



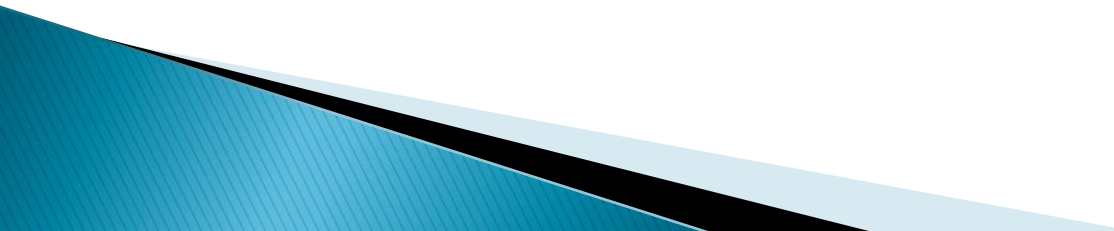
CENTRAL BANK OF  
TRINIDAD & TOBAGO

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

Presented by: Joseph Jason Cotton  
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# OUTLINE

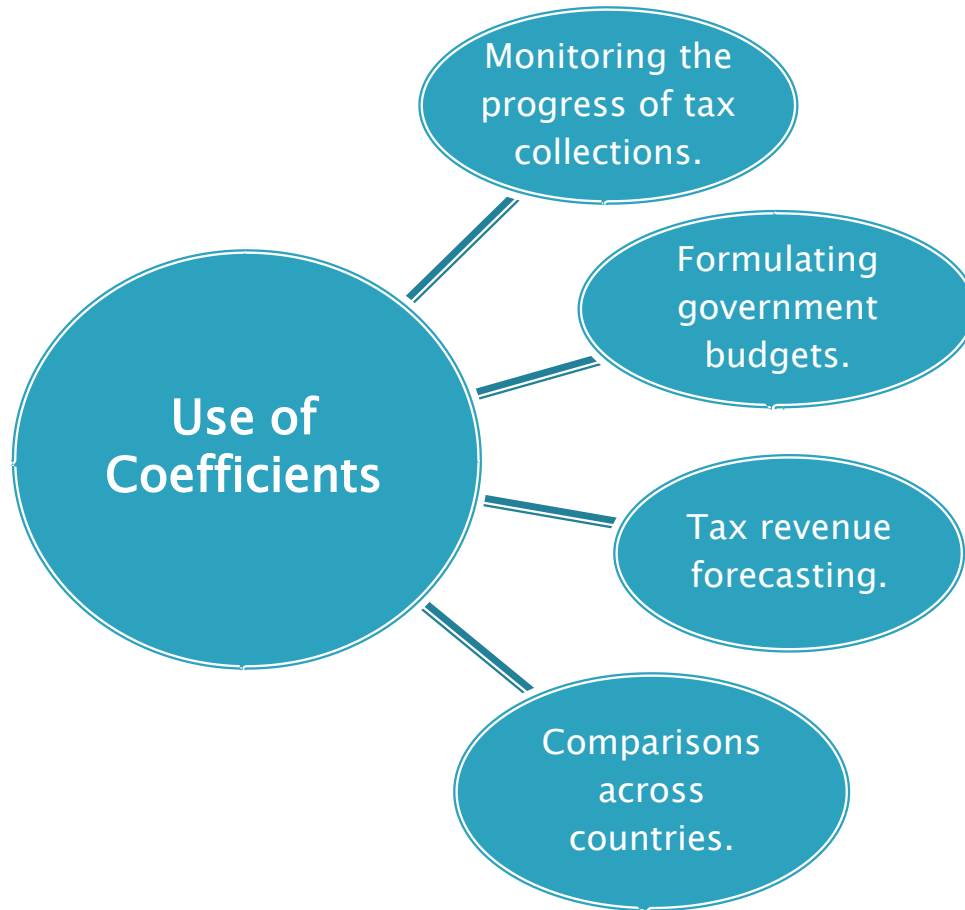
1. Explanation of key terms
  2. Previous studies on Tax Buoyancy
  3. Methodology
  4. Conclusions
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# Explanation of key terms

