DUTCH DISEASE, REVEALED COMPARATIVE ADVANTAGE AND ECONOMIC DIVERSIFICATION IN A SMALL OIL BASED ECONOMY

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ABSTRACT

This article investigates the link between Dutch Disease and the revealed comparative advantage structure of the Trinidad & Tobago economy for the period 1991 -2011. The article divided the labor market into booming tradable, tradable and non-tradable sectors. The article starts with an elaboration of the Dutch Disease model with a clear directive as to why there is the need to diversify the production structure of the Trinidad & Tobago economy, even though the economy is producing its comparative advantage good — hydrocarbon products. The article then provides a variety of suggestions regarding how to strengthen the non-booming tradable aspect of the economy.

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1. Introduction

Booming sector models have been used throughout the literature to shed some light on several historical episodes where adverse general equilibrium effects occurred. For example, Cairnes (1859) was among the first to recognize that the negative economic outcomes in Australia during the 1850s were attributed to the massive gold discoveries in 1851. The concept of the Dutch Disease was applied to this case by Maddock and McLean (1983). Even so, Forsythe and Nicholas (1983) noted that the influx of American resources during the sixteenth century negatively affected the Spanish industrial sector in terms of the Dutch Disease. The term 'Dutch Disease' itself was first used in 1977 by the *Economist* magazine to describe the decline of the manufacturing sector in the Netherlands, as a consequence of the appreciation of the Dutch Guilder, which followed the discovery of a large natural gas deposit in the North Sea in 1959.

Corden and Neary later formalized the model in 1982. In this seminal addition to the literature, the authors explained that the negative outcomes of the Dutch Disease occurred as a result of the combined mechanisms associated with the Dutch Disease. They showed that a resource boom, later generalized to explain a boom in any tradable sector, resulted in a resource movement and spending effect. Corden in 1984 further developed the model.

This article builds on the work of Corden and Neary (1982) and Corden (1984). The article is therefore organized as follows: section two examines the theory of the Dutch Disease, followed by a discussion on the links between the Dutch Disease and sectoral trade performance, an assessment of the macroeconomic landscape, comparative advantage and maximizing economic rents and some interventions re-

quired to help sprout the diversification of the non-booming petroleum sector. This will be followed by the conclusion.

2. The Theory of the Dutch Disease

The theory of the Dutch Disease is premised on several key assumptions. In the first instance, the economy is comprised of two sectors: a tradable (T) and a non-tradable (NT) sector. The T sector is further subdivided into a booming tradable (BT) segment and a non-booming tradable (NBT) segment. Each segment employs one fixed factor and one flexible factor of production. For the purposes of this article, the flexible factor of production is assumed to be labor. The model also assumes that the economy operates under conditions of full employment. This assumption is key, given that the model explains that labor flows between the sectors in response to the boom.

In the initial conditions of full employment, the employed labor force L, is distributed as:

$$L = BT_0 + NBT_0 + NT_0 \quad (1)$$

Assume now that the price of the good sold in the BT sector increases on the international marketplace, or, alternatively, that there is a resource discovery or a favorable technological shock, then the marginal revenue productivity of labor in the BT sector would increase, and other things being constant —that is assuming no income benefits —the most mobile resources from the non-booming sectors would migrate towards the BT sector. This is the resource movement effect (R^m). Thus with the R^m effect, the distribution of employment in the economy becomes:

$$L^R = NBT_1 + BT_1 + NT_1 \quad (2)$$

Diagrammatically, the resource movement effect is illustrated as a rightward shift of the demand curve for BT labor and a corresponding leftward shift of the supply curves for NBT and NT labor (see Figure 1). This adjustment exerts an upward pressure on the domestic wage rate from w_0 to w_1. Note that the level of employment in the BT sector increases while the level of employment in the NBT and the NT sector declines because of the R^m effect.

