Tax Policy and Economic Growth in Jamaica

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November 2011

Abstract

Numerous studies have indicated that tax policies aimed at increasing government revenue have been regarded as an impediment to economic growth in both the short and long run. This paper explores the impact of taxation on economic growth in Jamaica. This is done by using a general autoregressive distributed-lag model, which jointly captures both short and long run effects. Additionally, an attempt to ascertain the directional relationship between the explanatory variables and economic growth is done using Granger causality tests. The findings indicate that increasing revenue from indirect taxes is more conducive to economic growth in the long run. On the other hand, increasing the share of taxes from personal income (P.A.Y.E.) has the greatest harm on per capita GDP over time and correction to equilibrium from such an impact would take up to nine quarters.

[1] The views expressed in this paper are those of the author and in no way represent an official position of the Bank of Jamaica.

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1.0 Introduction

Between 2008 and 2010, the Jamaican economy contracted on average by 1.7 per cent per annum, following average annual growth of 2.1 per cent over the previous five years. A combination of factors contributed to the poor performance of the economy over the last three years, chief among them being the global financial crisis. At present, one of the primary objectives of the authorities is to restore growth to the Jamaica economy, in the short, medium and long-term. In this context, the aim of this paper is to analyse the effectiveness of different tax measures given the current economic crisis as well as their impact on long run growth in the Jamaican economy.

Tax policies from time to time have been implemented for a variety of reasons. According to Romer and Romer (2010) tax policies are implemented either to: (i) finance a budget deficit, (ii) promote long run growth or (iii) counter other influences in the economy. In the case of Jamaica, and that of many other developing countries, with relatively high public debt to gross domestic product (GDP) ratio, tax policies have for the most part been geared towards filling a financing gap. Kneller, Bleaney and Gemmell (1999) suggest that in designing tax policies to promote growth, greater reliance should be placed on indirect taxation. This is seen as being less harmful to the economy as it does not reduce the return on investment when compared to direct taxation, which presents a disincentive to invest in physical and human capital. Over the last decade, Jamaica's tax composition favours indirect taxes, which on average accounted for approximately 52.2 per cent of tax revenue per annum. This bias is essentially in line with the taxation characteristic for many developing countries.

The paper uses a standard growth function, within an autoregressive distributed lag framework, with quarterly data from 1990 to 2010, to assess the impact of taxation on economic growth. The research does not discount the fact that tax measures could be a function of the economic condition, a very familiar situation for Jamaica and other small open economies.

The remainder of the paper is structured as follows. Section two presents the theoretical perspective of tax policy and economic growth, while section 3 presents the literature review. Section four presents the data incorporated in the study along with the framework employed to

assess the impact of tax policy on per capita GDP. This is followed by section five that discusses the empirical findings while section six gives the closing remarks and the policy recommendations.

2.0 Theoretical Perspective of Tax Policy and Economic Growth

Fiscal policy, on a whole, is geared towards having an impact on demand in the long run. Within the context of tax policy, tax incentives and holidays are offered to sectors of the economy in an effort to spur growth or to protect the small and vulnerable enterprises from external competition. Tax measures have to be complemented by other fiscal and developmental measures that are in line with the long-term objective of the economy.

It has been argued by the Keynesians that reducing the rate of direct taxation, in particular personal income tax, will transfer greater spending power to the individual, thus facilitating an increase in consumption expenditure and hence economic activity. This increases savings and or investment opportunities. On the other hand, any attempt to increase tax collected from direct taxation may serve as a disincentive to work, that is a reduction in the supply of labour, and a switch to greater leisure and hence a reduction in productivity. Arnold et al (2011) posits that tax changes that are geared towards innovation and entrepreneurship may have persistent and positive long run growth effects. The Ricardians, however, argue that if taxes are reduced, it will require the Government to balance its budget in the short run by increasing borrowing. The implementation of any tax policy has to bear in mind the potential fiscal imbalance of the country. Additionally, the impact that a tax policy is likely to have on economic growth will vary and depend greatly on country's stage of development and the level of production. As indicated by Jones (2001), the distribution of income towards the factors of production, such as capital and labour, plays a vital role in the level of production. The author also indicated that external factors do contribute to the level of growth in output, given the fact that there exists a close relationship between the growth in output and growth in the volume of international trade.

In examining the impact of tax policy on economic growth, the theorists have utilized growth models coupled with varied tax measures to explain the nexus. The neoclassical model of Solow

(1956) suggests that tax policy has no impact on economic growth in the long run. This model assumes that key factors of production such as labour and technological advancement are determined outside the model. On the other hand, endogenous growth theorists, who believe that economic expansion is determined within the system, posit that tax policy do have an impact on economic growth over time. Assuming that output grows over time, Romer and Romer (2010) indicate that government tax actions can be taken to offset developments that may cause output to deviate from its normal path. For example, a tax cut may be implemented if policy makers need to stimulate demand to bring the economy out of a recession. Further, tax measures could be implemented to increase growth above its long-term trend.