**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.

**Table : Previous studies on Tax Buoyancy in Trinidad and Tobago**

	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)
<b>DIRECT TAXES</b>			<b>0.89</b>	<b>1.65</b>	<b>4.25</b>	<b>3.93</b>	<b>1.50</b>	<b>-0.21</b>	<b>0.98</b>	<b>0.81</b>	<b>1.33</b>	<b>0.38</b>
Income tax			2.26	1.75	1.23	2.08	1.49					
Corporation tax			0.48	1.31	6.11	4.44	1.49					
<b>INDIRECT TAXES</b>							<b>0.87</b>	<b>1.75</b>	<b>11.71</b>	<b>0.82</b>	<b>0.85</b>	<b>1.39</b>
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	
<b>TOTAL TAX REVENUE</b>	<b>0.94</b>	<b>0.96</b>	<b>1.20</b>	<b>1.40</b>	<b>2.30</b>	<b>2.34</b>	<b>1.21</b>	<b>0.08</b>	<b>-0.23</b>	<b>0.82</b>	<b>1.06</b>	<b>0.63</b>

Source: Various studies.

# 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	<b>Double Logarithmic Method</b> $\text{Log } T = \log \alpha + \beta \log Y$	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	<b>Double Logarithmic Method</b>  Log T = log α + β log Y	<b>0.97</b>	<b>0.96</b>	<b>0.99</b>

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)
<b>Non-Oil Direct Taxes (excl. petro.)</b>	1.50	–	–	0.97
Income Tax	1.49	–0.34	2.38	0.79
Company Tax	1.49	0.49	2.38	1.16
<b>Non-Oil Indirect Taxes</b>	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
<b>Total Non-Oil Tax Revenue (excl. petro.)</b>	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

