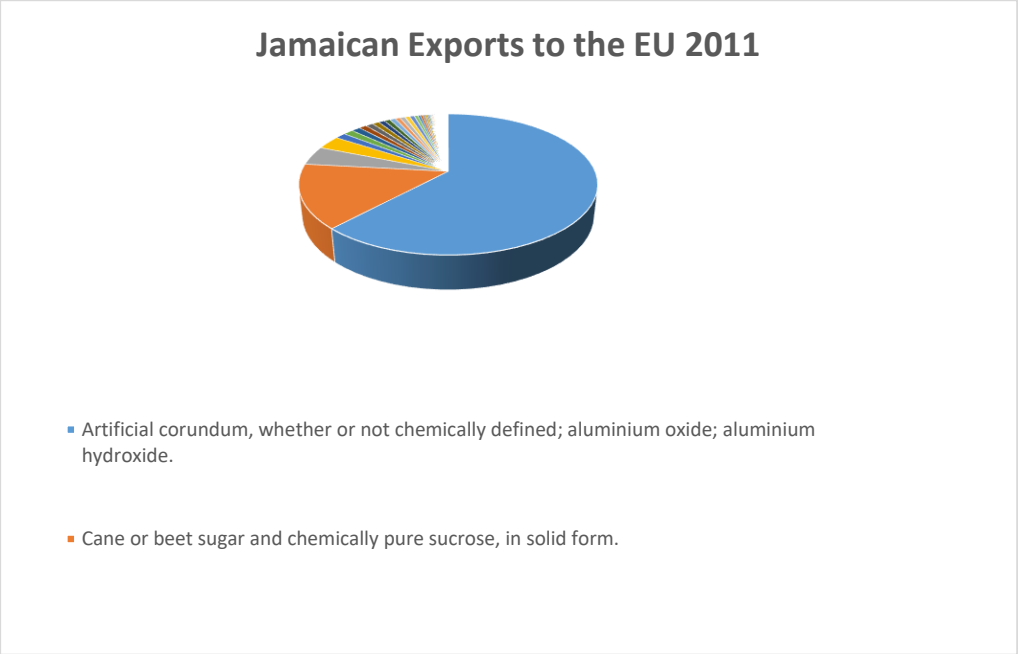
Imports from the EU to Jamaica have declined from US$369 million in 2009 to US$354 million in 2010, then grew to US$426 million in 2011 and fell to US$385 million in 2012. In 2011, Jamaica's imports from the EU totalled $436 million or approximately 7% of total imports, which represented an increase of approximately $74 million over the 2010 figure. As shown in Figure 4-3, five industrial categories account for over 50% of imports from the EU – Manufacture of motor vehicles (14%); manufacture of other chemicals (13%); manufacture of general purpose machinery (13%); manufacture of parts and accessories for motor vehicles (6%). The majority of these items are subject to import duties. However, it should be noted that 70% of non-agricultural tariff lines were duty-free and a further and 27% had applied rates of between 0%-25% (see WTO TPR (2010)).

**Figure 4-3 Jamaican Imports from EU 2011**




With respect to exports (Figure 4-4), total exports from Jamaica to the EU was US$328 million in 2011. Exports are concentrated in a few products – artificial corundum/aluminium oxide (62%), cane or beet sugar (15%) and undenatured ethyl alcohol (3%). These products already face low tariffs and so, there would appear to be few benefits for existing Jamaican exports under an EPA.

**Figure 4-4 Jamaican Exports to the EU 2011**




*Trade Agreements*

Jamaica is a member of the Caribbean Community (CARICOM) since its inception in 1973 and is in the process of further deepening integration through the implementation of the Caribbean Single Market and Economy. Goods entering the country from CARICOM states enter the country duty-free, provided they meet the rules of origin, and the same applies to the country's exports to other member states.

The WTO Trade Policy Review (2010) outlines the bilateral agreements negotiated by the Community, to which Jamaica is a party, which includes preferential trade agreements with the Dominican Republic (1998), Cuba (2000), Colombia (1995), Costa Rica (2004) and Venezuela.

The CARICOM/Costa-Rica and the CARICOM/Dominican Republic free trade agreements provide for reciprocal tariff concessions for goods from CARICOM More Developed Countries (MDCs), and Costa Rica and the Dominican Republic, respectively. At the time of the Review, none of these two agreements was fully implemented. The CARICOM/Venezuela Agreement is non-reciprocal and provides preferential access for most of CARICOM's exports to the Venezuelan market. The CARICOM/Colombia Agreement not only covers market access but also includes provisions for trade promotion and investment, and the phasing out of Non-Tariff Barriers (NTBs). The CARICOM/Cuba agreement provides duty-free markets access for an agreed set of goods and includes provisions for trade promotion, services, intellectual

property rights and other broad trade areas. The latter agreement is being implemented provisionally by Jamaica.

In addition to these agreements, Jamaica, as a CARICOM member, benefits from preferential trade agreements with major trading partners such as the United States, Canada and the European Union. However, some of these arrangements have had to be modified to comply with WTO rules. Jamaica's trade with the European Union is currently governed by the CARIFORUM-EU Economic Partnership Agreement (2008) which provides for reciprocal duty-free treatment of exports from both groups. Jamaica has begun to implement the phased reduction as detailed in the phasing schedule for the CARIFORUM-EU EPA. The Agreement goes beyond market access for goods to include provisions for services, public procurement, intellectual property rights, NTBs, and Sanitary and Phyto-Sanitary (SPS) measures, among other areas.

With respect to the United States, Jamaica benefits from the Caribbean Basin Trade Partnership Act (2000) which provides preferential access to the US market for certain goods detailed under the Caribbean Basin Initiative (CBI) and additional items that were excluded under the CBI such as footwear and petroleum products. The WTO TPR (2010) reported that over 90% of Jamaica's trade with the United States fell under the CBI according to Government of Jamaica sources. Jamaica is party to negotiations with the United States for a Free Trade Area of the Americas; however, according to the Caribbean Office of Trade Negotiations (OTN), this process is considered dormant.

Jamaica's products have duty-free access to the Canadian market under CARIBCAN, an agreement between the Commonwealth Caribbean and Canada (1986). The agreement provides duty-free access to over 97% of Jamaica's exports to Canada, provided they meet the requisite rules of origin. Excluded products include garments and footwear. CARICOM and Canada are currently negotiating a WTO-compatible reciprocal trade agreement. On November 30 2011, the WTO General Council approved a new waiver for CARIBCAN until December 31 2013 whilst the parties move towards finalising a Trade and Development Agreement.

### 4.3.2. Tariff Profile

The WTO Trade Policy Review (2010) notes that Jamaica, as a member of CARICOM, has implemented the Common External Tariff (CET) which harmonizes tariff rates among members in the community. The CET is 0%-20% for industrial goods and 0%-40% for agricultural products. There is differential implementation of the CET among members of the Community, with member states being allowed to maintain a sensitive list to which CET rates would not apply and particular exceptions for members of the Organization of Eastern

Caribbean States (OECS) and Haiti. According to the Revised Treaty of Chaguaramas Article 83 (1), changes to the Common External Tariff have to be agreed by the CARICOM Council for Trade and Economic Development (COTED). Article goes on to state that COTED may alter or suspend the CET where:

1. The product is not being produced in CARICOM
2. The quantity of the good produced is not sufficient to meet the demand from the Community
3. The quality of the good produced in the Community is below CARICOM standard or a standard authorised by COTED

There are therefore instances where the CET is not uniform across the Community as member states seek derogations based on the exceptions outlined above.

With respect to Jamaica itself, the WTO reports that the average tariff in 2011 for agricultural products was 17.9% and 6% for non-agricultural products. In its Trade Policy Review for Jamaica 2010, the WTO Secretariat noted the significant variation between the country's applied and bound tariff rates. In the case of agricultural products, for example, over 96% of goods in that category have duties bound between 50%-100% but only 1.5% of agricultural products have these rates applied to them at the border. In fact, 41% of agricultural products in 2011 had duty-free status while a further 46% had applied rates of between 15% and 50%. The case is slightly different for non-agricultural products – 82% of which had lower average bound rates of between 25% and 50%. Duty-free treatment was applied to 70% of non-agricultural tariff lines and 27% had applied rates of between 0%-25%.

The profile suggests that while the Government of Jamaica (GOJ) maintains relatively low applied rates when compared to its bound rates, it still retains the flexibility to increase tariff rates whenever it sees fit. Indeed, applied rates were increased for certain categories of motor vehicles in 2013 in an attempt to garner increased revenue to improve the country's primary surplus (a conditionality of the country's Extended Fund Facility with the International Monetary Fund). The applied rates vary by product category and Table 4-1 outlines the main product groups and their average tariff rates. The highest applied MFN tariff rates are found on: Fish and fish products (28.8%); animal products (26.5%); dairy products (25.2%); fruits, vegetables, plants (23%); and beverages and tobacco (23%). The lowest applied MFN rates are found on imports of cotton (0%); non-electrical machinery (1.5%); and chemicals (2.6%). Petroleum products and chemicals constitute the larger share of imports valuing 27.3% (40.4% duty-free) and 13% (64.2% duty-free), respectively.

Jamaica has high proportion of discretionary waivers, which can only be granted by the Minister of Finance and Planning. The WTO TPR (2010) states

that the cost of exemptions and waivers amounted to greater than 50% of total trade tax revenue in 2007-2008 and fell to over 25% in 2009/2010. There is therefore room to increase fiscal revenue simply by reducing the number of exemptions and waivers.

**Table 4-1: Jamaica Tariff Profile**

| Tariffs and imports: Summary and duty ranges | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Summary** | | | Total | Ag | Non-Ag | | | | | |
| Simple average MFN applied | | 2011 | 7.6 | 17.9 | 6.0 | | | | | |
| Trade weighted average | | 2010 | 10.1 | 16.4 | 8.5 | | | | | |
| | | | | | | | | | | |
| **Frequency distribution** | | Duty-free | 0 <= 5 | 5 <= 10 | 10 <= 15 | 15 <= 25 | 25 <= 50 | 50 <=100 | > 100 | NAV |
| | | Tariff lines and import values (in %) | | | | | | | | in % |
| Agricultural products | | | | | | | | | | |
| MFN applied | 2011 | 41.6 | 4.6 | 1.5 | 4.0 | 14.3 | 32.3 | 1.5 | 0 | 0.2 |
| Non-agricultural products | | | | | | | | | | |
| MFN applied | 2011 | 69.5 | 1.5 | 3.5 | 4.3 | 17.4 | 3.8 | 0 | 0 | 0.0 |

| Applied Tariffs and Imports by product groups | MFN applied duties (Tariff Lines) | | | Imports (Value) | |
|---|---|---|---|---|---|
| **Product groups** | AVG | Duty-free | Max | Share | Duty-free |
| | | in % | | in % | in % |
| **Animal products** | 26.5 | 9.5 | 100 | 1.6 | 28.2 |
| **Dairy products** | 25.2 | 11.7 | 75 | 0.8 | 8.1 |
| **Fruit, vegetables, plants** | 23.0 | 34.2 | 100 | 1.6 | 23.9 |
| **Coffee, tea** | 15.6 | 22.9 | 40 | 0.2 | 15.6 |
| **Cereals & preparations** | 12.4 | 47.5 | 40 | 6.7 | 50.8 |
| **Oilseeds, fats & oils** | 17.6 | 52.8 | 40 | 1.5 | 48.9 |
| **Sugars and confectionery** | 19.0 | 37.5 | 40 | 1.6 | 3.3 |
| **Beverages & tobacco** | 23.0 | 13.6 | 40 | 5.1 | 32.3 |
| **Cotton** | 0.0 | 100.0 | 0 | 0.0 | 100.0 |
| **Other agricultural products** | 5.6 | 82.5 | 40 | 0.9 | 81.3 |
| **Fish & fish products** | 28.8 | 18.8 | 40 | 1.8 | 34.6 |
| **Minerals & metals** | 4.1 | 74.6 | 50 | 8.4 | 63.0 |
| **Petroleum** | 4.8 | 33.5 | 25 | 27.3 | 40.4 |
| **Chemicals** | 2.6 | 84.7 | 40 | 13.0 | 64.2 |
| **Wood, paper, etc.** | 7.0 | 58.3 | 20 | 6.0 | 48.4 |
| **Textiles** | 3.1 | 84.0 | 25 | 1.4 | 40.6 |
| **Clothing** | 19.8 | 0.9 | 20 | 1.1 | 0.1 |
| **Leather, footwear, etc.** | 6.7 | 63.5 | 30 | 1.8 | 19.1 |
| **Non-electrical machinery** | 1.5 | 91.8 | 25 | 6.6 | 78.0 |
| **Electrical machinery** | 6.6 | 65.9 | 40 | 4.7 | 51.5 |
| **Transport equipment** | 7.5 | 70.1 | 50 | 5.3 | 21.3 |
| **Manufactures, n.e.s.** | 11.9 | 39.8 | 50 | 2.6 | 38.1 |

*Source: WTO Tariff Profile for Jamaica found at http://stat.wto.org/TariffProfiles/JM_e.htm. Date Accessed: September 13, 2013.*

The data for this essay were obtained from Jamaica Customs and were cleaned to remove free zone imports and government purchases which do not attract duties and would therefore, have overestimated the taxable base if they were included in the data set. Table 4-2 outlines the structure of the data. It shows that of total trade taxes collected of $610 million in 2011, the General Consumption Tax (GCT) comprises 57% of the total taxes collected on imports, with tariff collections and the Special Consumption Tax comprising 28% and third 13%, respectively. Total trade taxes collected from the EU amounted to $64.9 million, of which 54% was collected as GCT, 31% for tariffs, 8.4% for SCT, and 7% for Additional Stamp Duty. It should be noted that GCT and SCT also apply to domestic products at the same rates; however, Additional Stamp Duty is only applied to imports. The trade weighted average MFN tariff rate is 9.8% and the collected tariff rate (what is actually collected at the border weighted by the amount of imports per tariff line) is 3.6%. This suggests that the GOJ collects less than half of the value of statutory tariffs.

**Table 4-2: Jamaica TRIST Summary Data**

| | | | | | |
|---|---|---|---|---|---|
| | | | | | ***Summary of Jamaica Trade and Tariff Data for TRIST*** |
| *# of tariff lines* | 5091 | | | | |
| *# of partners* | 127 | | | | |
| *Total Imports (US$)* | 6,226,419,840 | | | | |
| | | | | | |
| | *Statutory tariff* | *Collected tariff* | *Additional Stamp Duty* | *General Consumption Tax* | *Special Consumption Tax* |
| *Total Value (US$)* | 610,098,835 | 224,600,926 | 16,200,605 | 452,944,249 | 107,482,013 |
| *Share Of Total* | | 28.0% | 2.0% | 56.5% | 13.4% |
| *Simple Average* | 10.2% | 7.7% | 0.6% | 15.1% | 0.3% |
| *Weighted Average* | 9.8% | 3.6% | 0.3% | 7.0% | 1.7% |

## 4.4 Methodology

There are several tools that may be used to analyse the impact of tariff reform on revenue and welfare. Two of those tools developed by the World Bank are the World Integrated Trade Solution (WITS) and the Tariff Reform Impact Simulation Tool (TRIST) which are partial equilibrium models developed to analyse the short-term impacts of tariff reform. This section analyses the uses, structure and methodology of both tools with a view to determining the most suitable software for simulating the impact of tariff reform for Jamaica. It then goes on to discuss the estimation of suitable elasticity values for the analysis and the calculation of the welfare effect.

### 4.4.1. World Integrated Trade Solution (WITS)

The World Integrated Trade Solution (WITS) software was developed by the World Bank, working closely with various International Organizations such as the United Nations Conference on Trade and Development (UNCTAD), International Trade Centre (ITC), United Nations Statistical Division (UNSD) and the World Trade Organization (WTO). The software accesses and retrieves information on trade and tariffs from the UN COMTRADE Data Base, the United Nations Conference on Trade and Development (UNCTAD) Trade Analysis Information System (TRAINS), and the World Trade Organization's (WTO) Integrated Data Base (IDB). In addition, there is the Consolidated Tariff Schedule Data Base (CTS) that contains WTO bound tariffs, Initial Negotiating Rights (INR) and other indicators. It also provides an analytical tool – the Single Market Partial Equilibrium Tool (SMART) – which assesses the impact of tariff reform on revenue, welfare and trade flows.

