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Abstract

Since 2003 policymakers in Barbados have implemented a series of tax reforms that have lowered both basic as well as marginal income tax rates. These changes have more than likely induced taxpayers to alter their behaviour in order to affect their reported taxable income. This paper employs an annual sample of 3,000 individual taxpayers between 2003 and 2006 to investigate the sensitivity of taxable income to changes in marginal tax rates. The empirical approach adopted also allows the researcher to provide evidence on the variation in taxable income by gender and income group. The paper finds that for every 1 percent rise in the marginal tax rate, taxable income decreases by 0.2 percent. Further disaggregation of the database also revealed that a strong negative labour supply effect causes the elasticity for low-income taxpayers to rise to 0.9, while females tend to be more responsive to changes in marginal taxes relative to males.

JEL Classification: H2; H31; C23

Keywords: Taxable income; Marginal tax rates; Tax avoidance

1. Introduction

Taxes are an important component of the economic policy mix. If high-income individuals pay relatively higher rates of tax and those revenues are redistributed to poorer members of the society, taxes can reduce income inequality. Taxes levied on income and the expenditure are used in developing countries to generate revenues to finance projects that can have significant benefits to long-run growth and development. If these taxes, however, are used to finance the continued growth of the public sector, they can crowd-out overall private capital investment (Hayek, 1960). In addition, by taking funds away from those members of society who are more likely to engage in investment activities, a poorly designed tax system can inhibit the long-run growth prospects for a country.

The empirical literature has, for the most part, found evidence supporting the inverse association between taxes and economic growth. Helms (1985) reports that higher tax rates, when used to fund transfer payments, has a negative impact on economic growth. However, if these additional funds are employed to finance improvements in public services such as education, highways and public health and safety, the relationship is reversed. This occurs since the quality of public services positively influences firms' location and production decisions. Analogous results are obtained by Hines (1996) using enterprise-level observations, while Bleaney, Gemmell and Kneller (2001), using observations on 22 Organisation for Economic Cooperation and Development economies between 1970 and 1995 find that distortionary taxes adversely influence growth in both the short and long run.

In an attempt to speed-up the process of economic convergence, developing countries have, since the 1970s, engaged in major tax reform plans (Gills, 1989). Tax reform is generally taken to imply some approach to improving the existing state of affairs. For the most part major attempts at tax reform usually arise from the recognition of distortions and/or inequities created by the tax system. Policymakers in these countries have therefore attempted to address these problems through broadening the tax base, flattening the tax rate structure as well as simplifying the overall tax administration systems.

The effectiveness of these attempts at tax reform largely depends on the response of economic agents. A fall in taxes, for example, could lead to a decline in labour supply by some economic agents as they take the opportunity to increase their leisure since their after-tax income has risen. In this scenario, the tax reform plan could lower national output. However, it is also possible that the cutback in tax rates will encourage some individuals to engage in more overtime and thus lead to greater economic output. Some economic agents can also respond to the change in taxes by changing the structure of their compensation packages, in an attempt to reduce their tax liabilities. The response of economic agents to changes in tax rates is therefore ambiguous, i.e. it has to be assessed empirically, and may vary from one country to the next.

Since the seminal work of Lindsey (1987) and Feldstein (1995) there have been numerous attempts to assess the impact of tax rate changes on taxpayers' responses. In general, these studies report a statistically significant association between changes in marginal tax rates and taxable income. However, the magnitude of this association is somewhat controversial. Earlier studies in the area usually report relatively large elasticities, while more recent studies report relatively modest estimates.

This paper attempts to add to this debate by providing estimates of relationship between marginal taxes and taxable income in the small island developing state of Barbados. Up until now, most of the research in the area has employed tax return data from US tax reforms that took place in 1981, 1986 and 1993. There are a number of reasons for utilising tax return data for Barbados. First, it allows the reader to assess whether the relationship between changes in tax rates and taxable income varies based on the country's level of economic development. Second, the study also gives an analysis of the gender differentials of taxpayer responses.

The remainder of this study is structured as follows. Following the introduction, Section 2 presents a review of the literature in the area. Section 3 offers a brief description of tax reform in Barbados as well as a discussion of the data and the econometric approach employed. Section 4 provides the empirical results and conducts various tests for the robustness of analysis. Section 5 summarises the key empirical findings as well as discuss the main policy implications arising from the findings.

