TAX BUOYANCY IN THE EASTERN CARIBBEAN CURRENCY UNION AND THE IMPLICATIONS FOR FISCAL CONSOLIDATION: A STUDY OF THE COMMONWEALTH OF DOMINICA, ST. LUCIA AND ANTIGUA AND BARBUDA.

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Abstract

The paper examines and analyses the concept of tax buoyancy in the Eastern Caribbean Currency Union (ECCU) and examines the implications for fiscal consolidation specifically in Dominica, Antigua and Barbuda, and St. Lucia from 1980 to 2010. The data was found to be non-stationary and the Dynamic Ordinary Least Squares method is applied to obtain the buoyancy coefficients. The Divisia Index (DI) is also applied to estimate the elasticity coefficients within the countries in order to complete the analysis. The results indicate that the countries being studied possess buoyant tax revenue structures. The results also show a heavy reliance on discretionary policy in order for effective tax revenue generation. The Paper concludes that in order for fiscal consolidation to be successful, on the revenue side, the tax base should be buoyant as well as sufficiently large.

Keywords: OECS; Tax Buoyancy; Fiscal Consolidation; Tax Policy; Divisia Index.

Contents

1. Introduction

"The current realities at the domestic level are conditioned by the structural features of Caribbean economies, that is, they are small, open and vulnerable."(ECCB, 2013) Sir K Dwight Venner appropriately describes the reality of the countries within the Eastern Caribbean Currency Union (ECCU) and the entire Caribbean Community by extension. Additionally, it gives insight and some intuition regarding the constraints faced as well as the scope for exploiting the opportunities placed before them. From this insight, it is therefore important to strategically implement mechanisms that directly and effectively address the specific circumstances faced.

Schipke (2013) indicates that in the period immediately following independence of the countries that formed the ECCU, there was slow but positive growth within these economies. However, as time progressed growth began moving at an even more sluggish pace. Schipke attributed this partly to changes in World Trade Organization (WTO) rules of engagement that consequently saw the removal of preferential trading agreements, along with terms of trade shocks and reductions in foreign aid disbursements and Official Development Assistance (ODA). The openness and vulnerability of the ECCU economies means that the currency union provides the ideal conditions to be affected by negative shocks. These shocks, which are mainly a function of the external environment, have throughout history never been kind to any small island grouping.

The Global Recession which originated in the fall of 2007 played a major role in redefining the conditions of the regions' external environment. Almost six years later, most of the major players in the global economy such as the United States and Europe, are still toiling with the prospects for a full recovery and relief as they face major difficulties including low growth, high unemployment and severe fiscal and debt issues. The World Economic Outlook 2013 projects global growth at 3.25% in 2013 and 4% in 2014 which indicates a bumpy road to recovery. Since the United States and Europe are our main trading partners, the negative impact on our economies has been and continues to be felt through the tourism industry, the manufacturing sector, foreign direct investment, remittances and access to their money markets. (ECCB, 2012)

These economic issues have posed problems to central governments in terms of their ability to carry out their sovereign responsibilities. Fiscal sustainability as it relates to social and economic policy is being brought to the fore of much debate as the world watches the Eurozone crisis and similar plights being faced by a number of economies in the wider world. In an interview by the IMF, Schipke made a comparison whereby he described the ECCU as a microcosm of the European economic and monetary union, since the ECCU has faced and is currently facing rising fiscal deficits as well as unsustainable debt levels in a number of states. There are indications that a lack of fiscal integration and challenges faced in parts of the financial sector can ultimately undermine the stability of the ECCU. It is noteworthy that through the European experience, overcoming these challenges is particularly difficult in monetary unions. The Economic Commission for Latin America and the Caribbean (ECLAC) (2013) suggests that in 2013, growth projections within the Union is expected to remain weak at 2.1% although there are some signs of recovery within the United States economy. However, continued fiscal strategies will limit government spending and the weak economic activity will keep inflation in check.

The International Monetary Fund (IMF) highlighted that policy makers in Latin America and the Caribbean (LAC) should strengthen fiscal shock absorbers, and control the buildup of financial vulnerabilities in order that they move forward with regional economic growth. However, it was

identified that within the Caribbean subgroup, the policy issues may be a bit more problematic as growth within the small island grouping is hindered by high debt levels as well as weak competitiveness of exports.

Solutions explored as counter measures for these economic problems in most countries looked towards fiscal consolidation. This mechanism calls for the appropriate balance of revenue and expenditure reforms in order to reduce seemingly destructive debt burdens and improve the fiscal capacity which is a key to motivating economic growth. This paper focuses on the revenue side of the strategy whereby the assessment of the appropriateness of tax revenue generation and tax policy serves as triggers for economic growth. The literature points to tax buoyancy and elasticity in ascertaining the productivity of any tax regime. It follows that any form of revenue reforms relies heavily on the ability of the fiscal space to accommodate such measures. Based on the assessed productivity of tax policy it is good to appreciate that there are no constants in the macro economy and thus it serves as a point of reference for the development of future reforms.

The remainder of the paper is organized as follows. Section 2 provides a briefing on fiscal consolidation as it relates to Small Island Developing States (SIDS). Section 3 highlights key issues in tax policy as it relates to developing countries. Section 4 looks at the literature available on tax elasticity and buoyancy. Section 5 provides a description of the methodology including the Divisia Index as well as the data used in the study. Section 6 provides an in-depth analysis of the results obtained from the study. Finally, section 7 provides conclusions as well as policy recommendations.

2. Overview of the Literature

2.1 Fiscal Consolidation and Small Island Developing States (SIDS)

The Organization for Economic Co-operation and Development (OECD) (2012) offers seemingly viable policy instruments for fiscal consolidation. These instruments include adopting 'best practices' in spending on education and healthcare. This mainly applies to governments that favour less harmful taxes which cause minimal distortions within the domestic economy. Adopting identical forms of these policy measures among others will lead to an eventual mitigating effect of the negative growth consequences associated with government fiscal policies. It is common practice in consolidation efforts to implement discretionary fiscal measures as well as balancing spending cuts and revenue increases. The effectiveness of such consolidation efforts can essentially be measured in one way by the total reduction of fiscal imbalances that result. "Fiscal consolidation is successful if, after four years, the debt to Gross Domestic Product (GDP) ratio reduces to five percentage points below the level prior to the start of consolidation." (Amo-Yartey et al., 2012)

Fiscal rules as defined by the International Monetary Fund (IMF) refer to permanent constraints on fiscal policies through simple numerical limits on certain budgetary aggregates. It follows that in order for successful consolidation to take place there must be certain fiscal rules that need to be applied and adhered to. The existence of these policy rules by their very design foster responsible public finance management as well as fiscal sustainability. The objectives of these policy rules include; budget balance rules, debt rules, expenditure rules and revenue rules. There has been a growing trend in Small Island Developing States (SIDS) whereby there have been increases in private (external and domestic) debt paralleled by decreases in ODA (Official Development Assistance) which has increased debt vulnerabilities in some countries (Hurley, 2010). This creates a situation whereby in the absence of policy rules, an environment that fosters debt overhang may be supported.

Additionally, the OECD indicates that fiscal rules with implanted targets set for expenditure tended to be associated with larger and longer adjustments, and higher success rates. This could effectively reflect that well-designed fiscal rules are effective. It is also reflective of the outcomes that are accrued to governments committed to a level of prudent public financial management.

A wide range of literature that assesses the levels of public debt with regards to a group of SIDS utilizes cross country surveys that provide figures identifying the levels of public debt as well as the magnitude of that debt that is obtained from foreign sources. In 2009, the majority of SIDS measured a debt to GDP ratio of above 60% while the minority recorded figures below 40%. It was also noted that most of the SIDS breached the existing debt sustainability threshold of 60% in 2010 with high levels of indebtedness being recorded in OECS countries. There is also a suggestion that since the occurrence of the global financial crisis, the average level of external debt as a percentage of total public debt has been reduced from a level of above 30% in 2000 to approximately 24% in the post crisis period. (UNDP, 2010)

In the Caribbean context, the consolidation efforts of Jamaica, Barbados and St. Kitts and Nevis have been captured by Amo-Yartey et al. (2012). It was highlighted that major debt reductions globally have been as a result of decisive and longsighted actions mainly as a result of fiscal consolidation efforts. The study reveals that the efforts that the SIDs focused on are not enough since the returns on policy are not sufficient in order to generate the fiscal surpluses that are necessary to reduce the debt-to-GDP ratio. The study further provides some analysis that distinctly addresses the peculiarities of economies within the region. It was pointed out that consolidation efforts should be short term measures as a means of avoiding the difficulties associated with taking minute steps over a course of time. It was suggested that governments should in fact engage in more fiscal consolidation as it has a very high success rate in some regional economies.

ECLAC (2013) recognized that although ECCU economies still produce disappointing performance results, the fiscal consolidation strategies pursued in most ECCU countries resulted in a tightening of the fiscal deficit. Deficits were narrowed to 2.6% of GDP in 2012, from 3.7% in 2011. Saint Vincent and the Grenadines and Antigua and Barbuda showed the most significant improvements in their fiscal balances, while St. Kitts and Nevis, Saint Lucia and Grenada saw their deficits widen. It is clear that there is some form of disconnection regarding the policy decisions being pursued and the 'right' timing of these measures as well as the institutional capacity to effectively implement measures.

In the aftermath of the most recent global financial crisis small island economies are struggling more than usual to implement adjustments. This issue, coupled with unsustainable debt levels and rigidities within the fiscal space (commitments of public expenditure), somewhat impedes efforts to restore fiscal balances in such economies. (Amo-Yartey et al. 2012)

2.2 Key Issues in Tax Policy for Open Developing Economies.

Taxation and tax policy have formed an integral part of the debate stemming from the school of public choice and how institutions influence fiscal outcomes. Stiglitz (2009) makes a very compelling statement that "no public policy issue is of more importance than the structure and level of taxes." The issue of taxation as a policy instrument has throughout history received a great deal of attention spanning from the early economists to the present day contemporary economists and policy-makers. Poterba (1998), in analyzing tax policy in the context of the political economy, indicates that political powers of various interest groups are a major determinant of tax policy. He further indicated that in this context, politicians assess policy in terms of the ability of the political costs to outweigh the benefits.

The wide span of public finance literature has highlighted key aspects of taxation and tax policy analysis that can be extrapolated and generally applied across borders. Lafoucade and Scott (2009) identify the main purpose of taxation as that of financing public expenditure. However, in financing public wants, policy makers should operate on the basis of certain fiscal principles. Lafoucade and Scott (2009) and Lledo et al. (2004) highlight that a tax system should be guided by the equity principle which stipulates that tax-payers should only pay what is deemed to be their fair share of taxes. Additionally, tax administration should have certain efficiency objectives whereby government collects sufficient revenue to carry out welfare and development objectives. Therefore, in the design of a tax system it is imperative that the equity principle and efficiency objectives do not come in direct conflict with each other.

The Pacific Financial Technical Assistance Centre (2010) points out that a problem most open developing economies face is that of designing an optimal tax structure that essentially fulfills its revenue objectives while at the same time leading to minimum amounts of distortions. Strategies of optimal taxation including the Ramsey rule, inverse elasticity rule and Corlett and Hague rule have been applied in developing countries. However, the context leaves much to be desired in terms of the assessment of the policy and ascertaining its success. The effects of tax policy can be analyzed in terms of its incidence, efficiency and equity. The view exists that developing countries have yet to develop a system deemed acceptable on all grounds to achieve their fiscal and development goals and objectives. This in itself may be a function of structural weaknesses, poor institutions or poor legislative structure.

With the apparent weakening of the tax base due to certain structural issues as well as the response of citizens and firms to tax policy, it is no surprise that states are faced with revenue constraints in order to finance fiscal as well as development objectives (OECD, 2008). It is established that mechanisms for financing development could be achieved at the internal level through fiscal budgets, domestic private saving and investment. Taxation is an important dimension in the development of the state because the structure and organization of the State form an integral part in the definition of the state (Sindzingre, 2006). The economic theory of taxation is seen as a pillar of public economics. Sindzingre further indicates that taxation is viewed as an important factor of growth, and it may be said that the disparity that exists in long-term growth rates stems from differences in national public policies, especially tax rates, because they affect the incentives to accumulate physical and

human capital. In terms of the level and structure of taxation, the literature is inconclusive as to what the optimal level is.

An Organization for Economic Cooperation and Development (OECD) report compiled a cross section of 1996 data from a group of developing countries showing that total tax revenue as a percentage of GDP range from 15% to 25% in most countries. Returns from the system of direct taxes implemented in most developing economies are such that it forms a substantial part of government revenue. The data revealed that such taxes contribute approximately 30% to 45% of total tax revenue. The form of direct taxation that has received the most attention throughout the public finance literature in the developing country context is that of personal income taxes. This is so since the OECD indicates this as the main income that is taxed. This is especially important since the OECD further indicates that rates of direct taxation affect the use and productivity of labour.

The Caribbean region has seen some changes in the structure of their direct taxes through the tax reform efforts of various countries such as Dominica, Jamaica and Barbados. Although the experiences of these countries differ, they were not widely varied. Ramsaran and Charles (2004) in their examination of reform in the countries, highlighted the guiding principles to reform that were utilized. These included removing tax credits, lowering taxable income thresholds, lowering the marginal tax rates as well as reducing the amount of taxable income brackets. Essentially, the ideal goal of this type of reform would have been to increase the level of tax effort, reduce the amounts of distortions caused by the tax structure and also to reduce the incidence of evasion and avoidance. Also, embedded within these reforms were the goals of developing certain sectors within the economy; for example, Barbados sought to develop their services sector and Dominica their agricultural sector.

Tanzi and Zee (2001) highlight that in most developing countries the marginal tax rates of the highest income earners in society are higher than the corporate tax rate. Due to the differentials in these effective rates, most high income earners opt to operate as corporations. Consequently, for tax revenue purposes, it is in the interest of the developing economies to keep both tax rates as close as possible in order to mitigate the incidence of avoidance.

