CENTRAL BANK OF
TRINIDAD & TOBAGO

The Buoyancy and Elasticity of Non-Oil Tax Revenues in Trinidad and Tobago (1990-2009)

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Outline

1. Rationale

2. Explanation of key terms

3. Previous studies on Tax Buoyancy

4. Methodology

5. Conclusions

Rationale

....**increasing non-oil tax collections could help improve the fiscal outturn and provide additional resources to re-invigorate the domestic economy.**
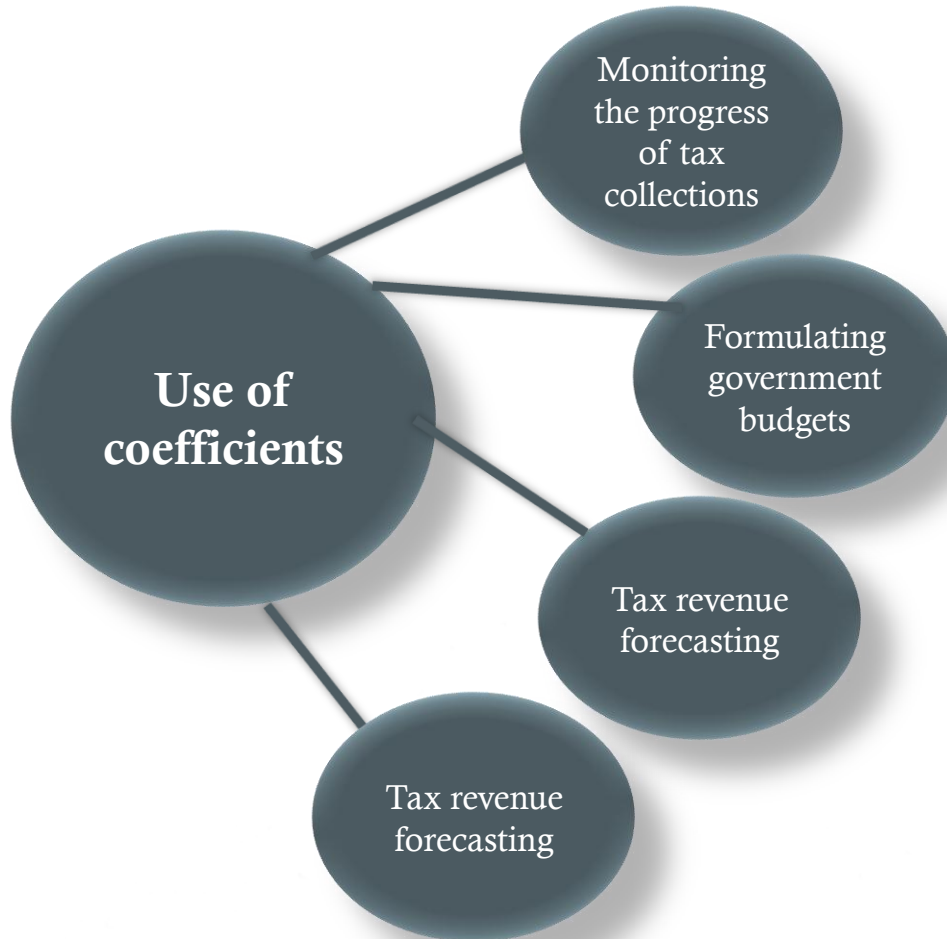