*Methodology*

WITS allows the user to simulate different effects of various trade liberalization measures through the SMART tool. The theoretical basis of the tool is the Armington model which assumes imperfect substitution between goods from different sources. On the demand side, the model assumes a representative agent that chooses a composite good that maximises its welfare at a given general price level. The import demand elasticity determines changes in the consumption of the good based on changes in price. The makeup of the composite good itself depends on the relative price of each good and the relationship between the relative price of the goods and their consumption is the Armington substitution elasticity.

On the supply side, SMART assumes infinite export supply elasticity, that is, exporters are price takers on the world market. This means that in a perfectly competitive market in equilibrium, changes in demand will only affect the quantity supplied and not price. This assumption can be changed, however, and the software can assume varying degrees of elasticity.

SMART analyses trade policy impacts in terms of trade diversion, trade creation, price effect, and effects on tariff revenue, consumer surplus and welfare changes. For SMART, trade diversion occurs where imports from one country increase as a result of a change in relative prices vis-à-vis other countries that export the same product but are not part of a preferential grouping such as a Free Trade Area (FTA). Trade creation is the increase in imports as a result of a reduction in prices due to the removal of or decrease in a tariff rate. Amjadi et al. (2011) note that SMART assumes infinite elasticity of supply by default but can also simulate cases where the supply curve of an imported good is characterised by finite elasticity.

The software calculates the tariff revenue impact as the final ad valorem duty times the final import value minus the initial ad valorem tariff times the initial import value. Amjadi et al. (2011) point out that the result is not automatic but depends in the elasticity of demand of the imported good. They also note that SMART does not calculate the final consumer surplus. The welfare change is generally given as the reduction in deadweight loss as a result of the tariff reduction and comprises the effects of the changes in tariff revenue and consumer surplus as a result of increased imports. The change in tariff revenue itself reflects two competing effects – a reduction in tariff revenue at the pre-reform import quantity and an increase in tariff revenue from the post reform increase in imports. Amjadi et al. (2011) note that in most cases, given the import demand elasticity assumptions of SMART, the simulation provides a net negative tariff revenue effect.

In addition to SMART, WITS allows the user to simulate tariff cuts using prescribed formulas such as specification of new rate or new maximum rate, linear percentage cut or Swiss formula. Any number of different formulas, and variations of a given formula, may be applied for different products and countries. Both pre- and post-tariff cut rates are reported for every importer-exporter combination and for each product at HS 6-digit level.

The software also features a global simulation model (partial equilibrium) that analyses global trade policy changes at the industry (product) level. The framework employs national product differentiation, and allows for the simultaneous assessment of trade policy changes, at the industry level, on a global, regional, or national level. Results allow the assessment of importer and exporter effects related to trade values, tariff revenues, exporter (producer) surplus, and importer (consumer).

### 4.4.2. Tariff Reform Impact Simulation Tool (TRIST)

TRIST was also developed by the World Bank and uses Microsoft Excel to perform trade policy simulations at a very detailed level; typically at the HS-8 digit level. According to Brenton et al. (2009), the main advantages of TRIST lie in its simplicity, transparency of formulas used, inexpensiveness, flexibility, and policy relevance due to the use of actual tariff revenue rather than simulated data based on statutory tariffs. The tool also explicitly includes other taxes levied on trade such as value added taxes in the analysis of the impact of tariff reform on tax revenue, in general. Other features, subject to data availability, include the ability to assess sensitive sectors in the short-run in terms of possible negative domestic employment and output effects, and the impact on household expenditure of price changes that result from trade reform. Like SMART and other partial equilibrium models, TRIST does not assess the long-run economy wide impact of trade reform which would be more appropriate for general equilibrium models.

*Methodology*

TRIST uses two Excel files – the Data Aggregation Tool and the Simulation Tool – to perform trade policy simulations. Brenton et al. (2009) note that the model has five main features:

1. Using standard economic theory, elasticities determine the magnitude of the change in demand as a result of price changes due to tariff reform.
2. The Armington assumption of imperfect substitution between similar goods applies; that is, consumers differentiate goods by source.
3. There is no direct substitution between different products.
4. There is an infinite supply of the import good. This means that domestic changes in demand due to trade reform have no impact on global supply of the good in question.
5. As a partial equilibrium tool, there is no capacity to analyse sectoral linkages and economy-wide impacts.

The model assumes that a given change in the tariff is fully transmitted to the consumer and that there is no resulting change in the world price. For a change in the tariff (with VAT and excise taxes remaining the same), TRIST utilises the following formula to calculate the percentage change in the price of good *i* from exporter *j*:

$$\frac{\Delta p_j}{p_j^{old}} = \frac{\left[\frac{p_j^{new}}{P_{wld}}\right] - \left[\frac{p_j^{old}}{P_{wld}}\right]}{\left[\frac{p_j^{old}}{P_{wld}}\right]}$$

$$= \frac{\left(1 + t_j^{new}\right)\left(1 + ext_j\right)\left(1 + vat_j\right) - \left(1 + t_j^{old}\right)\left(1 + ext_j\right)\left(1 + vat_j\right)}{\left(1 + t_j^{old}\right)\left(1 + ext_j\right)\left(1 + vat_j\right)}$$

$$= \frac{t_j^{new} - t_j^{old}}{\left(1 + t_j^{old}\right)} \quad (1)$$

Where

$\Delta p_j$ – change in price of imports from country j

$p_j^{old}$ – price of imports from j before tariff change

$p_j^{new}$ – price of imports from j after tariff change

$P_{wld}$ – world market price

$t_j^{old}$ – tariff rate applied to imports from country j before tariff change

$t_j^{new}$ – tariff rate applied to imports from country j after tariff change

$ext_j$- excise tax rate applied to imports from country j

$vat_j$ – VAT rate applied to imports from country j

TRIST utilises a three-step process to calculate the effects of trade reform on fiscal revenue, demand for imports, and domestic production. In the first instance, the model estimates an exporter substitution effect, for a user-assumed export substitution elasticity, which shows how consumers substitute between imports from different trading partners as a result of changes in relative prices due to a preferential trading regime, for example. Imports are held constant at this stage. Brenton et al. (2009) highlight that the value of the export substitution elasticity determines the extent to which changes in relative prices lead to changes in relative imports from various sources. The formula, provided below, utilised by TRIST at this stage deflates imports from each supplier post-substitution effects by the ratio of total imports for the particular product pre-tariff reform to the sum of total imports of the product from all suppliers post-substitution effect.

$$q_j^{ES} = \left[\frac{\Delta p_j}{p_j^{old}} * \gamma_j^{ES} + 1\right] q_j^{old} * \frac{\sum_{j=1,\ldots,n}(q_j^{old})}{\sum_{j=1,\ldots,n}\left\{\left[\frac{\Delta p_j}{p_j^{old}} * \gamma_j^{ES} + 1\right] q_j^{old}\right\}} \quad (2)$$

Where:

$q_j^{ES}$ – imported quantity from country j after exporter substitution step

$q_j^{old}$ – imported quantity from country j before tariff reform

$\gamma_j^{ES}$ – exported substitution elasticity for imports from country j

Provided that data on domestic production is available, the model then estimates the domestic substitution effect, for a user-assumed domestic substitution elasticity. This effect captures the extent to which consumers substitute between imports and domestic production as a result of changes in relative prices of goods from these two sources. The change in total imports from this step is distributed across all importers based on their share of the import market. As the weighted average of the prices of imports from individual countries change, there is a change in total imports relative to domestic products. The extent of this change is determined by the elasticity of substitution between domestic and imported products (*eds*). The resulting change in total imports is then distributed across all sources of imports based on their share in total imports. The model assumes that any change in total imports is matched by an equal change in domestic output in the opposite direction; hence, aggregate consumption is held constant at this stage. Formally, the model estimates the following equation:

$$Q_{imp}^{DS} = \left[\frac{\Delta \bar{P}_{imp}}{\bar{P}_{imp}^{old}} * \delta^{DS} + 1\right] Q_{imp}^{old} \quad (3)$$

$$q_j^{DS} = q_j^{ES} + \left[Q_{imp}^{DS} - Q_{imp}^{old}\right] * \left[\frac{q_j^{old}}{\sum_{j=1,\dots,n}(q_j^{old})}\right] \quad (4)$$

Where:

$Q_{imp}^{old}$ – is initial total imports
$Q_{imp}^{DS}$ – is total imports after substitution with domestic products
$q_j^{DS}$ – is quantity imported from supplier j after substitution between imports and domestic output
$\delta^{DS}$ – is domestic substitution elasticity for imports from country j
$\frac{\Delta \bar{P}}{\bar{P}_{old}} = \sum_{j=1,\dots,n}\left[\frac{q_j^{old}}{\sum_{j=1,\dots,n}(q_j^{old})} * \frac{\Delta p_j}{p_j^{old}}\right]$ is the change in the price of total imports

Finally, the model calculates an overall demand effect which captures the change in demand, and ultimately domestic consumption, as a result of the change in prices of imports (equal to the change in the total price of imports weighted by their share in domestic consumption). The change in consumption from this stage is distributed across imports and domestic production based on their initial shares of total consumption of the good. The change in imports is then distributed across individual import suppliers based on their share in total imports. The formula used by TRIST is:

$$Q_{TD}^{new} = \left[\frac{\Delta \tilde{P}}{\tilde{P}_{old}} * \mu^{D} + 1\right] Q_{TD}^{old} \quad (5)$$

$$Q_{imp}^{new} = Q_{imp}^{DS} + \left[Q_{TD}^{new} - Q_{TD}^{old}\right] * \left[\frac{Q_{imp}^{old}}{Q_{imp}^{old} + Q_{dom}^{old}}\right] \quad (6)$$

$$q_j^{new} = q_j^{DS} + \left[Q_{imp}^{new} - Q_{imp}^{DS}\right] * \left[\frac{q_j^{old}}{\sum_{j=1,\dots,n}(q_j^{old})}\right] \quad (7)$$

Where

$Q_{TD}^{old}$ – is initial total demand for product i
$Q_{TD}^{new}$ – is total demand after the change in the price of product i
$Q_{dom}^{old}$ – is the initial quantity demanded for domestic products
$Q_{dom}^{new}$ – is the final demand for domestic products
$Q_{imp}^{new}$ – is the final demand for imports for product i
$q_j^{new}$ – is the amount imported form supplier j after all three effects from changes in the price of imports (exporter substitution, domestic substitution and the demand effects)
$\mu^D$ – is the elasticity of demand for product i
$\frac{\Delta \bar{P}}{\bar{P}_{old}} = \left[\frac{Q_{imp}^{old}}{Q_{imp}^{old}+Q_{dom}^{old}} * \frac{\Delta \bar{P}}{\bar{P}^{old}}\right]$ is the change in price of total domestic consumption

The responsiveness of imports to price changes is determined by the elasticity of demand for imports which is assumed by the user of the tool. TRIST provides default values of all these elasticities. However, if the user chooses not to use these values, Brenton et al. (2009) point to the possibility of using import demand elasticities estimated in Kee et al. (2008), SMART, and local sources where available.

### 4.4.3 Choice of Tool

TRIST and SMART are both partial equilibrium models that assess the short-term impact of trade reform. TRIST operates at a more detailed level (HS-8) than SMART (HS-6) and the former utilizes actual collected revenue data while the latter simulates effects based on imports and the statutory applied tariff rate. TRIST also explicitly includes additional duties and charges in its analysis of the impact of trade reform. The theoretical framework for the two models is similar. Both use standard consumer demand theory and incorporate the Armington assumption. The choice of tool depends on the level at which the analysis will be conducted and the ease with which other duties and charges on imports can be accommodated in the analysis. Singh et al. (2014) note that the WITS/SMART framework is limited as it is not set up to include domestic production in the analysis of adjustments due to tariff reform. While domestic production data is often not available at a similar level of detail to import data, it would be useful to have this as an option for modelling purposes. In contrast, TRIST allows for the inclusion of domestic production data where available.

This essay utilizes TRIST as the main analytical tool as it allows for analysis at the most detailed tariff line level and for the inclusion of additional duties and charges in the model, which are a significant source of government revenue for small island developing states such as Jamaica.

Both models have their limitations as reflected in the assumptions that underpin the framework. Importantly, the models will not estimate a change in imports for a product from a source where the original import value is zero. This means that, for example, where Jamaica did not import cars from the EU before the EPA, the model will not show that there will now be imports of cars from the EU when the EPA is fully implemented. This may not be a realistic assumption for all products. However, as noted by Singh et al. (2014), TRIST and SMART are unable to factor the possible entry of new imports in their analysis as this would itself require a modelling approach to estimate the demand for these new products (and assuming infinite supply). While this is a limitation, it does not diminish the value of these models to estimate the likely effects of the EU-CARIFORUM EPA and other FTAs, given existing trade flows.

### 4.4.4 Setting Elasticity Values for TRIST

TRIST utilises elasticities to determine the responsiveness of alternative suppliers (both domestic and international) and demand to changes in price. Elasticities determine the final estimated effects of tariff reform. In the "Elasticity Management" panel, TRIST provides the user with the option of choosing two default elasticity values for individual products – those used in the World Bank SMART simulation tool or values obtained from Kee et al. (2008). The WITS user manual (2011) which outlines the SMART tool, however, states that the import demand elasticity values used in SMART are also based on estimates Kee et al. (2008). With respect to the values for substitution elasticity, SMART uses 1.5 as the default value but it is recognised that a higher substitution elasticity value may be appropriate for primary products as compared to industrial products whose complexity of production suggests that there may be supply rigidity issues.

This study will utilise the import demand elasticity values estimated by Kee et al. (2008) for Jamaica, given the rigour of the study and its ability to facilitate cross-country comparisons as the estimates of import demand elasticities for various countries are calculated using the same methodology. The estimated import demand elasticities are defined by Kee et al. (2008) as the percentage change in the quantity demanded of an imported good when the price of this good increases by 1 percent, holding external prices, productivity levels, and endowments constant.

With respect to Jamaica, Kee et al. (2008) estimate a simple average import elasticity of demand of -1.16 and an import weighted average import demand elasticity of -1.05. The median value is -1.08 and the standard deviation is -1.1. This compares with the highest average import elasticity of demand in the study of -4.05 which belongs to Japan and the lowest average of -1.02 which is Suriname's. For their study on the EU-CARIFORUM EPA, Singh et al. (2014) utilize two variants of import demand elasticities in their model. In the

"original elasticities" model, they use elasticity values based on World Bank (Kee et al. (2008) values), adjusted in a few cases with expert judgement. In the "simplified elasticities" model, an import demand elasticity of -1.16, which is the simple average import demand elasticity estimated by Kee et. al (2008) for some of the CARIFORUM countries studied, is used for all products.

With respect to values for the elasticities of domestic and export substitution, there are fewer detailed empirical studies when compared to studies on import demand elasticity estimates. In their review empirical studies on trade elasticities in Latin America, Fullerton et al. (1999) note that Gafar (1995) derives a relative price elasticity of imports to domestic products for Guyana of -0.32 (significant at the 5% level). This estimate is in line with the general finding of Fullerton et al. (1999) that imports tend to be highly price inelastic in the Latin American region, with most of the values of relative price elasticities between 0 and -0.60. They also note that estimates across import categories are similar; for example, in the case of agricultural and consumer goods in Brazil conducted by Zini (1988) and Weiskoff (1979).

Another review conducted by McDaniel and Balistreri (2003) mainly focusses on US estimates of Armington elasticities at varying levels of aggregation of the SIC. They note that higher estimates of substitution elasticity are usually observed as the level of disaggregation increases. In this regard, Gallaway et al.'s (2003) average long-run Armington elasticity estimate of about 2 at the 4-digit SIC level is much lower than Hummels' (1999) 7 at the 3-digit SIC level.

In their analysis of the impact of the EU-CARIFORUM EPA, Singh et al. (2014) utilise two alternative value of the elasticity of substitution. In the first instance, they use a value of five for imports in categories HS01 to HS24 and 1.5 for HS25 to HS92 and HS94 to HS97. In the second instance ('simplified elasticities" model, they utilise an elasticity of substitution value of 1.5 that is applied to all products. This mirrors the default value in SMART/WITS.