The reform efforts within the region met its successes in that the share of tax revenue attributable to direct taxation was reduced significantly thereby reducing the tax burden on the low income members of society. This essentially achieved the intended equity objectives within some of these states. The system of reform increased the progressivity of the income taxes. Duncan and Peter (2012) indicate that the more progressive a tax is, the more desirable it is on equality and equity grounds. However, from an efficiency standpoint there was failure identified in Jamaica where there was a lack of administrative capacity either due to inadequate expertise and training or to the capabilities of the human resource stock.

Developing countries have shifted their focus from their reliance on direct taxes to a greater reliance on indirect taxes (OECD, 2006). Early reform efforts within the Caribbean region saw the elimination of a number of indirect taxes which in most instances were condensed into one broad based tax. This was approached by effectively lowering the marginal tax rates that were previously applied (Seerattan and Charles, 2004). This was further supplemented by replacing a myriad of small indirect taxes into one broad-based sales tax. Initial objectives of this strategy would essentially be the increasing of efficiency and reductions in inequity. However, concerns regarding the ability of this

move to achieve equitable objectives were raised by Seerattan and Charles as well as by Ghandi (1992). These concerns can be deemed justifiable since the literature identifies that sales taxes by their very nature are regressive.

The redesign of the indirect tax scheme within the region was successful in countries such as Jamaica, Barbados, Trinidad and Tobago, and Dominica. This success was judged in terms of the percentage of indirect tax revenue that forms part of the total tax revenue. In every case, indirect taxes accounted for more than fifty per cent of total tax revenue. Theodore (1992) indicated that developing countries should not haphazardly implement tax reforms as a means of obtaining buoyant revenue sources as the practicality of implementing a certain type of tax regime is important in achieving the specified goals and objectives of the tax system. He further indicated that all other revenue bases such as key sectors within the economy should be fully exploited before seeking to increase domestic revenue via taxation.

In most instances reform within the region involved the implementation of the broad-based Value Added Tax (VAT) implemented on efficiency grounds. Many countries in the Caribbean began implementing the tax in the early 2000's and throughout that decade it has been an increasing trend. Bain (2002) indicated that international institutions such as the International Monetary Fund (IMF) and the World Bank encourage countries within the region especially those that are going through structural adjustment programs to implement VAT as a medium term revenue enhancing strategy. The regime is seen to be revenue enhancing since the tax is levied on a buoyant base. The revenue created is very valuable especially in countries where the income tax base is relatively small as well as countries experiencing problems with the implementation of property tax. The Economic Commission of Latin America and the Caribbean (ECLAC) (2006) as well as Ebeke and Ehrhart (2011) supported the notion of the stability of the VAT revenues in that countries with VAT experience 40% to 50% less tax revenue instability than countries that do not have a VAT system. These effects however differ with levels of economic development and trade openness. Thus the effect is stronger in low income countries that have a low exposure to external shocks which is mainly a function of their degree of trade openness. Bain applied this theory to the Eastern Caribbean Currency Union (ECCU) by indicating that the system of taxes that was previously used that targeted specific sectors, yielded low revenues.

Factors that should be considered before the actual implementation of a VAT system include administration, legislation and the distortions that may be caused with the current system of taxes (Cotton, 2006). Various country studies conducted by the IMF within the Caribbean region have indicated that the VAT implementation procedures, legislation and administration are fairly uniform within the region's participating countries.

Cotton (2006) further draws heavily from the Caribbean experience with specific reference to Barbados, Jamaica and Trinidad and Tobago. A major feature of the VAT system is the avoidance of "cascading" or "tax on tax" that causes distortions that arises from the taxes being levied on inputs of the production process and those same taxes being levied on the output from that same production process. Furthermore, by its very design, VAT facilitates a greater level of transparency since all firms whose annual revenue exceeded a particular threshold was legislatively bound to participate.

The regressive impacts of VAT, like any indirect tax, can be neutralized and might even be reversed through a redistribution mechanism whereby goods that are consumed by the lower income earners in society are exempt from the tax (Barreix et al., 2010). A major concern highlighted with the existence of VAT is the existence of these zero-rated goods and services that are exempted from the tax. The view is that a significant amount of revenue is forgone with the existence of these items as the tax base is undermined (Cotton, 2012). Further disadvantages identified with the VAT can be examined in terms of the administrative and compliance costs associated with initially instituting the system (Keen, 2012). Attempts to simplify the perceived rigid administrative structure of the system were seen as a major reason for its underperformance, in addition to zero rated items. However, attempts to make adjustments to the tax base were widely unsuccessful. Other administrative weaknesses that have been identified with the system are the efficiency in the processing of tax refunds, the inadequate training for proper implementation as well as the requirement for VAT registered companies to keep proper books.

The higher the tax rates, the more difficult it is to sustain in the competitive globalized economy. This is especially true for taxes on capital income, including taxes on dividends, interest, capital gains, business profits, and wealth. High taxation of capital income may potentially reduce domestic savings and investment and drives out capital, which reduces a nation's productivity, wages, and income levels over time (Cato Institute, 2009).

Other forms of direct taxation, such as corporate income tax structures in developing economies, have in many instances been modeled along the lines of structures in more developed countries. In many cases tax rates were cut while there was a simultaneous increase in the bases (Abbas et al., 2012). The OECD (2008) indicated that due to the increasing mobility of investments across borders as well as the declining corporate tax base, rates have been on the decline globally.

In the developing country context there are other issues relating to tax policy and the tax base that are extremely relevant. Foreign Direct Investments (FDI) forms a major part of developing economies and has a major role to play in developing the productive capacity of such nations (Sun, 2002). There is the rational expectation that taxes increase the cost of capital and therefore serve as a disincentive to invest. This leads to what many theorists call corporate income tax competition. This is commonly defined as the lowering of a country's tax burden relative of other jurisdictions in order to attract FDI. This type of behaviour is consistent with what is termed in economic theory as, 'a race to the bottom' which essentially characterizes the demise of capital income taxation as a form of government revenue (Nassar, 2007).

One school of thought that includes Oates (1972) indicates that corporate income tax competition leads to an inefficient provision of public goods. This is directly as a result of the low inefficient taxes levied on mobile capital. Bain (1995) and Chai and Goyal (2006) in analyzing this type of competition within the Eastern Caribbean Currency Union (ECCU), indicated that there is a considerable amount of revenue foregone due to tax concessions. Additionally, in quantifying the effects of harmful tax competition, it is estimated that within the currency union, an amount approximating to nine per cent of GDP is forgone annually.

Given the recent wave of trade liberalization, developing economies have become more open especially with the formation of regional trade and economic partnership agreements. Most of these Regional Economic Partnership Agreements (REPAS) institute tariff cuts as part of bilateral trading

arrangements. In analyzing the impact of tariff cuts on particular countries, Elborgh-Woytek et al. (2006) indicate that the actual impacts depend on the initial trade value taxes and falling tariff revenues is an unavoidable consequence.

In an OECD analysis on the impact of trade liberalization on 24 countries, it was revealed that countries with higher and more dispersed tariff barriers, while being well positioned to benefit from tariff reform, are also more vulnerable to losses in revenue. While there are identified problems associated with tariff reduction, some benefits can actually be derived from increased liberalization. Some positive impacts include; (i) a reduction in tariffs can lead to increased import volumes as a result from both the income and substitution effects; (ii) demand could shift items with higher tariff rates as a result of an income effect; (iii) the depreciation of the domestic currency following trade liberalization could raise the value of imports and tariff exchanges in local currency; and (iv) over the longer term, there would be an expected increase in economic growth which is directly related to trade liberalization (Elborgh-Woytek et al. 2006).

Tanzi and Zee (2001) highlighted some suggestions as it relates to the losses in revenue due to the existence of tariffs. They identified that reducing tariffs as part of trade policy is a major challenge. However, losses can be avoided through the implementation of some separate measures that offers compensation. The suggested measures would effectively reduce the scope of tariff exemptions currently in the system which is followed by compensation for the reduction on taxed imports by an increase in excise rates followed by an eventual adjustment of consumption taxes such as VAT to meet revenue shortfalls.

Prior to the wave of globalization and trade liberalization, the general design of tax policy in the developing country context was such that the protection of domestic industries as well as the traditional sector took precedence. Mourmouras and Rangazas (2008) made the point that taxation and other government policies have the effect of pushing economic activity underground. They made reference to instances whereby government policies in the long term lead to an increase in informal sector activity which in effect significantly impacted economic growth. The growth in the informal sector also has significant impacts on the public sector infrastructure. Loayza (1997) studies the urban informal sector which indicates that the traditional sector is difficult to tax due to each country's special case whereby it is actually difficult to identify the sector. Empirical evidence suggests that the reduction in the tax base, when tax rates are raised, is directly proportional to the size of the traditional sector. Given this situation an identified problem with tax policy is the methods of evasion that are utilized in the developing countries even if they are marginal. It was indicated that when the traditional sector is relatively attractive, it generally gives households a legal way to avoid taxes. Conversely, if the traditional sector is not attractive, households and firms will remain in the modern sector and must illegally avoid taxes or create complicated legal ways of doing so.

In an investigation on shuttle trade in a cross section of Caricom countries Franklyn (2010) indicates that governments can use their policies to better facilitate these traders. Essentially, changes in government policy would encourage these traders to open registered businesses. In this article, it was identified that tax burden was seen as the main causal factors for the increasing incidence of shuttle trade in Dominica, Jamaica and Guyana. The growth of shuttle trade may be seen in some spheres as increasing evasion and avoidance costs due to informal sector development.

In some instances Gordon and Li (2008) found that firms are able to successfully avoid taxes by conducting transactions in cash and avoiding the financial system. There is an assumption that governments rely heavily on the financial sector for information to identify taxable entities and measure the level of taxable activities. Based on this assumption albeit weak, it is plausible to therefore make an additional assumption that firms become subject to taxes if they opt to utilize the financial system. When tax rates are high enough, firms may forgo whatever benefits are derived from using the financial institutions in order to avoid taxes. In developed countries this is of little relevance, however in the developing country context where major revenue constraints are faced, this can have serious implications for the domestic revenue base.

Developing countries are faced with a special set of circumstances in that there are limited public finances to undertake desired development goals and objectives. The literature identifies that key to overcoming this challenge is through the identification of an optimal tax policy that effectively reallocates resources efficiently in order that desired objectives materialize. Therefore, in order to improve social and economic welfare given the domestic income constraints, it is imperative that the right mix of direct and indirect taxes form part of tax policy. Furthermore, practical sustainable solutions to boost tax revenue while mitigating economic distortions should be backed by legislation independent of political motives and supported by a strong institutional framework.

2.3 Tax Elasticity and Tax Buoyancy: A Theoretical and Empirical Overview

Indraratna (2003) in investigating facets of the Pakistan tax structure indicated that one of the primary motives for tax reforms in developing countries has been the need for increased revenues to finance the domestic budget. It is therefore becoming increasingly important for the central government to raise more tax revenue while simultaneously increasing expenditure whether current or recurrent when compared to other sources of resource mobilization such as deficit financing and money creation.

In many instances especially with regard to the developing state, the tax system fails to generate sufficient revenue to finance recurrent expenditure hence the state consistently operates with budget deficits. This phenomenon could be attributed to lack of responsiveness of tax revenue to changes in national income. Therefore productivity of the tax system is determined by applying the concepts of tax buoyancy and elasticity. The assessment of tax productivity is important not only because it allows us to examine the responsiveness of the tax system, but also because it affects the system's equity and efficiency effects. (Isaac and Samwel, 2012)

In early studies on tax elasticity and tax buoyancy, Mansfield (1972) defines tax elasticity as the change in tax revenue that arises directly from a unit change in income. In more specific terms, tax elasticity may refer to the ratio of proportionate change in tax revenue to the proportionate change in income as measured by the gross domestic product (GDP). Additionally, in further defining tax elasticity, Cotton (2012), like many other writers on the issue, highlighted that the measure of tax elasticity is exclusive of discretionary changes in domestic tax policy. Tax elasticity of total tax revenue can be expressed as follows:

$$E_{Tt}y = \frac{\Delta T_t}{\Delta Y} \frac{Y}{T_t}$$

$E_{Tt}y$, elasticity of total tax revenue to income

T_t: total tax revenue

ΔT_t: percentage change in tax revenue

Y: income (GNP)

ΔY: Percentage change in income [2]

Mansfield (1972) further defined the closely related concept of tax buoyancy as the percentage change in tax revenues, including discretionary changes, associated with a given percentage change in income. Tax buoyancy for the total tax system is expressed as:

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[2] Mansfield (1972)

$$E^b{}_{TY} = \frac{\Delta T^b}{\Delta Y} \cdot \frac{Y}{T^b}$$

$E^b{}_{TY}$: buoyancy of tax revenue to income

T^b: Total tax revenue

ΔT^b: Percentage change in tax revenue

Y: Income (GNP)

ΔY: percentage change in income[3]

An important distinction that can be made between the two measures is the inclusion and exclusion of discretionary changes in tax policy. Therefore, tax buoyancy which includes the discretionary changes is a measure of both the soundness of the tax bases and the effectiveness of tax policy changes in terms of revenue collection. One way for countries to raise additional revenue to finance development includes the implementation of discretionary tax policy. Such changes may take the form of changes in the tax rates, brackets, coverage, exemptions and deductions in a given fiscal year. Tax elasticity on the other hand reflects only the built-in responsiveness of tax revenue to movement in national income (Jenkins et al., 2000). Howard et al. (2009) highlighted that in the developing country context measures of tax elasticity and tax buoyancy are of extreme importance since in these economies there are considerable lags in tax collection which makes it possible for individuals and firms to evade taxes.