2. Literature Review

Lindsey (1987) provides one of the first attempts to assess the relationship between changes in tax rates and taxable income using observations on individual tax returns. Observations on 100 data items for a stratified sample of 100,000 taxpayers are employed to assess the impact of the 1981 Economic Recovery Tax Act. This legislation provided for a series of tax rate reductions over a period of four years (1981-9184) and also shrink the size of the tax base by extending

Individual Retirement Accounts to basically all taxpayers and a two-earner deduction for working married couples. To assess the effects of tax rates on taxable income, Lindsey first ranked the taxpayers by adjusted gross income and then did the same for tax returns in 1982. The implicit assumption behind this approach is that taxpayers in successive fractiles corresponded to the same individuals in both years. Using this approach, the author reported elasticity estimates with respect to tax rates and taxable income. These elasticity estimates ranged from 0.7 for taxpayers earning \$50,000, and up to as high as 2.0 for taxpayers with incomes of \$1,000,000. These elasticity estimates were large, suggesting that for high-income taxpayers a 1 percent reduction in the tax rate leads to greater than proportionate increase in taxable income. The implication of this for policymakers is that tax rate increases, would likely generate less revenue than tax rate reductions. The rise in reported income obtained by Lindsey could have occurred due to changes in labour supply and participation, changes in the form of compensation, reduced tax evasion and avoidance as well as changes in decisions regarding deductions.

The main limitation's of Lindsey's (1987) study was that the database employed did not provide the researcher with a panel of observations to conduct the empirical analysis. In addition, the assumption that individuals in the successive fractiles are identical is quite strong and could have influenced the overall results. Building on this early research, Feldstein (1995), utilised a panel of individual tax returns that allows the researcher to follow the same individual over several years. In contrast to Lindsey, Feldstein conducted his analysis around the Tax Reform Act of 1986, however, the characteristics of both plans were similar: reduced marginal tax rates as well as broadened the tax base. Nevertheless, Feldstein also obtained relatively large elasticity estimates: around 1.0 to 1.5.

Auten and Carroll (1999), however, notes that these earlier studies did not employ effective controls for other nontax factors that may have impacted on income changes. A panel of over 15,000 individuals is examined for the years before and after the 1986 tax reform episode. Utilising a two-stage regression approach, Auten and Carroll attempt to control for the effects of various individual taxpayer characteristics (for example, age, occupation, marital status and region) on reported income. The empirical results, in contrast to earlier studies, suggest an elasticity estimate of around 0.6. In reconciling Auten and Carroll's result to those of Lindsey (1987) and Feldstein (1995), Goolsbee (2000) notes that there may be significant differences between the short- and long-run elasticities. Using a restricted sample of only corporate executives, the author finds that while the short-run response of taxable income to changes in tax rates exceeds 1, after just one year the elasticity estimate drops to 0.4.

Gruber and Saez (2002) also attempt to control for these dynamic effects by using a database containing a large number of households observed over the 1980s. The regression model expresses changes in individual income as a function of marginal tax rate change, changes in after-tax income, the previous year's income, base year, marital status dummies and a spline term to capture the non-linear effects of taxes rate changes on income distribution. Gruber and Saez obtain an elasticity estimate of 0.4, with lower estimates for real and broadly defined income. Using a somewhat different approach, which compares the effects that differences in state income tax rates have on taxable income of individuals with the same income and demographic characteristics, Long (1999) obtains a relatively similar elasticity estimate. Kopczuk (2005) also find relatively low elasticity estimates, but notes that elasticity may depend on available deductions.

There are two main drawbacks of these early approaches: (1) the tax reform episodes considered usually involved a change in tax rates as well as allowances or deductions, making it difficult to separate these two effects, and; (2) the analysis was based on comparisons of high and low- to middle-income taxpayers, which could be affected by increased inequality. Saez (2003) employs a somewhat different approach to evaluate the relationship between tax rates and income. Instead, the author uses ‘bracket creep’ as the source of variation in tax rates. Using observations on around 40,000 individuals observed between 1979-1981, Saez obtained elasticity estimates of 0.3 for the full sample, and 0.4 for married taxpayers and 0.2 for singles. While these estimates are significantly lower than earlier studies, such as those by Lindsey (1987) and Feldstein (1995), they are in line with recent studies in the area.

3. Tax Reform in Barbados

The income tax system in Barbados is presently regulated by Income Tax Act, Cap. 73 and requires that income taxes should be levied on all persons that have earned income in Barbados during the year. Taxable income generally includes income from all business, property, offices and employment. There are two tax rates, the basic and marginal rates of tax. The basic tax rate, set at 20 percent is applied to the first \$24,200 of taxable income for the tax year. The marginal tax rate, presently at 35 percent, is then assessed on all income in excess of \$24,200.