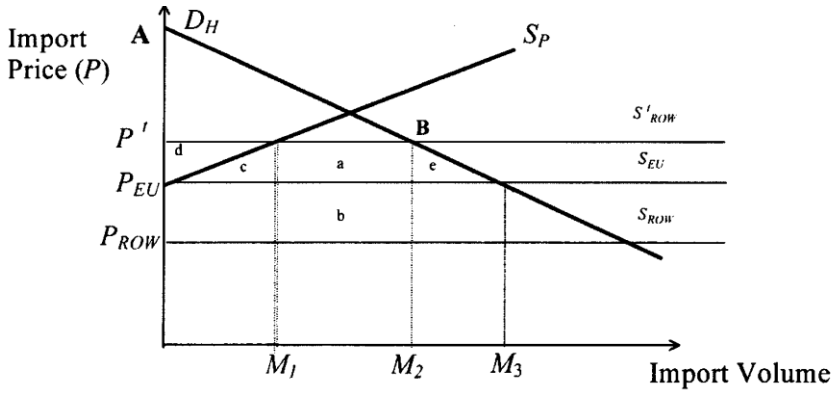
Due to the lack of agreement on set values for the elasticity of substitution, this study will apply the default value of 1.5 as used in SMART, which assumes that some source substitution is possible as a result of tariff reform. However, I will also run the models with two alternative values for the elasticity of domestic substitution – eds=1 and eds=2 – to examine the sensitivity of model estimates to changes in this parameter.

### 4.4.5. Calculating the welfare effect

As discussed in the Literature Review, the net welfare effect depends on the relative strength of the trade creation and diversion effects which is also dependent on the shape of the supply curve. Although the TRIST tool does not

calculate the welfare effect directly, it calculates trade diversion estimates for each scenario. Using this information, the trade creation and ultimately, the welfare effects can be derived. The welfare effect is calculated using the same methodology as Greenaway and Milner (2006) to analyse the effect of a Regional Economic Partnership Agreement between CARICOM and the EU in the case of perfect substitution. The perfect substitution scenario, illustrated in Figure 4-5, is chosen as it is similar to the framework within which the scenarios are conducted in TRIST. There are other approaches, such as Laird and Yates (1986) and Zafar (2005) to modelling the welfare effect; however, some, such as Kowalski (2005) do not apply to the CARIFORUM EPA where there is differentiated trade liberalisation, that is, tariffs will continue to be imposed on ROW imports while imports from the EU and CARICOM countries will enter duty-free.

**Figure 4-5: Effect of an EPA with Perfect Substitution – Greenaway and Milner (2006)**




Where

$D_H$ represents the demand curve for a small home country in the regional agreement

$S_P$ is the supply curve for producers in the home country

$S_{EU}$ is the supply curve for producers in the EU

$S_{ROW}$ is the supply curve for producers in the Rest of the World

Greenaway and Milner (2006) start with an initial scenario of a tariff inclusive price, $P^t$, where the home country imports $OM_2$, with $OM_1$ coming from domestic suppliers and $M_1M_2$ from ROW sources. In this simple case, there is assumed to be no domestic production (also true for the tariff simulations in TRIST due to lack of data) and therefore, the welfare effect is given by the triangle $ABP^t_{ROW}$ plus tariff revenue on extra-regional imports (a + b). When goods from the EU are allowed duty-free while tariffs are applied to ROW imports, the ROW supply curve shifts upwards ($S^t_{ROW}$) and imports from the EU

now replace ROW imports and constitute the area $OM_3$. Greenaway and Milner (2006) note three effects, shown in Figure 4-5, of introducing a discriminatory tariff in a regional trade agreement where EU prices are higher than those in the rest of the world:

I. A trade creation effect ($M_2M_3$) as a result of increased consumption (due to price reduction from high cost local/CARIFORUM suppliers to lower cost EU suppliers).
II. An extra-regional trade diversion effect $(M_1M_2)$ where goods that were previously imported from suppliers in the rest of the world (ROW) are now imported from less-efficient EU suppliers. It should be noted that this cost also includes tariff revenue foregone from ROW suppliers (a + b).
III. A trade creation effect $(OM_1)$ caused by the replacement of intra-regional suppliers with more efficient EU suppliers (shown by c in Figure 4-5). Consumer surplus increases by c + d which represents resource saving and the loss of producer surplus.

In the final analysis, the welfare effects are unclear and depend on the weight of the consumption and trade creation effects (welfare increasing) and the trade diverting effects. Formally, the change in welfare is given by:

$$\Delta W = (c+d+e) - b \qquad (8)$$

The perfect competition case is highly stylised. Where the price of EU imports is close to ROW sources, the trade diverting effects under the EPA are minimized. However, governments may be concerned about revenue loss where it is shown that the EPA is likely to lead to a significant reduction in revenue from tariffs on ROW imports. Additionally, the case presented assumes no domestic production; however, where this assumption does not hold (as is likely the case), the EPA will likely result in adjustment costs for the domestic market which will need to be addressed.

It should also be noted that the assumptions for the elasticity values are likely to have a significant impact on the reform outcome. Where the import elasticity of demand is low, one may expect to see less trade diversion effects than at higher elasticity of demand values. Similarly, where the elasticity of export substitution is low, one may observe very limited replacement of ROW imports with EU imports, for example, and thus limited revenue and trade creation effects as a result of the EPA. These issues are analysed fully in the next section where the tariff liberalisation scenarios under the EPA are presented and discussed.

## 4.5 Tariff Liberalisation Scenarios

This section examines two tariff reform scenarios for the EU-CARIFORUM EPA and their implications for tariff revenue, total tax revenue and welfare. As cited by Singh et al. (2014), revenue concerns have been one of the main factors influencing the delay in implementing commitments made under the EPA. In the case of Jamaica, however, revenue considerations may not necessarily be driven by the EPA as there is a high rate of discretionary waivers. In 2011, the government collected less than half of the value of statutory tariffs. It may therefore be possible to address revenue concerns post-EPA by reducing the amount of duty waivers and exemptions.

The first two scenarios assess the revenue and welfare impacts of a highly stylized outcome of full liberalisation of all EU imports into Jamaica. The scenarios serve as a yardstick to measure the most extreme revenue impacts possible and can therefore be used to judge the extent to which the end term EPA mitigates fiscal concerns. For these scenarios, the model is estimated with both statutory and collected tariff rates to illustrate the impact of discretionary waivers (collected tariff rates) and to explore the possibility of mitigating negative revenue effects of the EPA (through applying statutory tariffs). Subsequently, the model estimates the revenue and welfare impact of the actual EU-CARIFORUM EPA to assess if Jamaica addressed revenue concerns in the final tariff commitments made. A model is not estimated for the short-term implementation of the EU-CARIFORUM EPA as Singh et al. (2014) already highlight, based on the estimates from their model, that the revenue impact is quite small over the five-year period (2008-2013) and that the fiscal impacts are estimated to be much higher in the long run where tariffs on high revenue imports are slated for reduction.

Additionally, the models assume that consumption tax rates stay constant. Based on the tariff revenue data available, the GCT already comprises the majority of total trade tax revenue at 57% in 2011. The scenarios therefore do not envisage further increases in GCT at this time. In fact, the GCT rates were reduced in 2012 from 17.5% to 16.5% and so, it would not be realistic to model an increase in GCT across the board. A differentiated GCT structure is also not attractive due to the added inefficiencies that would attend the processing of transactions and returns.

### 4.5.1. Full liberalisation of EU imports with Collected and Statutory Tariff Rates on ROW Imports

TRIST may be used to estimate trade diversion as a result of full liberalization with the EU. From this step, one can then estimate the welfare changes of a given tariff reform scenario, in addition to the revenue effects. It should be

recalled that the formula used by TRIST to calculate trade diversion to the EU is:

$TD_{EU} = M_{xs}^{EU} - M_0^{EU}$ (9)

where $M_{xs}^{EU} = (M_0^{EU} + [M_0^{EU}*(-e_{xs})*\Delta P_{rm}]*TM_0/TM_{xsp})$

$M_{xs}^{EU}$ is imports from the EU after the exporter substitution effect is applied.

$M_0^{EU}$ is the initial level of EU imports.

$e_{xs}$ is the elasticity of exporter substitution.

$\Delta P_{rm}$ is the change in the relative price of imports from the EU vis-à-vis other imports.

$TM_0$ is total initial imports of commodity i.

$TM_{xsp}$ is total imports of commodity i after the substitution effect and change in relative price.

The trade creation estimate is obtained from the following formula:

$TC = \Delta M_{EU} - TD_{ROW}$ (10)

For the tariff reform simulation exercise, two scenarios are examined:

1. Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.
2. Duty-free access of EU exports to the Jamaican market; no tariff change for CARICOM imports; and the application of statutory tariff rates to imports from the Rest of the World.

For both scenarios, the value of the elasticity of domestic substitution is 1 and the elasticities of demand are Kee et al. (2008) estimates for Jamaican imports. Key results for Scenarios 1 and 2 with an elasticity of export substitution (Ees) value of 1.5 are summarized in Table 4-3. Sensitivity analysis of changes in the Ees, with three alternative values of 1, 1.5, and 2, were conducted for all three scenarios and are reported in Table 4-5. While the approach of applying a single Ees value to all products greatly simplifies the modelling approach, there are obvious limitations to the analysis. These include the reality that different products have varying elasticities of export substitution, with some not having any real option of substitutability, particularly where there are not competing suppliers. In a limited sense, the TRIST framework does account for some of that effect by not creating trade where initial imports are zero for that tariff line. Nonetheless, the results have to be interpreted with the caveat that source substitution will actually take place at varying extents for different tariff lines.

In defining the first scenario, the "all duty free" option is selected for the EU and "no tariff change" for CARICOM and the Rest of the World (ROW). The elasticity of export substitution is estimated at 1.5; the elasticity of domestic substitution at 1, and the elasticities of demand are Kee et al. (2008) estimates for Jamaican imports. Total initial imports in 2011 amounted to US$6.2 billion, with $436 million from the EU, over $1 billion from CARICOM member states and $4.8 billion from ROW suppliers. In 2011, over 71% of total imports from CARICOM comprised petroleum products. The remaining 29% comprised mainly imports of grain, beverages, meat, other food, paper and chemical products. The TRIST simulation estimates that imports will increase by 0.4% or US$22.6 million as a result of full liberalization under the EU-EPA. Revenue loss is estimated at 9% for collected tariff and 2.4% for total taxes on imports (includes the General Consumption Tax, Additional Stamp Duty and other duties) from the pre-EPA full liberalization level. The fall in import duties of $20 million is close to Busse and Lüehje's (2007) estimated reduction in revenue from import duties of $22.2 million using 2002 data. When there is no change in the tariffs applied to petroleum products under an EPA, the estimated reduction in import duties is slightly less at $19 million. There is minimal impact on petroleum imports in the model as the UEU is not a significant source of petroleum imports for Jamaica.

For scenario 2, statutory tariff rates are applied to imports from the Rest of the World while there is no change in the tariff regime for imports from CARICOM, and EU imports are now duty-free. Similar to the first scenario, the elasticity of export substitution is assumed to equal 1.5; the elasticity of domestic substitution at 1, and the elasticities of demand are Kee et al. (2008) estimates for Jamaican imports. As outlined in Table 4-3, with the application of statutory tariff rates to ROW imports, total imports fall by over $338 million or 5.4% from the pre-EPA level. However, there are strong positive revenue effects as collected tariff revenue increases by 54.7% or $123 million. Total tax revenue (which includes tariff revenue as well as revenue from General Consumption Tax (GCT), Additional Stamp Duty, and Special Consumption Tax) increases by 13.5% or $108 million. It is noted that the increase in total tax revenue is less than the increase in tariff revenue. This is due to the fact that revenue from other duties and charges fall because of the reduction in value of ROW imports (ROW imports fall by over $345 million) compared to a much smaller rise in imports from the EU (almost $33 million). It should be recalled that other duties and charges are levied on the tariff inclusive price, that is, the tariff is added to the value of imported good. As an illustration, under scenario 2, Additional Stamp Duty calculated for tariff line 020130100 (additional beef cuts of high quality) fell from $2,186 pre-reform to $2,037 post-reform because ROW imports of this line item fell and even though tariff revenue increased, it was not enough to offset the reduction in the value of goods

imported. Practically, this means that the effect of tariff reform on total revenue is very important as while an increase in the tariff is likely to increase tariff revenue, depending on elasticity assumptions, the effect on other duties and charges is not as straightforward. The change in other duties and charges is dependent on the same elasticities that determine the change in value of imports in response to tariff reform as the value of imports is the main basis on which these charges are levied.

**Table 4-3: Trade and Revenue Impact of Full Liberalisation for Jamaica under the EU-CARIFORUM EPA**

| Impact on imports: | Scenario 1 (Ees=1.5) | Scenario 2 (Ees =1.5) |
|---|---|---|
| Imports pre | $6,226,419,840 | $6,226,419,840 |
| Imports post | $6,249,067,713 | $5,888,048,811 |
| | | |
| Change in imports | $22,647,873 | -$338,371,029 |
| % change in imports | 0.4% | -5.4% |
| | | |
| Impact on Revenue: | | |
| Collected Tariff revenue pre | $224,600,926 | $224,600,926 |
| Collected Tariff revenue post | $204,336,619 | $347,481,019 |
| | | |
| Change in collected tariff revenue | -$20,264,307 | $122,880,092 |
| % change in collected tariff revenue | -9.0% | 54.7% |
| | | |
| Total Tax Revenues on Imports | | |
| Total revenue pre | $801,227,793 | $801,227,793 |
| Total revenue post | $782,208,856 | $909,223,928 |
| | | |
| Change in Total revenue | -$19,018,937 | $107,996,135 |
| % change in Total revenue | -2.4% | 13.5% |
| | | |
| Collected Tariff rate: | | |
| Collected applied tariff rate pre | 3.6% | 3.6% |
| Collected applied tariff rate post | 3.3% | 5.9% |
| % change in collected applied tariff rate | -9.4% | 63.6% |

Scenario 1: Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.

Scenario 2: Duty-free access of EU exports to the Jamaican market; no tariff change for CARICOM imports; and the application of statutory tariff rates to imports from the Rest of the World.

Table 4-4 summarises the changes in the pattern of trade as a result of liberalisation under the EPA under both scenarios. Using calculations from the four-step TRIST calculation, imports from the ROW and CARICOM decrease and are replaced by EU imports after accounting for the exporter substitution effect under Scenario 1. The demand effect then leads to an increase in imports from the EU and much smaller reductions in imports from CARICOM

and the ROW. For Scenario 2, the reduction in imports from CARICOM and the ROW is much larger (over $26 million and $340 million, respectively). This suggests that there is much greater displacement when statutory tariffs are applied and therefore, the trade diversion estimates are expected to be greater under Scenario 2.

**Table 4-4: Change in Pattern of Imports – Scenarios 1 and 2**

| Change in Pattern of Imports Scenarios 1 and 2 (US$ million) | | | | |
|---|---|---|---|---|
| | **EU** | **CARICOM** | **ROW** | **Total** |
| **Initial Imports** | 436.24 | 1,035.79 | 4,754.39 | 6,226.42 |
| **Scenario 1** | | | | |
| **Imports after Exporter substitution effect** | 450.66 | 1,034.93 | 4,740.83 | 6,226.42 |
| **Imports after demand effect** | 460.77 | 1,035.77 | 4,752.53 | 6,249.07 |
| **Scenario 2** | | | | |
| **Imports after exporter substitution effect** | 477.93 | 1,078.50 | 4,669.95 | 6,226.38 |
| **Imports after demand effect** | 469.21 | 1,009.65 | 4,409.19 | 5,888.05 |

Scenario 1: Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.
Scenario 2: Duty-free access of EU exports to the Jamaican market; no tariff change for CARICOM imports; and the application of statutory tariff rates to imports from the Rest of the World.