Mansfield (1972) and Howard et al. (2009) highlighted that high tax elasticities and buoyancies are considered good for developing countries because governments can pursue expenditure policies without the need for increasing tax rates and the tax base frequently. Essentially, this is important for financing developing states in cases where the central government does not have the political will to raise taxes that may be socially harmful to the populace. An elasticity coefficient of one would indicate a similar growth for both revenue and GDP while a coefficient less than one would show lagged tax revenue growth compared to GDP growth. An elasticity of more than one would indicate tax revenue growth exceeding GDP growth. Likewise, a buoyancy of one would indicate a revenue growth in line with GDP growth. A buoyancy of less than one would be indicative of a growth in revenue which is less than proportionate to GDP growth while a buoyancy of more than one would show a more than proportionate growth in revenue. (Indraratna, 2003)

Given that developing economies are characterized by large primary sectors of which the agrarian sector forms a large part, determining elasticity and buoyancy is of extreme relevance as the tax policy in such states is characterized by certain peculiarities. Such peculiarities are directly related to the structural make up of those states. Ahmed and Mohammed (2010), in attempting to determine the

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[3] Mansfield (1972)

factors that influence elasticity and buoyancy, identified that the agricultural sector growth coefficient is insignificant in the economy studied in most of the developing countries. This is due to the fact that within the agriculture sector income is exempted from being taxed because of the need to grow and protect such sectors in these economies. This is one of the important reasons for low tax buoyancy and hence low tax to GDP ratio in developing countries. The same study by Ahmed and Mohammed found that the manufacturing and growing services sectors within developing economies positively impact tax collection through personal income taxes, corporate taxes and payroll taxes. Furthermore, in most developing countries the development of the banking and financial sector causes a significant impact on direct tax buoyancy.

In studies on tax elasticity and buoyancy, the methods utilized to estimate coefficients are; the proportional adjustment method, constant rate structure, dummy variable approach and the Divisia Index. In terms of the Partial Adjustment method, Mansfield (1972) indicates that a relationship should be established between tax and GDP. This is done by utilizing a linear Ordinary Least Squares (OLS) approach. By doing this, the buoyancy coefficient is estimated. However, in order to calculate elasticity, the effects of discretionary changes in tax policy must be eliminated from the data utilizing a 'data cleaning' exercise. Mansfield indicated that in cleaning the data, first a preliminary series of tax yields is prepared. This is done by subtracting from the actual yield for each year the amount estimated to be attributed to the discretionary changes in that particular year. Second, the adjusted series is further fine-tuned by the application of a formula that excludes the continuous impacts of discretionary measures in future periods in order to eliminate the effects of the tax base being examined. A major drawback of the Partial Adjustment (PA) method as identified by Ehdaie (1990) is that budget estimates of discretionary tax changes are difficult to obtain from many developing countries and most times if they are available; their reliability will be questionable and may differ from actual discretionary figures.

Ehdaie (1990) indicates that the constant rate structure (CRS) method requires data on income bracket rates as well as disaggregated information in the growth and distribution of the tax bases. Given that the information is available, a constant rate-base series representative of hypothetical yields is developed. The method only takes into account discretionary changes resulting from statutory tax changes and ignores changes attributed to administrative efficiency and changes in the tax base. The method also incorporates some facet of the PA method in calculating elasticity. Choudhry (1979) indicates that the method is inefficient not because of data issues identified by Ehdaie, but in instances where the tax base has a variety of progressive elements as well as in instances where the tax base grows at a constant rate.

The third method, which is the dummy variable approach, uses dummy variables as proxies for discretionary tax measures for the period being investigated. Using this method, elasticity is estimated using a single equation econometric model (Ehdaie, 1990). Ehdaie further indicated that this estimation method may not be precise as problems with multicolinearity may be encountered through the use of more than one dummy variable.

The final method, which is the Divisia Index (DI) approach as utilized by Choudry (1979), goes through the following process. This measure uses trends in the data as a proxy for discretionary tax measures (DTMs) in an aggregated tax function (Ehdaie, 1990). In estimating the Divisia Index, first a

formula is derived which generates an index representing the revenue impact of DTMs. Second, the growth rate of this index is divided by that of the tax base; this ratio measures the growth rate of tax revenue resulting from DTMs in terms of a one per cent increase in the base. Finally, tax elasticity is calculated by subtracting this ratio from the tax buoyancy. [4]

In bringing the study of tax elasticity and buoyancy to the Caribbean region, Boamah et al.(2003) of the Central Bank of Barbados conducted a study on elasticity and buoyancy in Barbados from 1977 to 1999. What the study sought to do was to evaluate the performance of the Barbados fiscal system based on their analysis of the productivity of tax revenue within the system. The study found direct taxes to be elastic; furthermore there was an indication that the tax system can be made responsive with the vigilant implementation of some discretionary changes to current tax policy. Additionally, the study indicated that the implementation of the value added tax (VAT) in 1997 would in the future boost the responsiveness of indirect tax revenues and would essentially replace the need for frequent discretionary changes in policy. Among the direct taxes there exist high elasticities and low buoyancies, which indicates that the direct taxes become more regressive when discretionary changes are made.

In a study conducted in Jamaica, Milwood (2011) investigated the period 1998 to 2010. The study found that discretionary changes in tax policy had an overall impact on the growth in total revenue over the period under review. Additionally it was revealed that the coefficient representing the automatic response of revenue to changes in the tax base was found to be less than unity. The interpreted was that the ability of the economy to raise revenue independently is weak and shortfalls are reconciled by discretionary measure as well as by borrowing. This was further justified by the finding that the actions of the central government to utilize discretionary policies indicate that certain administrative and structural factors can account for this. However, the propositions made as to the types of structural factors involved are difficult to support with evidence. The first proposition was that of the operation of the industrialization model using foreign investment deprived the public sector of essential revenue. This low buoyancy was as a result of tax incentives that were granted to foreign investors. Additionally, issues relating to the growth of the informal sector and underground economy in Jamaica and to some extent in Barbados account for some low level of buoyancy.

The results of a study conducted by Mitchell and Andrews (1999) on all ECCU countries focusing mainly on the annual buoyancy of tax revenue indicate that in most ECCU economies including Dominica, St. Lucia and Antigua and Barbuda during the 1980's each of their tax systems was very buoyant. The results of the study further indicate that as time progressed going into the 1990's the total tax revenue in these economies started to become less buoyant. The paper suggests as a reason for the decreasing buoyancy is the changing of the sociopolitical state of affairs within these countries in terms of them shifting from colonies to independent states. This was posited because as colonial states the administration and compliance of taxes were tight. Thus, the metropolis was able to maintain buoyant revenues with narrow bases that are characteristic of the economies of the ECCU.

In accounting for low buoyancy coefficients in the region, Howard et al. (2009) also indicated those administrative factors such as evasion, as well as the lags in the collection of revenue, have a part to play. It was identified that there was relatively high evasion in Jamaica, Trinidad and Tobago and Barbados. There was also an indication that multinational firms reduce their tax liability through the

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[4] Drawbacks to this method in terms of biases are highlighted under the methodological section.

mechanism of transfer pricing. It is difficult however to ascertain the total cost to the public of the losses accrued due to transfer pricing, but it can be considered to be a substantial figure.

3. Methodology

In order to calculate the tax elasticity and tax buoyancy, annual time-series data were collected for 1980 to 2010. The data comprise of GDP, aggregated direct taxes and aggregated indirect taxes. Data was collected for Antigua and Barbuda, the Commonwealth of Dominica and St. Lucia from the Eastern Caribbean Central Bank, and from an Economic Activity in Caribbean Countries report produced by ECLAC. Additionally, to complete the analysis and properly justify the results of the study, information was needed on discretionary tax measures that were exercised in each individual country. This information was obtained from the budget speeches that spanned 1980 to 2010 for each country.

The tax buoyancy coefficient is obtained through an econometric methodology utilizing econometrics software EVIEWS by regressing the independent variable (GDP) on the dependent variable (components of tax revenue). Best practices stipulate that in order to determine the appropriate methodology which obtains best results, the time series of each variable should be tested for stationarity - whether the variable fluctuates around a fixed mean. The most commonly used test of stationarity is the Augment Dickey-Fuller (ADF) test and the Phillips Perron (PP) test (tests for stationarity in the presence of structural breaks). It must be noted that these two measures complement each other and substantiate conclusions relating to stationarity.

Most studies on tax buoyancy utilize the Ordinary Least Square (OLS) approach in estimating the short run buoyancy coefficient and this method has a requirement that the time series be stationary. If a non-stationary time series is used to estimate OLS then the results of the estimation may be statistically unsound. In this case all the variables were found to be I (1) being integrated of order one (stationary after obtaining the first difference) thus making the OLS method an inappropriate measure.[5] The variables therefore seemed appropriate for cointegration. Before obtaining the coefficients, the separate specifications were tested to determine whether cointegrating vectors exists using the Johansen procedure.[6] The Vector Error Correction Mechanism (VECM) was utilized as an appropriate method for obtaining coefficients; however this yielded results that were not consistent with expectations. By rejecting the VECM an alternate measure, the Dynamic Ordinary Least Squares (DOLS) was explored.

Stock and Watson (1993) initially utilized the procedure in order to estimate the long run demand for real money balances (M1) in the United States. Additionally, for completeness, Milwood (2011) included the procedure in obtaining tax buoyancy coefficients for Jamaica. The DOLS, regression is specified as follows;

$$Y_t = X_t \acute{\beta} + D_{1t} \acute{\gamma}_1 + \sum_{j=-q}^{r} \Delta X_{t+j} \acute{\delta} + v_{1t}$$

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[5] See Appendix B
[6] See Appendix B

The study requires the estimation of three cointegrating regressions of a log linear specification for each component of taxation: total taxes (logT), direct taxes (logDT) and indirect taxes (logIDT). In each equation GDP is regressed on each component of taxation. This is done for each country.

The DOLS as conceptualized developed by Stock and Watson (1993) includes q lags and q leads of the first difference of the independent variable as expressed in cointegrating equations. These leads and lags essentially remove the harmful effects that the short run specification may have on the stochastic white noise process on the estimation of the cointegrating vector. The equation also possesses appropriate deterministic terms *D*. The derived DOLS estimator for the normalized cointegrating vector β is assumed to be consistent, asymptotically normally distributed and efficient. Additionally, various diagnostic tests (Jarque Bera test for normality, heteroscedasticity and Breusch Pagan test for serial correlation) are undertaken to verify the correctness of the models specification as well as the appropriateness of the selected methodology for the estimation of the buoyancy coefficient.

3.1 The Divisia Index Applied to Tax Elasticity

The Divisia Index (DI) will be the measure used for estimating the elasticity and buoyancy coefficients for the study. The measure was selected based on the advantages and the information requirements when compared with the other methods of estimation. In early studies relating to tax elasticity and buoyancy the DI method was applied by Choudhry (1979) in a study which utilized annual time series data for Malaysia, Kenya, United States and the United Kingdom. The method was also applied in the Caribbean region by Millwood (2011) in a Bank of Jamaica study in which monthly data over a ten year period was utilized.[7]

Choudhry (1979) renders the motivation as well as the theoretical and intuitive appeal for the utilization of the Divisia Index. The DI, which is an index of technical change, was employed by Choudhry because he posited that discretionary changes in tax policy accrue yields that transcend that which can be obtained from automatic growth in the tax base.[8] The analogy can be made based on the fact that technical change motivates changes in total productivity more than what is accounted for by changes in factor inputs alone. The index is essentially derived from a weighted sum of growth rates of factor inputs, where the weights are represented by the share of output attributed to that factor.

The measure in its original form is interpreted in terms of the percentage increase in total productivity that can be attributed to technical progress which is equivalent to the percentage increase in output divided by the percentage increase in factor inputs. The attractiveness of this index lies in the invariance property which indicates that if there is no technical change, then the index will remain

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[7] Although the aim of the study is not to calculate elasticity, the result from the DI methodology validates the consistency of buoyancy coefficients.

[8] The index of technical change is defined as an index the ratio of an index of total productivity to an index of factor productivity. The index of factor productivity is measured by the Divisia Index. The index applied in its general form and to public finance comes as a development from Solow (1957) as he exhibited '*Technical Change as an Aggregate Production Function'.* Choudry (1979)

unchanged and growth in productivity can only be attributed to input growth. Choudhry further highlighted two necessary and sufficient conditions whereby the invariance property is guaranteed;

i) There exists a continuously differentiable aggregate function, $f(x_1(t),.....,x_k(t))$ [9]
ii) The function f is linearly homogeneous (there exists constant returns to scale

These two properties are crucial to the workability and applicability of the index. Choudry indicates in the case of the continuously differentiable property, it is important to establish a relationship between tax yields and bases. This property also ensures the regularity of the function which acts against erratic behaviour within the function. The homogeneity property posits that with the existence of a progressive rate structure, as in the case of direct taxes such as income, an increase in per capita GDP is seen to cause a more than proportional increase in tax revenues.

The intuitive appeal of the DI makes it applicable to the issue of tax policy and obtaining coefficients for tax elasticity and buoyancy. Choudhry (1979), in applying the index, indicated that the Divisia Index of discretionary tax change corresponds to the index of technical change. The index would therefore be equal to the percentage increase in the total tax yield directly related to the increases in the tax base. Furthermore, it follows that a change in this index is reflective of the revenue effects of discretionary tax measures.

Trends in tax ratios can be explained by writing the aggregate tax revenue function T as a homogeneous function of GDP (x).

3.2 Derivation of the Divisia Index

$T = \alpha x^{\beta}$……………………………………………… (1)

T: tax revenue

X: Proxy base

β: coefficient for buoyancy

As the GDP rises over time, the tax ratio represented by T/x remains constant or rises when the value of β equals or bypasses unity. Equation 1 can therefore be rewritten as:

$\log T = \alpha + \beta \log x$…………………………………….(2)

The index can therefore be derived from:

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[9] An aggregate tax function is analogous to a production function. Choudry (1979)

$$D\ (n) = \left.\frac{\frac{T\ (n)}{T(0)}}{\ }\middle/ \prod_{i=1}^{k}\left[\frac{x_i(n)}{x_i(0)}\right]^{\tilde{\phi}_i}\right. \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (3)^{10}$$

D (n): index of discretionary tax growth (analogous to a shift in the tax function)

T (n): tax revenue in period n

T (0): tax revenue in period 0

X_i (n): Proxy base in period n

X_i (0): Proxy base in period 0

$\tilde{\phi}_i$: Weight for growth rate of automatic tax revenues - a weighted sum of growth rates of the proxy bases.[11]

Equation 3 represents the form of the DI which is a growth index for total tax revenues divided by the index of automatic growth of tax revenues which is expressed by the denominator. Equation 3 can also be rewritten in logarithmic form:

$$\text{Log } D\ (n) = \log\left[\frac{T\ (n)}{T\ (0)}\right] - \sum_{1}^{k}\tilde{\phi}_i \log\left[\frac{x_i(n)}{x_i(0)}\right] \quad \ldots\ldots\ldots\ (4)$$

Equation 4 defines the growth of discretionary tax revenues which is the difference between the growth rates of total tax revenues and automatic tax revenues. One of the methodological advantages of the DI over other methods is the non-adjustment of time series data. This is because the index provides growth of discretionary revenue without the need for 'data cleaning' to account for discretionary tax policy. It is noteworthy that the index is a precise index of discretionary measures of the underlying equation since it is the integral of all discretionary changes along the tax yield curve.