Legend: Fiscal balance (as % GDP) — Real GDP — Energy Revenue (as % GDP)
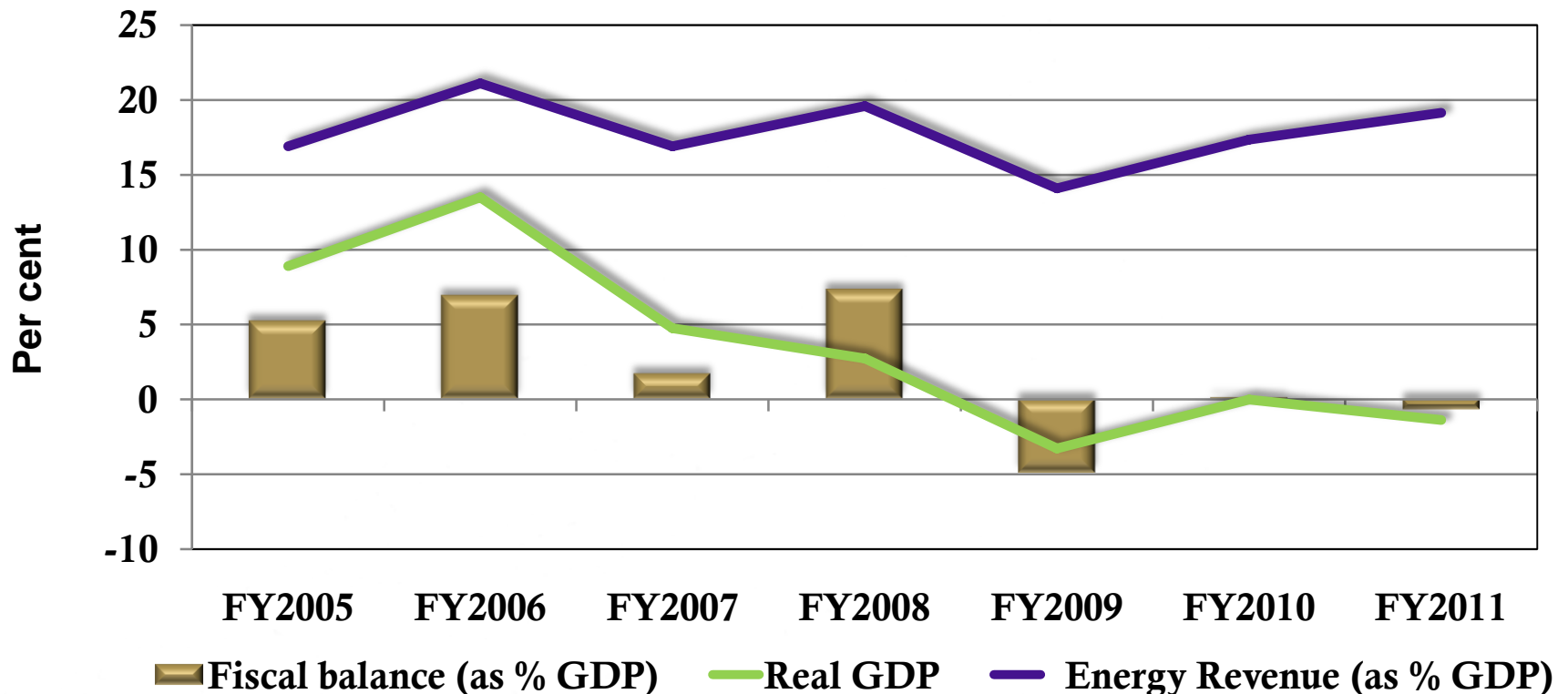
Explanation of key terms

Tax Buoyancy is a measure of the responsiveness of a tax system to changes in the tax base, including discretionary changes

Tax Elasticity is a measure of the responsiveness of a tax system to changes in the relative tax base, excluding discretionary changes

Explanation of key terms

Monitoring the progress of tax collections

Formulating government budgets

Use of coefficients

Tax revenue forecasting

Tax revenue forecasting

…Tax buoyancy and elasticity coefficients provide an indication of the strengths and weaknesses of a tax system and can be useful for revenue policy making.

Buoyancy and Elasticity Algebra

$$E_{tY} = \frac{\%\Delta T}{\%\Delta Y} = \frac{\Delta T}{T} \times \frac{Y}{\Delta Y} = \frac{\Delta T}{\Delta Y} \times \frac{Y}{T}$$

Eq.1

$$ET_{tY} = \frac{\Delta T_t}{\Delta Y} \times \frac{Y}{T_t} = \frac{T_1}{T_t}\left(\frac{\Delta T_1}{\Delta Y} \times \frac{Y}{T_1}\right) + \left(\frac{\Delta T_2}{\Delta Y} \times \frac{Y}{T_2}\right) + \ldots + \frac{T_n}{T_t}\left(\frac{\Delta T_n}{\Delta Y} \times \frac{Y}{T_n}\right)$$

Eq.2

$$ET_{kY} = \left(\frac{\Delta T_k}{\Delta B_k} \times \frac{B_k}{T_k}\right)\left(\frac{\Delta B_k}{\Delta Y} \times \frac{Y}{B_k}\right)$$

Eq.3

$$ET_{tY} = \sum_{i=1}^{n} \frac{T_i}{T_t}\left[\left(\frac{\Delta T_i}{\Delta B_i} \times \frac{B_i}{T_i}\right)\left(\frac{\Delta B_i}{\Delta Y} \times \frac{Y}{B_i}\right)\right]$$

Eq.4

Where:

E_{tY} – Income elasticity of tax;

Y – Income of GDP;

T_t - Total tax revenue;

B_k – base of kth tax;

T_k - revenue from kth tax.