### 4.5.2. Trade Diversion, Trade Creation and Net welfare effects

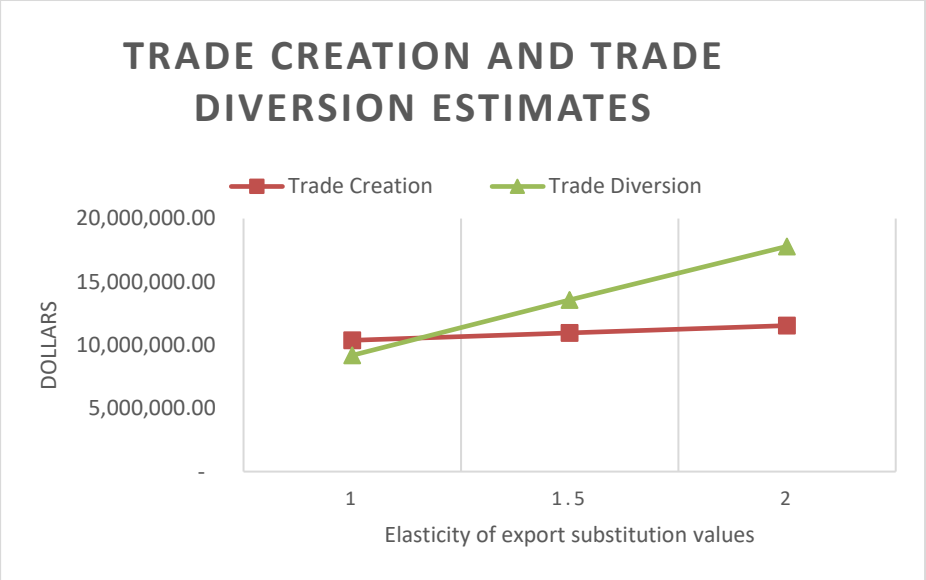
**Table 4-5: Revenue and Welfare Effects of the EU-CARIFORUM EPA for Jamaica - Scenarios 1 and 2**

| Ees Value | Trade Creation (US$) | Trade Diversion (US$) | Net Welfare Effect (US$) | % change in total tax revenue | % change in tariff revenue |
|---|---|---|---|---|---|
| **Scenario 1: ROW and CARICOM No tariff change; EU duty-free** | | | | | |
| **1** | 10,376,670 | 9,187,788 | 19,616.55 | -2.30% | -8.70% |
| **1.5** | 10,967,103 | 13,560,794 | -42,795.90 | -2.40% | -9% |
| **2** | 11,539,276 | 17,805,628 | -103,394.81 | -2.50% | -9.30% |
| **Scenario 2: Statutory rates ROW and No tariff change CARICOM; EU duty free** | | | | | |
| **1** | 18,294,176 | 52,631,792 | -995,790.86 | 14.00% | 56.90% |
| **1.5** | 32,973,222 | 84,442,734 | -1,492,615.85 | 13.50% | 54.7% |
| **2** | 58,728,530 | 141,191,937 | -2,391,438.80 | 12.70% | 51.50% |

Scenario 1: Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.
Scenario 2: Duty-free access of EU exports to the Jamaican market; no tariff change for CARICOM imports; and the application of statutory tariff rates to imports from the Rest of the World.

For Scenario 1, trade diversion effects of the EPA (with Ees = 1.5) are estimated as $14.4 million in TRIST, with $13.56 million and $862,000 diverted from the ROW and from CARICOM, respectively (see Table 4-5 and Figure 4-6)). In line with Milner et al.'s (2005) estimation of welfare effects under an EPA, trade creation also occurs where Jamaican imports from CARICOM move from less efficient CARICOM producers to more efficient EU producers.

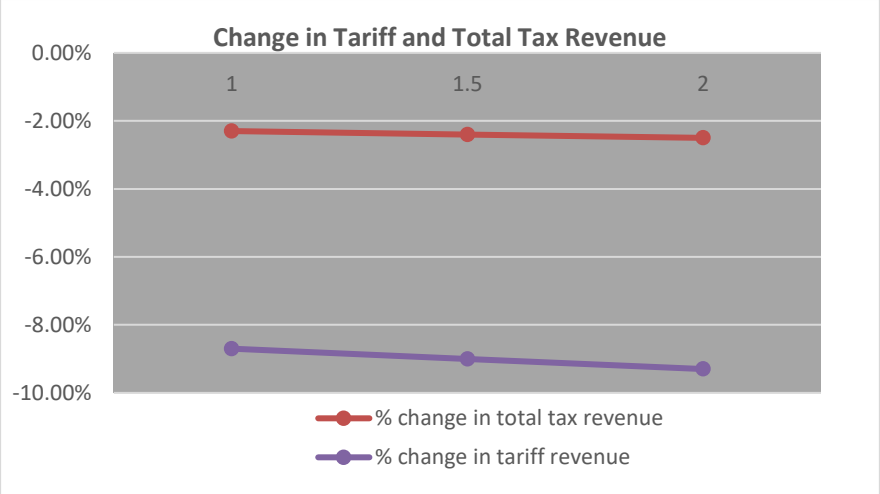
**Figure 4-6: Scenario 1 Trade Creation and Diversion estimates**




Scenario 1: Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.

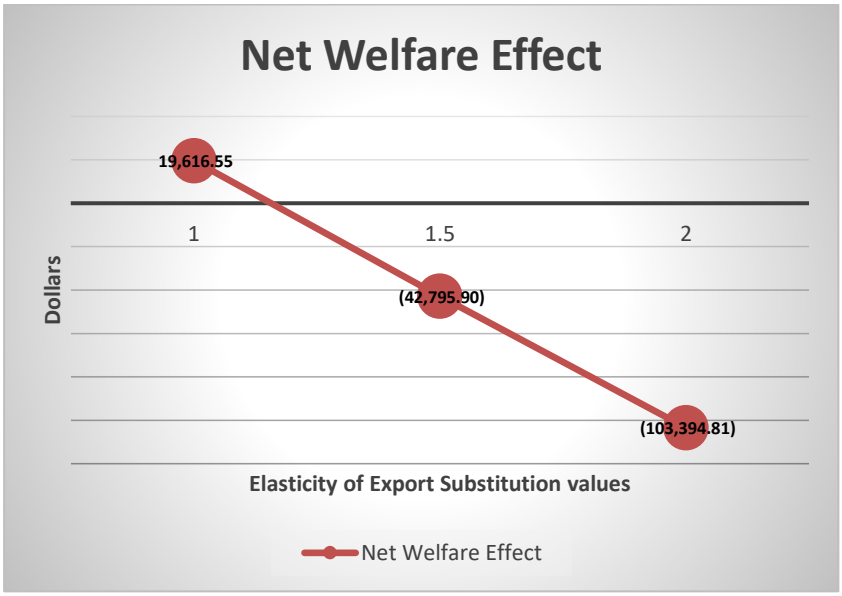
Sensitivity analysis of estimates to changes in the value of the elasticity of export substitution were conducted for Ees = 1 and Ees = 2. Higher elasticity of export substitution values should mean that it is easier for consumers to switch between alternative sources; that is, there is increased competition based on price (assuming that the products are sufficiently similar). The converse is also true. Lower elasticity of export substitution values should mean that it is more difficult for consumers to switch suppliers and thus, lead to lower trade diversion estimates. At the same time, in the case of a regional trade agreement, an increase in the tariff may have limited welfare effects as consumers may have to pay a higher price for goods from the extra-regional supplier if there is no regional supplier. These effects are illustrated by using alternative values of the elasticity of export substitution.

**Figure 4-7: Scenario 1 Change in Tariff and Total Tax Revenue**




Scenario 1: Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.

**Figure 4-8: Scenario 1 Net Welfare Effects**




Scenario 1: Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.

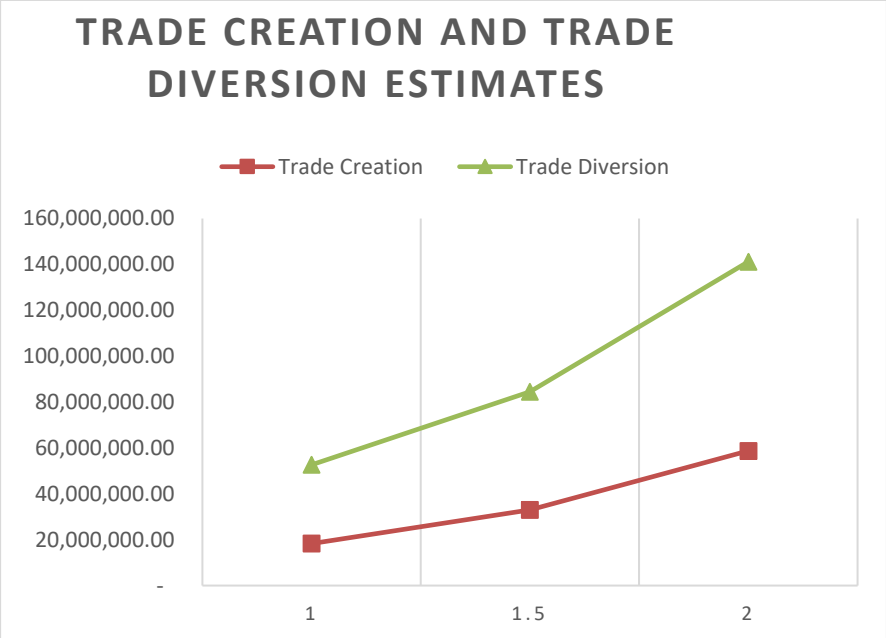
When the Ees is reduced to 1, there is a marginal fall in the change in tariff and total tax revenue of 0.1 percentage point and 0.3 percentage point, respectively (see Figure 4-7). The trade diversion and trade creation estimates are also lower when compared to the values obtained for Ees = 1; however, the change in the trade diversion is more substantial, falling by over $4 million. This result suggests that based on the relatively low source substitution parameter (Ees=1) and the elasticity of demand for imports estimates, there is

less trade diversion as consumers change the source of imports from ROW suppliers to EU suppliers to a smaller extent when compared to an Ees value of 1.5.

The net welfare effect is small and positive in the case of Ees = 1 and negative in the case of Ees = 1.5 (Figure 4-8). As expected, when the Ees is increased to 2, the values of trade creation and trade diversion are higher, as well as the percentage change in total tax and tariff revenue. The welfare effect is also small and negative in this case. However, when one examines the range of values for trade creation and those for trade diversion, it is clear that trade diversion estimates are the most sensitive to changes in the Ees.

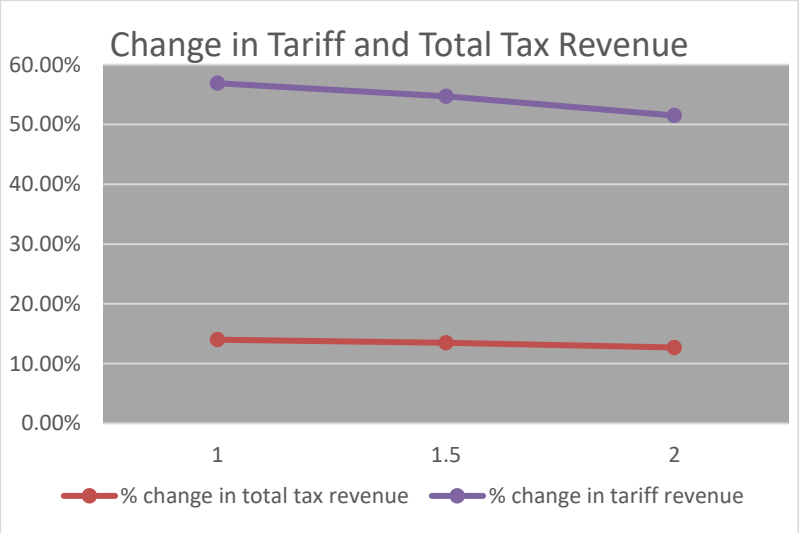
The trade diversion and trade creation effects are much higher under Scenario 2 which is expected given the effective removal of tariff exemptions for imports from the ROW under this scenario (see Fig 4-9). The trade diversion effects of the EPA are estimated at $84 million in TRIST. The trade creation effect is estimated at $1.5 million which is the change in EU imports after the consumption effect. This therefore means that there is a welfare loss (-$1.5 million) when imports from the EU enter the Jamaican market duty-free and statutory rates are applied to ROW imports. It should be recalled, however, that under this scenario, there were large positive revenue effects (over $123 million increase in tariff revenue) which may offset the welfare loss.

**Figure 4-9: Scenario 2 Trade Diversion and Trade Creation Estimates**




Scenario 2: Duty-free access of EU exports to the Jamaican market; no tariff change for CARICOM imports; and the application of statutory tariff rates to imports from the Rest of the World.

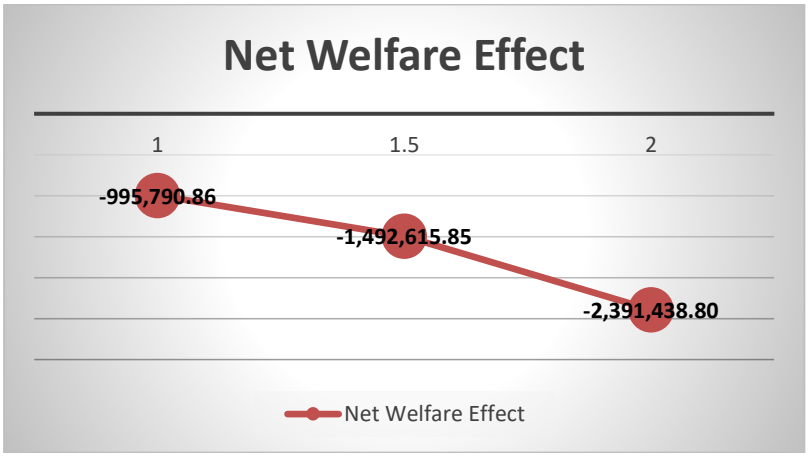
**Figure 4-10: Scenario 2 Change in Tariff and Total Tax Revenue**




Scenario 2: Duty-free access of EU exports to the Jamaican market; no tariff change for CARICOM imports; and the application of statutory tariff rates to imports from the Rest of the World.

Similar to Scenario 1, sensitivity analysis of estimates to changes in the value of the elasticity of export substitution were conducted for Ees = 1 and Ees = 2. When the Ees is reduced to 1, there is a 2.2 percentage point increase in total tariff revenue. This compares to a fall of 3.2 percentage points when the Ees is increased to 2 (see Figure 4-10). As expected, the net welfare loss increases as the elasticity of export substitution increases, moving from -$995 million at Ees = 1 to -$2.4 billion at Ees = 2 (see Figure 4-11).

**Figure 4-11: Scenario 2 Net Welfare Effect**

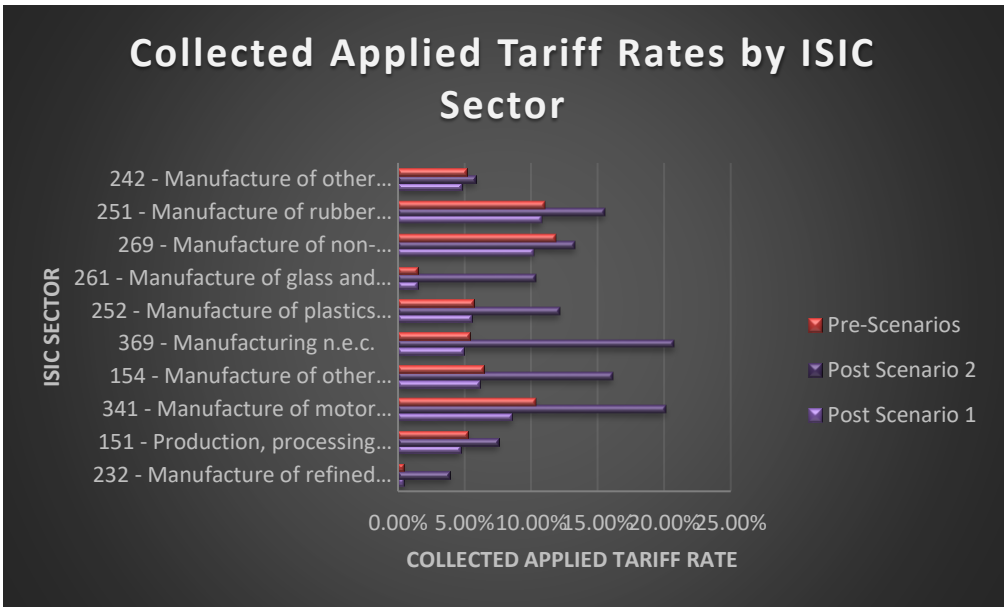



Scenario 2: Duty-free access of EU exports to the Jamaican market; no tariff change for CARICOM imports; and the application of statutory tariff rates to imports from the Rest of the World.

