

CENTRAL BANK OF
TRINIDAD & TOBAGO

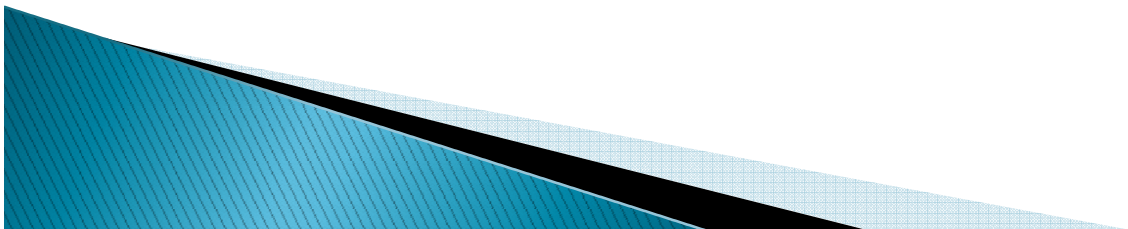
The Buoyancy and Elasticity of Non-Oil Tax Revenues in Trinidad and Tobago (1990–2009)

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OUTLINE

1. Explanation of key terms
2. Highlights of Major Tax Reforms
3. Previous studies on Tax Buoyancy
4. Methodology
5. Conclusions

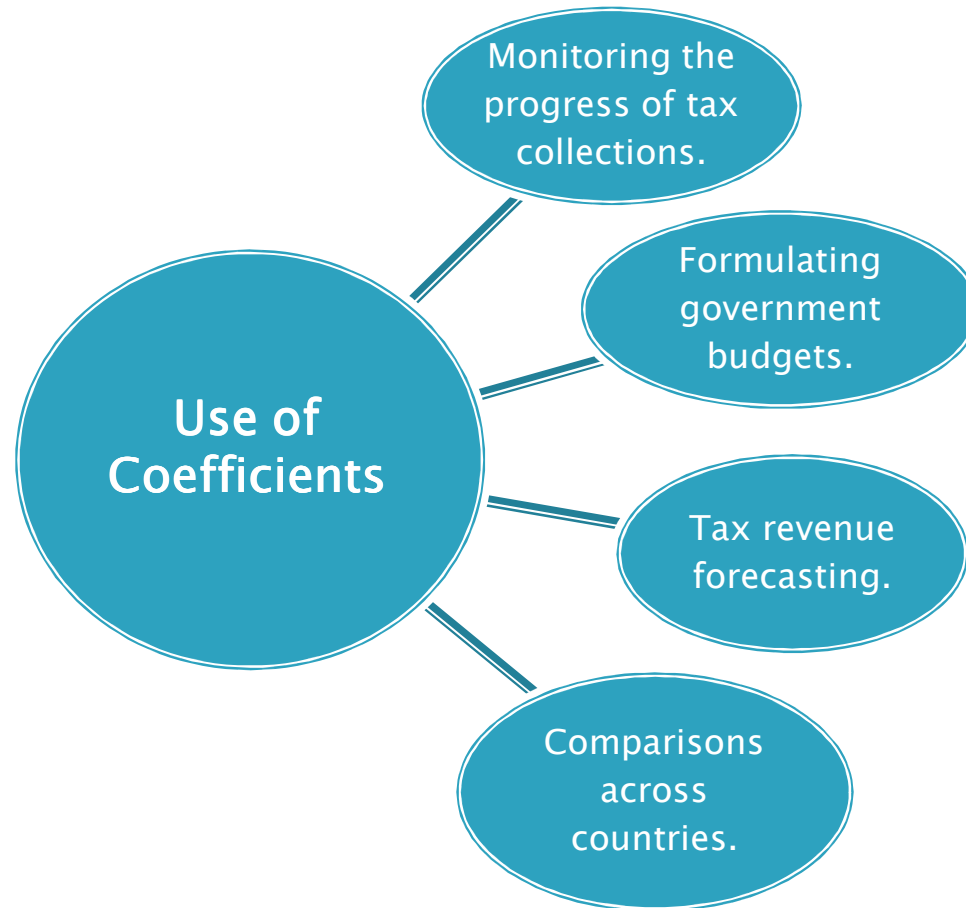


Explanation of key terms

TAX BUOYANCY is a measure of the responsiveness of a tax system to changes in the relative 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.