Table 1 shows the importance of personal taxes to revenue collections in the island by providing observations on the amount and share of various taxes collected over five year intervals since

FY1985/86. At the end of FY2006/07 total personal income tax receipts were \$297.4 million, the third largest single category behind the value-added tax (VAT) and company taxes.

Table 1: Tax Revenue in Barbados

	1985/86	1990/91	1995/96	2000/01	2006/07
<i>BDS \$m</i>					
Tax Revenue	606.5	891.8	1081.5	1596.3	2066.6
Taxes on Income and Profit	204.2	249.6	376.5	599.0	810.3
Personal Income Tax	134.5	140.0	213.6	293.4	297.4
Company Tax	56.8	95.1	133.5	268.8	444.9
Other	12.9	14.6	29.4	36.8	68.0
Levies	29.5	91.3	13.4	14.6	0.0
Taxes on Property	34.7	46.2	69.7	95.3	150.8
Taxes on Goods and Services	166.7	285.7	438.0	753.7	911.8
Import Duties	115.5	117.8	93.1	120.6	167.6
Other Taxes	85.5	101.1	90.7	13.1	26.1
<i>% of Total</i>					
Tax Revenue	100.0	100.0	100.0	100.0	100.0
Taxes on Income and Profit	33.7	28.0	34.8	37.5	39.2
Personal Income Tax	22.2	15.7	19.8	18.4	14.4
Company Tax	9.4	10.7	12.3	16.8	21.5
Other	2.1	1.6	2.7	2.3	3.3
Levies	4.9	10.2	1.2	0.9	0.0
Taxes on Property	5.7	5.2	6.4	6.0	7.3
Taxes on Goods and Services	27.5	32.0	40.5	47.2	44.1
Import Duties	19.0	13.2	8.6	7.6	8.1
Other Taxes	14.1	11.3	8.4	0.8	1.3

Source: Central Bank of Barbados' *Annual Statistical Digest*.

Prior to the 2002-2006 tax reforms, there were three prior major tax reform efforts in Barbados' history in 1986, 1992 and 1997 (Howard, 2006). The 1986 tax reform system reduced the taxable income of a large number of taxpayers, as individuals earning \$15,000 or less were now exempted and all taxpayers were provided with a standard deduction of \$15,000. In the ensuing years, the tax system was made more complex and inefficient via a system of itemised allowances and deductions. These policy changes resulted in a significant fall in taxable income: the contribution of personal income taxes to total tax receipts fell by 6.5 percentage points to just

15.7 percent, contributing to one of the largest single fiscal deficits on record in 1990/1991. The 1992 reform effort there attempted to simplify the system and improve the efficiency of the income tax system. The main policy changes were a reduction in standard deduction to \$13,000, a reduction in the top marginal tax rate from 50 to 40 percent and the elimination of most itemised deductions. These policy changes were more revenue efficient and therefore resulted in a 4 percentage point or \$38.4 million increase in the contribution of personal income taxes to overall tax receipts. The third reform in 1997 replaced a number of consumption based taxes with a VAT system.

The most recent tax reform effort began in 2001. In the 2001 Financial Statement of Economic and Financial Policies, the Government communicated the desire to ensure that tax rates in Barbados were not out of sync with other regional economies. No changes were, however, made to individual income taxes payable in this year. From 2003 onward, however, Government made sweeping changes to both the standard deduction as well as basic and marginal tax rates. Table 2 shows that the standard deduction jumped by 50 percent: from \$15,000 in 2002 to \$22,500 by 2006. In addition, both the basic and marginal tax rates were lowered by 5 percentage points over the four year period.

Table 2: 2002-2006 Tax Reform

	2002	2003	2004	2005	2006
Standard Deduction	\$15,000	\$15,000	\$17,500	\$20,000	\$22,500
Basic tax rate	25%	22.5%	20%	20%	20%
Marginal tax rate	40%	40%	40%	37.5%	35%

Although the 2002-2006 tax reform effort constituted one of the most significant changes in tax policy in recent memory, little or no research has examined the implications of this reform. To provide an initial investigation of the distributional impact of this change, an approach similar to that outlined by Mascoll (1991) is employed: using income and allowance values for the representative tax payer, the effective tax rate is calculated for three representative individuals and the results are provided in Table 3. The results provided in the table suggest that the primary beneficiaries of the tax change seemed to have been middle- to high-income individuals as these representative tax payers would have experienced a three percentage point decline in their effective rates of tax after the 2002-2006 tax reform effort.