Highlights of Major Tax Reforms

DIRECT TAX REFORMS
- Overall simplification of the taxation system
- Reduce the incidence of tax avoidance & evasion
- Reduced tax rates and brackets
- Inefficient tax credits were eliminated
- Introduction of a personal allowance
- Gradual movement towards one flat tax rate
- Shift the tax structure towards indirect taxes

INDIRECT TAX REFORMS
- Introduction of the VAT
- Eliminate minor indirect taxes and purchase tax

The Value Added Tax

Actual Net VAT (TT$ Mn)
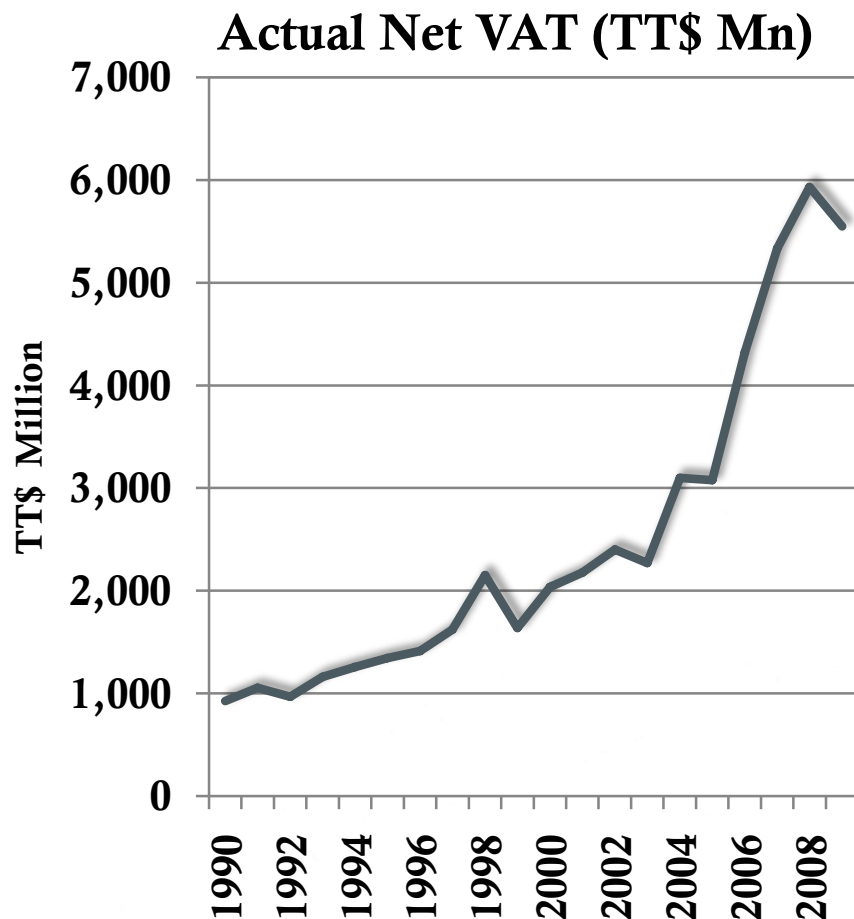
- The most notable change to the taxation system during the reform period was the introduction of VAT.

- Collections from the VAT is the largest single contributor to taxes on goods and services averaging about 71 per cent of receipts during the period 1990-2009.

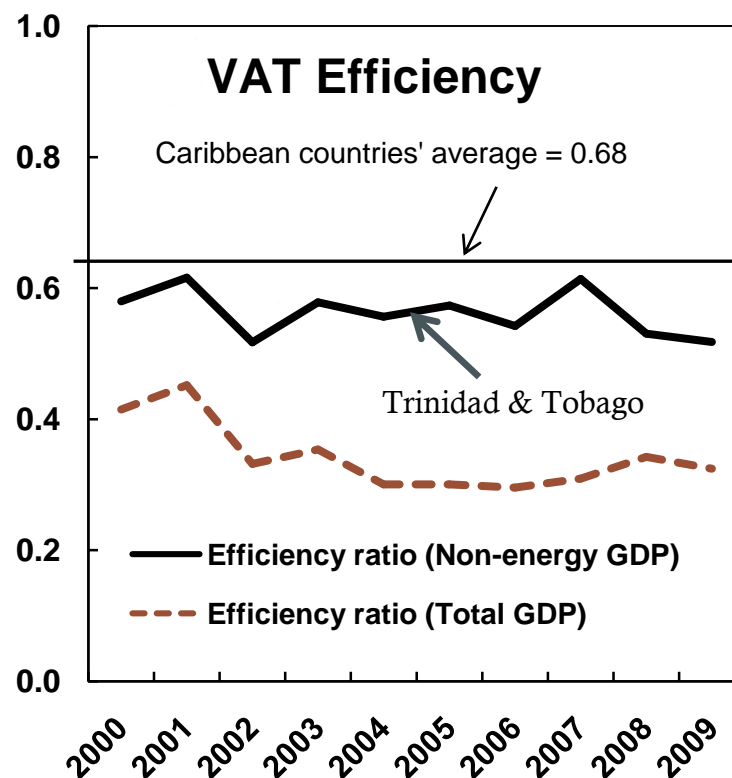# The Value Added Tax

… since the introduction of VAT there have been concerns that the base of the tax is being eroded.