Tax Buoyancy and Elasticity



Buoyancy and Elasticity Algebra

$$E_{tY} = \frac{\% \Delta T}{\% \Delta Y} = \frac{\Delta T}{T} \times \frac{Y}{\Delta Y} = \frac{\Delta T}{\Delta Y} \times \frac{Y}{T} \quad \text{Eq. 1}$$

$$ET_{tY} = \frac{\Delta T_t}{\Delta Y} \times \frac{Y}{T_t} = \frac{T_1}{T_t} \left(\frac{\Delta T_1}{\Delta Y} \times \frac{Y}{T_1} \right) + \left(\frac{\Delta T_2}{\Delta Y} \times \frac{Y}{T_2} \right) + \dots + \frac{T_n}{T_t} \left(\frac{\Delta T_n}{\Delta Y} \times \frac{Y}{T_n} \right) \quad \text{Eq. 2}$$

$$ET_{kY} = \left(\frac{\Delta T_k}{\Delta B_k} \times \frac{B_k}{T_k} \right) \left(\frac{\Delta B_k}{\Delta Y} \times \frac{Y}{B_k} \right) \quad \text{Eq. 3}$$

$$ET_{tY} = \sum_{i=1}^n \frac{T_i}{T_t} \left[\left(\frac{\Delta T_i}{\Delta B_i} \times \frac{B_i}{T_i} \right) \left(\frac{\Delta B_i}{\Delta Y} \times \frac{Y}{B_i} \right) \right] \quad \text{Eq. 4}$$

Where:

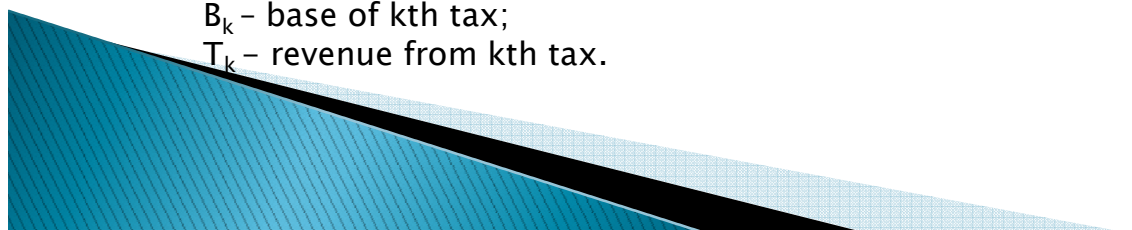
E_{tY} – Income elasticity of tax;

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

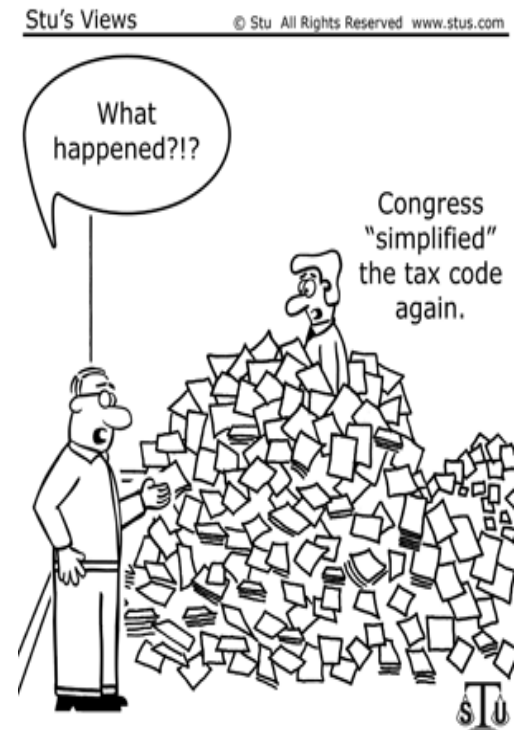


Table: Changes in Tax Rates and Brackets, 1988-2009

Chargeable Income TT\$	1988 Tax Rate %
0-2,000	5
2,001-4,000	10
4,001-6,000	13
6,001-8,000	18
8,001-10,000	23
10,001-15,000	28
15,001-20,000	33
20,001-25,000	38
25,001-30,000	43
30,001-40,000	48
Over 40	50