3.0 Empirical Literature

The impact of taxation on economic activities varies across countries, in both the short and long run. Empirical studies have utilized growth models with varied specifications to test the theory to ascertain the directional and degree of impact of tax policies across countries and territories. The models often start with the standard growth variables, physical capital, human capital and growth of the labour force to which tax indicators are incorporated.

Kneller et al (1999) examined the impact of fiscal policy on growth using an annual panel data set of twenty-two (22) countries within the Organization for Economic Co-operation and Development (OECD) over the period 1970-95. The approach included the complete specification of the government budget constraint (revenue and expenditure), in contrast to other endogenous growth models, which only incorporate the revenue aspect. This approach as indicated by Kneller et al (1999) built on the methodology proposed by Barro (1990) where the complete specification of the government's budget constraint corrected for the biases that existed with a partial specification. The model involved the regression of non-fiscal and fiscal variables on economic growth rates, with one component of the fiscal variable being omitted.[2] The findings indicate that increasing direct taxation significantly reduces growth, when compared to

[2] The omitted variable is regarded as the implicit financing element and as such the impact is revenue neutral.

consumption based taxes which have a less discernible negative or distortionary impact on growth.

Greenidge and Drakes (2009) utilized an unrestricted error correction model to examine tax policy and its effect on macroeconomic activity in Barbados. The approach initially proposed by Pesaran and Shin (1997) jointly captured both short and long run effects from a general autoregressive distributed-lag model. This procedure, when compared to others, has the ability to assess the cointegration of variables despite their order of integration and better at handling small samples and dynamic source of biases. The model is first estimated with standard growth variables, to which the tax indicators were individually added. The tax indicators were constructed using a tax index and principal component analysis.[3] Total and indirect taxation had a contractionary impact on the economy in the short run with no long run impact, while direct taxation had a negative impact on growth in both short and long run.

Romer and Romer (2010) investigated the impact of tax changes on economic growth in the United States during the post-war period. Information on the legislative tax changes were gathered from narrative sources (including presidential speeches) and regressed on changes in real GDP over the period 1947 to 2007. The tax changes were separated into those related to prospective economic conditions and exogenous (other) reasons.[4] The results indicated that tax changes have very large effects on output resulting in reduction of between 2.5 and 3.0 per cent. In addition, output effects were found to be more closely linked to changes in actual taxes rather than to news about future changes.

Arnold *et al* (2011) examined the long run relationship between tax structures and economic growth within the OECD. The authors utilized an error correction model with annual panel data of 51 countries. The model included individual tax indicators (expressed as a share of total tax revenue) along with the typical growth variables (physical & human capital and population growth) as well as a control variable, tax revenue to nominal GDP.[5] The explanatory variables, including the lagged dependent variable, were used in both levels and first differences to account

[3] See Greenidge and Drakes (2009) for further details. The principal component analysis aggregates the individual tax index.
[4] See Romer and Romer (2010) for further details.
[5] The control variable eliminates any bias that could result from a correlation between the tax mix and overall tax burden, given the varied tax structure across the countries examined.

for transitional dynamics. The findings indicated that long run economic growth could be improved by gradually increasing taxes on consumption and immovable property as well as improving the design of individual taxes. Personal & corporate income taxes, consumption and immovable property taxes had the least harmful impact on long run GDP per capita. It is also suggested that reducing income taxes on low income earners would be the best option for increasing economic growth and aiding economic recovery. This is in a context where reduced income taxes on low incomes would stimulate demand, increase work incentives and lessen income inequality.

4.0 Data & Methodology

4.1 Data

Using a standard growth model framework, the impact that changes in Jamaica's tax structure have on economic growth is assessed with the use of quarterly data from 1990 to 2010. The data set include GDP per capita, physical capital and human capital as well as growth rate of the labour force and nineteen (19) tax indicators. The measurement for each variable is outlined in *Table I in the Appendix*.

Physical capital, human capital and population growth rate have been regarded as the fundamental factors of economic growth. As indicated by Földvári1 and Bas van Leeuwen (2009) various studies on economic growth have utilized either literacy rates, primary school enrolment, age-heaping or average years of education (most commonly used) as a proxy for human capital. This study uses primary institution enrollment as the proxy for human capital. Literacy rate is not used as a proxy for human capital as it is close to unity and as such would pose empirical problems and lead to inaccurate estimation as indicated by Benhabib and Spiegel (1994). The proxy use for physical capital accumulation is gross fixed capital as a share of GDP, which is widely accepted and also provides information as to the level of reinvestment into the economy and thus its contribution to economic growth.

To examine the impact of Government's tax policy measures, the tax policy variable is defined as the share of tax revenue that is raised from a given tax as proposed by Arnold *et al* (2011).