An important practical issue as it relates to the DI is that ϕ_i(t) is discrete and thus will contain some discretionary effects. In this discrete form, there is a likelihood that ϕ_i(t) will be biased and thus will affect the automatic growth revenue expressed by; $\prod_{i=1}^{k}\left[\frac{x_i(n)}{x_i(0)}\right]^{\tilde{\phi}}$. The bias will be upward (downward) when discretionary changes produce positive (negative) revenue effects. Thus, there is an

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[10] Seen Appendix D for derivation.

[11] $\tilde{\beta}_i = \frac{1}{n}\sum_{t=1}^{n}\phi_i(t)\frac{\rho_i(t)}{\bar{\rho}_i}$. Where, ϕ_i (t)$= \frac{T_i\ (t)-T_i\ (t-1)}{x_i(t)-x_i(t-1)} * \frac{x_i(t)}{T(t)}$. Also, $\rho_i(t) = \frac{x_i(t)-x_i(t-1)}{x_i(t-1)}$ and $n\bar{\rho}_i = \log\left(\frac{x_i(n)}{x_i(0)}\right)$

overestimation (underestimation), when discretionary measure produces positive (negative) revenue effects.

Once the DI is estimated or derived, then the buoyancy coefficient can be estimated from the underlying aggregate tax function in equation (1). Based on the assumption that the aggregate tax function f has a degree of homogeneity where $r > 0$, then it can be exhibited that the growth rates of all tax bases are equal to that of GDP, the tax function can be rewritten as follows:

$$T = \alpha x(t)^r D^*(t) = \alpha x(t)^\beta \quad\quad\quad\quad\quad\quad\quad (5)$$

x: GDP; D*: index for revenue growth due to revenue changes in the interval [o,t]; β: buoyancy coefficient of the tax yield. D* is said to be a special case of index D and has the same defined time interval [o, n] which may be expressed as:

$$D^*(n) = \frac{\dfrac{T(n)}{T0)}}{\left[\dfrac{X(n)}{X(0)}\right]^{\widetilde{\phi*}}} \quad\quad\quad\quad\quad\quad\quad (6)$$

$\tilde{\beta*} = \dfrac{1}{n}\int_0^n \phi(t)\dfrac{\rho(t)}{\rho}\,dt$, where ρ represents the growth rate of GDP. From 5, D* for the time interval [o, n] can be rewritten as:

$$D^*(n) = \left[\frac{x(n)}{x(0)}\right]^{\beta - r} \quad\quad\quad\quad\quad\quad\quad (7)$$

D* is invariant, therefore if there is no discretionary change in the time interval [o, n], both the elasticity and buoyancy coefficients will be equal which implies that D*(n) =1. The estimate for DI may also be represented as:

$$D(n) = \left[\frac{x(n)}{x(0)}\right]^{\beta - \hat{r}} \qu\quad\quad\quad\quad\quad\quad (8)$$

Taking the log and rearranging equation (8), elasticity coefficient can be derived.

$$\hat{r} = \beta - \frac{\log D(n)}{\log\left[\frac{x(n)}{x(0)}\right]} \quad\quad\quad\quad\quad\quad\quad (9)$$

Utilizing some alternative estimate for DI, D*(n) the elasticity of tax revenue can be derived as follows:

$$\hat{r*} = \beta - \frac{\log D*(n)}{\log\left[\frac{x(n)}{x(0)}\right]} \quad\quad\quad\quad\quad\quad\quad (10)$$

Essentially, $\hat{r}$ and $\hat{r}^*$ are equal if the bases grow at the same rate as GDP or at a rate that is proportional to the growth rate of GDP. The estimate $\hat{r}$ is based on a disaggregated DI method since it takes into account more than one base, while $\hat{r}^*$ is based on the aggregative DI method as it only considers GDP as the base. For the purposes of this paper, the aggregative method will be utilized.

4 Results and Interpretation

4.1 A Brief Overview of Trends in Total Tax Revenue from 1980 to 2010

Within the ECCU region taxes have always served as a prominent part of government revenue. In 1980, the ratio of total tax revenue to total government revenue lay between 0.5 and 0.75 which is deemed as very significant for the countries being studied. The rather vital nature of tax revenue to the countries within the small island grouping necessitates there must be productivity within whatever tax policies that are implemented. The ratio remained very high over the period under review in all three countries attaining highs of 0.93 in Dominica, 0.94 in St. Lucia and 0.95 in Antigua and Barbuda. The contribution of taxes to total revenue showed minimal deviation in terms of its relative importance to the revenue base in these countries. Over the 31 year period the average ratios approximated 0.82, 0.88 and 0.83 for Dominica, St. Lucia and Antigua and Barbuda respectively.

Chart 1:

Tax Revenue as a Ratio of Total Revenue for Dominica, St. Lucia and Antigua and   Barbuda
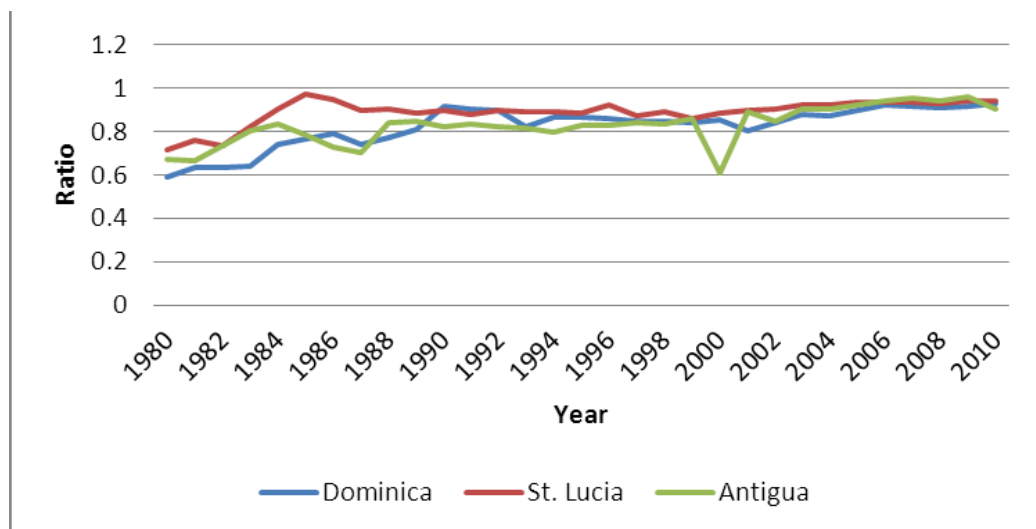
During the period under review the countries exhibited relatively stable trends in total tax revenue as well as the direct and indirect components. This is apparent in the clearly observed upward trends that the time series exhibit. This upward movement in tax revenue in each of these jurisdictions can be attributed to expansion of the actual bases of different components of the tax regime, the effects of discretionary policy materializing (which will be explored further) or both.

The data for Dominica indicate that for the period under review, total tax revenue ranged from $33.2 million Eastern Caribbean dollars (XCD) to $327.9 million XCD. The data exhibit a slight peak in 1992 where total tax revenue approximated to $125 million XCD. This slight increase decayed thereafter and the series returned to it uniform trend upwards until 2000 when total revenue peaked

again at $182 million XCD. This was followed by a decrease in 2001 (to $162 million XCD) and 2002 (to $161 million XCD). Thereafter, there was some sign of revenue recovery as it started to increase at what seems to be at an increasing rate which showed revenue increasing to $179 million XCD in 2003 and steady increases to $327 million XCD in 2010.

Chart 2:

Composition of Tax Revenue for Dominica
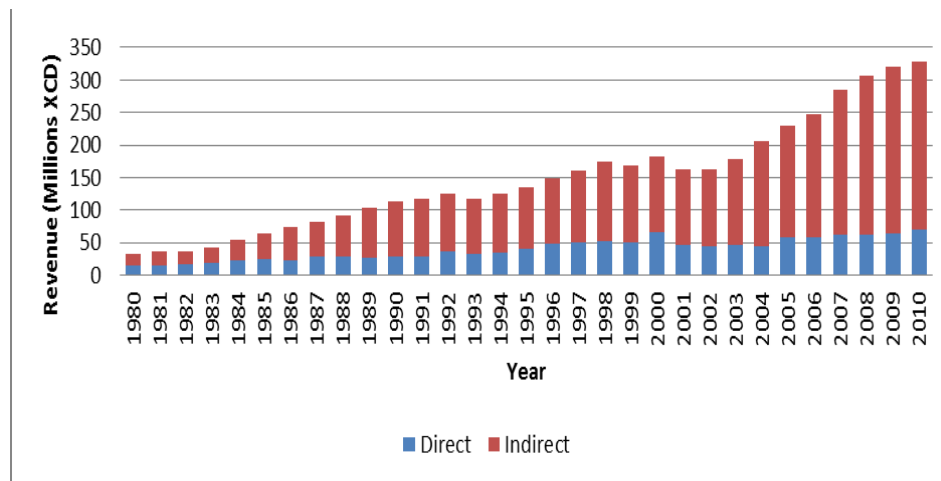
Like the total tax revenue for Dominica, that of Antigua and Barbuda exhibited the same pattern of behaviour throughout the series. There were no major spikes or troughs in the data until 2008 when total revenue peaked at $693 million XCD. Before this major spike in revenue, there were several years of steady increases starting in 2001 and began increasing sharply in 2005. However, revenue dipped following this major increase in 2009 to an amount of $573 million XCD which showed slow signs of recovery in 2010.

Chart 3:

Composition of Tax Revenue for Antigua and Barbuda
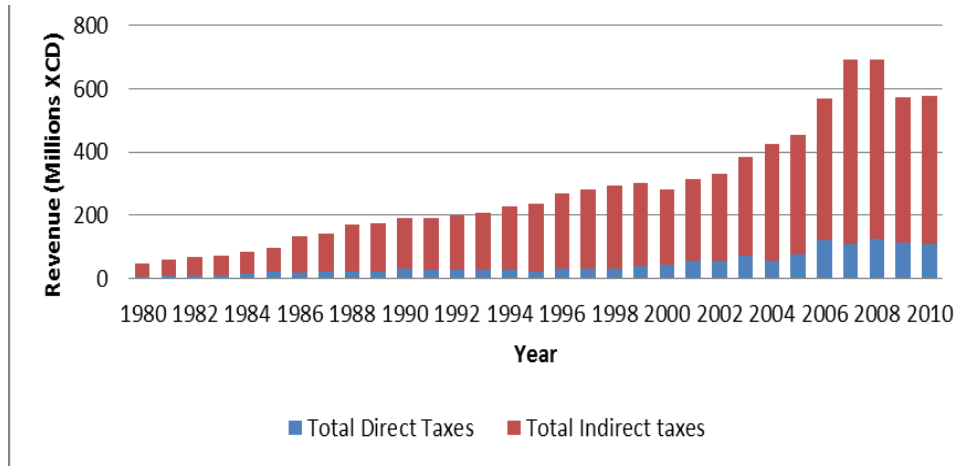
Unlike Dominica, and Antigua and Barbuda, there were no major spikes in total tax revenue observed over the period under review for St. Lucia. Total tax revenue in 2010 is over ten times more than what it was in 1980. The time series exhibited only two slight dips in revenue in 1997 and 2002 when tax revenue approximated $281 million XCD and $332 million XCD respectively. However, an increasing rate of growth was observed from 2003 to 2008 when total tax revenue reached its maximum at $693 million XCD. Total revenue however began a slow decay thereafter.

Chart 4:

Composition of Tax Revenue for St. Lucia
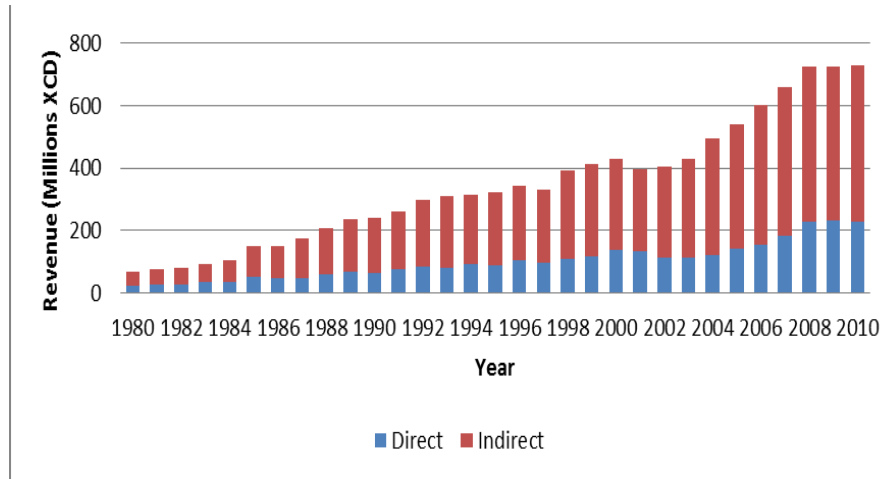
The characteristics within economies of the ECCU as in any other economy are major determining factors in terms of the structure and composition of each economy. In 1980, the value of the tax ratio (measured by total tax revenue divided by GDP) in all three jurisdictions was approximated at 15% in St. Lucia, 20% in Dominica and 23% in Antigua and Barbuda. Over the years there is an apparent upward trend in the tax ratio that suggests that tax revenue is becoming an increasingly important component to the revenue base of Small Island Developing States (SIDS). In 2010, the tax ratio was over 70% approaching 80% for Dominica and Antigua and Barbuda, while it was not significantly lower for St. Lucia at just over 60%. This tax ratio as highlighted by Choudry (1979) is an important determinant of buoyancy as well as elasticity estimates for economies and the period being investigated.