Net VAT/Non-Oil GDP (%)
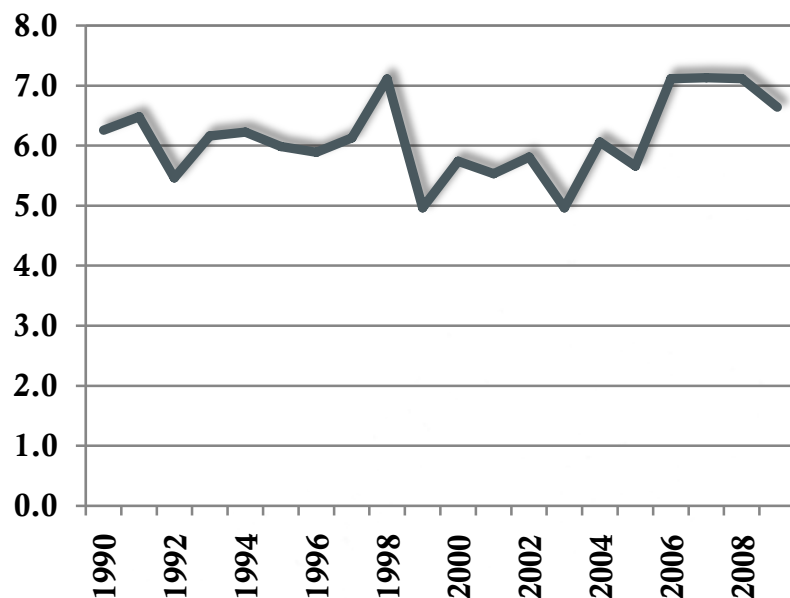
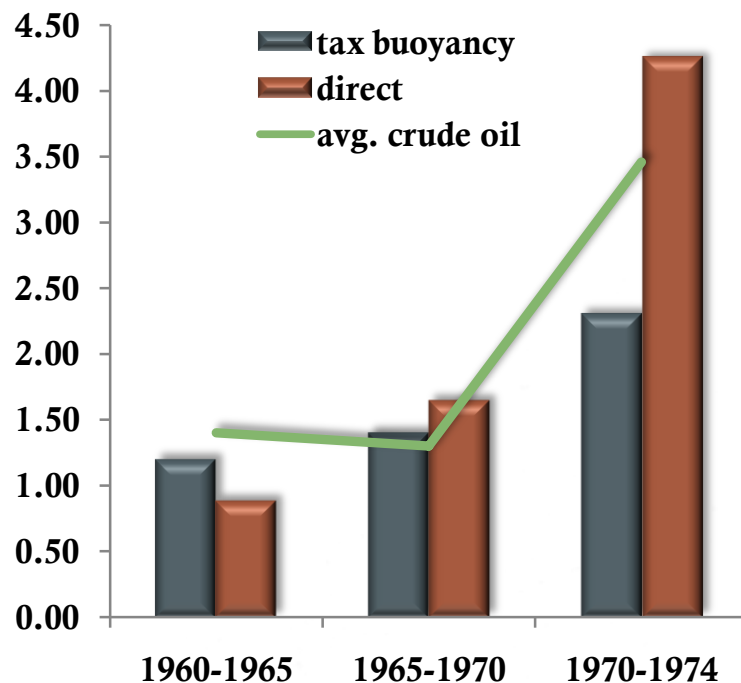**….the VAT efficiency ratio in T&T appears to be lower than in other Caribbean countries.**

Previous studies- Tax Buoyancy in Trinidad and Tobago

…when oil prices are rising the buoyancy coefficient for total tax revenue is usually high.

…high buoyancy coefficients may be masking weaknesses in the non-oil tax system.
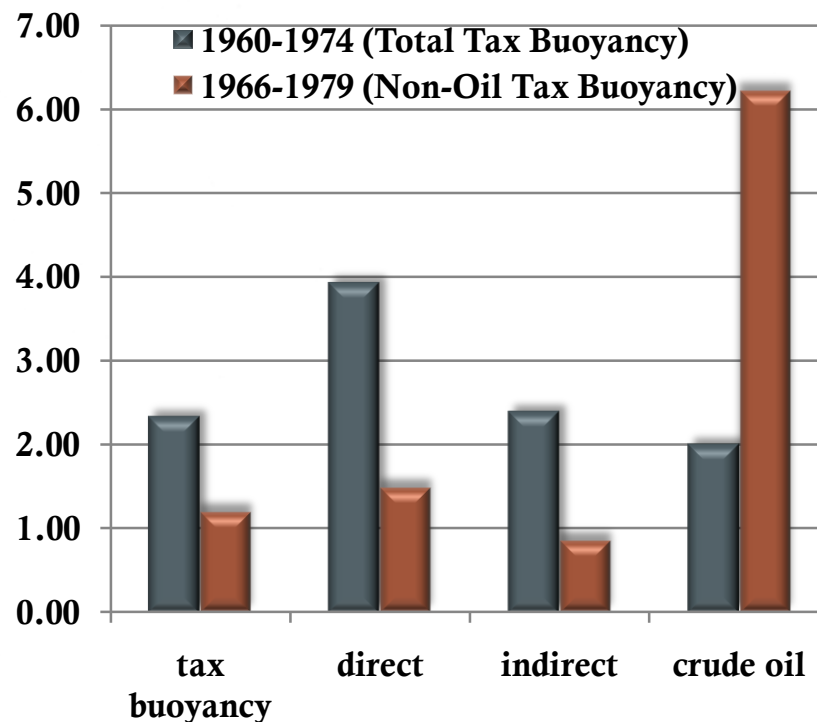
Previous studies- Tax Buoyancy in Trinidad and Tobago