The tax measure essentially provides an indication of the level of taxation and the policy action of the fiscal authority. However, one has to bear in mind that the tax structure will take into consideration the targeted tax group. In this regard, the tax structure is grouped into six categories. It is important to note that an increase in the share of tax revenue for one tax group will automatically reduce the amount of taxes required to be raised from the other tax groups. This implies that the tax impact would be revenue neutral. The groups are defined as follows, (the components of each are outlined in *Table II* in the *Appendix*) *Direct*, *Indirect*, *Consumption*, *International Trade*, *Income & Profit* and *Production & Consumption*. Figures 1 and 2 below depict the structure of Jamaica's tax system and the share of each tax group to tax revenue, respectively.

Figure 1

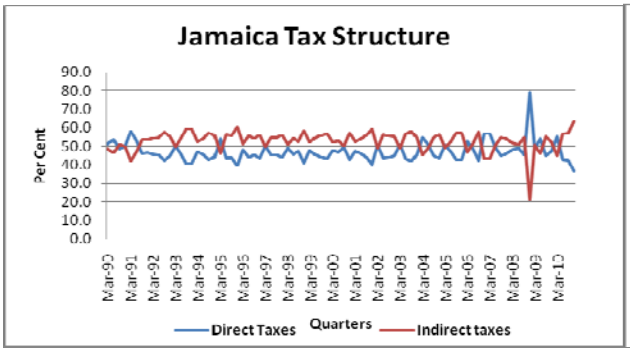
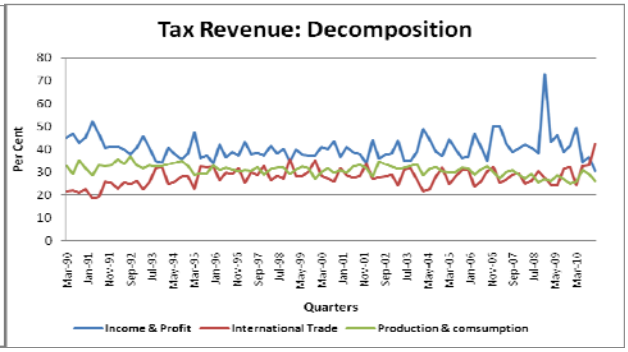


Figure 2



A descriptive statistics of the variables employed in this study along with their correlation with per capita GDP and order of integration are given in *Table III* in the *Appendix*. The order of integration is determined using the Phillips-Perron test at 5.0 per cent level of significance.[6] In addition, Granger Causality test are carried out to examine the causal relationship between per capita GDP and the explanatory variables. The null hypotheses tested are: (i) economic growth does not Granger cause the 'explanatory variables' and (ii) 'explanatory variables does not Granger cause economic growth. As a testing criterion, the probability value used is at the 5.0

[6] Phillip-Perron is said to be best suited for small sample size.

per cent level of significance.[7] This analysis will aid in providing some insight into the relationship between taxation and economic growth.

4.2 Description of the Model

The model used in the paper is based on a Cobb-Douglas function, in which output (*Y*) is a function of physical capital (*K*), human capital (*H*), level of technological and economic efficiency (*A*) and labour (*L*), as indicate below:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} (A(t)L(t))^{1-\alpha-\beta} \quad \text{…….[1]}$$

where, α & β are partial elasticity relative to the variable.

Variable, *A*, is dependent on policy actions

After log transformation equation 1 models GDP per capita as a function of investment rate, per capita human capital and growth rate of the working population. In an attempt to assess the impact of changes in tax measures on economic activity within this growth model framework, a general autoregressive distributed-lag (ARDL) model is used. This paper utilized the ARDL approached instead of an error correction model as utilized by Arnold et al (2011) and others for the following reasons.[8] Firstly, the ARDL model is selected on the basis that the model specification has no bias to the order of integration of the variables when assessing a long run relationship compared to other error correction models, such as the vector error correction model, which requires all variables to be integrated of the same order.[9] Thus have the advantage of yielding consistent estimates of the long-run coefficients that are asymptotically normal. Secondly, the estimation of the model can be carried out using ordinary least squares (OLS) from which the long run relationships can be ascertained.

The ARDL framework implemented in its log format is outlined below:

[7] Granger causality measures precedence and information.
[8] It should be noted that both procedures are capable of accounting for off-equilibrium dynamics of GDP per capita explicitly without losing any information.
[9] This highlights the point that cointegration does exist between variables integrated of varied orders.

$$\Delta \ln y_t = c_0 - \alpha \ln y_{t-1} + a_1 \ln k_{t-1} + a_2 h_{t-1} - a_3 wkp_{t-1} + \psi_i V_{t-1} + \sum_{i=1}^{4} b_i \Delta \ln y_{t-i} + \sum_{i=0}^{5-1} \omega_{1i} \Delta \ln k_{t-i} + \sum_{i=0}^{5-1} \omega_{2i} \Delta \ln h_{t-i} + \sum_{i=0}^{5-1} \omega_{1i} \Delta \ln wkp_{t-i} + \sum_{i=0}^{5-1} \gamma_i \Delta \ln V_{t-i} + \varepsilon_t \quad \text{..... [2]}$$