Chart 5:

Trends in the Tax Ratio (Total Tax Revenue/ GDP) in Dominica, St. Lucia and Antigua and Barbuda from 1980-2010
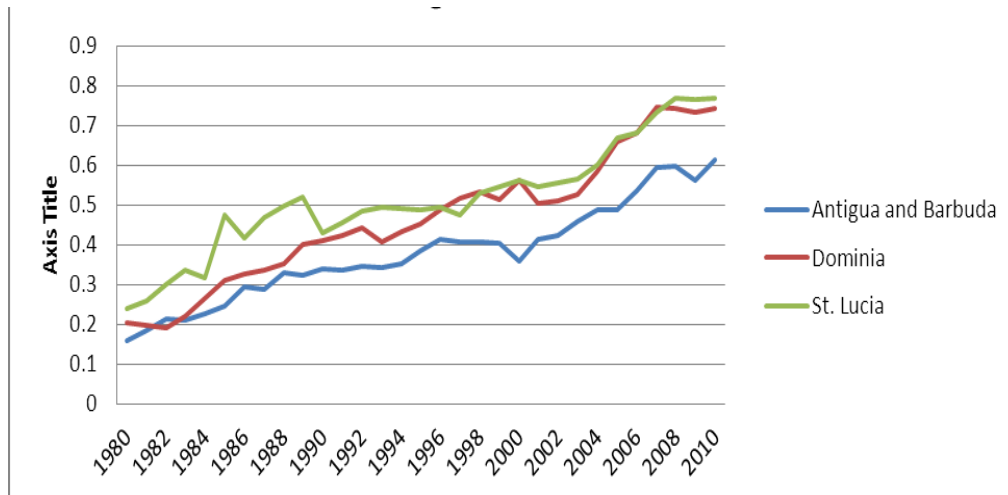
Given these obviously high tax ratios, it is very important that these SIDS maintain elastic as well as buoyant tax regimes. The values obtained for those coefficients will have a lot to say regarding the productivity as well as efficiency of the tax system. These phenomena may have further implications in terms of financing development objectives in the face of revenue constraints.

4.2 The Index and Coefficients

The calculated Divisia Index for each individual jurisdiction reveals that tax revenue has grown marginally from the period 1980 to 2010. The growth of total tax revenue for Dominica was 0.99, 1.04 for St. Lucia, and 1.07 for Antigua and Barbuda. In the case of Antigua and Barbuda and St. Lucia, there was little variation between the growth of direct as well as indirect taxes. However, in the case of Dominica, the low growth of the direct taxes contributed to the low overall growth of total tax revenue. Additionally, it is indicative that discretionary tax measures had a role to play in the growth of total tax revenue. In all cases discretionary changes accounted for less than 1% of the growth in total revenue; the index reveals that for Dominica discretionary growth was 0.92% and 0.96% for St. Lucia and 0.99% for Antigua and Barbuda. The results indicate that for each category of tax revenue, discretionary measures had the bigger part to play.

Given that the automatic growth within each country for each tax category is tending to zero, this says that these economies have a limited ability to raise revenue independently. It follows that shortfalls in revenue have to be met by the implementation of discretionary measures or supplemented by external borrowing. These results tell a different story from that which was told by Millwood (2011), as he indicated in his study that growth in total tax revenue in Jamaica was mainly attributable to the built-in response of revenues to growth within the tax base.

Table 1:

Discretionary Growth, Automatic Growth and Total Growth of Tax Revenue

	Dominica			St. Lucia			Antigua and Barbuda		
	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect
Discretionary Growth	0.92	0.67	1.08	0.96	1.01	0.99	0.99	1.13	0.98
Automatic Growth	0.07	0.02	0.06	0.08	0.02	0.05	0.08	0.01	0.07
Total Growth	0.99	0.69	1.14	1.04	1.03	1.04	1.07	1.14	1.05

The Gross Domestic Product of each individual jurisdiction was used as the proxy base for each category of tax. This common base is justifiable on the grounds that each tax category represents an aggregate and the principle macroeconomic aggregate of GDP would serve as the most appropriate base. Braz et al. (2009), in investigating sustainable fiscal policy in Eurozone economies, indicates that the identification of appropriate bases is important in explaining the mechanisms of the government revenue especially within the tax system.

Table 2:

Tax Categories and Relevant Bases

Tax Category	Proxy Base
Total	GDP
Direct	GDP
Indirect	GDP

The results obtained from the generic Dynamic OLS model for the buoyancy estimates for each of the countries revealed that over the period, each category of tax revenue possesses very buoyant revenue structures. The buoyancy for total tax revenue for Dominica was estimated at 2.67 and 1.74 and 1.82 for St. Lucia and Antigua and Barbuda respectively. It is noteworthy that in Dominica and St. Lucia the buoyancy coefficients were higher for indirect components; whereas for Antigua the buoyancy coefficient for the direct taxes was higher. Furthermore, it can be said that the components

that possess the higher coefficients are the components that contribute the most to the overall buoyancy of the system. The somewhat high buoyancy coefficients which are estimated to be above unity indicate that the rates of tax revenue increase are equal to or greater than the rates of increases in income. ECLAC (2006) indicates that a coefficient that is higher than unity implies that in times of economic fluctuations, the fiscal balance is likely to deteriorate as the reductions that occur in domestic production will result in more than equi-proportional decreases in revenue. It also implies that tax revenue increases faster than growth in GDP. This also followed results from a study which indicated that countries within the ECCU possess a more buoyant tax revenue structure than other countries within the Caribbean region.

The cointegrating regression estimated to obtain buoyancy coefficients for each country:

Total Taxes: $\log T = \alpha + \beta_1 \log GDP + \sum_{j=-q}^{p} d_1 \Delta \log GDP_{t-j} + U_t$

Direct Taxes: $\log DT = \alpha + \beta_1 \log GDP + \sum_{j=-q}^{p} d_1 \Delta \log GDP_{t-j} + U_t$

Indirect Taxes: $\log IDT = \alpha + \beta_1 \log GDP + \sum_{j=-q}^{p} d_1 \Delta \log GDP_{t-j} + U_t$

Table 3:

Estimate of Buoyancy and Elasticity from 1980 to 2012 Utilizing Dynamic OLS Estimates

	Dominica		St. Lucia		Antigua and Barbuda	
	Buoyancy	Elasticity	Buoyancy	Elasticity	Buoyancy	Elasticity
Total Taxes	2.67	1.78	1.74	0.83	1.82	0.87
Direct Taxes	1.76	1.11	1.40	0.44	1.84	0.75
Indirect Taxes	3.02	1.97	1.88	0.94	1.49	0.55

The estimated elasticity coefficients that are derived from the Divisia Index which adjusts the buoyancy coefficients indicate slightly differing results for each country. Dominica's total tax system and its components are elastic, but these elasticities are very low.[12] St. Lucia and Antigua both have inelastic tax structures in terms of the overall tax system and the components. In observing the contribution of each component to the overall elasticity of the tax system, indirect taxes favour a more elastic structure with the coefficients for indirect taxes for Dominica and St. Lucia being 1.97 and 0.94 respectively. On the other hand, in Antigua and Barbuda direct taxes seemed to favour the elasticity of the overall system with a coefficient of 0.75. Choudry (1979) indicated that the larger the value of the elasticity and buoyancy, the faster the rise of the tax ratio. Thus, based on this study, it is indicative that the countries being studied possess high tax ratios with Dominica at 74%, St. Lucia at 77% and Antigua at 69%. Therefore, given that Dominica's tax ratio has been increasing the fastest of all in the

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[12] See appendix C for full results of estimation using Dynamic OLS.

three jurisdictions, it is clear that the buoyancy and elasticity coefficients are consistent with expectations.

The high tax-to-GDP ratios are indicative of the efforts of the governments of the region towards fiscal consolidation using revenue side policies. The Organization for Economic Corporation and Development (OECD) (2012) indicates that increasing tax rates on the more elastic bases may severely impact growth negatively. This in itself should serve as a point of reference in terms of the way central governments design their fiscal policy. This should be done in such a way that it encourages growth while at the same time minimizing the amount of macroeconomic distortions that may take place.

In each of the countries and in each category of taxes, the buoyancy coefficients exceed the elasticity coefficients with the variation being greater in some countries than in others. The higher variations were found for total taxes in St. Lucia (0.91) and Antigua (0.95) which both have inelastic tax structures; also the variation between elasticity and buoyancy for Dominica was 0.89. All these values are not significantly different from each other and have little variation among them. The difference in the size of these coefficients is due partly to the revenue generating effects of the discretionary policies that have been implemented. Thus, it is clear that discretionary policy has a slightly greater impact in Antigua and Barbuda and St. Lucia than in Dominica.

Tax reform as exercised through discretionary policy has been actively implemented within the ECCU countries throughout the past 30 years. The literature distinctly indicates that discretionary measures to a great extent impact GDP growth. However, in the current context, have these changes in tax policy significantly induced GDP growth?[13]

Each of the countries being studied has made various changes to their direct taxes throughout the period under review. The direct taxes within these countries mainly include taxes on income from individuals, corporate income taxes and property taxes. However, these tax components are seen to have their weaknesses in terms of the effectiveness of their revenue generation abilities. In all cases within these countries it was observed that there have been similar trends in terms of the measures of tax reform which have been put in place.

With regards to personal income taxes, on multiple occasions the taxable income threshold has increased thereby excluding more and more people from taxable brackets. Additionally, marginal income tax rates in all of these countries have been reduced. The measures implemented offered some relief to taxpayers. Furthermore, the number of individuals paying income taxes was reduced with each income tax reform implemented. These measures wherever implemented have the overall goal of encouraging participation and reducing levels of evasion and avoidance. These reforms seem to be successful as it appears that income taxes contribute more to buoyancy of direct taxes than the other taxes in that category since the measures did not affect the progressivity of the tax. However, the number of exemptions and low income tax rates significantly limit the revenue generating capacity of direct taxes in these economies. This limitation is mainly due to the small bases and relatively low rates that exist in these countries.

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[13] See Appendix E for details regarding discretionary tax policies that have been implemented in Dominica, St. Lucia and Antigua and Barbuda for the period under review.

Additionally, there was a need for countries to reduce their reliance on direct taxes (Cotton, 2012). In all these jurisdictions there have been multiple decreases in the corporate income tax level. In addition to the small size of the corporate sectors in each of the countries, low buoyancy of the corporate income taxes is also attributed to the concessions granted to private firms in an attempt to boost economic activities in certain areas of the private sector through FDI inflows. This is analogous to what was described by Nassar (2008) and the inelastic relationship between FDI and corporate income taxes since tax policy is counterproductive in attaining FDI.

In terms of property taxes there has been little tampering with the established rates. However, St. Lucia and Antigua and Barbuda have amended how property is appraised, switching from the rental value of the property to the market valuation of the property. Allowing the free market determination of assessing the tax payable to the state was believed to attract some form of cooperation from the general public. Essentially this would mitigate the occurrence of the issues of tax evasion and avoidance. Overall property taxes contribute little to total tax revenue and its weak administration within the region indicates that it contributes very little to the buoyancy of the tax system. "Real property in the OECS/ECCU is taxed at a low recurrent rate, ranging between 0.001 per cent and 0.5 per cent of the market value of the property" (Cebotari et al., 2013). Property taxes are seen as being underutilized as a potential source of tax revenue to be exploited since rates applied in the region are significantly lower than rates that are applied internationally.

In many countries, indirect taxes are the major contributors to domestic tax revenue and are the subject in many cases to the most reforms. Throughout the period under review there has been the introduction and abolition of different components of indirect taxes. Additionally, there are those components that have been faithful contributors to revenue and can be blamed for a minimum amount of distortions within the domestic economy.

The tax levied on foreign exchange in Dominica and St. Lucia as well as taxes on bank deposits and taxes on loans to non-nationals were seen to contribute little value to the domestic economy. In earlier reforms, they were reduced and this led to their eventual elimination altogether in the case of Dominica. However, some facets of these taxes are still existent in the tax system of St. Lucia. Although the removal of these taxes deprives the state of revenue, it is justifiable on efficiency grounds. Less is required of the tax authority for administration and in some instances there is an improvement when considering equity outcomes.

In some instances, there has been the consolidation of various taxes such as stamp duties and taxes on domestic transactions into one broad-based consumption tax. There was the effective reduction in the number of tax categories and the broadening of bases. There was also the exemption of various items from being subject to taxation with the most common items being building and housing material. The exemption of items from being taxed was a policy which sought to encourage the growth within the construction sectors which will lead to an eventual increase in physical infrastructure. It is noteworthy that with regards to consumption taxes, their rates were increased; additionally, in other periods there was a decrease in the consumption tax rates.

Import duties, consumption tax and customs service charges form the major parts of international trade taxes in ECCU economies. ECLAC indicated that revenue derived from international trade for small, service-type economies is the most important source of tax revenue. These levies on trade transactions make up over half of total tax revenue collected by the revenue authorities

in those countries. Thus, in Antigua and Barbuda and St. Lucia, which are service-intensive economies, international trade taxes contribute significantly to the buoyancy of the indirect taxes.

One of the most recent implementations legislated within some ECCU economies is the 15% value added tax (VAT) on goods and services. This was implemented in Dominica in 2006, Antigua in 2007 and St. Lucia in 2012. St. Lucia implemented VAT as a means of widening the tax base and the same can be said for Dominica and Antigua and Barbuda. Although VAT is evidently very recent in the Caribbean, it may have made a significant contribution to the buoyancy of the indirect taxes in Dominica with similar effects expected for St. Lucia as revenue gains begin to be realized as years go by. VAT replaced the consumption tax that was previously levied on goods in Dominica and also serves as a replacement of a few nuisance inefficient taxes. The design of VAT effectively increased the efficiency and the stability of indirect taxes on domestic goods and services. However, though VAT is a very buoyant tax, it was identified by Cebotari et al. (2013) that features such as the exemptions and zero ratings and treatment of tourism services weakens the system and places limitations on its revenue generating ability.