Chargeable Income TT\$	Tax Rate %						
	1989	1990	1991	1992	1994	1995	1996
0-12,000	5	5	5	5	5	5	5
12,000-20,000	20	15	15	15	15	15	15
20,001-40,000	40	30	30	35	38	33	30
40,001 and above	45	35	35	40	40	38	35

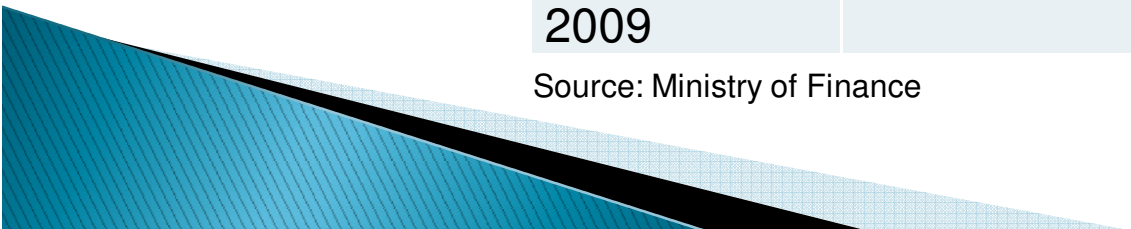
	Tax Rate %								
Chargeable Income TT\$	1997	2002	2004	2005	Chargeable Income TT\$	2006	2007	2008	2009
0-50,000	28	28	25	25	0-60,000	0	0	0	0
50,000 and above	35	35	30	30	60,000 and above	25	25	25	25

Source: Ministry of Finance

Table: Corporation Tax rates for selected years

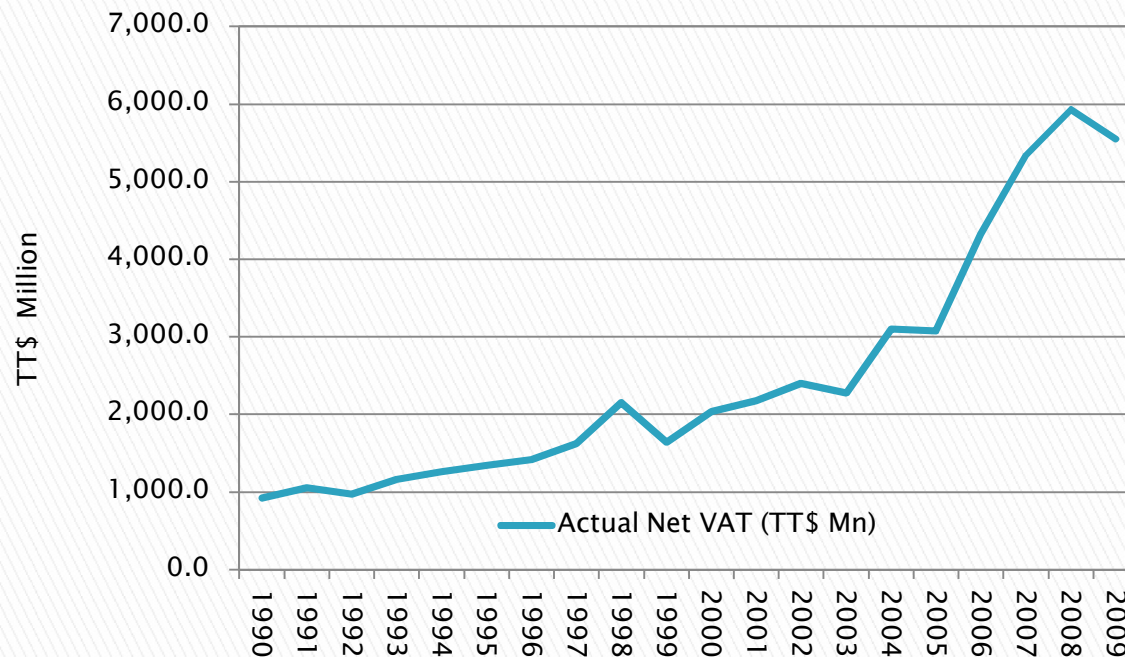
Year	Corporation Tax Rates (%) on Chargeable Profits
1989	45
1999	35
2000	35
2001	35
2002	35
2003	30
2004	30
2005	30
2006	25
2007	25
2008	25
2009	25

Source: Ministry of Finance



The Value Added Tax

Actual Net VAT (TT\$ Mn)



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"No, it doesn't stand for
vodka and tonic!"