Where *y* represents GDP per capita, *k* for physical capita accumulation, *h* for human capital, *wkp* for growth rate of the working population, *V* for policy variables/tax indicators and ε_t for the error term. The coefficients on the level effects are α, a_i, ψ_i with the long run effects estimated as $-\left(\frac{a_i}{\alpha}\right) and -\left(\frac{\psi_i}{\alpha}\right)$, with α representing the convergence parameter (speed of adjustment to the long run relationship. Additionally, the short run coefficients are ω and γ. Based on the literature, in the long run, the coefficients on physical and human capital are supposed to be positive, while that of population growth should be negative. The latter is true in the steady state as the level of capital responds negative to population growth. As indicated by Jones (2001), at the current level of capital, as the population growth rate increases, the investment per worker will no longer be high enough to keep the capital-labour ratio constant. This will result in the economy having less capital per worker than it began with and is therefore poorer, thus a lower per capita output. Further, the direction in the short run varies across economies, as it would depend on effective substitution of factors of production.

The estimation of each equation takes into account the revenue neutral tax changes. That is, the greater use of one tax measure will inevitable reduces the amount of taxes needed to be raised from other tax measures. To account for this, one tax measure enters the equation at a time. The growth equation is subjected to the implicit constraint that the summation of all tax measures (ratio) is equal to one. This assumption ensures the estimation of the different tax policies under the assumption of revenue neutrality (Arnold et al (2011). Each equation is estimated by taking the general to specific approach. In that, four lags are included for the short run as shown in equation [2], after which the model is pared down. All equations are estimated with the Eviews package, using the OLS method and incorporating the Newey-West correction. It is important to note that the Newey-West correction produces consistent coefficients in the presence of heteroskedasticity and unknown correlation.

The coefficient on the convergence variable (y_{t-1}) is expected to be negative and significant. Various diagnostics tests are conducted to check for normality, long run relationship and stationarity of the residual. The residuals are tested for stationarity to avoid the production of spurious results. Additionally, the existence of a long run relationship between the variables is carried out by the use of a standard F-statistics to ascertain if the coefficients on the lagged level variables are jointly significant.[10] The F-statistics is then compared against two sets of asymptotic critical values calculated by Pesaran, Shin and Smith (2001), which takes into consideration the level of significance and the number of explanatory variables in the equation. These two set of critical values provide a band for the variables whether they are I(0), I(1) or fractionally integrated. In this regard, the hypothesis tested is as follow:

H_0: The coefficients on the lagged level variables are not jointly significant

H_1: The coefficients on the lagged level variables are jointly significant

If the calculated F-statistics falls outside the upper level of the band, the null hypothesis is rejected. However, if the F-statistics falls below the lower band of the critical value, the null hypothesis cannot be rejected. It is important to note that the test for a long run relationship is inconclusive if the test statistics falls within the band.[11]

5.0 Results and Discussions

The result for the unit root tests is shown in Table IV in Appendix. The Granger causality test results indicate that a bilateral relationship exist between per capita GDP and direct taxation as well as between per capita GDP and international trade, G.C.T. on imports, S.C.T. and 'Other Trade' taxes (see *Table V* in *Appendix*). It is important to note that the bilateral relationship between GDP per capita and taxes from international trade is in line with the close relationship that exists between output growth and volume of international trade as indicated by Jones (2001). The other significant results from the Granger causality test points to GDP per capita influencing

[10] The Wald coefficient test is used to determine the F-Statistic, where the coefficients are set equal to zero. It should be noted that the asymptotic distribution of the F-Statisrtics is non-standard.
[11] See Pesaran, Shin and Smith (2001) for further details.

the other variables, with the exception of the growth rate of the population which impacted GDP per capita.

The results from the final estimates of the basic growth model with only physical & human capital and population growth (baseline model) as well as those including the tax indicators are included in Table VII in the Appendix. The findings capture short run and long run changes in GDP from changes in tax policies. The results from the robustness tests for each model are displayed in the respective tables. In addition, based on the coefficient of variation, the models explain between 52.0 per cent and 70.0 per cent of the variation in per capita GDP.

5.1 Growth Components: Baseline Equation

From the baseline equation [1] the coefficient on the lagged per capita income is -0.115 (see Table VI in the Appendix). This indicates that 11.5 per cent of deviations from long run equilibrium level are corrected for in each quarter. As a result, it will take approximately nine quarters to ensure full correction. In the other estimates, the average correction time is nine quarters. Additionally, the presence of a long run relationship between GDP per capita and the determinants of growth is confirmed based on the F-statistics of 13.02, which falls above the upper band of the critical value of 4.01, thus signalling the presence of a long run relationship between the variables at the 5.0 per cent level of significance.