### 4.5.3 Analysis by International Standard Industrial Classification (ISIC)

Given that both Scenarios 1 and 2 apply changes to different tariff rates, it is expected that both scenarios would have different impacts on the collected tariff rate for various industries. As an example, Figure 4-12 illustrates the collected applied tariff rates by ISIC after the implementation of tariff reform under both scenarios. Results are shown for the top 10 industries with the largest reduction in imports under Scenario 2 where imports from the EU and CARICOM enter the Jamaican market duty-free and statutory tariff rates are applied to imports from the Rest of the World. An Ees of 1.5 is assumed for both scenarios. It should also be noted that the value of the elasticity of substitution is a major determinant of the final changes in imports from various sources. In reality, Scenario 2 would have to be implemented based on careful analysis of individual products as applying statutory tariffs to ROW imports on products such as petroleum could have a deleterious effect on the economy. Other trading partners may also demand similar treatment to the EU and resist any perceived increase in the effective tariff.

**Figure 4-12: Collected Applied Tariff Rate by ISIC Sector Scenarios 1 and 2**




Scenario 1: Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.
Scenario 2: Duty-free access of EU exports to the Jamaican market; no tariff change for CARICOM imports; and the application of statutory tariff rates to imports from the Rest of the World.

The industries that experience the highest reduction in imports under Scenario 2 are:

- 232 - Manufacture of refined petroleum products
- 151 - Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats

- 341 - Manufacture of motor vehicles
- 154 - Manufacture of other food products
- 369 - Manufacturing n.e.c.
- 252 - Manufacture of plastics products
- 261 - Manufacture of glass and glass products
- 269 - Manufacture of non-metallic mineral products n.e.c.
- 251 - Manufacture of rubber products
- 242 - Manufacture of other chemical products

In most cases, the collected applied tariff rate more than doubles from its initial value; for example, the collected applied tariff rate for the manufacture of refined petroleum products and for the manufacture of motor vehicles move from 0.46% and 10.40% to 3.87% and 20.09%, respectively (see Table 4-6). In the case of motor vehicles, imports from the EU increased by over $14 million under scenario 2, with the share of EU imports in total motor vehicle imports increasing from 17.3% pre-reform to 24% post-reform. It should also be noted that, as TRIST does not estimate changes for tariff lines with an initial value of zero, where there are no initial imports from the EU in a particular tariff line, the demand effect is especially strong as consumers face higher prices to purchase the same goods due to the application of statutory tariff rates.

In contrast, the change in the collected applied tariff rate is much lower under Scenario 1. For petroleum products and motor vehicle industries, the collected applied tariff rates move from the initial levels of 0.46% and 10.4% to 0.45% and 8.58%, respectively. Both scenarios therefore yield very different trade diversion and trade creation effects and consequently, varied net welfare effects. For Scenario 1, the Top 10 industries with the largest increases in import value are:

- 341 - Manufacture of motor vehicles
- 155 - Manufacture of beverages
- 151 - Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats
- 011 - Growing of crops; market gardening; horticulture
- 242 - Manufacture of other chemical products
- 269 - Manufacture of non-metallic mineral products n.e.c.
- 152 - Manufacture of dairy products
- 154 - Manufacture of other food products
- 343 - Manufacture of parts and accessories for motor vehicles and their engines
- 101 - Mining and agglomeration of hard coal

Table 4-7 shows the changes in the collected applied tariff rate for these industries under both scenarios at an Ees of 1.5. In the case of scenario 1, these rates are reduced and this has a positive overall effect on demand and consequently increases imports from these industries. In the case of motor vehicle imports, the share of imports from the EU increases from 17.3% to 19% - less than the increase observed under Scenario 2. Motor vehicle imports from the EU increase by over $7.3 million while ROW imports of motor vehicles fall by approximately $800,000. This is not surprising as the lower change in tariffs on ROW imports means that there is less source substitution and consequently, only a minor reduction in ROW motor vehicle imports.

**Table 4-6: Top 10 Industries by Imports Value Change for Scenario 1**

| RESULTS BY ISIC SECTOR | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Protection (Collected applied tariff rate) | | | Price Change for Imports | | Initial Value of | Value Change | | % Change in imports | |
| ISIC | Initial Rates | Post Scenario 1 | Post Scenario 2 | Scenario 1 | Scenario 2 | Imports | Scenario 1 | Scenario 2 | Scenario 1 | Scenario 2 |
| 341 - Manufacture of motor vehicles | 10.40% | 8.58% | 20.09% | -1.56% | 10.67% | 351,471,551 | 6,566,486 | -45,990,003 | 1.87% | -13.08% |
| 155 - Manufacture of beverages | 4.30% | 3.03% | 1.92% | -1.15% | -2.10% | 198,669,622 | 3,485,620 | 5,643,207 | 1.75% | 2.84% |
| 151 - Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats | 5.27% | 4.72% | 7.54% | -0.48% | 4.25% | 365,045,414 | 2,434,779 | -50,218,001 | 0.67% | -13.76% |
| 011 - Growing of crops; market gardening; horticulture | 3.54% | 2.33% | 3.01% | -0.99% | 0.01% | 194,933,187 | 2,227,563 | -1,670,690 | 1.14% | -0.86% |
| 242 - Manufacture of other chemical products | 5.18% | 4.83% | 5.86% | -0.31% | 0.81% | 297,990,725 | 1,040,387 | -3,710,465 | 0.35% | -1.25% |
| 269 - Manufacture of non-metallic mineral products n.e.c. | 11.85% | 10.21% | 13.30% | -1.34% | 1.83% | 73,528,592 | 1,024,782 | -5,868,754 | 1.39% | -7.98% |
| 152 - Manufacture of dairy products | 6.71% | 5.27% | 10.73% | -1.26% | 4.59% | 57,341,256 | 926,671 | -2,601,924 | 1.62% | -4.54% |
| 154 - Manufacture of other food products | 6.48% | 6.12% | 16.12% | -0.31% | 10.84% | 221,741,816 | 751,089 | -39,203,217 | 0.34% | -17.68% |
| 343 - Manufacture of parts and accessories for motor vehicles and their engines | 10.79% | 9.84% | 10.08% | -0.78% | -0.55% | 59,781,915 | 624,243 | 450,419 | 1.04% | 0.75% |
| 101 - Mining and agglomeration of hard coal | 4.99% | 0.00% | 0.01% | -4.76% | -4.75% | 7,459,043 | 319,202 | 318,853 | 4.28% | 4.27% |

**Table 4-7: Top 10 Industries by Imports Value Change for Scenario 2**

| RESULTS BY ISIC SECTOR | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Protection (Collected applied tariff rate) | | | Price Change for Imports | | Initial Value of | Value Change | | % Change in imports | |
| ISIC | Initial Rates | Post Scenario 1 | Post Scenario 2 | Scenario 1 | Scenario 2 | Imports | Scenario 1 | Scenario 2 | Scenario 1 | Scenario 2 |
| 232 - Manufacture of refined petroleum products | 0.46% | 0.45% | 3.87% | -0.01% | 3.60% | 1,347,858,663 | 214,137 | -125,683,773 | 0.02% | -9.32% |
| 151 - Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats | 5.27% | 4.72% | 7.54% | -0.48% | 4.25% | 365,045,414 | 2,434,779 | -50,218,001 | 0.67% | -13.76% |
| 341 - Manufacture of motor vehicles | 10.40% | 8.58% | 20.09% | -1.56% | 10.67% | 351,471,551 | 6,566,486 | -45,990,003 | 1.87% | -13.08% |
| 154 - Manufacture of other food products | 6.48% | 6.12% | 16.12% | -0.31% | 10.84% | 221,741,816 | 751,089 | -39,203,217 | 0.34% | -17.68% |
| 369 - Manufacturing n.e.c. | 5.37% | 4.98% | 20.75% | -0.33% | 20.69% | 73,638,004 | 79,813 | -28,219,927 | 0.11% | -38.32% |
| 252 - Manufacture of plastics products | 5.66% | 5.52% | 12.13% | -0.13% | 6.30% | 129,883,222 | 197,448 | -10,666,467 | 0.15% | -8.21% |
| 261 - Manufacture of glass and glass products | 1.51% | 1.46% | 10.34% | -0.05% | 9.08% | 48,459,700 | 30,618 | -6,864,365 | 0.06% | -14.17% |
| 269 - Manufacture of non-metallic mineral products n.e.c. | 11.85% | 10.21% | 13.30% | -1.34% | 1.83% | 73,528,592 | 1,024,782 | -5,868,754 | 1.39% | -7.98% |
| 251 - Manufacture of rubber products | 11.01% | 10.78% | 15.52% | -0.19% | 4.20% | 72,973,826 | 159,077 | -3,836,731 | 0.22% | -5.26% |
| 242 - Manufacture of other chemical products | 5.18% | 4.83% | 5.86% | -0.31% | 0.81% | 297,990,725 | 1,040,387 | -3,710,465 | 0.35% | -1.25% |

### 4.5.4. Scenario 1 Summary Results by Product

It would be useful to examine Scenario 1 in more detail in order to set a basis for examining alternative scenarios of tariff reform that may increase revenue while enhancing welfare at the same time. It should be recalled that in Scenario 1, the "all duty free" option is selected for the EU and "no tariff change" for CARICOM and the Rest of the World (ROW). The elasticity of export substitution is estimated at 1.5; the elasticity of domestic substitution at 1, and the elasticities of demand are Kee et al. (2008) estimates for Jamaican imports. The TRIST simulation estimates that under this scenario imports will increase by 0.4% or US$22.6 million as a result of full liberalization under the EU-EPA. Revenue loss is estimated at 9% for collected tariff and 2.4% for total taxes on imports (includes the General Consumption Tax, Additional Stamp Duty and other duties) from the pre EPA full liberalization level. With respect to the net welfare effect, the simulation showed a small net welfare loss of -$42,796 at an elasticity of export substitution value of 1.5. The sensitivity analysis showed that the net welfare effect is small and positive in the case of Ees = 1 and negative in the case of Ees = 2 at a value of (-$103,395), which led to the conclusion that the Ees value had a very strong effect on the trade diversion estimate as diversion increased substantially as the Ees value was raised. It would appear that at lower Ees values, the EPA would result in less consumers switching from ROW to EU suppliers.

**Table 4-8: Average Collected Applied Rates**

| **Average Collected Applied Tariff Rates** | | |
|---|---|---|
| | Pre Scenario 1 | Post Scenario 1 |
| **Import Weighted Average Collected Applied Tariff Rate** | 3.6% | 3.3% |
| **Import Weighted Average ROW Collected Applied Tariff Rate** | 4.284% | 4.281% |
| **Simple ROW Average Collected Applied Rate** | 7.43265% | 7.43121% |

Scenario 1: Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.

Table 4-8 provides summary statistics on the average import weighted applied tariff for imports in general and ROW imports specifically. It shows that the average collected applied tariff rate (weighted by imports) declines by 9.4% as a result of full trade liberalisation of EU products. The average applied tariff for ROW imports declines marginally from 4.284% to 4.281%. In real terms, while total imports increase by $22.6 million after full liberalisation of EU imports under the EPA, ROW imports decline by -$1.9 million. This explains the marginal change in the import weighted average ROW collected applied tariff as the change in ROW imports is relatively small. However, the change

in revenue is much greater. Under this scenario, collected applied tariff revenue declines by $20.3 million and total fiscal revenue (tariff revenue plus value added taxes, and stamp duties, etc.) declines by $19 million.

In order to assess the main products that would generate the revenue loss, Table 4-9 lists the Top 25 tariff lines with the highest revenue loss (see Appendix 4A for tariff line descriptions). These 25 lines constitute 59% of the total loss in collected applied tariff revenue and 61% of the loss in ROW tariff revenue. Of the 25 lines, 10 are related to motor vehicle imports of varying engine sizes. The product with the highest revenue loss is onions. Motor vehicles of engine size between 2000cc and 3000cc; other potatoes, prepared or preserved; tiles, cubes, etc; and Motor vehicles of engine size between 2500cc and 3200cc round out the Top 5. For these products, the net welfare loss/gain varies. For example, although onions have the highest revenue loss for any tariff line, there is a small welfare gain as a result of full liberalisation with the EU under an EPA.

Like other free trade agreements, trade liberalisation is considered to take place within the trade agreement once substantially all trade is not subject to import duties (see Article 24 of the General Agreement on Tariffs and Trade 1994). In practice, for the EPA, 'substantially all trade' has been interpreted to mean that at least 80% of trade in goods between CARICOM and the EU would have to be liberalized. Table 4-10 provides the share of these top 25 tariff lines in total EU imports. In order to avoid negative revenue effects, Jamaica may simply exclude the majority of these lines from import liberalisation as their exclusion would still mean that substantially all trade has been liberalized. If the condition used is 20% of EU trade before the tariff reform scenario is implemented, then 21 out of the 25 products could be excluded as they comprise 19% of total EU imports into Jamaica. If the condition is 20% post-scenario, then 19 of these lines could be excluded, comprising 20% of total EU imports. It would be therefore instructive to compare these results with the actual end term EU-CARIFORUM EPA that was negotiated with excluded products.

**Table 4-9: Top 25 Tariff lines by Revenue Loss with Change in Imports and Welfare (US$)**

| Tariff Line | ROW Post collected applied tariff | Change in Collected Applied Tariff Revenue (US$) | Change in Collected Applied Tariff Revenue from ROW Imports (US$) | Change in Total Fiscal Revenue (US$) | Change in Total Fiscal Revenue from ROW Imports (US$) | Total Change in Imports (US$) | Change in Imports from ROW (US$) | NET WELFARE LOSS/GAIN (US$) |
|---|---|---|---|---|---|---|---|---|
| **Total** | | -20,264,307 | -256,600 | -19,022,713 | -622,762 | 22,644,920 | -1,862,552 | -42,796 |
| **0703101000** | 35.8% | -1,616,022 | 1,089 | -1,562,488 | 2,450 | 1,766,240 | 3,045 | 23,915 |
| **8703234030** | 8.2% | -1,245,245 | -16,054 | -1,088,750 | -58,484 | 1,416,168 | -194,600 | -11,219 |
| **2004109000** | 18.3% | -1,073,052 | -15,663 | -1,064,370 | -38,354 | 1,115,259 | -85,775 | 2,250 |
| **6908901000** | 17.9% | -925,794 | -42,613 | -948,134 | -100,073 | 813,958 | -237,630 | -11,347 |
| **8703339030** | 10.3% | -911,467 | -14,559 | -831,948 | -44,710 | 926,348 | -140,909 | -1,560 |
| **8703233030** | 10.5% | -887,791 | -16,533 | -823,399 | -49,590 | 1,009,035 | -156,809 | -12,640 |
| **0701900000** | 40.0% | -657,645 | -19,132 | -657,661 | -19,148 | 426,827 | -47,838 | 3,634 |
| **2202909030** | 20.0% | -654,169 | 8,669 | -473,863 | 29,943 | 1,095,390 | 43,344 | 10,830 |
| **2204100010** | 28.4% | -477,708 | -16,385 | -504,596 | -65,708 | 432,384 | -57,634 | -1,112 |
| **8703232031** | 12.4% | -389,798 | -6,998 | -350,777 | -21,121 | 434,668 | -56,651 | -3,748 |
| **2701190000** | 5.0% | -372,402 | -1 | -384,372 | -6 | 319,202 | -21 | 5,265 |
| **8703322031** | 10.0% | -289,262 | -251 | -274,088 | -646 | 346,855 | -2,520 | 5,129 |
| **0402210010** | 0.0% | -278,521 | 0 | -278,521 | 0 | 317,057 | -2,410 | 2,820 |
| **2208700020** | 11.7% | -226,193 | 193 | -203,105 | 592 | 297,421 | 1,653 | 2,692 |
| **8703234010** | 20.6% | -219,463 | -5,125 | -177,125 | -7,509 | 235,835 | -24,912 | -3,144 |
| **2005519000** | 16.6% | -202,296 | 7,550 | -151,801 | 17,910 | 433,603 | 45,386 | 4,111 |
| **8703249032** | 15.9% | -197,737 | 187 | -138,589 | 851 | 274,620 | 1,177 | 2,256 |
| **8418300000** | 19.5% | -184,821 | -5,945 | -186,308 | -13,970 | 177,517 | -30,414 | -1,440 |
| **8703233011** | 17.0% | -181,066 | -3,602 | -171,504 | -3,707 | 195,756 | -21,235 | -2,568 |
| **2208201020** | 0.9% | -168,588 | 192 | -101,414 | 1,996 | 433,916 | 21,536 | 5,982 |
| **8703339011** | 16.4% | -166,800 | -4,643 | -143,684 | -6,832 | 160,679 | -28,281 | -1,673 |
| **2106909010** | 17.8% | -164,587 | -5,322 | -172,060 | -12,687 | 142,141 | -29,882 | 386 |
| **8703232030** | 13.3% | -158,822 | -3,717 | -158,371 | -9,737 | 182,550 | -27,938 | -1,515 |
| **1904100000** | 18.7% | -156,050 | -3,147 | -159,115 | -7,633 | 142,420 | -16,796 | 932 |
| **2004909000** | 20.0% | -154,524 | 5,600 | -126,573 | 13,160 | 278,760 | 28,007 | 1,784 |