The Value Added Tax

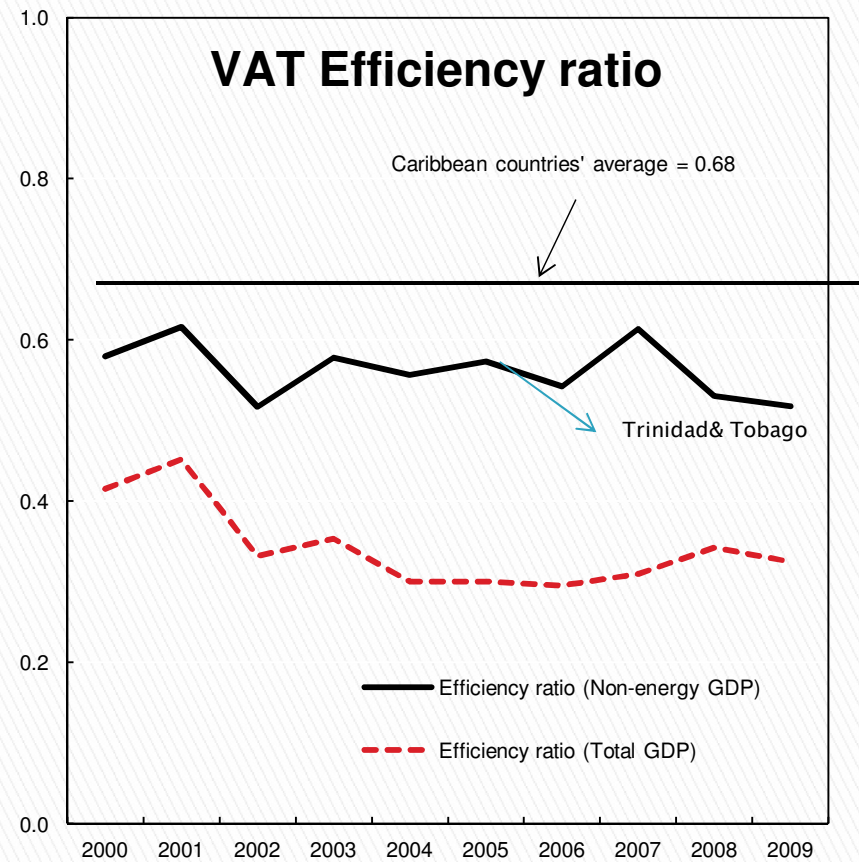
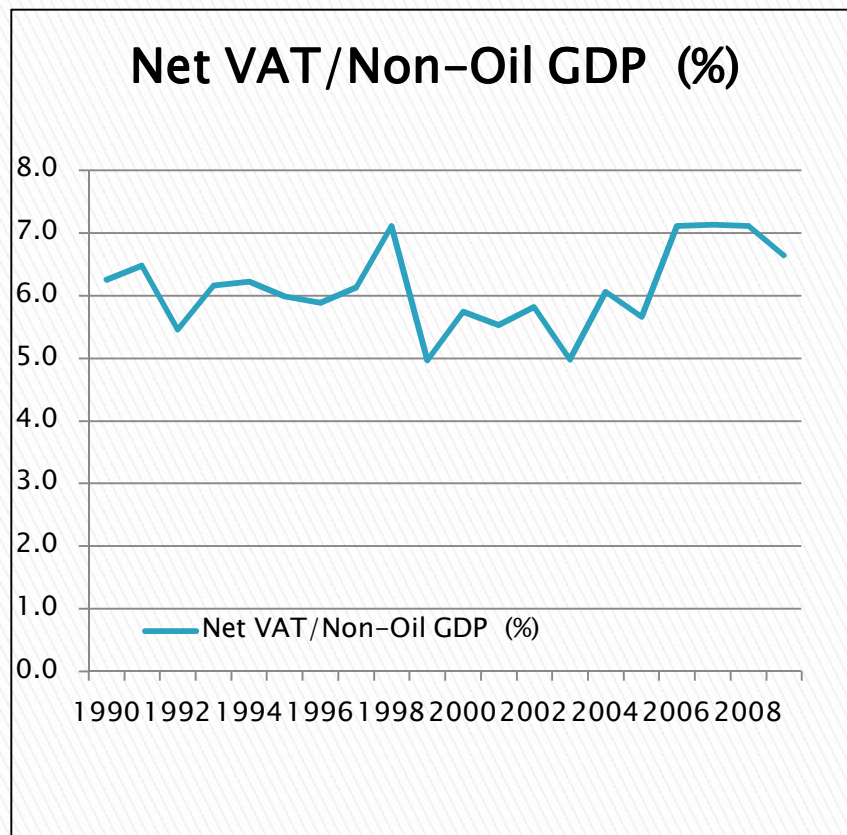