The signs of the coefficients on the key indicators of growth as depicted in the baseline model are in line with expectation where the coefficients on physical and human capital are positive, while that on population growth is negative. It is important to note that the coefficients on human capital and population growth display significant impact on GDP per capita in the long run, while physical capital did not exhibit a significant long run impact on per capita GDP.[12] The long run value on human capital from the baseline equation [1] suggests that a per cent increase in that variable human capital will result in a 1.9 per cent increase in economic growth over time. Additionally, a one per cent increase in the growth of the population will result in a 12.5 per cent contraction in per capita GDP in the long run. Although Arnold *et al* (2011) results indicate a negative impact on per capita GDP for the OECD, the magnitude was much smaller. In the short

[12] This is evident in all equations that include a tax variable.

run, all the variables display significant results. A one per cent increase in the population growth will result in a 1.2 per cent expansion in economic growth. While physical and human capital have negative impacts on per capita GDP, with a one per cent increase in these variables resulting in a 0.03 per cent and 0.6 per cent decline in per capita GDP, respectively. Based on the results for physical capital, one could opine that there has not been adequate investment in capital or the reinvestment of profits in Jamaica. This is in a context where many of the large businesses have repatriated their profits to the parent company or have invested heavily in Government bonds. Notably, 52.3 per cent of the variation in per capita GDP in the baseline equation is explained by the model.

5.2 Growth Model with Tax Measures

The results from the growth model which includes the long and short run impact of increases in the different shares of tax revenue are shown in Tables VI, VII and VIII, in the Appendix. It is important to note that the various tax measures have different impacts on per capita GDP.

5.2.1 *Direct and Indirect Taxation*

It is found that by increasing the share of revenue via *indirect* taxes has a positive and significant impact on per capita GDP in the long run. In that, a one per cent increase in indirect taxes is expected to increase per capita GDP by 0.2 per cent and hence contribute to an expansion in the GDP per capita over time. The positive impact was in line with the findings of Arnold *et al* (2011) and Kneller *et al* (1999). The results from the growth model for *Direct* taxes (equation 2.1) show that increasing direct taxation had a negative impact on per capita GDP in the long run, however, this impact is not significant. The impact in the short run for both *Direct* and *Indirect* taxation are insignificant.

5.2.2 Consumption

In the short run, the positive coefficient on the changes in the share of Consumption taxes indicates that increases in these taxes have a significant impact on GDP per capita. In this regard, the result suggests that a one per cent increase in the share of these taxes will only in the short run lead to a 0.05 per cent increase in GDP per capita. It is seen that the positive effect of

consumption taxes on GDP per capita is only mirrored in the SCT in the short run. The result shows that a one per cent per cent increase in the share of SCT will lead to a 0.03 per cent increase in GDP per capita in the short run. The Consumption coefficient had a negative impact on GDP per capita, which was, however, insignificant in the long run (equation [3] *Table VI* in *Appendix*). An examination of the components of Consumption, GCT and SCT provided mixed and insignificant long run results ([4] *Table VI* in *Appendix*).

5.2.3 *International Trade*

Based on equation [5], an increase in the share of *International Trade* taxes has a positive but not significant impact in the long run on per capita GDP (see *Table VII* in the *Appendix*). The components of *Trade*, that is, GCT collected from imports and 'other trade taxes', exhibited significant long run positive effects, while SCT on import showed no significant impact [equation 6]. A one per cent increase in the share of GCT on imports and other trade taxes will result in increases of 0.2 per cent and 0.1 per cent, respectively in GDP per capita. Within the short run, an increase in the share of taxes from *International Trade* has a significant positive impact on economic growth, with a one per cent increase resulting in a 0.04 per cent rise in GDP per capita. However, the components of *International Trade* taxes, in particular SCT on imports and 'other trade taxes' displayed significant negative impacts in the short run, while the positive coefficient on GCT is insignificant. In this regard, a one per cent increase in SCT on imports and 'other trade taxes' will lead to a 0.01 per cent and 0.08 per cent decline, respectively, in GDP per capita in the short run.

5.2.4 Income & profits

Within Income & Profits, the significant negative impact on GDP per capita is evident in P.A.Y.E. and the 'interest' category in the long run, with a one per cent increase in the share of these taxes resulting in respective contractions in economic growth of 0.3 per cent and 0.1 per cent in the long run [equation 8], (in *Table VII* in the *Appendix).* However, an increase in the share of taxes garnered from companies has a positive but insignificant impact on growth over time. Within the short run, significant impacts were only evident for P.A.Y.E. and 'interest', with each having a negative and positive impact, respectively.

5.2.5 Production & Consumption

Based on the results, an increase in the share of taxes collected from *Production & Consumption* [equation 9] has a positive, however, insignificant impact on per capita GDP in the long run (see *Table VIII* in *Appendix*). Similar results are found for the short run. The result for the components of *Production & Consumption* group did not pass the normality test (see *Table VIII*, in the *Appendix*).