Table 3: Distributional Impact 2002-2006 Tax Reform on the Representative Tax Payer

	Before	After
INCOME		
Low Income Individual		
1. Gross Annual Income	25,000	25,000
2. Less Allowances	23,000	23,000
3. Taxable Income	2,000	2,000
4. Income Taxes Paid	500	400
5. Effective Tax Rate	2%	2%
6. Real after-tax Income	24,500	24,600
Middle Income Individual		
1. Gross Annual Income	64,000	64,000
2. Less Allowances	27,500	27,500
3. Taxable Income	36,500	36,500
4. Income Taxes Paid	10,970	9,145
5. Effective Tax Rate	17%	14%
6. Real after-tax Income	53,030	54,855
High Income Individual		
1. Gross Annual Income	125,000	125,000
2. Less Allowances	40,500	40,500
3. Taxable Income	84,500	84,500
4. Income Taxes Paid	30,170	25,945
5. Effective Tax Rate	24%	21%
6. Real after-tax Income	94,830	99,055

It is likely, however, that the tax reform plan may have changed the behaviour of individual tax payers. For example, individuals might decide to increase their supply of labour to the labour market as a result of the reduction in effective tax rates or vice versa. The results reported in Table 3 do not take such behavioural responses into account. The following section therefore outlines an empirical approach that can be employed to examine the behavioural response of Barbadians to changes in marginal tax rates.

4. Empirical Approach

The empirical approach employed in this study is similar to that proposed by Gruber and Saez (2002) who develop a microeconomic model to decompose the changes in taxable income due to changes in marginal tax rates and after-tax income. The empirical specification of the regression equation is of the following form:

$$\log(y_{it} / y_{it-1}) = \mu_i + \lambda_t + \beta \log[(1 - T_t) / (1 - T_{t-1})] + \gamma \log[(y_{it} - T_t(y_{it})) / (y_{it-1} - T_{t-1}(y_{it-1}))] + v_{it} \quad (1)$$

where y_{it} is before-tax income for individual i in period t , μ_i and λ_t are unobserved individual- and time-specific effects respectively, T_t is the marginal tax rate, $T_t(y_{it})$ is the tax liability and v_{it} is an error term that is assumed to have normal properties. The term $\log[(1 - T_t) / (1 - T_{t-1})]$ in Equation (1) captures the effect that changes in tax rates have on reported income, while the term $\log[(y_{it} - T_t(y_{it})) / (y_{it-1} - T_{t-1}(y_{it-1}))]$ is the change in tax liability or the income effect of a change in tax rates.

Both of the terms on the right-hand side of Equation (1) are likely to be correlated with the error term. As a result, the equation is estimated using two stage least squares (2SLS). To control for the endogeneity of these terms, the predicted log of net-of-tax rate change and the predicted log of after-tax income change if there were no behavioural response if real income does not change are employed as instruments for $\log[(1-T_t)/(1-T_{t-1})]$ and $(y_{it} - T_t(y_{it}))/y_{it-1} - T_{t-1}(y_{it-1})$, respectively.

There are a number of other factors that can impact on changes in before-tax income. If these factors are not captured in the regression model the elasticity of income to changes in tax rates could be imprecisely estimated. As a result, the log of initial income, age, initial age-squared, the initial number of children and marital status are included in the regression equation. The initial income variable captures any reversion-to-the-mean effects, while age, age-squared, the number of children and marital status attempt to capture any life-cycle and household effects.

The observations employed in this study use a specially generated database of randomly selected individuals from the Inland Revenue Department of Barbados. The analysis is conducted over the period 2003 to 2006 and provides information on all the items on the tax return form for 3000 individuals each year. Since the database provides cross-section rather than panel data, the approach proposed by Lindsey (1987) is employed to use the four separate samples of tax returns to approximate the difference-in-differences method to analysing the impact of changes in tax rates. The framework ranks the taxpayers by before-tax income for all four years and then stacks the cross-sections to create a panel. The technique therefore makes the assumption that individual's ranks remain unchanged from year to year.