5. Conclusion and Recommendations

Following the 2008 global economic downturn most developing and emerging economies have found themselves falling victim to spillovers of fiscal difficulties faced in the more advanced economies. The ECCU, given its nature of being highly open and susceptible to shocks from its external environment, was no exception. Although the members of the ECCU had trouble regarding fiscal and trade balances long before the financial crisis, its very occurrence to some extent exacerbated the economic problems faced.

As a means of coping and countering the current economic realities and drastically changed economic circumstances, more and more countries have been implementing fiscal consolidation measures. Those countries within the Caribbean region that have actually implemented measures to that effect have seen their successes as well as their failures. The effective implementation of such measures requires reform on both the expenditure and the revenue side. However, within small states such as the Caribbean the expenditure reform option is explored to a lesser extent and revenue growth has been a priority.

In developing countries such as the ECCU, it is important to determine what tax bases are reliable for revenue growth. With the myriad of taxes available in developing countries the right taxes and appropriate rates should be taken into consideration when policy reforms are up for debate. It follows that whatever taxes are targeted for reform their bases should be very buoyant. The assessment of total taxes, direct taxes and indirect taxes in Dominica, St. Lucia and Antigua and Barbuda indicate very high tax ratios of above 70% in these countries. Furthermore, there is slow growth of tax revenue and GDP over the 30-year period under review.

The Dynamic Ordinary Least Squares (DOLS) linear regression method utilized to determine the buoyancy of the tax system produces results that suggest the tax structure in Dominica, St. Lucia and Antigua and Barbuda are buoyant. This is an indication that tax revenue responds well to discretionary measures and reforms to the tax structures in these economies. The Divisia Index which assesses the effectiveness of the ability of tax revenue to respond to economic growth indicates that the economies being studied have little built-in responses that allow growth of tax revenue. Additionally, this low built-in response indicates that the tax structures of those countries are inelastic. This finding therefore emphasizes the importance of discretionary measures within the tax system of those countries.

Results obtained indicate that the reforms implemented within the countries being studied were in fact effective as the reforms have been conducted on buoyant bases. The removal of unproductive taxes, consolidation of a number of nuisance taxes, income tax reform and the implementation of VAT have simplified the tax systems in these countries and have reduced the burden on the administrative authority for collection in some instances. Essentially, these impacts should cause increases in tax revenue to the extent where fiscal imbalances are corrected; however there exist certain structural issues within the ECCU economies that limit the revenue-generating capacity of the tax system.

Overall, the ECCU economies studied possess very buoyant tax revenue structures which are a very desirable feature of any tax regime. However, the small bases and some tax policies applied limit

the revenue generating capacity of those countries. It follows that in order for there to be successful fiscal consolidation utilizing revenue side policies the tax base should not only be buoyant, it should be sufficiently large along with high levels of compliance. This further suggests that additional policies to broaden the tax base within these economies are essential.

Cebotari et al. (2013) suggest tax policy coordination based on the harmful tax competition and partial race to the bottom phenomena. The ECCU countries have very small corporate sectors and therefore attempts should be made at broadening the tax base. This should be done by removal of some of the concessions granted to firms and a second measure would be the harmonization of corporate income tax rates throughout the ECCU and recoup revenues lost from previous policies.

The ECCU has in the past made attempts at simplifying the tax base through the merging of different types of taxes into one broad-based tax. However, there still remains a problem of administration and compliance. The revenue authority should make an attempt to consolidate many of the duties that are conducted. This would essentially result in increased revenue through the efficiency gained through the administrative departments of the tax system. This suggestion was also made by Mapp (2012).

Central governments should adopt policies of disclosure and community engagement. The reality of facing fiscal consolidation is becoming more and more apparent and the state should therefore inform and educate the populace about the possible implications of fiscal consolidation such as cuts in healthcare, education and other social spending. These engagements should highlight the importance of tax revenue of the government revenue base in small island states. Essentially this should dissuade avoidance and improve compliance.

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Appendices

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Appendix D: Mathematical Derivation of Divisia Index

Appendix E: Summary of Discretionary Policies Implemented in Dominica, St. Lucia and Antigua and Barbuda.

Appendix A: Datasets and Descriptive Statistics

Table 4: GDP, Total Revenue, Components of Tax Revenue and Tax Ratio for Dominica.

Year	GDP	Total Revenue	Total Tax	Total Direct Taxes	Total Indirect taxes	Tax Ratio	Share of Tax Revenue to total Revenue
1980	164.0523	56.698	33.29	14.67	18.62	0.202923	0.587146
1981	183.877	56.7	36.04	15.89	20.15	0.196001	0.635626
1982	191.4793	57.7	36.68	16.53	20.15	0.191561	0.635702
1983	196.6333	67.2	43.01	18.73	24.28	0.218732	0.64003
1984	207.3034	74.82	55.28	22.45	32.83	0.266662	0.73884
1985	209.9664	84.4	64.86	25.78	39.08	0.308907	0.768483
1986	224.8272	93.27	73.6	23.69	49.91	0.327363	0.789107
1987	241.7313	109.66	81.24	28.72	52.51	0.336076	0.740835
1988	262.4211	120.1	92.5	28.7	63.8	0.352487	0.770192
1989	261.783	129.3	104.5	27.5	77	0.399186	0.808198
1990	275.5394	123	112.78	28.4	84.38	0.409306	0.916911
1991	277.2145	130	117.5	28.8	88.7	0.42386	0.903846
1992	282.8901	139.5	125.6	36	89.6	0.443989	0.900358
1993	287.6453	142.87	117.5	32.1	85.4	0.408489	0.822426
1994	291.7624	144.89	125.92	35.26	90.66	0.431584	0.869073
1995	297.5239	155.22	134.55	40.26	94.29	0.452233	0.866834
1996	305.3839	173.8	149.41	48.61	100.8	0.489253	0.859666
1997	309.9366	188.6	160.23	51.45	108.78	0.516977	0.849576
1998	325.3655	205	173.87	53.11	120.76	0.534384	0.848146
1999	327.5887	200.7	168.34	50.44	117.9	0.513876	0.838764
2000	324.4638	213.73	182.09	66.57	115.52	0.561203	0.851963
2001	324.2503	202.32	162.91	46.9	116.01	0.502421	0.80521
2002	317.3388	192.9	161.96	44.21	117.75	0.510369	0.839606
2003	340.7975	204.3	179.43	47.1	132.33	0.5265	0.878267

2004	351.1224	234.58	205.2	43.85	161.35	0.584412	0.874755
2005	348.2521	255.1	229.26	57.55	171.71	0.658316	0.898706
2006	363.4652	269.03	247.87	58.03	189.84	0.681964	0.921347
2007	382.9994	312.24	285.46	62.49	222.97	0.745328	0.914233
2008	413.7949	337.77	307.35	62.54	244.81	0.742759	0.909939
2009	438.1948	350.07	320.57	65.08	255.49	0.73157	0.915731
2010	442.4213	351.88	327.94	71.05	256.89	0.741239	0.931965

Table 5: GDP, Total Revenue, Components of Tax Revenue and Tax Ratio for St. Lucia.

Year	GDP	Total Revenue	Total Tax	Total Direct Taxes	Total Indirect taxes	Tax Ratio	Share of Tax Revenue to total Revenue
1980	281.7331	93.86	67.03	20.98	46.05	0.23792	0.714149
1981	291.6226	99.12	75.34	27.07	48.27	0.258348	0.760089
1982	260.0643	106.1	78.11	28.2	49.91	0.300349	0.736192
1983	271.1193	111.3	91.42	36.31	55.11	0.337195	0.821384
1984	334.838	117.7	106.44	36.76	69.68	0.317885	0.904333
1985	315.3916	149.1	145.1	50.6	98.9	0.460063	0.973172
1986	362.3131	158.9	150.6	48.3	102.3	0.415663	0.947766
1987	369.324	193.8	173.5	48.3	125.2	0.469777	0.895253
1988	414.2624	228.1	206.2	57.8	148.4	0.497752	0.903989
1989	451.8101	265.7	234.9	67	167.9	0.519909	0.88408
1990	558.1883	266.6	240	64.1	175.9	0.429962	0.900225
1991	573.1362	296.7	261	75.2	185.8	0.455389	0.879676
1992	613.3802	331.9	297.5	84.6	212.9	0.485017	0.896354
1993	629.1623	349	310.9	80.4	230.5	0.494149	0.890831
1994	638.1038	351.3	313.2	93.81	219.39	0.490829	0.891546
1995	659.0837	364.14	321.71	88.36	233.35	0.488117	0.883479
1996	694.7878	371.95	343.71	103.56	240.15	0.494698	0.924076
1997	697.5923	378.97	331.32	96.8	234.52	0.474948	0.874264
1998	741.9114	439.59	392.18	108.92	283.26	0.528608	0.89215
1999	759.41	482.44	414.91	118.74	296.17	0.546358	0.860024
2000	764.4577	486.31	430.54	136.32	294.22	0.563197	0.88532
2001	727.7914	442.32	397.41	135	262.41	0.546049	0.898467
2002	728.6001	448.47	404.95	114.52	290.43	0.555792	0.902959

Year	GDP	Total Revenue	Total Tax	Total Direct Taxes	Total Indirect taxes	Tax Ratio	Share of Tax Revenue to total Revenue
2003	761.0157	466.57	431.01	113.97	317.04	0.566362	0.923784
2004	824.9152	537.92	495.71	121.4	374.31	0.600922	0.921531
2005	809.2968	576.87	540.83	143.65	397.18	0.668272	0.937525
2006	884.4924	647.77	603.83	153.08	450.75	0.682685	0.932167
2007	897.7199	703.4	659.05	181.47	477.58	0.734138	0.936949
2008	945.5141	781.26	725.32	227.99	497.33	0.767117	0.928398
2009	946.7655	770.85	724.04	230.48	493.56	0.764751	0.939275
2010	950.5766	776.24	729.02	226.45	502.57	0.766924	0.939168

Table 6: GDP, Total Revenue, Components of Tax Revenue and Tax Ratio for Antigua and Barbuda.

Year	GDP	Total Revenue	Total Tax	Total Direct Taxes	Total Indirect taxes	Tax Ratio	Share of Tax Revenue to total Revenue
1980	308.7663	73.2	49.12	7.87	41.25	0.159085	0.671038
1981	321.3754	89.4	59.4	11.1	48.3	0.184831	0.66443
1982	321.9131	93.6	68.7	11.8	56.9	0.213412	0.733974
1983	336.9734	87.8	70.6	11.7	58.9	0.209512	0.8041
1984	369.8406	100.1	83.3	15.5	67.8	0.225232	0.832168
1985	399.392	125.1	98.5	21.7	76.8	0.246625	0.78737
1986	450.1923	181.5	132.7	20.3	112.4	0.294763	0.731129
1987	487.3925	201.2	141	22.3	118.7	0.289295	0.700795
1988	513.818	201.4	169.5	21.3	148.2	0.329883	0.841609
1989	543.4801	206.5	174.9	20.9	154	0.321815	0.846973
1990	557.3122	230.7	189.68	30.7	158.98	0.340348	0.822193
1991	568.6615	228.6	190.5	27.1	163.4	0.334997	0.833333
1992	573.4848	239.7	197.5	26.1	171.4	0.344386	0.823947
1993	604.3962	253.6	206.2	27	179.2	0.341167	0.813091
1994	642.6402	283.71	226.11	26.82	199.29	0.351845	0.796976
1995	615.7982	287.55	237.34	23.45	213.89	0.385418	0.825387
1996	657.3003	328.48	271.13	28.9	242.23	0.41249	0.825408
1997	689.415	333.81	281.43	30.43	251	0.408216	0.843084
1998	719.8021	349.67	292.95	31.36	261.59	0.406987	0.83779
1999	749.4695	350.97	302.38	39.33	263.05	0.403459	0.861555
2000	787.6934	465.12	283.59	42.18	241.41	0.360026	0.609714

2001	763.1172	355.8	316.25	53.76	262.49	0.414419	0.888842
2002	785.2096	392.8	332.7	55.8	276.9	0.423709	0.846996
2003	836.9095	422.85	383.16	73.68	309.48	0.457827	0.906137
2004	878.0235	472.34	427.21	56.39	370.82	0.486559	0.904454
2005	931.7137	493.68	455.05	74.32	380.73	0.488401	0.921751
2006	1057.846	602.68	567.61	122.77	444.84	0.536571	0.94181
2007	1159.704	724.66	690.87	109.87	581	0.59573	0.953371
2008	1160.05	736.01	693.86	127.07	566.79	0.598129	0.942732
2009	1022.51	595.85	573.38	112.86	460.52	0.560757	0.962289
2010	941.6384	639.58	576.45	110.16	466.29	0.612178	0.901295

Table 7: Descriptive Statistics of GDP and Components of Tax Revenue for Dominica, St. Lucia and Antigua and Barbuda

	Dominica				St. Lucia				Antigua and Barbuda			
	GDP	Total Taxes	Total Direct Taxes	Total Indirect taxes	GDP	Total Taxes	Total Direct Taxes	Total Indirect taxes	GDP	Total Taxes	Total Direct Taxes	Total Indirect taxes
Mean	295.871	148.927	40.4019	108.524	618.012	345.199	100.649	244.549	669.543	282.034	44.9845	237.05
Standard Error	12.9940	15.1666	2.99321	12.4019	40.3261	35.8179	10.5103	25.5493	44.2736	33.1819	6.47298	27.0043
Median	297.523	134.55	40.26	94.29	659.083	321.71	93.81	233.35	642.640	237.34	28.9	213.89
Mode	#N/A	117.5	#N/A	20.15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Standard Deviation	72.3480	84.4441	16.6655	69.0512	224.526	199.425	58.5188	142.253	246.505	184.749	36.0400	150.354
Sample Variance	5234.24	7130.80	277.739	4768.07	50412.2	39770.6	3424.45	20235.9	60764.7	34132.2	1298.88	22606.
Kurtosis	-0.35879	-0.2445	-1.14735	0.00092	-1.20852	-0.55129	0.19570	-0.74914	-0.63693	-0.07033	0.27860	-0.08672
Skewness	0.13264	0.64672	0.16138	0.80127	-0.24451	0.49825	0.83243	0.39912	0.36664	0.86262	1.24525	0.77149
Range	278.369	294.65	56.38	238.27	690.512	661.99	209.5	456.52	851.283	644.74	119.2	539.75
Minimum	164.052	33.29	14.67	18.62	260.064	67.03	20.98	46.05	308.766	49.12	7.87	41.25
Maximum	442.421	327.94	71.05	256.89	950.576	729.02	230.48	502.57	1160.05	693.86	127.07	581
Sum	9172.02	4616.74	1252.46	3364.27	19158.	10701.1	3120.14	7581.04	20755.8	8743.07	1394.52	7348.55
Count	31	31	31	31	31	31	31	31	31	31	31	31
Confidence level(95.0%)	26.5374	30.974	6.11295	25.3282	82.3570	73.1499	21.4649	52.17881	90.4188	67.76652	13.2196	55.15031