5.3 Discussion

All the significant results from the impact of the tax measures on GDP per capita are summarized in Table 2. These results facilitate the creation of a tax and growth rank, that is, tax groups that have the least to most harmful impact on GDP per capita. The results show that indirect taxation has a positive and significant impact on economic growth in the long run. In this regard, tax policies geared towards indirect taxes would be beneficial, not only to increasing Government revenue, but increasing GDP per capita thereby stimulating long run economic growth. This result is collaborated with the findings of Kneller et al (1999). In the long run, based on the tax growth rank, revenue garnered from GCT on imports have the largest positive and significant impact on per capita GDP, followed by 'other international taxes' (see ***Table 2***). On the other hand, P.A.Y.E has the greater negative impact on per capita GDP in the long run followed by interest on earnings. The results suggest that an increase in the share of taxes from P.A.Y.E. has the greatest harm to economic growth in the long run and any distortion to GDP per capita will take approximately nine (9) months to be corrected. Furthermore, for a country such as Jamaica that is in a recovery phase of its growth cycle, it would be unwise for policymakers to attempt to increase revenue intake from this measure. Arnold et al (2011) suggests that it would be more beneficial to reduce the taxes on personal income with the aim of increasing spending and further stimulate economic growth. In this context, within the short run (as shown in ***Table 2)***, consumption tax has the greatest beneficial impact on growth, in particular from SCT. It is important to note that the GCT index does indicate strong impact in the short run. Interest on earnings essentially has no impact on per capita GDP in the short run. PAYE and 'other international trade' taxes have negative impacts in the short run. Notably, *International Trade* taxes have an overall positive impact on growth in the short run.

Table 1: Significant Results from Equations with Tax Measures

	Impact	
Variables	**Long run**	**Short run**
Indirect	positive*	-----
Consumption	-----	positive***
SCT	-----	positive***
International Trade	-----	positive**
GCT on Imports	positive***	-----
PAYE	negative ***	negative*
Other international Taxes	positive**	negative***
Interest	negative***	positive*
* Significant at 10.0 % level; ** at 5.0 %; *** at 1.0 % level. See Tables VI, VII and VIII for details.		

6.0 Conclusion & Recommendations

The paper set out to examine the impact taxation has on economic growth, using quarterly data in an autoregressive distributed lag framework. The results indicate that by increasing the share of tax revenue garnered from indirect taxes, in particular GCT on imports, policymakers actions would result in long run economic growth benefits. However, if policymakers are myopic or interested in the impact on economic growth in the short run, increasing the share of tax revenue from consumption taxes, in particular SCT would be conducive to growth. The results show that any policy action aimed at increasing the P.A.Y.E. tax would have a negative and significant impact on GDP per capita over time. Additionally, this negative impact will take approximately 9 quarters to correct. Greater benefit would be derived by reducing the taxation on personal income if the objective is to stimulate demand. With the country currently in a recovery phase, tax policy strategy aimed at stimulating demand is important. As such, any strategy should be guided by the findings of this study.

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8.0 Appendix

***Table I*: Variables and Measurement**

Variables	Measure/Proxy	Data Sources
GDP per capita	GDP per head of working age population 14 years and over	Statistical Institute of Jamaica (STATIN)
Determinants of Growth: (X)		
Physical Capital	Gross capital formation share of GDP	STATIN
Stock of Human Capital	Quarterly primary institution enrolment, calculated by interpolating annual primary institution enrolment[13]	Economic and Social Survey of Jamaica (ESSJ)
Population growth	Growth rate of the working age population	ESSJ
Tax Indicators	Percentage Share of Tax Revenue: **Income & Profit**: P.A.Y.E., bauxite & Other Companies and Interest (Tax on dividend) **Production & Consumption**: GCT (local), SCT (local) and licenses **Trade**: GCT (import), SCT (import) and Other International trade **Consumption**: GCT and SCT Direct and Indirect Taxation	Ministry of Finance & Public Service, Jamaica.

[13] Using quadratic matched-average method in EVIEWS

Table II: Definition of Variables

Name	Definition
y	Gross Domestic Product per capita
K	Physical Capital Accumulation
H	Stock of Human Capital
wkp	Population Growth
	Tax Indicators
Inc	Income & Profit
paye	Pay as you earn (P.A.Y.E.)
comp	Bauxite and Other Companies
int	Tax on Dividend, other individuals and tax on interest
prdcon	Production and Consumption
gctlcl	General Consumption Tax (local)
sctlcl	Special consumption tax (local)
lice	Motor vehicle licenses, other licenses, 'betting, gaming & lottery', education tax, contractors levy and stamp duty (local)
trade	International Trade
gctimp	General consumption tax (imports)
sctimp	Special consumption tax (imports)
othint	Custom duty, stamp duty and travel tax
consp	Consumption
gct	General consumption taxes
sct	Special consumption taxes
direct	Direct taxes
indtax	Indirect taxes