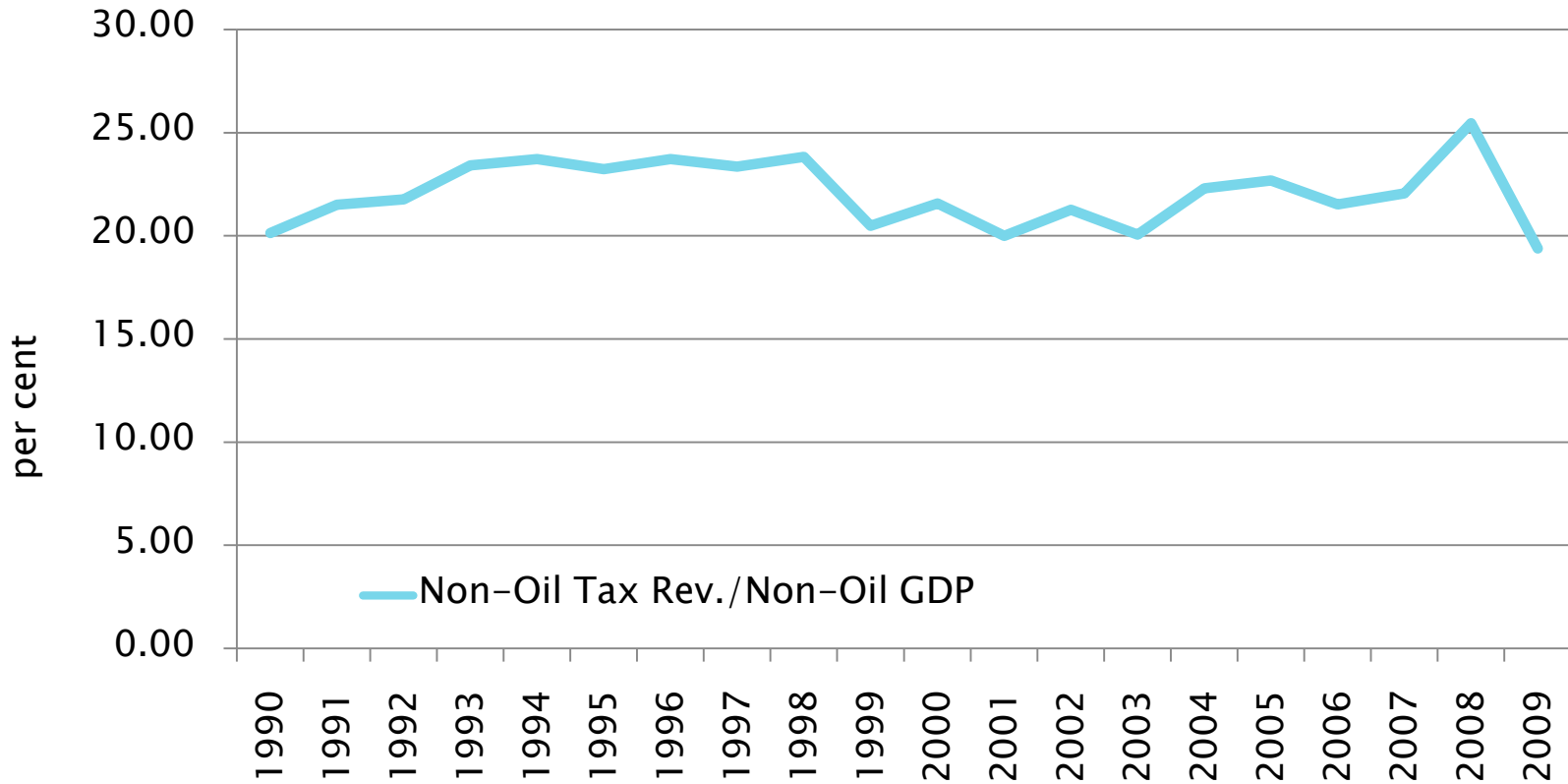
	Buoy.	t-ratio	R <sup>2</sup>	D.W.	P-value	Tax Base
<b>Non-Oil Direct Taxes (excl. Petro.)</b>	<b>0.97</b>	<b>14.03</b>	<b>0.95</b>	<b>2.17</b>	<b>0.00</b>	Non-Oil GDP
Income Tax	0.79	9.32	0.94	2.17	0.00	Non-Oil GDP
Company Tax (incl. petro.)	1.66	21.07	0.98	1.69	0.00	Non-Oil GDP
Company Tax (excl. petro.)	1.16	11.05	0.87	1.63	0.00	Non-Oil GDP
<b>Non-Oil Indirect Taxes</b>	<b>0.96</b>	<b>17.84</b>	<b>0.98</b>	<b>2.04</b>	<b>0.00</b>	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
<b>Total Non-Oil Tax Revenue (excl. petro.)</b>	<b>0.99</b>	<b>31.92</b>	<b>0.98</b>	<b>1.62</b>	<b>0.00</b>	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 a 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.
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# 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 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.
    - $\text{Log } T = \log \alpha + \beta \log Y$
  - **The method used to adjust the historical tax series** for discretionary changes

# Proportional Adjustment Method

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

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

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

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

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
<b>DIR.</b>																
Com.	-30		+30		9.3	-101	<b>-43.2</b>					-48	<b>-14.4</b>	-200		
Indiv.	-200		124	36	-1.0	-72	<b>-108</b>	-100		-50		-55	-58	-289		
<b>INDIR.</b>																
VAT	<b>863</b>		-18	129		5				<b>-21</b>		-28	<b>-31.2</b>	<b>-29.5</b>		<b>-40</b>
Trade	109	-27	55	-76	-128											
Prop.				120												

Source: Ministry of Finance, Budget speeches, various years and author's estimates.

## Notes:

Figures in bold indicate the author's estimates of the revenue effect of budget measures.