Appendix B: Unit Root Testing and Johansen Cointegration Test

Table 8: Dominica

Variable	Augmented- Dickey Fuller Test			Phillips –Perron Test		
	Constant T-stat	Constant and Trend T- stat	No constant, no trend T-stat	Constant T-stat	Constant and Trend T- stat	No constant, no trend T-stat
LogGDP	-1.96	-2.83	5.89	-1.88	-2.81	5.04
Δ(LogGDP)	-5.13***	-5.02***	-3.44***	-5.13***	-5.02***	-3.44***
LogT	-1.61	-2.08	3.80	-1.70	-2.02	3.80
Δ(LogT)	-5.31***	-5.46***	-3.81***	-5.31***	-5.47***	-3.88***
LogDT	-1.44	-2.80	2.59	-1.50	-2.80	2.92
Δ(LogDT)	-7.04***	-7.05***	-5.92***	-7.13***	-7.29***	-5.89***
LogIDT	-1.68	-1.89	3.61	-1.71	-1.89	3.55
Δ(LogIDT)	-5.02***	-5.220***	-3.73***	-5.02***	-5.20***	-3.79***

*(significant at 10% level), ** (Significant at 10%, 5% level), *** (significant at 10%, 5%, 1% level)

Table 9: Antigua and Barbuda

Variable	Augmented -Dickey Fuller Test			Phillips- Perron Test		
	Constant T- stat	Constant and Trend T- stat	No constant, no trend T-stat	Constant T-stat	Constant and Trend T- stat	No constant, no trend T-stat
LogGDP	-1.84	-2.37	1.22	-1.78	-1.32	3.09
Δ(LogGDP)	-2.51	-2.84	-2.20**	-2.61	-2.76	-2.19**
LogT	-2.51	-2.31	4.60	-2.44	-1.99	4.60
Δ(LogT)	-4.03***	-4.31***	-2.99***	-3.96***	-4.21**	-2.93***
LogDT	-1.20	-2.79	2.57	-1.20	-2.86	-2.57
Δ(LogDT)	-6.88***	-6.75***	-5.68***	-6.94***	-6.81***	-5.65***
LogIDT	-2.42	-2.07	3.99	-2.41	-1.84	3.99
Δ(LogIDT)	-2.89*	-3.22*	-3.11***	-4.38***	-4.74***	-3.25***

*(significant at 10% level), ** (Significant at 10%, 5% level), *** (significant at 10%, 5%, 1% level)

Table 10: St. Lucia

Variable	Augmented Dickey- Fuller Test			Phillips –Perron Test		
	Constant T-stat	Constant and Trend T- stat	No constant, no trend T-stat	Constant T-stat	Constant and Trend T- stat	No constant, no trend T-stat
LogGDP	-1.27	-1.19	3.20	-1.13	-1.09	3.48
Δ(LogGDP)	-6.06***	-6.21***	-2.21**	-6.03***	-6.21***	-4.73***
LogT	-2.57	-1.81	5.24	-2.93*	-1.78	4.61
Δ(LogT)	-4.57***	-5.13***	-2.93***	-4.57***	-5.13***	-2.93***
LogDT	-1.84	-3.19	3.67	-2.14	-3.18	4.22
Δ(LogDT)	-6.78***	-6.18***	-4.81***	-6.76***	-6.81***	-4.85***
LogIDT	-2.31	-1.39	4.60	-2.35	-1.39	3.88
Δ(LogIDT)	-4.08***	-4.61***	-2.78***	-4.08***	-4.58***	-2.66***

*(significant at 10% level), **(Significant at 10%, 5% level), *** (significant at 10%, 5%, 1% level)

Table 11: Results from Cointegration Tests: Number of Cointegrating Vectors and Trace Statistic

	LogGDP								
	Dominica			St. Lucia			Antigua and Barbuda		
	Trace Test	Max. Eigen Value Test	Trace Stat.	Trace Test	Max. Eigen Value Test	Trace Stat.	Trace Test	Max. Eigen Value Test	Trace Stat.
LogT	1	1	2.06	1	0	1.55	1	0	5.55
LogDT	1	1	2.46	1	1	0.73	1	1	6.46
LogIDT	1	0	1.87	1	0	2.4	1	1	0.64

Appendix C: Dynmamic Ordinary Least Squares Estimates

Table 12: Lags and Leads for Dynamic OLS Estimation Based on SIC Criteria

	LogGDP					
	Dominica		St. Lucia		Antigua and Barbuda	
	Lags	Leads	Lags	Leads	Lags	Leads
LogT	1	1	4	0	2	0
LogDT	5	0	0	0	6	5
LogIDT	0	0	4	0	6	6

Dominica

$LogT= -33.49+ 2.68LogGDP$

$\quad\quad\quad\quad (48.22)$

$\quad\quad R^2=0.98 \quad\quad Adj.\ R^2= 0.98 \quad\quad D.W= 1.78 \quad S.E=0.05 \quad\quad SSR= 0.15$

Chart Showing Movement of the Error Term
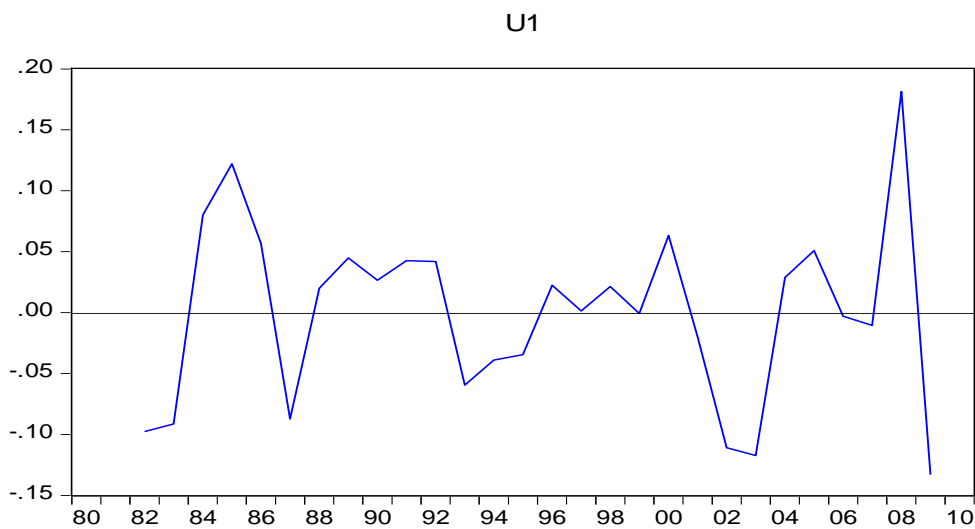
$LogDT= -16.80+ 1.76LogGDP$

$\quad\quad\quad\quad (6.94)$

$\quad\quad R^2=0.91 \quad\quad Adj.\ R^2= 0.87 \quad\quad D.W= 0.90 \quad S.E=0.25 \quad\quad SSR= 0.36$

Chart Showing Movement of the Error Term

U2
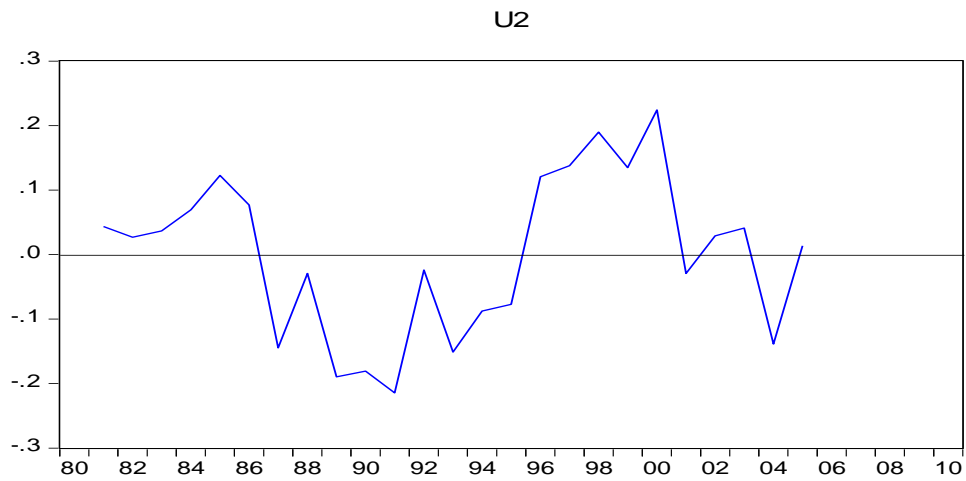
LogIDT= -40.57+ 3.02LogGDP

              (26.03)

    R^2=0.97   Adj. R^2= 0.97   D.W= 1.1   S.E=0.12   SSR= 0.42

Chart Showing Movement of the Error Term

U3
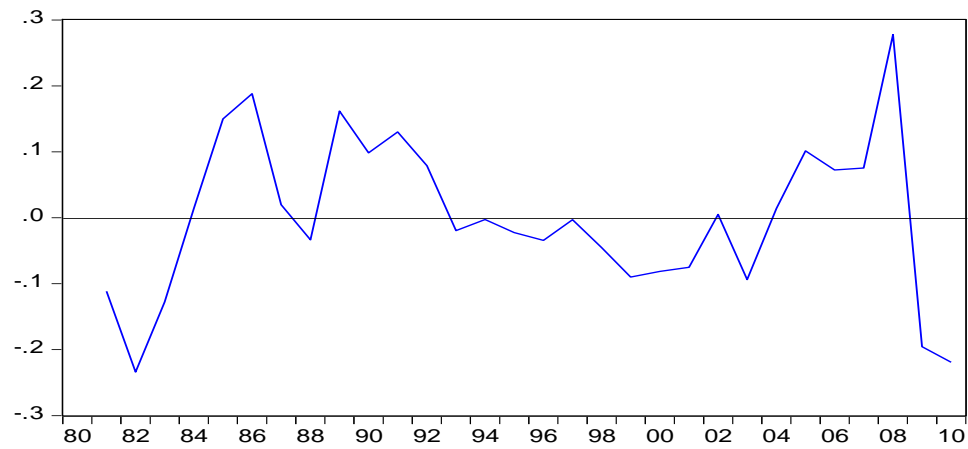
St. Lucia

LogT= -15.74+ 1.73LogGDP

(32.90)

R^2=0.99   Adj. R^2= 0.98   D.W= 1.40   S.E=0.05   SSR= 0.10

Chart Showing Movement of the Error Term

U1
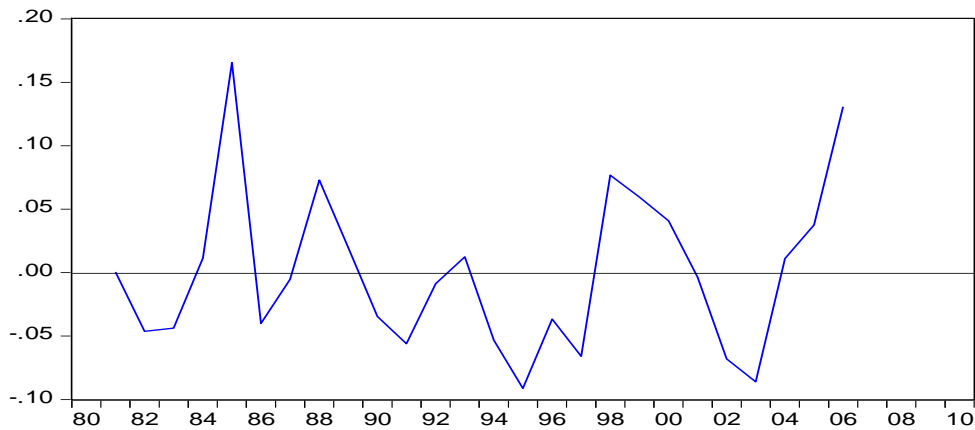
LogDT= -9.95+ 1.40LogGDP

(13.80)

R^2=0.94   Adj. R^2= 0.93   D.W= 0.66   S.E=0.10   SSR= 0.63

Chart Showing Movement of the Error Term
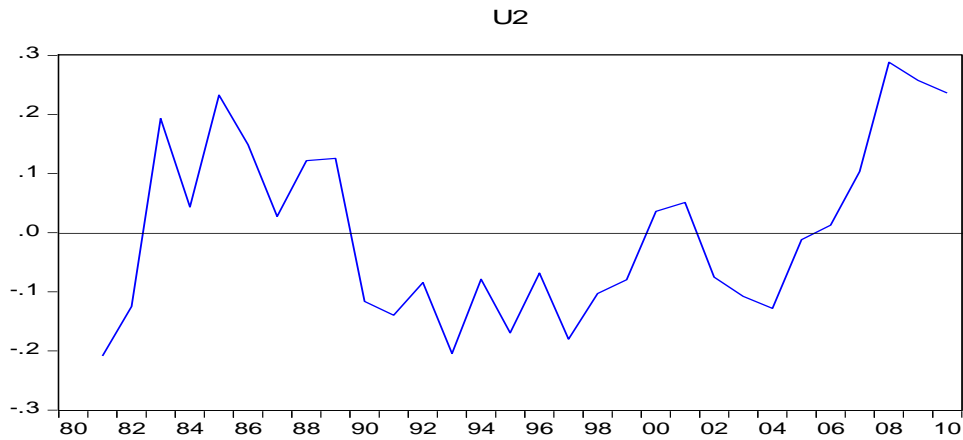
LogIDT= -19.18+ 1.89LogGDP