Table III: Descriptive Statistics

Variables	Mean	Standard Error	Minimum	Maximum
	Growth (%)			
GDP per capita	-0.22	2.65	-7.30	5.88
Primary Institution Enrollment	-0.13	0.89	-3.09	3.29
Working Population	0.30	0.50	-0.54	3.25
Capital Accumulation/GDP	-0.86	17.14	-41.31	41.20
	Share of Tax Revenue (%)			
Direct Taxes	47.07	0.60	36.71	79.09
Indirect Taxes	52.93	0.60	20.91	63.29
Consumption	34.99	0.64	15.42	48.42
International Trade	27.88	0.43	18.65	42.22
Income & Profit	40.60	0.61	30.46	72.74
Production & Consumption	30.91	0.26	25.22	36.76

Source: Author's calculations

Table IV: Correlation and Order of Integration of Variables

	Correlation of variables with GDP per capita	Order of Integration
GDP per capita	1	I(1)
Population Growth	-0.072	I(0)
Physical Capital	0.073	I(0)
Human Capital Stock	0.001	I(1)
Trade	-0.1783	I(0)
GCT Imports	-0.184	I(0)
SCT Imports	-0.074	I(0)
Other International	-0.217	I(0)
Consumption	-0.255	I(1)
GCT	-0.146	I(0)
SCT	-0.184	I(1)
Production & Consumption	-0.323	I(0)
GCT (local)	-0.013	I(0)
SCT (local)	-0.259	I(1)
Motor vehicle licenses, other licenses, 'betting, gaming & lottery', education tax, contractors levy and stamp duty (local)	-0.306	I(0)
Income & profit	0.261	I(0)
P.A.Y.E.	0.047	I(0)
Bauxite and Other Companies	0.241	I(0)
Tax on Dividend, other individuals and tax on interest	0.122	I(0)
Source: Author's calculations		

Table V: Results from the Granger Causality Tests

Pairwise Granger Causality Tests
Sample: 1990Q1 2010Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DLINC does not Granger Cause DLY	81	2.13376	0.1254
DLY does not Granger Cause DLINC		3.98448	0.0226
DLCOMP does not Granger Cause DLY	81	1.07329	0.347
DLY does not Granger Cause DLCOMP		6.44106	0.0026
DLINT does not Granger Cause DLY	81	4.85851	0.0103
DLY does not Granger Cause DLINT		1.16227	0.3183
DLPRDCON does not Granger Cause DLY	81	0.24296	0.7849
DLY does not Granger Cause DLPRDCON		4.12554	0.0199
DLLICE does not Granger Cause DLY	81	1.73568	0.1832
DLY does not Granger Cause DLLICE		4.85481	0.0104
DLTRADE does not Granger Cause DLY	81	8.06038	0.0007
DLY does not Granger Cause DLTRADE		10.4589	0.0001
DLGCTIMP does not Granger Cause DLY	81	6.75867	0.002
DLY does not Granger Cause DLGCTIMP		5.90921	0.0041
DLSCTIMP does not Granger Cause DLY	61	3.09886	0.0529
DLY does not Granger Cause DLSCTIMP		1.09506	0.3416
DLOTHINT does not Granger Cause DLY	81	8.72831	0.0004
DLY does not Granger Cause DLOTHINT		15.5679	0.00
DLCONSP does not Granger Cause DLY	81	1.92338	0.1532
DLY does not Granger Cause DLCONSP		2.71158	0.0729
DLSCT does not Granger Cause DLY	81	2.57251	0.083
DLY does not Granger Cause DLSCT		5.8611	0.0043
DLGCT does not Granger Cause DLY	81	2.37053	0.1003
DLY does not Granger Cause DLGCT		2.69856	0.0738
DWKP does not Granger Cause DLY	81	4.7478	0.0114
DLY does not Granger Cause DWKP		1.7568	0.1795

Calculated with EViews

Table VI: Results for taxation and Growth

Dependent Variable: GDP per capita					
Variables	**Baseline (1)**	**Direct Taxation [2.1]**	**Indirect Taxation[2.2]**	**Consumption [3]**	**Components of Consumption [4]**
Long run Impact					
C					
Baseline Model					
LK_{t-1}	0.026	0.090	0.077	0.173**	0.145
LH_{t-1}	1.939***	1.917***	1.988***	1.995***	1.959***
WKP_{t-1}	-12.452***	-21.602***	-17.735***	-19.824***	-16.649***
Tax Structure Variables					
$LDIRECT_{t-1}$		-0.365			
$LINDIRECT_{t-1}$			0.243*		
$LCONSP_{t-1}$				0.002	
$LGCT_{t-1}$					-0.030
$LSCT_{t-1}$					-0.040
Short run Impact					
DLY_{t-2}	-0.621***	-0.683***	-0.643***	-0.666***	-0.591***
DLK_{t-3}	-0.034**				-0.056***
DLK_{t-4}		0.040***	0.041***	0.042***	
DLH_{t-2}	-0.568*	-0.340	-0.337*		-0.694**
DLH_{t-4}				-0.462*	
$DWKP_{t-1}$	1.175***	1.405***	1.567***	1.679***	1.356***
$DLDIRECT_{t}$		0.003			
$DLINDIRECT_{t}$			-0.002		
$DCONSP_{t-1}$				0.052***	
$DLGCT_{t-1}$					0.004
$DLSCT_{t-1}$					0.033***
Adjusted R^2	0.523	0.572	0.586	0.649	0.618
S.E. of regression	0.018	0.0174	0.017	0.016	0.016
Durbin-Watson	2.151	2.376	2.176	2.503	2.229
Wald test: F-Statistics	8.968	13.0	11.54	8.277	11.846
ARCH	1.523 [0.2047]	3.677 [0.0089]	1.165 [0.334]	0.722 [0.580]	0.475 [0.7542]
Residual Stationary	Yes	Yes	Yes	Yes	Yes
Norm (prob)	2.5 [0.287]	0.4500 [0.779]	5.918 [0.052]	0.460 [0.794]	1.380 [0.501]