Table 4 provides descriptive statistics for the database. Median net income from employment over the sample period for individuals captured in the database was \$27,783, with the maximum earnings from income for any one individual being \$787,977. The median individual paid about \$1,125 in taxes after claiming \$21,419 in deductions. Besides the personal allowance, the median taxpayer also claimed about \$11,211 in allowances for home improvement, savings in credit unions as well as the purchase of new shares or mutual funds. Savings in credit unions was the most popular allowance claimed with 35 percent of taxpayers utilising this vehicle to reduce their tax liability. In contrast, less than one percent of tax payers utilised the allowance for investment in venture capital funds.

Table 4: Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
Age	41.666	41.000	102.000	16.000	12.571	11670
Marital Status	2.229	3.000	3.000	1.000	0.965	7956
Gender	1.472	1.000	2.000	1.000	0.499	10756
Resident	1.012	1.000	2.000	1.000	0.109	7898
Total Assessable Income	34297.630	27435.460	786976.800	-85671.000	30411.400	12000
Tot Deductions Allowed	22303.850	21419.520	65500.000	0.000	6103.351	12000
Taxable Income	13585.660	5412.515	766476.800	0.000	27329.710	12000
Tax Payable	3609.982	1118.000	301748.000	0.000	9408.222	12000
Tax Paid	3618.629	1125.000	301748.000	0.000	9415.951	12000
PAYE	4196.302	1681.030	302553.200	-2372.290	8797.850	12000
Income from Employment	35493.940	27782.740	786976.800	0.000	31802.330	11339
Net Income from Employment	32598.080	26466.480	786976.800	0.000	30172.390	12000
Income from Pensions	11824.080	0.000	170661.200	0.000	19747.620	1009
Personal Allowance	19033.490	20000.000	30000.000	0.000	3679.664	11870
Spouse Allowance	2773.014	3000.000	3000.000	0.000	793.871	793
Venture Capital Funds	1235.239	0.000	10000.000	0.000	3068.047	71
Share/Mutual Funds	5102.274	4159.800	10000.000	0.000	4321.169	711
NIS Contributions	518.453	117.580	3636.600	0.000	726.485	253
Savings in Cooperative	2012.134	2197.615	6000.000	0.000	1269.929	4190
Trade Union Subs	212.802	234.000	240.000	0.000	54.016	3430
Parliamentary Subs	422.938	0.000	5000.000	0.000	1104.356	105
Home Improvement	5040.358	4855.390	10000.000	0.000	3400.843	3567
Total Other Deductions	2648.558	321.385	35500.000	0.000	4037.276	12000

5. Results

5.1 Preliminary Estimates

Table 5 utilises the methodology outlined in the previous section to estimate the elasticity of tax rate changes. Two income variables are considered, total income and taxable income, with the latter being total income adjusted for any changes in allowances. In addition, the results are reported with and without the control variables. Looking first at the results without the control variables, the model is able to explain about 55 percent of the fluctuation in total reported income over the sample period (column 2). The coefficient on the marginal tax variable is positive and statistically significant suggesting that as tax rates increase total income also rises. This result could be associated with the impact of tax rates on labour supply decisions: if tax rates encourage individuals to supply more labour then total income is likely to be positively associated with marginal tax rates. The coefficient on the tax liability variable is also positive and statistically significant and suggests that as individuals' after-tax income rises they are more likely to report higher levels of income.

Table 5: Basic Taxable Income Elasticity Estimates

	(1)	(2)	(3)	(4)	(5)
Dependent Variable: $\log(y_{it} / y_{it-1})$		Total Income	Taxable Income	Total Income	Taxable Income
$\log[(1 - T_t^b)/(1 - T_{t-1}^b)]$		0.117 (0.045)**	-0.381 (0.021)**	0.182 (0.027)**	-0.191 (0.018)**
$\log[(y_{it} - T_t^b(y_{it})) / (y_{it-1} - T_{t-1}^b(y_{it-1}))]$		1.702 (0.025)**	1.955 (0.012)**	1.697 (0.016)**	2.090 (0.011)**
$\log(y_{it-1})$		-	-	-0.046 (0.002)**	-0.022 (0.002)**
<i>Age</i>		-	-	0.001 (0.000)**	-0.000 (0.000)**
<i>Age</i> ²		-	-	0.000 (0.000)**	0.000 (0.000)**
<i>Marital Status</i>		-	-	-0.004 (0.004)**	-0.001 (0.000)*

Adjusted R-squared	0.549	0.900	0.622	0.904
s.e. of regression	0.054	0.025	0.042	0.023

Notes: ** and * indicates significance at the 5 percent and 10 percent level of significance, respectively.