…the tax reforms were not revenue enhancing for indirect taxes but improved the buoyancy of direct taxes.
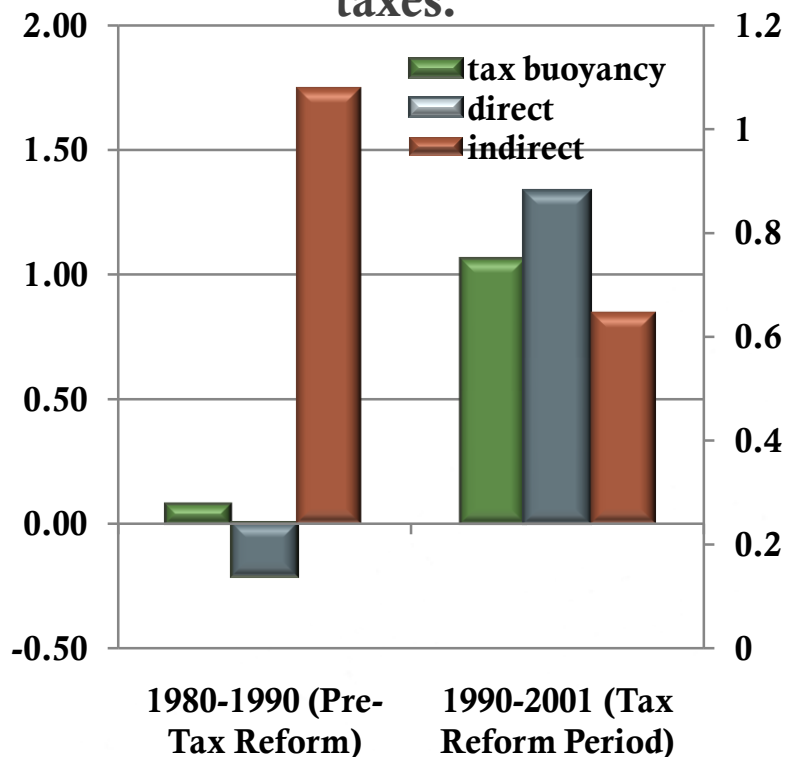
General Observations

- If we abstract times of buoyant commodity prices, the buoyancy coefficient broadly hovered around 1 per cent.

- Although there have been several studies estimating tax buoyancy in T&T there has been relatively little work done on elasticity.

Strengths and Weaknesses of Tax Buoyancy Methods

	Method Summary	Strengths	Weaknesses
Method 1	Annual Average	Simple to calculate	Affected by the value of outlier years
Method 2	Annual Trimmed Mean	Improves on the previous method	Not frequently utilized
Method 3	Growth Rate between end points	It requires only two data points	The results are sensitive to the end years chosen
Method 4	Growth Rate between average end years	Less sensitive to the choice of end years	Not frequently utilized
Method 5	Logarithmic Method	Generally reliable	Least successful in cases where coefficients are not statistically significant or where the growth rate of the tax base is small
Method 6	**Double Logarithmic Method** $\text{Log } T = \log \alpha + \beta \log Y$	**Most reliable of the above and frequently used**	**The assumption that the income elasticity is constant over the range of income considered**

Estimated Tax Buoyancy Coefficients (1990-2009)

	Method Summary	Non-Oil Direct Taxes	Non-Oil Indirect Taxes	Total Non-Oil Tax Revenue
1	Annual Average	-7.58	-2.34	-3.93
2	Annual **Trimmed** Mean	1.37	0.92	1.15
3	Growth rates between end points	1.25	0.78	0.96
4	Growth rates between average end years	1.28	0.91	1.07
5	Logarithmic Method	1.04	0.94	0.99
6	**Double Logarithmic Method** $\text{Log } T = \log \alpha + \beta \log Y$	**0.97**	**0.96**	**0.99**

Comparing Tax Buoyancy Coefficients using different methods (1990-2009)