**Table 4-10: Proportion of EU imports in each tariff line in total EU imports Pre and Post Scenario 1**

| Tariff Line | Change in Collected Applied Tariff Revenue (US$) | Pre-Scenario 1 Proportion of Tariff line Imports in total EU Imports | Pre-Scenario 1 Cumulative Proportion | Post-Scenario 1 Proportion of Tariff line in total EU Imports | Post-Scenario 1 Cumulative Proportion |
|---|---|---|---|---|---|
| **0703101000** | -1,616,022 | 0.93% | 0.93% | 1.26% | 1.26% |
| **8703234030** | -1,245,245 | 3.49% | 4.42% | 3.65% | 4.91% |
| **2004109000** | -1,073,052 | 1.26% | 5.67% | 1.45% | 6.36% |
| **6908901000** | -925,794 | 1.11% | 6.78% | 1.28% | 7.64% |
| **8703339030** | -911,467 | 2.02% | 8.80% | 2.14% | 9.78% |
| **8703233030** | -887,791 | 2.35% | 11.15% | 2.48% | 12.26% |
| **0701900000** | -657,645 | 0.37% | 11.51% | 0.45% | 12.71% |
| **2202909030** | -654,169 | 1.43% | 12.94% | 1.58% | 14.29% |
| **2204100010** | -477,708 | 0.39% | 13.33% | 0.48% | 14.77% |
| **8703232031** | -389,798 | 0.78% | 14.11% | 0.84% | 15.61% |
| **2701190000** | -372,402 | 1.71% | 15.82% | 1.69% | 17.30% |
| **8703322031** | -289,262 | 0.77% | 16.59% | 0.80% | 18.10% |
| **0402210010** | -278,521 | 0.23% | 16.82% | 0.29% | 18.39% |
| **2208700020** | -226,193 | 0.30% | 17.12% | 0.35% | 18.74% |
| **8703234010** | -219,463 | 0.23% | 17.35% | 0.28% | 19.02% |
| **2005519000** | -202,296 | 0.24% | 17.59% | 0.31% | 19.33% |
| **8703249032** | -197,737 | 0.46% | 18.05% | 0.49% | 19.82% |
| **8418300000** | -184,821 | 0.21% | 18.25% | 0.24% | 20.06% |
| **8703233011** | -181,066 | 0.20% | 18.45% | 0.24% | 20.29% |
| **2208201020** | -168,588 | 0.40% | 18.85% | 0.47% | 20.76% |
| **8703339011** | -166,800 | 0.17% | 19.02% | 0.20% | 20.96% |
| **2106909010** | -164,587 | 3.34% | 22.36% | 3.20% | 24.16% |
| **8703232030** | -158,822 | 0.91% | 23.27% | 0.91% | 25.07% |
| **1904100000** | -156,050 | 0.18% | 23.45% | 0.21% | 25.28% |
| **2004909000** | -154,524 | 0.18% | 23.63% | 0.23% | 25.51% |

### 4.5.5. Full Liberalisation of trade with the EU vis-à-vis the end term EU-CARIFORUM EPA with Excluded Products

In order to compare the revenue and welfare effects of full liberalisation of all EU imports under the EPA and the actual end term EU-CARIFORUM EPA with excluded products, the 2011 tariff structure is taken as the base situation for both scenarios. In both scenarios, ROW and CARICOM tariffs are unchanged. The EU-CARIFORUM EPA provides for phased scheduling of certain products over five to twenty-five years with some products being totally excluded from the agreement. For CARIFORUM countries and specifically, Jamaica, the number of tariff lines excluded as a proportion of total tariff lines is estimated at 15%. The list of excluded products includes high revenue products such as onions, alcoholic beverages, malts and milk; and products in 'sensitive' industries such as dairy, fisheries, essential oils and furniture. For the countries of the European community, only products that fall in Chapter 93 (arms and ammunition) are excluded from duty-free treatment.

Singh et al. (2014) highlight that the end-term fiscal effects of the EPA are likely to be much greater than the short-term impacts as CARIFORUM countries scheduled tariff lines with higher revenues and greater possibility for trade diversion in the higher phasing baskets or excluded these items altogether. So far, this proposition is supported by data as Singh et al. (2014) calculate that that over the five-year period since the EPA was signed (2008-2013), revenue for the Caribbean Single Market and Economy (CSME)[15] region has fallen by only about 2%.

**Table 4-11: Full Liberalisation of EU Imports vs End term EPA with Excluded Products**

| | Trade Creation (US$ million) | Trade Diversion (US$ million) | Net Welfare Effect (% of GDP) | % change in total tax revenue | % change in tariff revenue |
|---|---|---|---|---|---|
| **Scenario 1** | 10.97 | 13.56 | -0.00030% | -2.40% | -9% |
| **End term EU-CARIFORUM EPA** | 5.48 | 9.83 | -0.00051% | -1.50% | -5.7% |

Scenario 1: Duty-free access of EU exports to the Jamaican market, with no (collected) tariff change for imports from CARICOM and the Rest of the World.

Table 4-11 summarizes the different results under both scenarios. Not surprisingly, the end term EPA results in a lower decline in tariff revenue and

[15] CSME comprises Antigua and Barbuda; Barbados; Belize; Dominica; Grenada; Guyana; Jamaica; St. Kitts and Nevis; St. Lucia; St. Vincent and the Grenadines; Suriname; Trinidad and Tobago.

total tax revenue when compared with the full liberalisation of EU imports into Jamaica. The 5.7% decline in tariff revenue is not as high as the 12% decline estimated for Jamaica under the EPA by Busse and Lüehje (2007). In absolute terms, the model estimates a lower reduction in tariff revenue of $12.8 million for the End-term EU-CARIFORUM EPA than those estimated by Stevens et al. (2009) for the Overseas Development Institute (€26.8 million or $39.5 million) and Fontagné et al. (2009) for CEPII (€14.1 million or $20.7 million).

Additionally, trade creation and trade diversion levels are less for the end term EPA than under full liberalisation of EU imports. This is expected given that full liberalisation removes duties on all EU imports thereby increasing the potential for trade diversion from ROW products and increasing opportunities for trade creation by diverting more expensive imports from ROW and CARICOM producers to more efficient EU producers. It should also be noted that the welfare loss is greater for the end term EPA; however, both levels are less than one-thousandth of a percent of Jamaica's 2011 GDP. The reduction in welfare is much lower than the 4.5% welfare loss estimated for Jamaica by Greenaway and Milner (2006) in the case where CARICOM grants reciprocal market access to the EU only (EU reciprocity case). Indeed, since the signing of the EPA in 2008, the global financial crisis of 2007/8 and inadequate initial trade links between CARIFORUM and the European Union have meant that some of the projected benefits and costs of the EPA have not materialised. Singh et al. (2014) note that, in 2012, imports from the EU for Jamaica had fallen back to close to 2004 levels. It is clear therefore that in line with Ambassador Amedi's[16] comments, there are other factors that influence competitiveness and market penetration besides market access.

While the approach outlined above is useful and expedient for policy purposes, a more holistic approach to tariff reform is recommended, which might generate both positive changes in revenue and welfare. In addition, where welfare and revenue concerns intersect, the issue is often posed as a trade-off – increased tariff revenue often means lower welfare and vice versa. The next section also explores whether this is necessarily the case. Indeed, it may not be possible to achieve both and the final decision will be made by policymakers based on their judgement of what is most appropriate for their economies at a given point in time.

[16] "EU Laments Jamaica's Failure To Maximise EPA Benefits", Jamaica Gleaner, 23 October 2014

## 4.6 Welfare Increasing and Revenue Enhancing (WIRE) Tariff Reform Outcomes

Policymakers are often confronted with the trade-off between increased welfare and lower fiscal revenue when contemplating tariff reform. As a member state of CARICOM, reform of Jamaica's tariff under the scenarios proposed would likely require amendment to the common external tariff (CET) of the group. A review of the theoretical literature reveals that there is very little research on setting the CET in second best conditions. Yi (1996) examines the formation of customs unions in imperfectly competitive markets. However, his analysis focuses on the extent to which the existence of limitations on membership of the customs union affects global welfare. Srinivasan (1997) examines two approaches to setting the CET within the context of Article XXIV of the General Agreement on Tariffs and Trade which allows for the formation of customs union as an exception to the MFN principle. In the framework of Ricardian theory with Cobb-Douglas social utility functions, he illustrates that an average of pre-union tariffs and subsidies weighted by consumption expenditure in each member country can be used to determine a CET that maintains the welfare of non-member states at the pre-customs union level.

Syropoulos (2003) also examines rules on the determination of the CET in a customs union based on how tariff revenues are distributed among members of the customs union and its influence on the strategic voting of member countries. While there is some consideration of the relationship between setting the CET and welfare and revenue effects in these papers, there is none that analyses the issues simultaneously in the context of optimal tariff reforms that have both positive welfare and revenue impacts post-customs union. This section analyses the extent to which it is possible for a member country (Jamaica) to achieve both outcomes, i.e. welfare increasing and revenue enhancing outcomes, after the formation of a free trade area (full liberalisation under the EPA).

Scenario 1 (duty-free access to all imports from the EU while tariffs on imports from the ROW remain) is chosen as the base scenario for WIRE reforms as it is close to what will obtain after the full implementation of the EPA. In this context and utilising existing tariff rates, the WIRE reform scenarios examined are based on three often cited methods of reducing tariffs (see Kowalski (2005)) – setting a uniform tariff, a linear cut, and setting a maximum tariff. A uniform tariff is simple to implement and may lead to greater efficiency in the tax collection process as tax officials do not have to contend with varying tax rates for different goods. Alternatively, setting a maximum tariff may smooth out the tariff schedule and eliminate tariff peaks. This is particularly applicable in cases where tariff levels are above their revenue maximising level; setting a

maximum tariff level that is below this level may in fact increase tariff revenue and welfare. Finally, a linear cut is one of the most frequently used methods for reducing tariff rates. Falvey and Kim (1992) note a general rule that a proportional reduction in all tariffs raises welfare. In order to select appropriate values for the three scenarios, different values were utilised in TRIST to illustrate the possibilities of WIRE reforms empirically. After reviewing the results of the simulations, the ones presented here are judged to be the most appropriate for the dataset and scenarios. From the outset, it should be noted that as a member of CARICOM, Jamaica implements the CET, with some derogations. In presenting these scenarios, it is understood that Jamaica would need to seek derogations or amendments to the CET from CARICOM/COTED to give effect to some of these proposals.

Taking Scenario 1 (duty-free access to all imports from the EU while tariffs on imports from the ROW remain) as the initial scenario, the three additional scenarios are:

I. Scenario 3 – A linear cut of a) 5% and b) 10% on ROW duties, with duties on imports from the EU and CARICOM being duty-free provided that they meet the rules of origin.
II. Scenario 4 – A maximum tariff of a) 15% and b) 20% c) 30% and d) 32% applied to ROW imports, with duties on imports from the EU and CARICOM being duty-free.
III. Scenario 5 – A uniform tariff of a) 7.4% and b) 4.5% c) 4.3% and d) 3.3% applied to ROW imports, with duties on imports from the EU and CARICOM being duty-free

It is important to frame the results in the context of the existing tariff structure in order to understand the impacts of each tariff reform scenario. From the data analysis section, Jamaica's simple average tariff in 2011 for agricultural products was 17.9% and 6% for non-agricultural products. Forty-one percent of agricultural products in 2011 had duty-free status while a further 46% had applied rates of between 15% and 50%. Duty-free treatment was applied to 70% of non-agricultural tariff lines and 27% had applied rates of between 0%-25%. The highest applied MFN tariff rates were found on: Fish and fish products (28.8%); animal products (26.5%); dairy products (25.2%); fruits, vegetables, plants (23%); and beverages and tobacco (23%). The lowest applied MFN rates were found on imports of cotton (0%); non-electrical machinery (1.5%); and chemicals (2.6%). Petroleum products and chemicals constituted the larger share of imports valuing 27.3% (40.4% duty-free) and 13% (64.2% duty-free), respectively.

**Figure 4-10: Comparison of Initial Applied Tariff Rates and Statutory Tariff Rates**

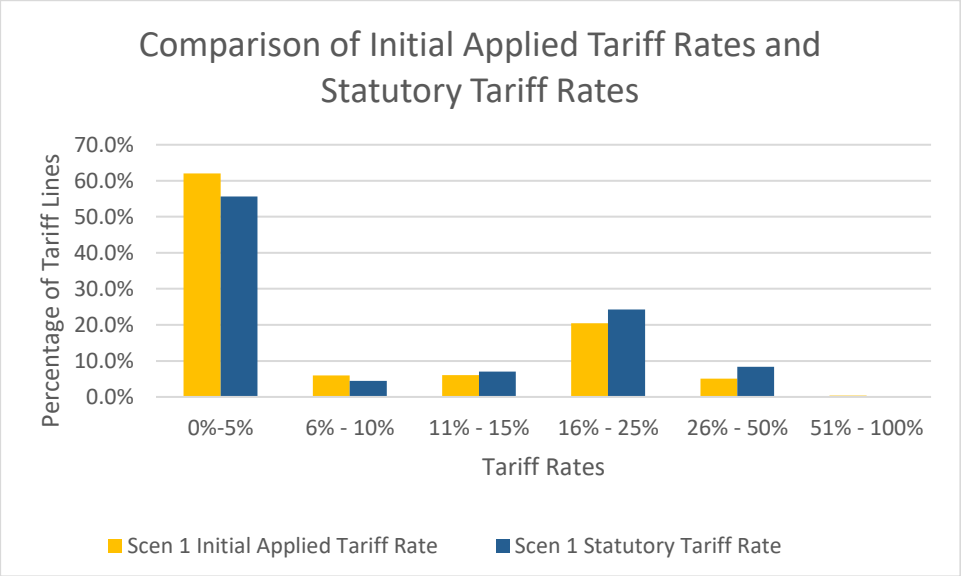
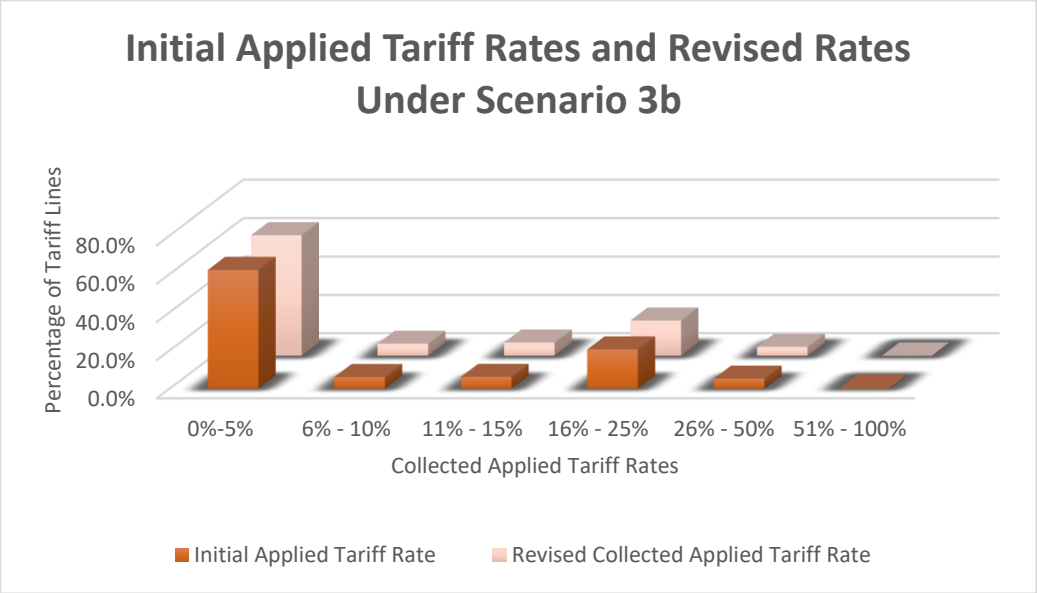



Figure 4-13 shows the variation between the collected applied tariff rate and the statutory tariff rate, that is, the difference in what is authorised (the statutory rate) and what is in fact collected by the tax authorities (the initial applied tariff rate) after full liberalisation of EU imports under the EU-CARIFORUM EPA, with ROW and CARICOM tariffs unchanged. While a statutory tariff rate of less than 10% applies to 60% of all tariff lines, a tariff of less than 10% is collected in 71% of tariff lines. Additionally, a statutory tariff of between 26% - 50% applies to about 8% of tariff lines; however, tariff rates of between 26% - 50% were actually collected in only about 4% of tariff lines. This suggests that there is some revenue loss that occurs through the discretionary application of the statutory tariff. The analysis of the scenarios that follow use the collected applied tariff rate as this presents a more realistic picture of the likely outcome of tariff reform than if the statutory tariff rates were utilised.