The exclusion of important life-cycle and household effects could potentially lead to some bias in the reported coefficient estimates in column 2. As a result, the regression model was augmented with controls for initial income, age and marital status. The inclusion of these variables in the regression model resulted in the elasticity of total income to changes in marginal tax rates rising from 0.117 to 0.182: for every 1 percent increase in marginal tax rates, total income usually increases by about 0.2 percent. In contrast, the coefficient on the tax liability variable falls slightly to 1.697. The response of tax payers to changes in tax liability is therefore highly elastic and could be due to the incentive effects of tax rates on tax evasion and tax avoidance. Individuals that were previously evading taxes may be encouraged to file if their tax liability is likely to be relatively low, while tax avoiders may not find it worthwhile to engage in complex financial transactions to reduce their tax liability.

It is also of interest to policymakers to have an estimate of the impact that changes in marginal tax rates have on taxable income, total reported income less any allowances and deductions. The relationship between taxable income and marginal tax rates could provide evidence of whether or not higher tax rates encourage filers to find vehicles to reduce their tax liability. Column 4 and 5 of Table 5 reports the taxable income elasticities. The regression results reported in the two columns suggest that the empirical model is able to explain about 90 percent of the fluctuation in reported taxable income in Barbados. The estimates of the elasticity of taxable income to changes in marginal tax rates in column 4 is -0.381 so that for every 1 percent increase in tax

rates, reported taxable income decreases by about 0.4 percent. This finding therefore agrees with *a priori* reasoning that higher marginal tax rates might encourage individuals to find ways of investing their assets in ways that would reduce their taxable income and therefore their tax liability. The elasticity estimate of 0.4 is also on par with recent estimates for the US derived by Gruber and Saez (2002). The tax liability coefficient also reinforces this result, with a rise in after-tax income leading to a rise in reported taxable income. When the model is augmented with control variables to account for life-cycle and household effects, the coefficient on the tax liability variable rises slightly. However, the elasticity of taxable income to changes in marginal tax rate falls to about 0.2 and on par with that obtained by Saez (2003).

5.2 *Income Levels*

Higher income individuals more respond in different ways to tax rate changes relative to lower income persons. Higher income individuals may be better placed to invest in assets that would reduce their tax liability. In contrast, since lower income persons are unlikely to utilise such instruments, they may respond to tax rate increases by reducing their labour supply. To examine the differences in responses to marginal tax rate changes on low and high income individuals, the lower quartile and the upper quartile of individuals were extracted from the database. Equation (1) was then re-estimated for each of these two groups.

The regression results for the two groups of tax payers are provided in Table 6. Column 2 of the table indicates that lower income individuals tend to report reduced levels of total income after an increase in marginal tax rates. These findings imply that higher taxes tend to have a negative and

significant disincentive effect on the amount of hours worked by lower income individuals in Barbados. The coefficient estimate suggest that there is one-to-one relationship between changes in tax rate and total income: for every 1 percent rise in the marginal tax rate, total reported income of lower income tax payers tends to fall by 1 percent.

There is also a significant difference in the response of changes in total income to changes in after-tax income for high- and low-income individuals. For lower income taxpayers, a 1 percent rise in after-tax income elicits a greater than proportionate change in total reported income, while for higher income filers a 1 percent rise in the after-tax income leads to a less than 1 percent change in total reported income.

Table 6: Taxable Income Elasticity Estimates (Income Differences)

(1)	(2)		(3)	
	Total Income		Taxable Income	
Dependent Variable: $\log(y_{it} / y_{it-1})$	High Income	Low Income	High Income	Low Income
$\log[(1 - T_t^b)/(1 - T_{t-1}^b)]$	0.287 (0.022)**	-0.955 (0.053)**	-0.188 (0.017)**	-0.853 (0.017)**
$\log[(y_{it} - T_t^b(y_{it})) / (y_{it-1} - T_{t-1}^b(y_{it-1}))]$	0.876 (0.019)**	1.687 (0.023)**	2.063 (0.015)**	1.735 (0.008)**
$\log(y_{it-1})$	-0.001 (0.000)**	0.000 (0.000)	0.001 (0.000)**	0.000 (0.000)**
<i>Age</i>	0.000 (0.000)**	0.000 (0.000)**	-0.000 (0.000)**	0.000 (0.000)*
<i>Age</i> ²	-0.000 (0.000)**	-0.000 (0.000)**	0.000 (0.000)**	-0.000 (0.000)
<i>Marital Status</i>	-0.001 (0.000)*	-0.006 (0.001)*	-0.000 (0.000)	-0.002 (0.000)*
Adjusted R-squared	0.334	0.751	0.917	0.963
s.e. of regression	0.035	0.031	0.017	0.011

Notes: ** and * indicates significance at the 5 percent and 10 percent level of significance, respectively.