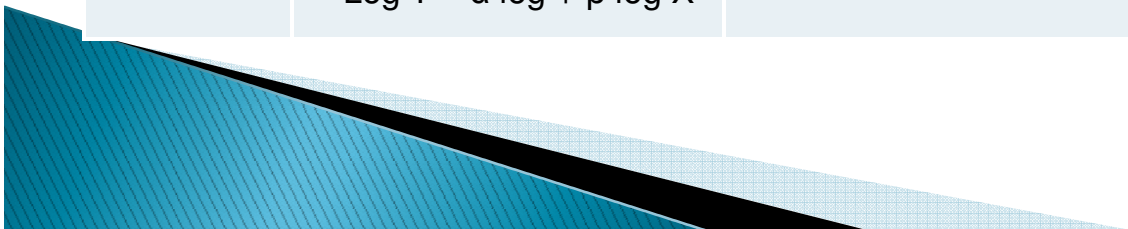
Table : Previous studies on Tax Buoyancy for Trinidad and Tobago, 1951-2001

	Bobb (1951-1967)		Ramsaran (1960-1974)				Roberts & De Silva (1966-1979) Non-Oil Tax Buoyancy	1980-2000				
	1951- 1967	1958- 1967	1960- 1965	1965- 1970	1970- 1974	1960- 1974		Seerattan & Charles 1980- 1990	Ramsaran & Tang 1980- 1990	Seerattan & Charles 1990-2000	Ramsaran & Tang 1990-2001	Seerattan & Charles Tax Buoyancy 1980-2000)
DIRECT TAXES			0.89	1.65	4.25	3.93	1.50	-0.21	0.98	0.81	1.33	0.38
Income tax			2.26	1.75	1.23	2.08	1.49					
Corporation tax			0.48	1.31	6.11	4.44	1.49					
INDIRECT TAXES							0.87	1.75	11.71	0.82	0.85	1.39
Purchase Tax/VAT			0.96	4.99	0.95	2.40	1.29		5.90		0.95	
Motor Vehicle Tax			1.49	1.35	0.45	0.81	1.01					
Excise duties							0.39					
Taxes on trade			1.45	0.49	0.26	0.43	1.00		0.23		0.56	
Property Tax			1.33	3.95	0.21	1.10			3.09		0.28	
TOTAL TAX REVENUE	0.94	0.96	1.20	1.40	2.30	2.34	1.21	0.08	-0.23	0.82	1.06	0.63

Source: Central Bank of Trinidad and Tobago.

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 $\text{Log } T = \alpha \text{ log } + \beta \text{ log } X$	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 $\text{Log } T = \alpha \log + \beta \log X$	0.97	0.96	0.99