Moving from an initial second-best scenario of full liberalisation with the EU and CARICOM, and ROW tariffs remaining unchanged, the welfare effects are positive while there is a small reduction in tariff revenue when the collected applied tariff rate on ROW imports is reduced by 5% and 10% (Scenarios 3a and 3b in Table 4-12, respectively). In the case of a 5% reduction, there is a positive welfare gain of $125,771 and tariff revenue falls by 4%. When the collected applied tariff rate is reduced by 10% (as shown in Figure 4-14), the welfare gain is almost double the amount observed at a 5% reduction, valuing $246,385. Tariff revenue also falls by 8%. Thus, under this scenario, as the rate of reduction increases, tariff revenue falls but welfare gains increase.

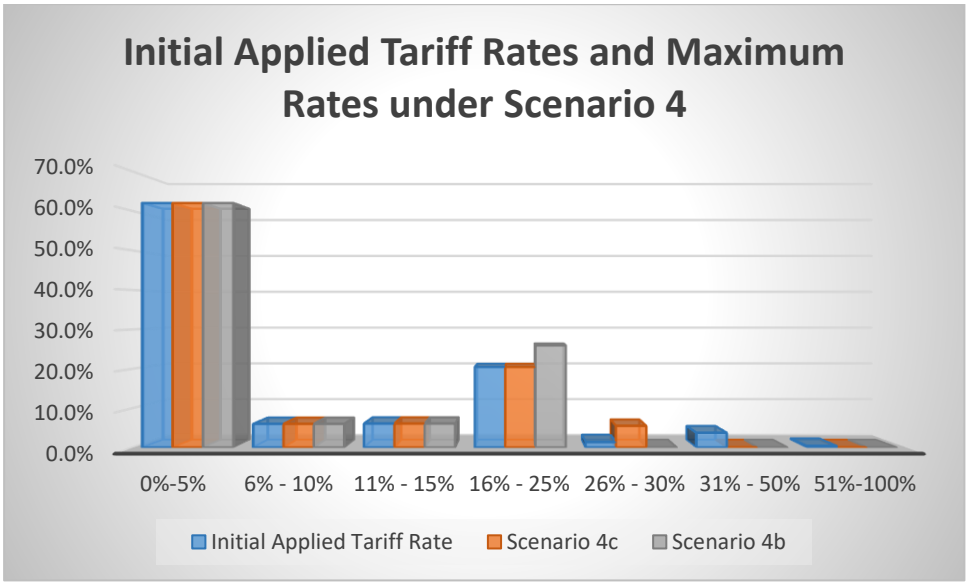
**Figure 4-11: Comparison of the Initial Applied Tariff Rate and Revised Rates under Scenario 3b**




Scenario 3b: A linear cut 10% on ROW duties, with duties on imports from the EU and CARICOM duty-free.

In Scenario 4, maximum tariffs are applied on ROW imports that effectively cap the collected applied tariff rate at given values (see Table 4-13). Under the base scenario, the maximum collected applied tariff for ROW imports is 100% which applies to five tariff lines. It should be noted that Scenario 4 yields positive welfare gains with the magnitude of the welfare effect decreasing the higher the maximum tariff applied. In the case of a 15% maximum tariff, tariffs that are greater than 15% are reduced on 23% of tariff lines when compared with the initial tariff structure under the base scenario. Welfare increases by $367,578 and tariff revenue declines by 14.1%. When the maximum tariff is increased to 20% (Scenario 4b), the decline in revenue of 3% is lower than that observed at the 15% maximum tariff and there is a small welfare gain of US$75,889. At maximum collected applied tariff rates of 30% (Scenario 4c) and 32% (Scenario 4d), the welfare effect remains positive and the decline in revenue is very small at 0.75% and 0.55%, respectively. As can be seen from Figure 4-15, as the maximum tariffs are set at higher levels, the welfare gain decreases because the percentage of tariff lines affected falls. For example, at a maximum tariff rate of 15%, 23% of tariff lines with rates higher than 15% are reduced. In contrast, when rates of 20% and 30% are set, approximately 16% and 3% of tariff lines are affected, respectively. This means that the higher the rates are set, the smaller is the revenue loss.

**Figure 4-12: Initial Applied Tariff Rates and Maximum Rates under Scenario 4**

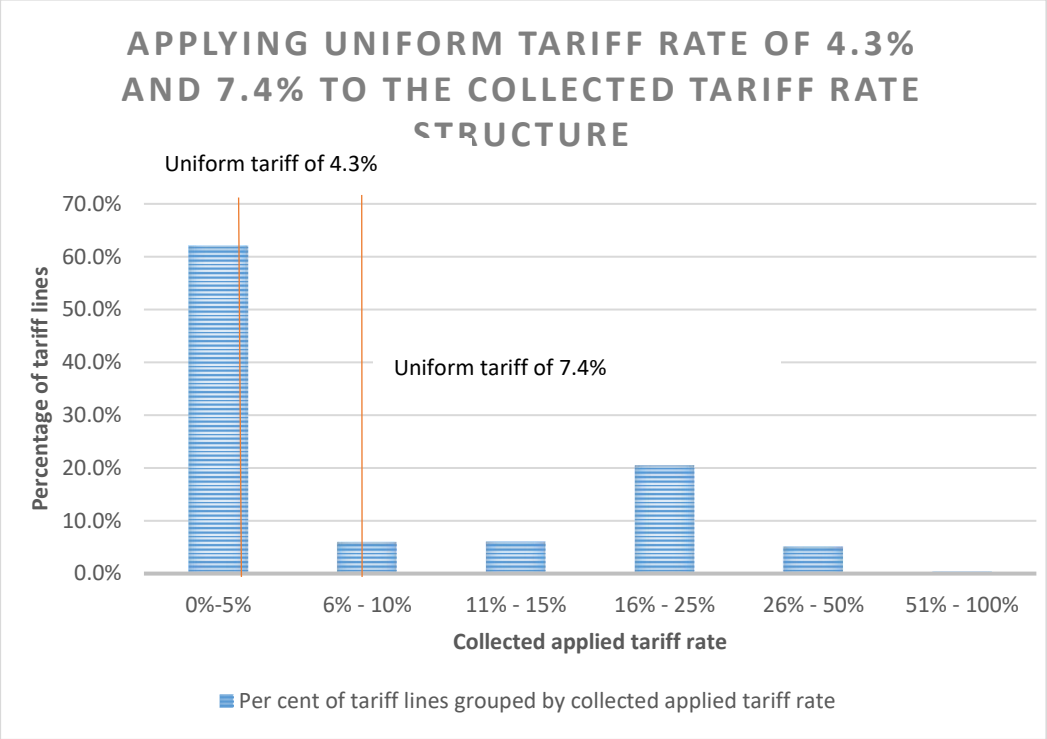



Scenario 4: Maximum tariffs are applied on ROW imports that cap the collected applied tariff rate at 20% (4b) and 30% (4c)

Scenario 5 examines the effect of applying a uniform tariff on ROW imports after full liberalisation of imports from the EU and CARICOM. In Scenario 5a, where the simple average collected applied tariff of 7.4% is set as a uniform tariff, there is an increase in tariff revenue of 37.6%; however, there is a net welfare loss of -US$835,660 (see Table 4-14). This net welfare loss should be anticipated as a uniform tariff of 7.4% increases the tariff rate on approximately 65% of tariff lines that previously had tariff rates below 7.4% under the initial scenario (see Figure 4-16). When the uniform tariff rate is lowered, it is expected that there will be a reduction in the net welfare loss and also a decrease in tariff revenue. This is observed in Scenario 5b where the uniform tariff is set at 4.5% and the net welfare loss is now -US$110,978. It should be noted that in this case, however, the new tariff revenue is above the initial level by US$6.8 million. Scenario 5c utilizes the import weighted ROW collected applied tariff rate of 4.3% while Scenario 5d applies the import weighted collected applied tariff rate from all sources of 3.3%. In comparison to applying the simple average collected applied tariff rate of 7.4%, the welfare loss is significantly less when the import weighted average tariff is used – US$886,818 in the case of the former compared to US$70,549 and US$23,895 when the import weighted ROW and all source average tariffs are used, respectively. In all cases, there is a decline in total imports, with the smallest decline and lowest welfare loss in the case of Scenario 5d. This is expected as Scenario 5d applies the lowest uniform tariff. However, as the welfare loss decreases with the reduction in the uniform tariff, the revenue loss increases. This is illustrated by the variation in the change in revenue between Scenario 5a and Scenario 5d where there is an increase in tariff revenue of 62% when

the simple average tariff of 7.4% is used compared to 23% reduction in tariff revenue when the import weighted average of 3.3% is applied.

**Figure 4-13: Applying a uniform tariff rate to the collected tariff rate structure**




It should be noted that all uniform tariff scenarios lead to welfare losses while both linear cut scenarios and maximum tariff scenarios see positive changes in welfare. At lower levels of the maximum tariff, higher welfare values are observed; however, they are associated with lower tariff revenues. Based on the results of the various scenarios, it may be said that there are certain conditions that increase the likelihood of WIRE reforms. Of all the scenarios, Scenario 4d seems the most likely to yield a WIRE reform. After applying a maximum tariff of 32%, there is a welfare gain of $15,128.42 and there is a fall in revenue of 0.55% that could be seen as a neutral effect. The results of the various scenarios suggest that the pre-existing tariff structure is a major determinant of a WIRE reform outcome. Countries with high tariffs and large variations between tariffs are more likely to have positive welfare effects as a result of tariff reform and especially in the case where a uniform tariff is applied, may see an increase in tariff revenue, depending on the assumptions relating to the elasticities of demand, and exporter substitution.

**Table 4-12: Revenue and Welfare Impacts of Linear Cuts in the Collected Applied Tariff Rate (US$ million)**

| | Total Imports | Imports from the EU | Imports from ROW | Imports from CARICOM | Percentage Change in Tariff Revenue | Percentage Change in Total Tax Revenue | Welfare Change (% of GDP) |
|---|---|---|---|---|---|---|---|
| **Scenario 1 (base values)** | 6,249.06 | 460.77 | 4,752.53 | 1,035.77 | 204.30 | 780.93 | |
| **Post Scenario 3a - Linear cut of 5% in the collected applied tariff rate** | 6,260.71 | 460.59 | 4,764.12 | 1,036.00 | -4.1% | -1.0% | 0.00087% |
| **Post Scenario 3b - Linear cut of 10% in the collected applied tariff rate** | 6,272.46 | 460.42 | 4,775.69 | 1,036.35 | -8.3% | -2.0% | 0.00171% |

**Table 4-13: Revenue and Welfare Impacts of Maximum Collected Applied Tariff Rates (US$ million)**

| | Total Imports | Imports from the EU | Imports from ROW | Imports from CARICOM | Percentage Change in Tariff Revenue | Percentage Change in Total Tax Revenue | Welfare Change |
|---|---|---|---|---|---|---|---|
| **Scenario 1 (base values)** | 6,249.06 | 460.77 | 4,752.53 | 1,035.77 | 204.30 | 780.93 | |
| **Post Scenario 4a - Maximum tariff of 15% for the collected applied tariff rate** | 6,285.85 | 460.40 | 4,789.50 | 1,035.95 | -14.1% | -3.5% | 0.00255% |
| **Post Scenario 4b - Maximum tariff of 20% for the collected applied tariff rate** | 6,256.43 | 460.70 | 4,760.00 | 1,035.73 | -2.9% | -0.7% | 0.00053% |
| **Post Scenario 4c - Maximum tariff of 30% for the collected applied tariff rate** | 6,251.06 | 460.77 | 4,754.55 | 1,035.74 | -0.7% | -0.2% | 0.00014% |
| **Post Scenario 4d - Maximum tariff of 32% for the collected applied tariff rate** | 6,250.56 | 460.77 | 4,754.04 | $1,035.74 | -0.5% | -0.1% | 0.00010% |

**Table 4-14: Revenue and Welfare Impacts of Uniform Collected Applied Tariff Rates (US$ million)**

| | Total Imports | Imports from the EU | Imports from ROW | Imports from CARICOM | Percentage Change in Tariff Revenue | Percentage Change in Total Tax Revenue | Welfare Change (% of GDP) |
|---|---|---|---|---|---|---|---|
| **Scenario 1 (base values)** | 6,249.06 | 460.77 | 4,752.53 | 1,035.77 | 204.30 | 780.93 | |
| **Post Scenario 5a - Uniform tariff of 7.4% applied to Imports from ROW** | 5,947.14 | 462.59 | 4,470.32 | 1,014.23 | 62.4% | 15.7% | -0.00614% |
| **Post Scenario 5b - Uniform tariff of 4.5% applied to Imports from ROW** | 6,156.68 | 460.65 | 4,671.35 | 1,024.68 | 3.3% | 0.9% | -0.00077% |
| **Post Scenario 5c - Uniform tariff of 4.3% applied to Imports from ROW** | 6,171.19 | 460.53 | 4,685.26 | 1,025.40 | -1.0% | -0.1% | -0.00049% |
| **Post Scenario 5d - Uniform tariff of 3.3% applied to Imports from ROW** | 6,243.83 | 459.91 | 4,754.87 | 1,029.05 | -22.8% | -5.6% | -0.00017% |

## 4.7 Conclusions

This chapter sought to examine different tariff reform scenarios for Jamaica under the EU-CARIFORUM EPA and analyse the possibility of achieving WIRE outcomes with tariff liberalisation. The specific aims introduction were to:

I. explore the tariff revenue, trade creating, trade diverting and welfare effects of full liberalisation under the EU-CARIFORUM EPA at the product level for Jamaica.
II. examine the different effects of utilising statutory tariff rates versus collected tariff rates in the analysis
III. analyse how Jamaica may adjust its tariffs on ROW imports after implementation of the EPA in order to address concerns about tariff revenue depletion and welfare loss, for example.
IV. examine the feasibility of achieving welfare increasing and revenue enhancing (WIRE) outcomes for tariff adjustments on ROW imports post-EPA.

With respect to points (i) and (ii), it is shown that Jamaica can mitigate negative fiscal effects of the EU-CARIFORUM EPA with the application of statutory tariff rates rather than collected tariff rates. However, there is a trade-off between revenue and welfare, as in the case of the application of statutory tariff on ROW imports, there is a significant increase in total tariff revenue but a net welfare loss. This essay also showed that the effects of tariff liberalisation under the EPA vary by industry and product. In particular, where there are no imports from the EU to replace imports from the ROW, the demand effect is especially strong as consumers face higher prices to purchase the same goods, particularly when statutory tariff rates are applied.