Notes:

L- denotes the log of the variable. D – denotes the first difference of the variables

* Significant at 10.0 % level; ** at 5.0 %; *** at 1.0 % level.

Norm: normality test of the residual based on probability value from the Jarque-Bera test statistics. The null hypothesis of a normal distribution. Wald test coefficient test for long run relationship. Heteroskedasticity Test: ARCH. The null hypothesis test suggests no Heteroskedasticity.

Table VII: Results for taxation and Growth				
Variables	**International Trade (5)**	**International Trade Components (6)**	**Income & Profit (7)**	**Income & Profit Components (8)**
Long run Impact				
Baseline Model				
LK_{t-1}	0.044	-0.055	-0.009	-0.027
LH_{t-1}	1.956***	0.485***	1.875***	1.823***
WKP_{t-1}	-10.184***	0.093	-11.696***	-8.667***
Tax Structure Variables				
$LTrade_{t-1}$	**0.053**			
$LGCTIMP_{t-1}$		0.152***		
$LSCTIMP_{t-1}$		0.000		
$LOTHINT_{t-1}$		0.114**		
$LINC_{t-1}$			**-0.241**	
$LPAYE_{t-1}$				-0.253***
$LCOMP_{t-1}$				0.022
$LINT_{t-1}$				-0.081***
Short run Impact				
DLY_{t-1}		0.346***		
DLY_{t-2}	-0.534***		-0.585***	-0.599***
DLK_t		-0.021		
DLK_{t-3}	-0.028**		-0.036***	-0.031***
DLK_{t-4}				
DLH_{t-2}			-0.584**	-0.693***
DLH_{t-3}	-0.537*	-1.028***		
$DWKP_t$				
$DWKP_{t-1}$	1.445***	0.877**	1.236***	1.194***
$DLTRADE_{t-1}$	0.041**			
$DLGCTIMP_{t-3}$		0.029		
$DLSCTIMP_{t-2}$		-0.006*		
$DLOTHINT_{t-3}$		-0.075***		
$DLINC_{t-1}$			0.008	
$DLPAYE_{t-2}$				-0.034*
$LCOMP_t$				0.004
$DLINT_{t-4}$				0.007*
Adjusted R^2	0.545	0.696	0.533	0.548
S.E. of regression	0.018	0.014	0.018	0.018
Durbin-Watson	2.21	1.697	2.064	2.184
Wald test: F-Statistics	6.26	31	7.162	6.704
Heteroskedasticity	[0.0735]	[0.8177]	[0.021]	[0.0166]
Residual Stationary	Yes	Yes	Yes	Yes
Norm (prob)	4.204 [0.122]	0.765 [0.682]	2.812 [0.245]	1.064 [0.588]

Table VIII: Results for taxation and Growth

Variables	Production & Consumption (9)	Production & Consumption Components (10)
Long run Impact		
LK_{t-1}	0.090	-0.131
LH_{t-1}	2.044***	1.071
WKP_{t-1}	-21.539***	-13.970***
$LPRDCON_{t-1}$	0.386	
$LGCTLCL_{t-1}$		-0.162
$LSCTLCL_{t-1}$		0.091
$LLICE_{t-1}$		0.616**
Short run Impact		
DLY_{t-2}	-0.627***	-0.652***
DLK_{t-3}	-0.030**	
DLK_{t-4}		0.03*
DLH_{t-2}	-0.502**	
DLH_{t-3}		-0.616**
$DWKP_{t}$		
$DWKP_{t-1}$	1.248***	1.184***
$DLPRODCON_{t-4}$	-0.043	
$DLGCTLCL_{t-3}$		-0.006
$DLSCTLCL_{t-4}$		-0.007
$DLLICE_{t-1}$		-0.058*
Adjusted R^2	0.565	0.604
S.E. of regression	0.018	0.017
Durbin-Watson	2.190	1.856
Wald test: F-Statistics	15.00	7.79
Heteroskedasticity	[0.0129]	[0.0789]
Residual Stationary	Yes	Yes
Norm (prob)	4.384[0.112]	22.02[0.000]