# 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.

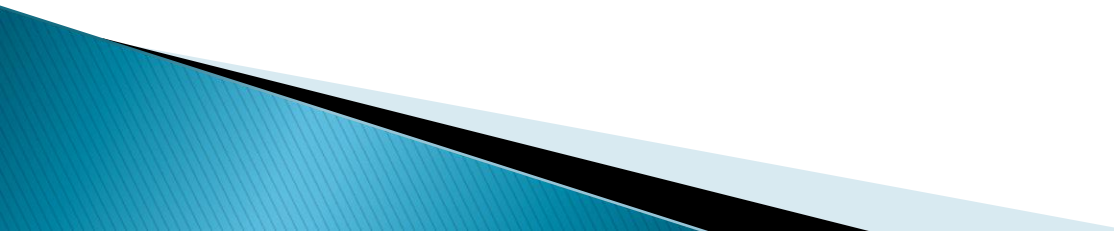
$\forall$  = for all

# Ordinary Least Squares Results for Tax Elasticity, 1990–2009

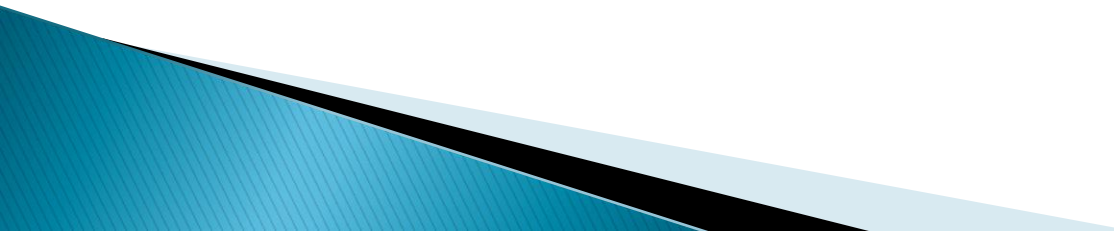
	Elasticity	t-ratio	R <sup>2</sup>	D.W.	P-value	Tax Base
<b>Non-Oil Direct Taxes (excl. Petro.)</b>	<b>1.21</b>	<b>21.20</b>	<b>0.95</b>	<b>1.97</b>	<b>0.00</b>	Non-Oil GDP
Income Tax	1.02	11.22	0.96	1.85	0.00	Non-Oil GDP
Company Tax (excl. petro.)	1.39	9.79	0.90	1.74	0.00	Non-Oil GDP
Company Tax (incl. petro.)	1.90	19.13	0.98	1.66	0.00	Non-Oil GDP
<b>Non-Oil Indirect Taxes</b>	<b>0.99</b>	<b>10.34</b>	<b>0.97</b>	<b>2.31</b>	<b>0.00</b>	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
<b>Total Non-Oil Tax Revenue (excl. petro.)</b>	<b>0.81</b>	<b>12.46</b>	<b>0.97</b>	<b>2.18</b>	<b>0.00</b>	Non-Oil GDP

Source: Central Bank of Trinidad and Tobago

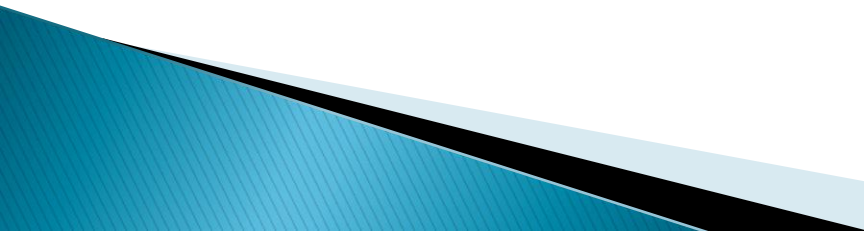
# Limitations of the Non-Oil Tax Elasticity Results

- ▶ 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.
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# Conclusions

- ▶ The non-oil tax system is relatively efficient at raising tax revenue but has weakened when compared with earlier years.
  - ▶ There is scope for improved collections from the non-oil tax system and especially within the categories of income tax, excise duties, property tax and VAT.
  - ▶ The elasticity coefficients for most of the categories of non-oil tax revenue were higher than the buoyancy coefficient.
  - ▶ Data gaps on the revenue effects of budget tax measures is a challenge for the calculation of elasticity coefficients in T&T.
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# Closing Remarks

- ▶ The buoyancy and elasticity coefficients point towards opportunities for improved collections from the non-oil tax system. This may mean that to support the re-invigoration of the domestic economy and return to a surplus position (in the short to medium term), the central government will be burdened to introduce major policy changes to boost revenue. Ideally, we would prefer a tax system that has a strong underlying elasticity rather than one that needs to be supported by major budget measures on a yearly basis.
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# QUESTIONS?



For comments on this paper please contact:  
[jcotton@central-bank.org.tt](mailto:jcotton@central-bank.org.tt)