Source: Central Bank of Trinidad and Tobago



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

Source: Central Bank of Trinidad and Tobago

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

Source: Central Bank of Trinidad and Tobago

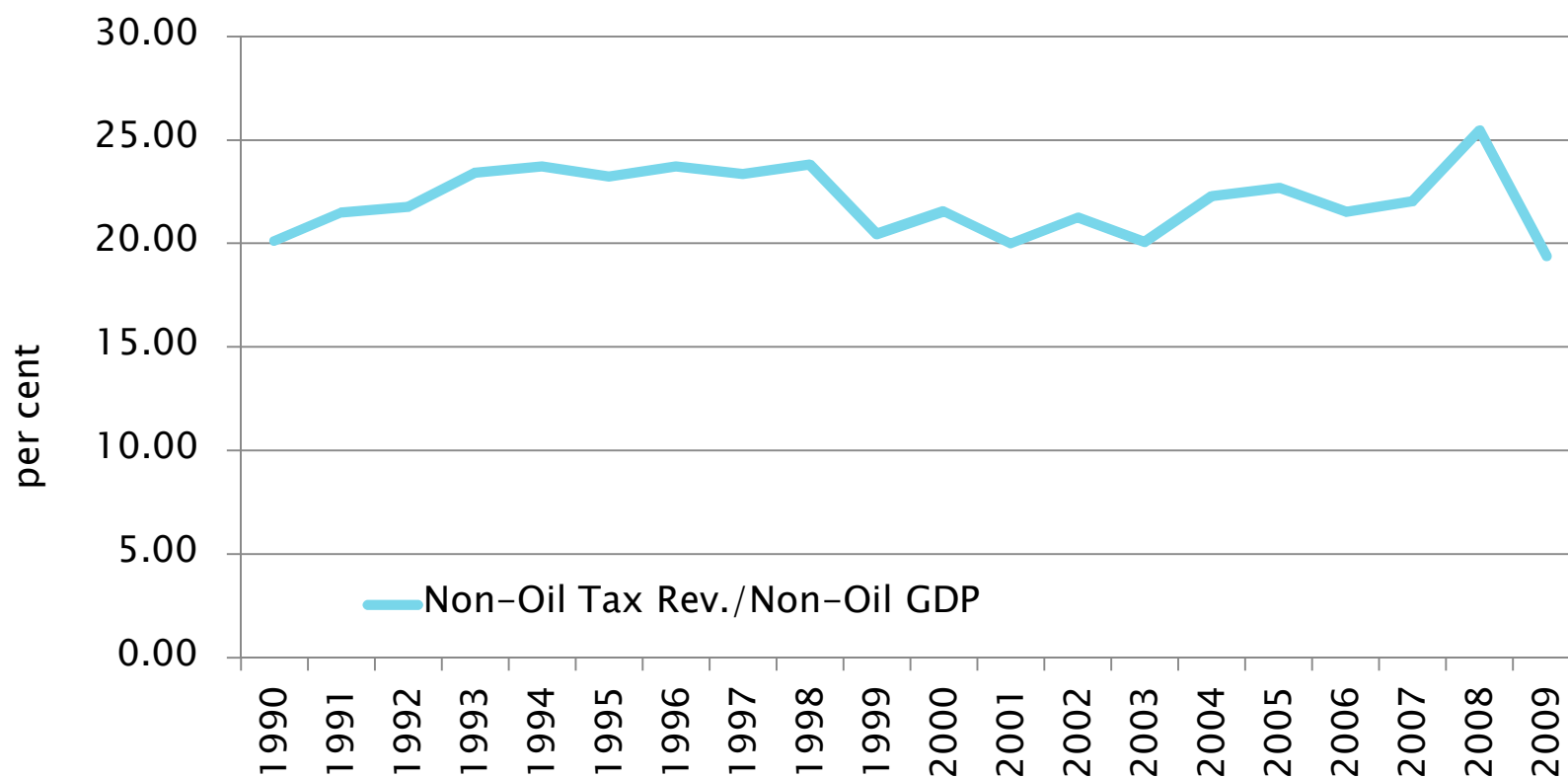
Limitations of the Non–Oil Tax Buoyancy Results

- ▶ 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:

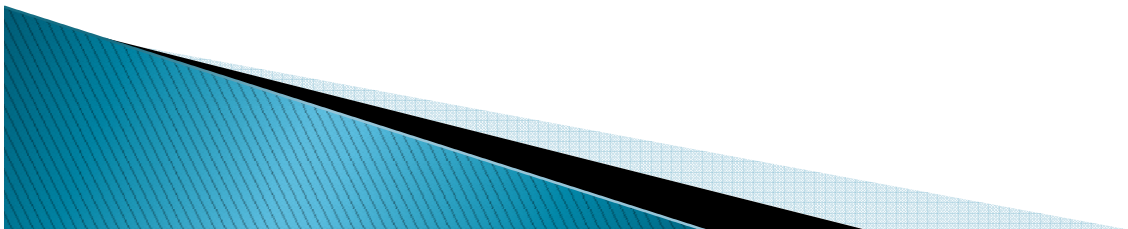
Non-Oil Tax Revenue/Non-Oil GDP



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

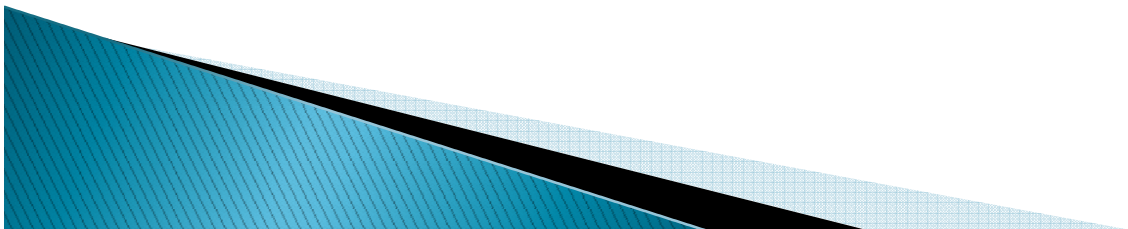
Non-Oil Tax Buoyancy Conclusions for the period 1990–2009

- ▶ 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 scope for improved tax revenue collections.
- ▶ 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.
 - $\log T = \alpha \log + \beta \log X$
 - The method used to adjust the historical tax series for discretionary changes



Proportional Adjustment Method

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

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

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

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

Where:

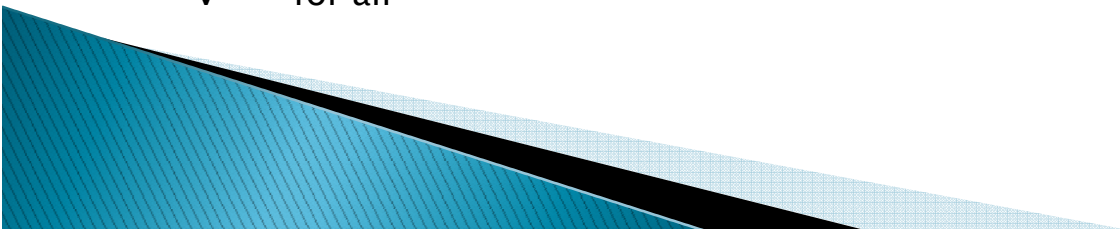
AT_i = the adjusted or cleaned tax yield in year i.

T_i = the actual tax yield in i.

D_i = budget estimate of the yield arising out of discretionary tax changes in year i.

T_1^e = 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.

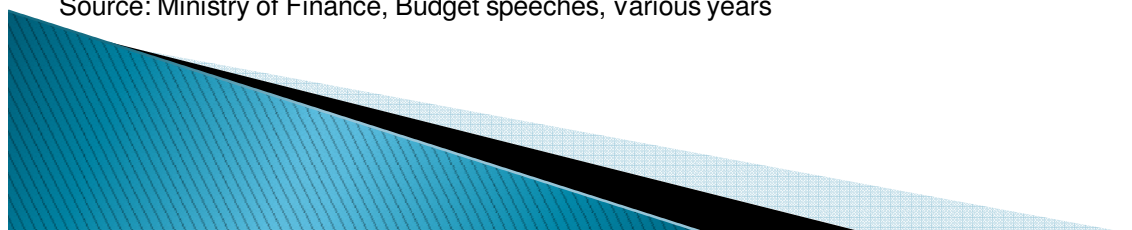


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Central Government Net Discretionary Changes in Non-Oil Tax Revenue TT\$Mn

	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												

Source: Ministry of Finance, Budget speeches, various years



Elasticity Method used in this study: Modified Proportional Adjustment Method

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

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

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

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

Where:

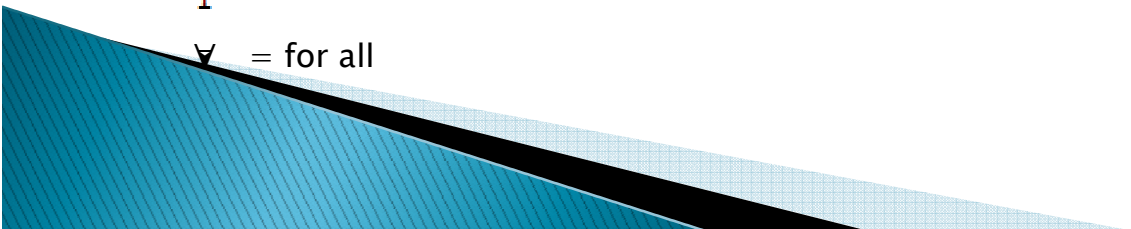
AT_i = the adjusted or cleaned tax yield in year i.

T_i = the actual tax yield in i.

D_i = budget estimate of the yield arising out of discretionary tax changes in year i.