Legend: Non-Oil Direct Taxes | Non-Oil Indirect Taxes | Total Non-Oil Tax Revenue
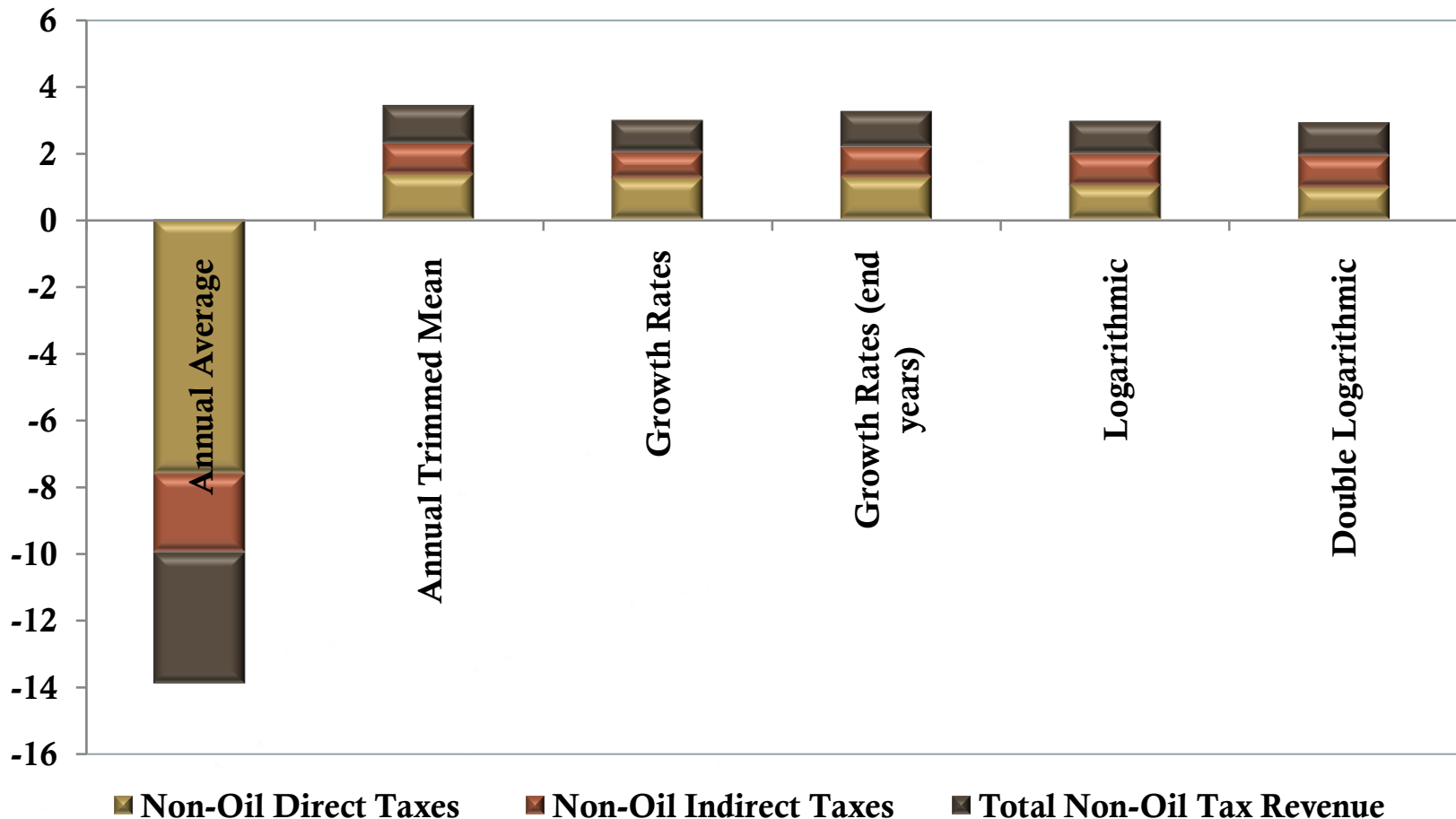
Non-Oil Tax Buoyancy Coefficients (1990-2009)

	Roberts & De Silva (1966-1979)	Ramsaran & Tang (1980-1990)	Ramsaran & Tang (1990-2001)	Current study (1990-2009)
Non-Oil Direct Taxes (excl. petro.)	1.50	-	-	0.97
Income Tax	1.49	-0.34	2.38	0.79
Company Tax	1.49	0.49	2.38	1.16
Non-Oil Indirect Taxes	0.87	-	-	0.96
Purchase tax/VAT	1.29	5.90	0.95	1.05
Trade Tax	1.00	0.23	0.56	0.94
Excise Duties	0.39	-	-	0.50
Property Tax	-	3.09	0.28	0.18
Total Non-Oil Tax Revenue (excl. petro.)	**1.21**	**1.14**	**1.32**	**0.99**
Note:				
Buoyancy method used:	Double Logarithmic	Annual Average	Annual Average	Double Logarithmic