Table 6 also attempts to measure the differences in the reported taxable income of low- and high-income taxpayers to changes in the marginal tax rate. The elasticity of taxable income to changes in the marginal tax rate was approximately 4.5 times larger than that for high income individuals: for every 1 percent rise in the marginal tax rate, taxable income decreases by 0.8 percent, compared to 0.2 percent for high income tax payers. This result could be driven by the strong labour supply response of low income taxpayers reported early that offsets the advantages high income individuals may have in terms of tax planning.

5.3 Gender

Aaberge et al. (1999) and Smith et al. (2003) both suggest that the labour supply responses of females may differ from that for males. For women, children can have a major impact on their labour supply decisions. Tax rate changes impact on these decisions by influencing the opportunity costs staying out of the labour force. Prohibitively high marginal tax rates reduces the opportunity cost of staying out of or leaving the labour force, while relatively lower marginal tax rates raises the opportunity cost and might therefore encourage more women to enter the labour force. If marginal tax rates have a relatively greater impact on the opportunity cost of staying out of the labour force for women relative to men, then the elasticity of income to changes in marginal taxes should be larger for females.

Table 7 provides the elasticities disaggregated by for different genders. The elasticity estimates provided in column 2 are in general agreement with *a priori* expectations: the coefficient on marginal tax rate for females is almost twice as large as that for males. Females, on average,

therefore tend to be more responsive to tax rate changes than males, supplying relatively more labour when the tax rate increases and reducing their working hours as the tax rate decreases. In terms of income responses to changes in after-tax income, there is relatively little difference in the responses of the two groups.

In terms of the impact of marginal tax rate changes on taxable income, the result was quite similar to that obtained earlier for total income. Females on average tend to report a significantly larger fall in taxable income as a result of a rise in the marginal tax rate. The elasticity of taxable income to changes in marginal tax rates was about one quarter larger than that for males.

Table 7: Taxable Income Elasticity Estimates (Gender Differences)

(1)	(2)		(3)	
	Total Income		Taxable Income	
Dependent Variable: $\log(y_{it} / y_{it-1})$	Males	Females	Males	Females
$\log[(1 - T_t^b)/(1 - T_{t-1}^b)]$	0.146 (0.042)**	0.284 (0.032)**	-0.191 (0.021)**	-0.238 (0.018)**
$\log[(y_{it} - T_t^b(y_{it})) / (y_{it-1} - T_{t-1}^b(y_{it-1}))]$	1.786 (0.026)**	1.626 (0.018)**	2.115 (0.013)**	2.023 (0.010)**
$\log(y_{it-1})$	-0.000 (0.000)*	-0.001 (0.000)**	0.000 (0.000)	0.000 (0.000)**
<i>Age</i>	0.001 (0.000)**	0.000 (0.000)**	-0.000 (0.000)**	-0.000 (0.000)**
<i>Age</i> ²	-0.000 (0.000)**	-0.000 (0.000)**	0.000 (0.000)**	0.000 (0.000)**
<i>Marital Status</i>	-0.004 (0.001)**	-0.001 (0.001)*	0.001 (0.000)**	-0.001 (0.000)*
Adjusted R-squared	0.625	0.618	0.917	0.887
s.e. of regression	0.035	0.026	0.017	0.016

Notes: ** and * indicates significance at the 5 percent and 10 percent level of significance, respectively.

6. Conclusions

Over the last five years, fiscal authorities in Barbados have made significant changes to the income tax structure in Barbados. The 2002-2006 tax reform effort was probably one of the most noteworthy of the all the tax reform efforts were undertaken in the country. During the period, the standard deduction rose by 50 percent and both the basic and marginal tax rates fell by 5 percentage points. These changes in the deductions as well as tax rates primarily benefited middle- to high-income individuals, with their marginal tax rates fall by about 3 percent, compared to no change for low-income individuals.

Changes in marginal tax rates can have an impact on the labour supply decisions of economic agents, as well as their efforts to either avoid or evade taxes. Previous research on the elasticity of taxable income to changes in marginal tax rates suggest that a reasonable estimate lies between 1 and 0.2 percent. These results, however, were derived using data for the US and therefore are only of academic interest to Barbadian policymakers as these estimates can not be employed to forecast the effects of future tax reform efforts. To provide estimates of the taxable income elasticity for Barbados, an annual database of individual taxpayers is obtained for the period 2003 to 2006. In each year a random sample of 3,000 tax payers is observed.