(32.50)

R^2=0.99   Adj. R^2= 0.98   D.W= 1.53   S.E=0.06   SSR= 0.13

Chart Showing Movement of the Error Term
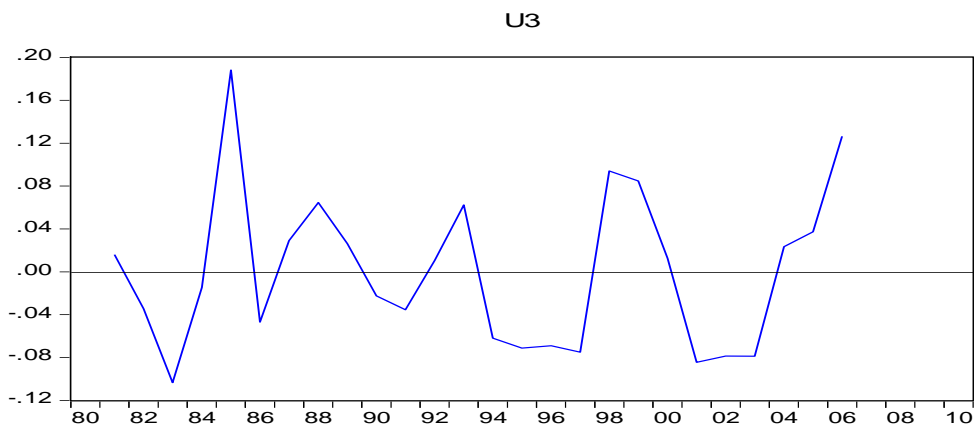
Antigua and Barbuda

LogT= -17.79+ 1.83LogGDP

          (46.42)

      R^2=0.99   Adj. R^2= 0.99   D.W= 1.28   S.E=0.04   SSR= 0.08
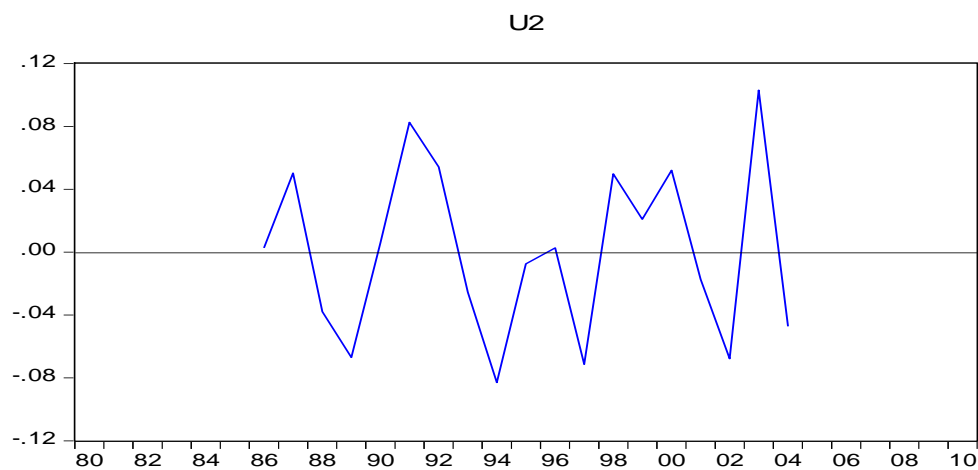
Chart Showing Movement of the Error Term

U1
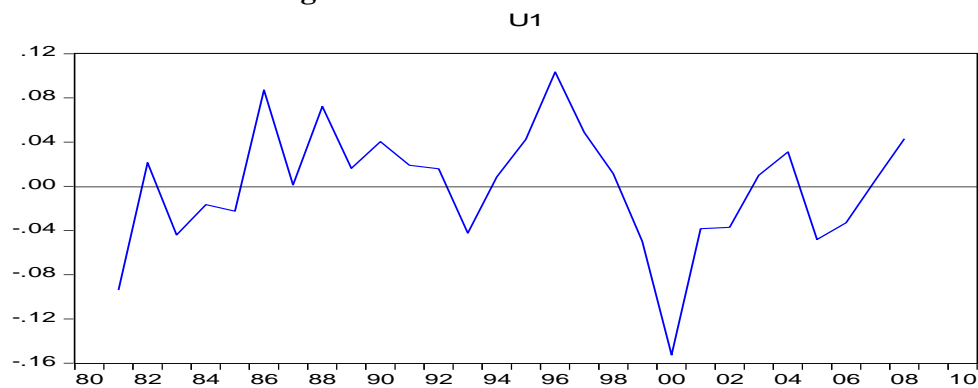
LogDT= -21.04+ 1.85LogGDP

          (19.57)

      R^2=0.98   Adj. R^2= 0.93   D.W= 2.20   S.E=0.10   SSR= 0.05
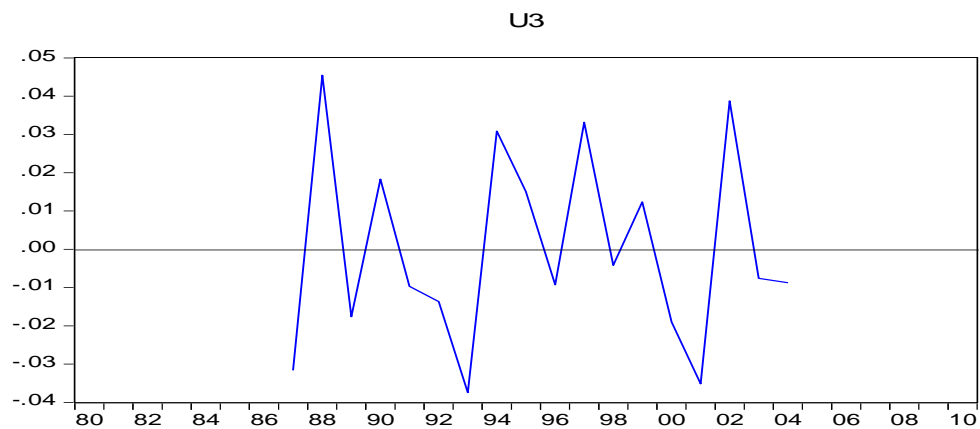
Chart Showing Movement of the Error Term

U2

LogIDT= -10.85+ 1.49LogGDP

$\qquad$ (48.22)

$\qquad$ R^2=0.99 $\qquad$ Adj. R^2= 0.96 $\qquad$ D.W= 2.72 $\qquad$ S.E=0.06 $\qquad$ SSR= 0.01

Chart Showing Movement of the Error Term

U3

Appendix D: Mathematical Derivation of Divisia Index

To derive the continuously differentiable function at each point in time is

$$T(t) = f(x_i(t), ..., x_k(t); t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where T is tax revenue, x is the tax base (GDP) and t is the time variable and is a proxy for discretionary tax measures. By taking the logarithm of the tax function, differentiating with respect to time and re-arranging gives equation (2) as:

$$\frac{f_{(t)}t}{f(t)} = \frac{\dot{T}(t)}{T(t)} - \sum_1^k \frac{f_i(t)x_i(t)}{f(t)} \frac{\dot{x}(t)}{x_i(t)} \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Setting $\frac{f_i(t)x_i(t)}{f(t)} = \beta_i(t)$ and $\frac{f_{(t)}t}{f(t)} = \frac{D(t)}{D(t)}$ where D (t) is the DI of discretionary change and the shift in the ratio $\frac{D(t)}{D(t)}$ indicates the growth of tax revenue as a result of the discretionary tax measures. Equation (2) can be rewritten as:

$$\frac{D(t)}{D(t)} = \frac{\dot{T}(t)}{T(t)} - \sum_1^k \beta(t) \frac{\dot{x}(t)}{x_i(t)} \ldots\ldots\ldots\ldots (3)$$

The index can also be obtained over the interval [0, n] by integrating equation (3) as:

$$\frac{D(n)}{D(0)} = \left[\frac{T(n)}{T(0)}\right] \exp\left(-\sum_1^k \beta_i(t) \frac{\dot{x}(t)}{x_i(t)}\right) \ldots\ldots\ldots\ldots (4)$$

By normalizing we set D(0) =1 and D(n) represents the index of revenue growth strictly as a result of discretionary tax measures at time n.

Although Equation (4) provides an estimate of the DI, $\beta_i(t)$ is time-varying and as such the computation of the DI is difficult. This problem has been overcome by Star and Hall (1976) who transformed the time-varying $\beta_i(t)$ into a constant $\tilde{\beta}_i$ which is the weighted average of $\beta_i(t)$. This gives the following equation:

$$\int_0^n \tilde{\beta}_i \frac{\dot{x}(t)}{x_i(t)} dt = \int_0^n \beta_i(t) \frac{\dot{x}_i(t)}{x_i(t)} dt \ldots\ldots\ldots\ldots..(5)$$

Equation (5) can be transformed as follows: $\tilde{\beta}_i = \frac{1}{n}\int_0^n \beta_i(t)\frac{\rho_i(t)}{\bar{\rho}_i}$ where $\rho_i(t) = \frac{\dot{x}_i(t)}{x_i(t)}$ and $n\bar{\rho}_i = \int_0^n \frac{\dot{x}_i(t)}{x_i(t)}\,dt$ $= \log\left(\frac{x_i(n)}{x_i(0)}\right)$. The constant $\tilde{\beta}_i$'s are the weighted average of the fluctuating $\beta_i(t)$ and the weights are the ratios of the instantaneous rates of growth of the bases to their average rates of growth in the interval [0, n].

Integrating the left- hand side of the equation (5) gives:

$$\tilde{\beta}_i \log\left(\frac{x_i(n)}{x_i(0)}\right) = \int_0^n \beta_i(t)\frac{\dot{x}_i(t)}{x_i(t)}\,dt\ldots\ldots\ldots\ldots\ldots\ldots\text{(6)}$$

Placing the left- hand side of the Equation (6) in to Equation (5) yields:

$$D(n) = \frac{T(n)}{T(0)} \Big/ \prod_{i=1}^{k}\left[\frac{x_i(n)}{x_i(0)}\right]^{\tilde{\beta}_i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(7)}$$

Appendix E: Summary of Discretionary Policies Implemented in Dominica, St. Lucia and Antigua and Barbuda.

<u>**Commonwealth of Dominica**</u>

Fiscal Period	Discretionary Measures
1981/1982	Increase of a 20% consumption tax on selected items
	Imposition of import duty on construction and building material. This formed part of an IMF three-year stabilization programme
	Levy on foreign currency transactions
1983/1984	Removal of surtax on certain items and consolidation of a number of rates for consumption tax
1986/1987	Reduction of corporate tax payable by manufacturing enterprises from 45% to 30%.
	Bank deposit levy abolished
	Foreign exchange levy was reduced form 2.5% to 1%
	Removal of 1% stamp duty on export sales and duties on export sales.
	10% increase of consumption tax on vehicles.
1987/1988	Increase in corporate income tax from 30% to 35%
	Increase in income tax threshold from $3700 to $9000
	Removal of stamp duties and consolidated into sales taxes
	Removal of foreign exchange levy
1989/1990	Reduction of corporate income tax from 35% to 30%
	Reduction of marginal income tax rates on earners in the top brackets from 45% to 40%.
	Increase of the income tax threshold from $9000 to $12000 per anum
1996/1997	Reduction of consumption taxes
1999/2000	Removal of consumption taxes on housing and building material

2006/2007	Implementation of a 15% value added tax with 10% for accommodation services and dive activities. Current threshold is $120,000 per annum; and $60,000 per annum for persons who supply hotel and similar accommodation, commercial property for lease and certain professional services.
2008/2009	Increase in income tax threshold as well as gradual reduction of marginal rates for all income brackets over a three-year period as part of new income tax reform measures.

Antigua and Barbuda

Fiscal Period	Discretionary Measures
1980/1981	Increase in consumption tax on a variety of items A move by the central government to collect outstanding tax revenue
1986/1987	Implementation of a customs service charge of 2.5% on imports (excluding capital goods above $100,000). Property tax enforced 3% tax on loans by local banks and non -residents
1994/1995	Removal of tamp tax and customs surcharge on building material and reduction of consumption tax on certain categories of vehicles. These taxes replaced by increases in customs service tax and hotel guest taxes.
1995/1996	Introduction of education levy on wages and salaries and a restaurant tax on sales.
2007/2008	Market valuation of property tax implemented Implemented the ABST (Antigua and Barbuda sales tax) in January 2007 at a standard rate of 15%, and a transitional rate of 10.5% for hotels. The threshold is $300,000 per annum

St. Lucia

Fiscal Period	Discretionary Measures
1980/1981	Increase in consumption tax rates
	Increase in excise duties
	Increase in hotel and accommodation taxes
	Introduction of a withholding tax
	Introduction of bank deposit tax
1986/1987	Increase in income tax threshold and reduction in the number of tax brackets
	Reduction of marginal income tax rates
	An amnesty on interest due to all income tax arrears. Removal of some aspects regarding withholding taxes.
1987/1988	Reduction of corporate income tax from 40% to 25% and a three-year progressive increase to 33.33%.
	Reduction of foreign exchange taxes from 2.5% to 1%
	Tax holidays on hotels of up to seven years and ten years for manufacturing companies.
1998/1999	Amendments to the hotel accommodation tax to include a head tax
	Consumption tax exemptions on medical and business security equipment
	10% consumption tax on cigarettes
2000/2001	Tax amnesty on property taxes in arrears
2001/2002	Reduction of multiple property tax rates into one single rate of 5% of residential rental value
	Amendments to the evaluation of property tax charges using open market valuation of property
	Property tax exemptions on homeowners of new homes for the first three years
	Increase in the income tax threshold

	Tax credits to offshore companies based on earnings
2002/2003	Waivers on settlement of income taxes in arrears
2012/2013	Changed from rental value to market value of property tax effective January 2012. The new rates were 0.4% of the market value for commercial properties and 0.25% for residential properties. Introduced VAT on 01 October 2012, at a standard rate of 15%, and a reduced rate of 8% on goods and services provided by hotels (until April 2013). The threshold is $180,000 per annum.