Ordinary Least Squares Results for Tax Buoyancy (1990-2009)

|	Buoy.	t-ratio	R^2	D.W.	P-value	Tax Base
Non-Oil Direct Taxes (excl. Petro.)	**0.97**	**14.03**	**0.95**	**2.17**	**0.00**	Non-Oil GDP
Income Tax	0.79	9.32	0.94	2.17	0.00	Non-Oil GDP
Company Tax (incl. petro.)	1.66	21.07	0.98	1.69	0.00	Non-Oil GDP
Company Tax (excl. petro.)	1.16	11.05	0.87	1.63	0.00	Non-Oil GDP
Non-Oil Indirect Taxes	**0.96**	**17.84**	**0.98**	**2.04**	**0.00**	Non-Oil GDP
Value Added Tax	1.05	23.31	0.97	1.65	0.00	Non-Oil GDP
International Trade Tax	0.94	4.33	0.95	1.22	0.00	Non-Oil GDP
Excise Duties	0.50	10.37	0.93	1.99	0.00	Non-Oil GDP
Property Taxes	0.18	1.42	0.32	1.89	0.22	Non-Oil GDP
Total Non-Oil Tax Revenue (excl. petro.)	0.99	31.92	0.98	1.62	0.00	Non-Oil GDP

Limitations of the Non-Oil Tax Buoyancy Results

- There were wide variations in the buoyancy results depending on the approach utilized.

- The estimation approach adopted in this paper is partial equilibrium approach in that the estimates are not obtained within the context of a complete model.

- The proxy tax base (Non-Oil GDP) may have contributed to the high buoyancy coefficients for VAT, International Trade Tax and Excise Duties.

- An AR(1) term was introduced in the regression equation to solve for the presence of positive autocorrelation, however in some cases the coefficients had high p-values.

- Even though an AR(1) TERM was introduced the D.W. statistic for International Trade Taxes was still low.

Graph:
Non-Oil Tax Revenue/Non-Oil GDP
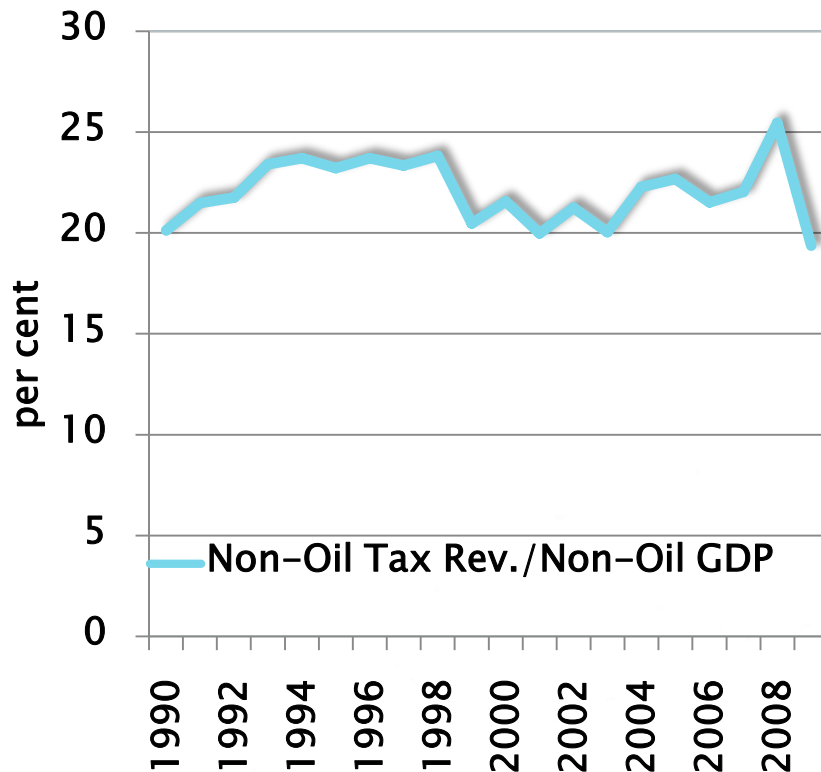
- The tax buoyancy coefficient appears to be relatively stable over time which suggests that the tax buoyancy is close to 1.

- For tax buoyancy to improve the tax/GDP ratio should be increasing over time.

Note: Collections from companies excludes receipts from petrochemical and service contracting companies.

Non-Oil Tax Buoyancy Conclusions for the period (1990-2009)

- **The Non-Oil tax buoyancy coefficient for the period 1990-2009 is unitary (0.99) which signals that the tax system is relatively efficient at raising tax revenues but has weakened when compared with earlier years.**

- **Opportunities for improved tax collections exist within the category of indirect taxes** as shown by the weakening in the buoyancy coefficient over the periods 1980-1990 (1.75); 1980-2000 (1.39) and 1990-2009 (0.96), with the most recent estimates showing a buoyancy coefficient lower than 1**.**

- **In comparison with other Caribbean jurisdictions the VAT efficiency ratios in Trinidad and Tobago were considered to be low.**

- **The simplification of the direct tax system seemed to improve its efficiency in the decade 1990-2000** (post tax reform), but there has been a decline in the tax buoyancy coefficient thereafter.

Measuring Tax Elasticity

- There are two basic issues in the measurement of tax elasticity's:

    - **The form of the equation** used to estimate the tax to income relationship.