Based on panel regression techniques, the study finds that for every 1 percent rise in marginal tax rates in Barbados total income of tax payers usually increases by about 0.2 percent. This result seems to suggest that economic agents in Barbados, on average, tend to respond to higher tax rates by increasing their labour supply. In relation to taxable income, in contrast, higher marginal tax rates seems to encourage motivate individuals to either avoid or evade taxes: a 1 percent rise

in marginal tax rates leads to a 0.2 percent reduction in taxable income. The disincentive effect is even larger for low-income individuals and females.

The findings reported in this study can not only be employed to forecast the effects of future changes in tax rates, but can also inform the overall process of conceptualising tax reform. The study suggest that rather than having higher rates of tax, fiscal authorities should attempt to have a relative broad tax base with relatively low rates of marginal taxes. Policymakers must also be cognisant of the impact that tax rate changes can have on the supply of labour and by extension growth and productivity. While higher tax rates may lead to a marginal gain in tax revenues, these gains may come at the cost of lower hours worked, overtime and decision of individuals of whether or not to enter the labour force.

References

- Aaberge, R., Colombino, U. and Strøm, S. (1999) "Labour Supply in Italy: An Empirical Analysis of Joint Household Decisions with Taxes and Quantity Constraints," *Journal of Applied Econometrics* 14(4): 403-422.
- Auten, G. and Carroll, R. (1999) "The Effect of Income Taxes on Household Income," *Review of Economics and Statistics* 81(4): 681-693.
- Bleaney, M., Gemmell, N. and Kneller, R. (2001) "Testing the Endogenous Growth Model: Public Expenditure, Taxation, and Growth over the Long Run," *Canadian Journal of Economics*, 34(1): 36-57.
- Gills, M. (1989) *Tax Reform in Developing Countries (Fiscal Reform in the Developing World)*. Duke University Press, Durham, NC.
- Goolsbee, A. (2000) "What Happens When You Tax the Rich? Evidence from Executive Compensation," *Journal of Political Economy* 108(2): 352-378.
- Gruber, J. and Saez, E. (2002) "The Elasticity of Taxable Income: Evidence and Implications," *Journal of Public Economics* 84(): 1-32.
- Hayek, F.A. (1960) *The Constitution of Liberty*. University of Chicago Press, Chicago.
- Helms, L.J. (1985) "The Effect of State and Local Taxes on Economic Growth: A Time Series – Cross Section Approach," *Review of Economics and Statistics*, 67(4): 574-582.
- Hines, J.R. (1996) "Altered States: Taxes and the Location of Foreign Direct Investment in America," *American Economic Review*, 86(5): 1076-1094.
- Howard, M. (2006) *The Economic Development of Barbados*. University of the West Indies Press, Kingston, Jamaica: 134-137.

- Feldstein, M. (1995) "The Effect of Marginal Tax Rates on Taxable Income: A Panel Study of the 1986 Tax Reform Act," *Journal of Political Economy* 103(3): 551-572.
- Gruber, J. and Saez, E. (2000) "The Elasticity of Taxable Income: Evidence and Implications," *Journal of Public Economics* 84(1): 1-32.
- Karras, G. (1999) "Taxes and Growth: Testing the Neoclassical and Endogenous Growth Models," *Contemporary Economic Policy*, 17(2): 177-188.
- Lindsey, L. (1987) "Individual Taxpayer Response to Tax Cuts: 1982-1984, with Implications for the Revenue Maximising Tax Rate," *Journal of Public Economic* 33: 173-206.
- Long, J.E. (1999) "The Impact of Marginal Tax Rates on Taxable Income: Evidence from State Income Tax Differentials," 65(4): 855-869.
- Mascoll, C. (1991) "Trends in Representative Tax Rates of Representative Individuals in Barbados during the 1980s," *Central bank of Barbados' Economic Review* 18: xxx-xxx.
- Saez, E. (2003) "The Effect of Marginal Tax Rates on Income: A Panel Study of 'Bracket Creep'," *Journal of Public Economics* 87(): 1231-1258.
- Smith, N., Dex, S., Vlasblom, J.D. and Callan, T. (2003) "The Effects of Taxation on Married Women's Labour Supply Across Countries," *Oxford Economic Papers* 55(3): 417-439.