With respect to point (iii), in order to mitigate negative revenue effects of tariff reform, the essay showed that Jamaica may exclude high revenue products from the EU-CARIFORUM EPA as their exclusion would still mean that substantially all trade has been liberalized under the GATT definition. For completeness, the results from the scenario of full liberalisation of EU imports under the EU-CARIFORUM EPA were compared with the provisions of the end term EU-CARIFORUM EPA that was signed in October 2008 which excludes approximately 15% of tariff lines. It was observed that the end term EPA resulted in a lower decline in tariff revenue and total tax revenue when compared with the full liberalisation of EU imports into Jamaica. The welfare loss was also found to be greater for the end term EPA. This finding suggests that the Jamaican authorities included high revenue products on the list of excluded products and this reduced the potential revenue loss from the EPA by 37%.

With respect to point (iv), the essay showed that it is challenging to design WIRE reforms. For Jamaica, applying a maximum tariff of 32% to ROW imports post-EPA is most likely to yield welfare increasing and revenue enhancing outcomes. All uniform tariff scenarios post-EPA led to welfare losses while both linear cut scenarios and maximum tariff scenarios post-EPA see positive changes in welfare. The results also suggest that the pre-existing tariff structure is a major determinant of a WIRE reform outcome; that is, where countries have high tariffs and large dispersion between tariffs, they are more likely to observe positive welfare effects as a result of tariff reform and particularly where a uniform tariff is applied, may see an increase in tariff revenue. It should be noted that Jamaica would have to seek derogations or amendments to the CET from COTED/CARICOM for changes in statutory tariff rates that are outside of the CET.

This essay has enriched the economic literature on tariff reform and the effects that it may have on welfare and fiscal revenue. While much of the theoretical literature on WIRE reforms is established in a first-best framework of non-preferential liberalisation, this essay explores these effects in the second-best context of the EU-CARIFORUM EPA, using an empirical approach and is a useful addition to the literature on WIRE reforms. In a first-best scenario, one can see that it is easier to establish clearer rules for achieving WIRE outcomes (Falvey (1994)). In the second-best context, it is not clear that lowering the tariff is necessarily welfare raising, particularly where the free trade agreement creates trade diversion. Ultimately, there may not need to be a choice between welfare and revenue as in the end, policymakers will make a decision based on their judgement of the needs of their economies.

The essay is also of direct relevance to policymakers in Jamaica and the wider CARICOM region. It offers a detailed analysis of multiple liberalisation scenarios, utilising statutory vs. applied tariff rates on ROW imports post-EPA, which may be used to inform future policy decisions on tariff reform. As Jamaica has already made provision for high revenue products in its schedule of commitments under the EPA by placing those items in the later phases of the agreement, the application of statutory rates, that is, limiting the number of discretionary waivers and exemptions is one relatively easy way of increasing tariff revenue. The research will also prove useful for those ACP regions that have not yet negotiated a final EPA agreement with the EU by highlighting the possible effects on fiscal revenue and welfare and how they may be mitigated, in the event that these effects are likely to be negative.

As with all partial equilibrium models, the findings of this essay are limited to impact effects that do not take into account changes in relative prices and income due to changes in tariff rates. This provides an opportunity for future research on economy-wide implications of tariff reform for countries such as Jamaica, in the context free trade agreements, using a computable general

equilibrium model, for example. In addition, there is scope for further research on WIRE reforms for larger, more developed countries in a similar second-best environment of a free trade agreement.

# APPENDIX 4A – TARIFF LINE DESCRIPTIONS

| Tariff Line | Description |
|---|---|
| **0703101000** | Onions |
| **8703234030** | Motor vehicle exceeding 2000cc but not exceeding 3000cc imported by dealers (petrol) |
| **2004109000** | Other Potatoes [Prepared or Preserved (Frozen; Excluding By Vinegar, Acetic Acid)] |
| **6908901000** | Tiles, cubes and similar articles the largest surface of which is capable of being enclosed in a square the side of which is 7 cm or more |
| **8703339030** | Motor vehicles 2500cc to 3200cc imported by dealers |
| **8703233030** | Motor Vehicle exceeding 1800cc but not exceeding 2000cc imported by Dealers (petrol) |
| **0701900000** | Other [Other Potatoes (Fresh or Chilled)] |
| **2202909030** | Red Bull, Arizona, Monster and similar energy drinks. |
| **2204100010** | Sparkling wine of fresh grapes. |
| **8703232031** | Motor vehicle exceeding 1600cc but not exceeding 1800cc imported by dealers (petrol) |
| **2701190000** | Other coal |
| **8703322031** | Motor vehicles of a cylinder capacity exceeding 1,600 cc but not exceeding 2000cc, imported by dealers |
| **0402210010** | Not containing added sugar or other sweetening matter [milk and cream, concentrated or sweetened] |
| **2208700020** | Liqueurs and Cordials, nesoi |
| **8703234010** | Motor Vehicle Exceeding 2000cc but not exceeding 3000cc imported by individuals (petrol) |
| **2005519000** | Other [Shelled Beans, Prepared or Preserved (Excluding By Vinegar; Not Frozen)] |
| **8703249032** | Motor vehicle exceeding 3,500 imported by dealers |
| **8418300000** | Freezers of the chest type, not exceeding 800 litre capacity |
| **8703233011** | SUVs/Wagons (Pathfinders and the like) exceeding 1800cc but not exceeding 2000cc imported by individuals (petrol) |
| **2208201020** | Brandy, in bottles of a strength not exceeding 46% volume, nesoi |
| **8703339011** | SUVs/Wagons (Pathfinders and the like) exceeding 2500cc but not exceeding 3200cc imported by individuals |
| **2106909010** | Dietary and nutritional supplements (vitamins and minerals etc, both in tablets and powders) |
| **8703232030** | Motor vehicle exceeding 1500cc but not exceeding 1600cc imported by dealers (petrol) |
| **1904100000** | Prepared foods obtained by the swelling or roasting of cereals or cereal products |
| **2004909000** | Other [Other Vegetables and Mixtures of Vegetable (Prepared or Preserved; Frozen)] |

# APPENDIX 4B – DETAILED RESULTS FOR WIRE TARIFF REFORM SCENARIOS

**Table 4-15: Change in Pattern of Imports - Details**

| Change in Pattern of Imports Scenarios 1 and 2 (US$ million) | | | | |
|---|---|---|---|---|
| | **EU** | **CARICOM** | **ROW** | **Total** |
| **Initial Imports** | $436,239,229 | $1,035,788,772 | $4,754,391,839 | $6,226,419,840 |
| **Scenario 1** | | | | |
| **Imports after Exporter substitution effect** | $450,661,532 | $1,034,927,263 | $4,740,831,045 | $6,226,419,840 |
| **Imports after demand effect** | $460,767,126 | $1,035,768,348 | $4,752,532,239 | $6,249,067,713 |
| **Scenario 2** | | | | |
| **Imports after exporter substitution effect** | $477,929,061 | $1,078,500,229 | $4,669,949,105 | $6,226,378,395 |
| **Imports after demand effect** | $469,212,451 | $1,009,646,200 | $4,409,190,160 | $5,888,048,811 |

**Table 4-16: Revenue and Welfare Impacts of Linear Cuts of 5% and 10% in the Collected Applied Tariff Rate (US$) Details**

| | Total Imports | Imports from the EU | Imports from ROW | Imports from CARICOM | Tariff Revenue | Total Tax Revenue | Welfare Change |
|---|---|---|---|---|---|---|---|
| **Scenario 1 (base)** | $6,249,064,760 | $460,767,126 | $4,752,529,286 | $1,035,768,348 | $204,304,795 | $780,927,887 | |
| **Post Scenario 3a - Linear cut of 5% in the collected applied tariff rate** | $6,260,705,579 | $460,589,825 | $4,764,115,633 | $1,036,000,121 | $195,958,928 | $773,289,339 | $125,771.02 |
| **Post Scenario 3b - Linear cut of 10% in the collected applied tariff rate** | $6,272,460,507 | $460,415,218 | $4,775,693,290 | $1,036,351,999 | $187,343,106 | $765,353,957 | $246,385.08 |

**Table 4-17: Revenue and Welfare Impacts of Maximum Collected Applied Tariff Rates of 15%, 20%, 30%, and 32% (US$) Details**

| | Total Imports | Imports from the EU | Imports from ROW | Imports from CARICOM | Tariff Revenue | Total Tax Revenue | Welfare Change |
|---|---|---|---|---|---|---|---|
| **Scenario 1 (base)** | $6,249,064,760 | $460,767,126 | $4,752,529,286 | $1,035,768,348 | $204,304,795 | $780,927,887 | |
| **Post Scenario 4a - Maximum tariff of 15% for the collected applied tariff rate** | $6,285,852,058 | $460,403,203 | $4,789,500,896 | $1,035,947,959 | $175,438,771 | $753,810,599 | $367,577.59 |
| **Post Scenario 4b - Maximum tariff of 20% for the collected applied tariff rate** | $6,256,433,042 | $460,700,974 | $4,759,997,263 | $1,035,734,805 | $198,343,651 | $775,300,068 | $75,887.98 |
| **Post Scenario 4c - Maximum tariff of 30% for the collected applied tariff rate** | $6,251,059,938 | $460,771,268 | $4,754,553,191 | $1,035,735,478 | $202,780,496 | $779,524,113 | $20,152.30 |
| **Post Scenario 4d - Maximum tariff of 32% for the collected applied tariff rate** | $6,250,558,712 | $460,774,818 | $4,754,043,028 | $1,035,740,865 | $203,186,536 | $779,912,773 | $15,128.45 |

**Table 4-18: Revenue and Welfare Impacts of Uniform Collected Applied Tariff Rate of 3.3%, 4.3%, 4.5%, and 7.4% (US$) Details**

| | Total Imports | Imports from the EU | Imports from ROW | Imports from CARICOM | Tariff Revenue | Total Tax Revenue | Welfare Change |
|---|---|---|---|---|---|---|---|
| **Scenario 1 (base)** | $6,249,064,760 | $460,767,126 | $4,752,529,286 | $1,035,768,348 | $204,304,795 | $780,927,887 | |
| **Post Scenario 5a - Uniform tariff of 7.4% applied to Imports from ROW** | $5,947,144,487 | $462,594,175 | $4,470,316,948 | $1,014,233,363 | $331,690,800 | $903,355,184 | -$886,817.85 |
| **Post Scenario 5b - Uniform tariff of 4.5% applied to Imports from ROW** | $6,156,682,145 | $460,652,982 | $4,671,351,713 | $1,024,677,450 | $211,095,020 | $788,258,369 | -$110,978.00 |
| **Post Scenario 5c - Uniform tariff of 4.3% applied to Imports from ROW** | $6,171,188,969 | $460,527,154 | $4,685,258,064 | $1,025,403,751 | $202,350,084 | $779,870,175 | -$70,549.17 |
| **Post Scenario 5d - Uniform tariff of 3.3% applied to Imports from ROW** | $6,243,827,764 | $459,912,735 | $4,754,869,332 | $1,029,045,696 | $157,793,662 | $737,053,641 | -$23,895.00 |

# 5. CONCLUSIONS

This thesis has examined several aspects of the fiscal and revenue impacts of trade liberalisation over the course of three chapters. In particular, the thesis answers the following questions:

- How does trade liberalisation affect total tax revenue, and international trade tax revenue in particular?
- Are there variations in the impact of trade liberalisation depending on a country's level of economic development and dependence on specific types of taxes, such as export taxes?
- Are the findings of the model sensitive to the indicator of openness used?
- Can reform be designed to achieve welfare increasing and revenue enhancing outcomes in the context of a small open economy?

Based on the results of the various models in the study, the impact of trade reform is country-specific, even though there are broad recommendations and best practices to achieve optimal outcomes. A country's level of development and in particular, its administrative capacity to tax are major determinants of the extent to which total tax revenue and trade tax revenue are impacted by trade reform. The study found that while there may be a negative effect on tax revenue within a year of liberalisation, the long-term effect is likely to be positive. Trade reform does not occur in isolation and it is clear that accompanying broader macroeconomic reforms often stimulate the economy and lead to additional activities that increase total revenue. There is also evidence that countries do replace trade tax revenue with domestic taxes over time and so, any reform program should have a component to strengthen tax administration capacity, examine mechanisms to regularise the informal economy, and encourage greater compliance with tax schedules to minimise any possible negative effects.

There is also some evidence that the existing tax structure influences the revenue impact of trade reform when assessed within the context of liberalisation events. Countries with different levels of dependence on export taxes may implement trade reform to minimise the risk of a sudden reduction in export tax revenue. These countries may therefore seek to convert export taxes to licensing fees or other charges that are linked to the provision of specific services. Although regressive, one could also explore moving to indirect taxation with appropriate safeguards for vulnerable members of society. The study found that it takes time for other sources of revenue to come on stream to mitigate the initial negative impact of trade reform. It is therefore suggested that broader tax reform take place at the same time that

the country is implementing trade liberalisation so that alternative sources of revenue are identified.

The thesis confirms that regression models that attempt to quantify the impact of trade reform on fiscal revenue are very sensitive to the indicator of openness used. More than five different indicators of openness or trade liberalisation were used in the study and they yielded different results due to differences in criteria and methodology. It is therefore recommended that researchers use multiple measures and triangulate findings with information on country context as well as global socio-economic conditions. This approach is more likely to ensure an accurate understanding of the factors that drive the regression results and appropriate variable selection.

In terms of a country's experience in implementing trade liberalisation and its effect on fiscal revenue, the thesis examined the case of Jamaica and the EU-CARIFORUM EPA and explored the possibility of achieving WIRE outcomes with tariff liberalisation. The scenarios analysed in the thesis are highly stylised and allow for broad conclusions on the type of reform that will most likely lead to WIRE reform outcomes – a maximum tariff of 32% applied to ROW imports post-EPA in the case of Jamaica. There also tends to be a trade-off between revenue and welfare; for example, in the case of applying statutory tariffs on ROW imports, there is a significant increase in total tariff revenue but a net welfare loss.

In reality, trade policy and tariff reform are influenced by complex economic, social and political considerations and so, implementing reforms as designed within a theoretical framework is rarely possible. Countries do take concrete steps to mitigate potential revenue loss from trade reform. Jamaica did this in the EU-CARIFORUM EPA by excluding a majority of high revenue products from the agreement as their exclusion still meant that substantially all trade was liberalized under the GATT definition. The liberalisation schedule saved the government potential revenue loss of 37% when the end term EPA is compared with full liberalisation of EU imports into Jamaica. Other countries and regions that have not yet negotiated a final EPA agreement with the EU may use this approach to identify sensitive products that should be excluded from liberalisation or placed in the last phase of liberalisation to minimize negative fiscal effects.

Realizing that other countries are likely to demand similar treatment to the EU, the government of Jamaica may wish to have a broader strategy to address tariff reform for ROW imports, minimizing tariff peaks and reducing tariff dispersion. The strategy should take into account producer and consumer impacts, along with revenue considerations.

## 5.1 Limitations of the study and opportunities for further research

As with all partial equilibrium models, the findings of this essay are limited to impact effects that do not take into account changes in relative prices and income due to changes in tariff rates. There is therefore room to analyse the net effect of trade liberalisation by using a general equilibrium model that can take account of the impact of relative prices and demand for final and intermediate goods. One could use this framework to examine the impact of changes in the price level due to adjustments in the tariff structure for a cross-section of countries or for individual countries such as Jamaica. Further research can also be undertaken to analyse the net impact of individual components of trade liberalisation; for example, changes in import and the removal of non-tariff barriers on government revenue.

The findings of the events analysis are limited because of the small number of countries in the sample based on the event indicators used. Sachs-Warner used thirty-four countries that liberalised in its original sample - twenty-nine of which were used in this study based on data availability for all indicators used in the models. The findings, therefore, cannot be generalised. Further work could be done to extend the Sachs-Warner (1995) methodology to other countries and update the dataset to see if there are other countries that have liberalised according to their criteria. The models could then be re-assessed within an events framework to yield more robust results.

In addition, while much of the theoretical literature on WIRE reforms is established in a first-best framework of non-preferential liberalisation, the thesis explored these effects in the second-best context of the EU-CARIFORUM EPA, using an empirical approach. In a first-best scenario, it is easier to establish clearer rules for achieving WIRE outcomes (Falvey (1994)). In the second-best context, it is not clear that lowering the tariff is necessarily welfare raising, particularly where the free trade agreement creates trade diversion. The empirical methodology utilised in the essay is therefore a very useful addition to the literature on WIRE reforms. However, there is scope for further research on WIRE reforms for larger, more developed countries in a similar second-best environment of a free trade agreement.

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