        - Log T = log α + β log Y

    - **The method used to adjust the historical tax series** for discretionary changes

Proportional Adjustment Method

$$AT_0 = T_0 \qquad\qquad \text{Eq. 1}$$

$$AT_1 = T_1 - D_1 \qquad\qquad \text{Eq. 2}$$

$$AT_j = (T_j - D_j) \cdot \frac{AT_{j-1}}{T_{j-1}} \quad \forall\, i = 2, \dots . n \qquad\qquad \text{Eq. 3}$$

$$AT_j = T_1 \cdot \prod_{i=2}^{j} \frac{(T_i - D_i)}{T_{i-1}} \quad \forall\, j = 2, \dots . n \qquad\qquad \text{Eq. 4}$$

Where:
AT_i = the adjusted or cleaned tax yield in year i.
T_i = the actual tax yield in i.
D_i = budget estimate of the yield arising our of discretionary tax changes in year i.
    = budget estimate of the tax receipt inclusive of any discretionary change in year i.
 $\forall$ = for all

Challenges in Measuring Tax Elasticity

- Inherent limitations of the various methodologies.

- The proxy measures used for the calculation of coefficients.

- Aggregation problems when elasticity's are calculated for broad categories of taxes.

- Errors in estimating the revenue impact of budget measures.

- Unavailable estimates of the revenue impact of budget measures.

Central Government Net Discretionary Changes in Non-Oil Tax Revenue TT$Mn

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
DIR.																
Com.	-30		+30		9.3	-101	-43.2					-48	-14.4	-200		
Indiv.	-200		124	36	-1.0	-72	-108	-100		-50		-55	-58	-289		
INDIR.																
VAT	863		-18	129		5				-21		-28	-31.2	-29.5		-40
Trade	109	-27	55	-76	-128											
Prop.				120												

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Elasticity Method used in this study: Modified Proportional Adjustment Method

$$AT_0 = T_0 \qquad \text{Eq.1}$$

$$AT_1 = \frac{(T_i^e - D_1).T_1}{T_1^e} \qquad \text{Eq. 2}$$

$$AT_i = (T_i^e - D_i).\frac{T_i}{T_i^e}.\frac{AT_{i-1}}{T_{i-1}} \quad \forall i = 2,....n \qquad \text{Eq.3}$$

$$AT_j = T_j.\prod_{i=1}^{j} \frac{(T_i^e - D_i)}{T_i^e} \quad \forall j = 1,....n \qquad \text{Eq. 4}$$

Where:
AT_i = the adjusted or cleaned tax yield in year i.
T_i = the actual tax yield in i.
D_i = budget estimate of the yield arising our of discretionary tax changes in year i.
    = budget estimate of the tax receipt inclusive of any discretionary change in year i.
$\forall$ = for all

Ordinary Least Squares Results for Tax Elasticity (1990-2009)

	Elasticity	t-ratio	R^2	D.W.	P-value	Tax Base
Non-Oil Direct Taxes (excl. Petro.)	**1.21**	**21.20**	**0.95**	**1.97**	**0.00**	Non-Oil GDP
Income Tax	1.02	11.22	0.96	1.85	0.00	Non-Oil GDP
Company Tax (excl. petro.)	1.39	9.79	0.90	1.74	0.00	Non-Oil GDP
Company Tax (incl. petro.)	1.90	19.13	0.98	1.66	0.00	Non-Oil GDP
Non-Oil Indirect Taxes	**0.99**	**10.34**	**0.97**	**2.31**	**0.00**	Non-Oil GDP
Value Added Tax	1.13	12.40	0.97	2.39	0.00	Non-Oil GDP
International Trade Tax	0.95	6.914	0.96	1.54	0.00	Non-Oil GDP
Excise Duties	0.62	4.41	0.96	1.60	0.00	Non-Oil GDP
Property Taxes	0.23	0.83	0.48	1.86	0.42	Non-Oil GDP
Total Non-Oil Tax Revenue (excl. petro.)	**0.81**	**12.46**	**0.97**	**2.18**	**0.00**	**Non-Oil GDP**

Limitations of the
Non-Oil Tax Elasticity Results

- Estimates of the revenue effects of policy changes were not available for all of the budget measures.

- Notwithstanding the elasticity coefficient for non-oil tax revenue, the elasticity coefficients in most instances were higher than the buoyancy coefficient.

- The property tax coefficient was not statistically significant.

- The proxy tax base (Non-Oil GDP) may have contributed to the buoyancy coefficients for VAT, International Trade Tax and Excise Duties.

Conclusions

- The non-oil tax system is relatively responsive to changes in non-oil GDP.

- Revenue collections suffered during the period under review (1990-2009) because of poor or a slackening in administration or an increase in evasion.

- Efforts to increase non-oil tax revenue should focus on indirect taxes.

- In particular, the coefficients for property tax, excise duties and international trade tax were lower than one which is an indication of weak performance.

QUESTIONS?

For comments on this paper please contact:
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Thank you