T_1^e = budget estimate of the tax receipt inclusive of any discretionary change in year i.

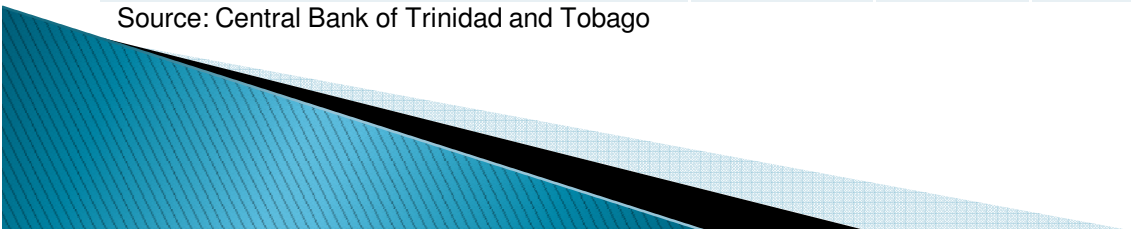
$\forall$ = for all



Ordinary Least Squares Results for Tax Elasticity, 1990–2009

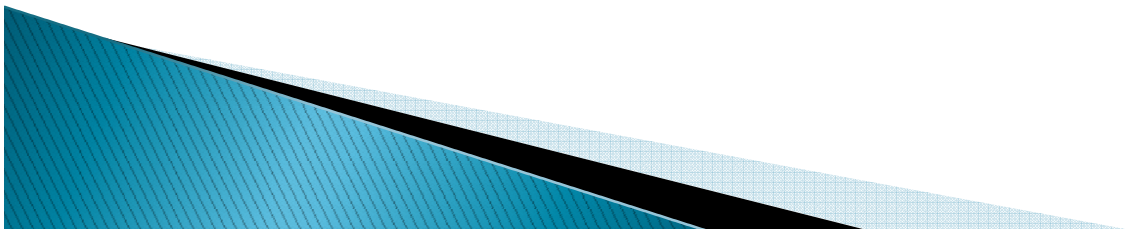
	Elasticity	t-ratio	R ²	D.W.	P-value	Tax Base
Non-Oil Direct Taxes (excl. Petro.)	1.21	21.20	0.95	1.97	0.00	Non-Oil GDP
Income Tax	1.02	11.22	0.96	1.85	0.00	Non-Oil GDP
Company Tax (excl. petro.)	1.39	9.79	0.90	1.74	0.00	Non-Oil GDP
Company Tax (incl. petro.)	1.90	19.13	0.98	1.66	0.00	Non-Oil GDP
Non-Oil 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

Source: Central Bank of Trinidad and Tobago



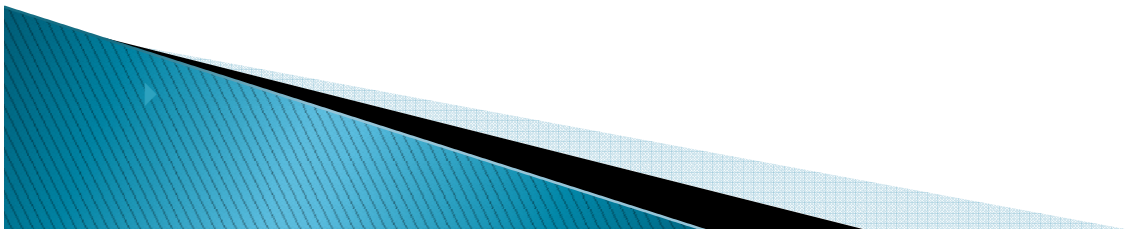
Limitations of the Non–Oil Tax Elasticity Results

- ▶ 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 in Trinidad and Tobago is relatively efficient as indicated by the buoyancy coefficient of 0.99. However a unit value of buoyancy could point to the need for substantial discretionary revenue measures annually to keep the economy at the same spot in terms of tax revenue/Non-Oil GDP.
- ▶ There is scope for improved collections from the non-oil tax system and preliminary indicators suggest that the efficiency of the VAT may be lower than in other Caribbean jurisdictions.
- ▶ There is significant potential for growth in collections from the property tax.
- ▶ Data gaps on the revenue effects of budget tax measures is a challenge for the calculation of elasticity coefficients in T&T.



QUESTIONS?



For comments on this paper please contact:
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