Figure 1: The Resource Movement (R^e) of Dutch Disease
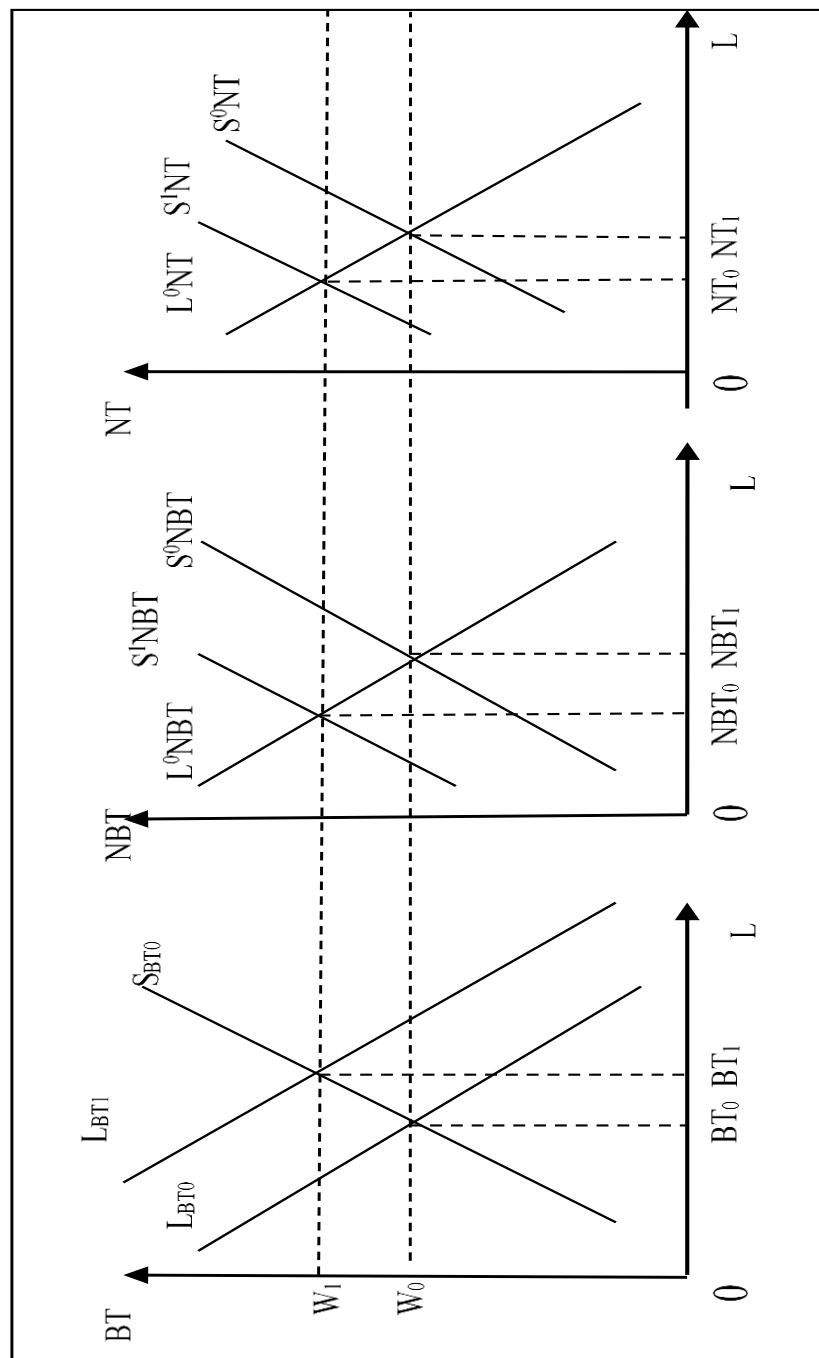
The change in distribution of employment between the resource movement induced employment situation (L^R) and the initial distribution of labor (L) can be illustrated algebraically as:

$$L^R - L = 0 = \Delta BT_1 + \Delta NBT_1 + \Delta NT_1 \quad (3)$$

$$\Delta BT_1 = -\left(\Delta NT_1 + \Delta NBT_1\right) \quad (4)$$

The contraction in the level of employment in the NBT sector attributable to the resource movement effect is known as direct de-industrialization (Corden 1982).

Regarding the mechanism by which the spending effect occurs in the economy, consider that in small economies the petroleum sector is typically an enclave sector. This means that the government acts as the conduit between the offshore and onshore sector. When workers in the BT sector and the government sector spend their higher incomes, the economy as a whole realizes an increase in demand for NT goods. This spending effect (S^e) results in an increase in the demand for labor in the NT sector from NT_1 to NT_2 and a further rise in the wage rate from w_1 to w_2 (see Figure 2).

The distribution of labor with the influence of the S^e becomes:

$L^{se} = BT_2 + NBT_2 + NT_2$ (5)

So that the change in the distribution of labor between the S^e and R^e episodes can be represented as:

$L^{se}-L^{re}= (BT_2 + NBT_2+ NT_2) - (BT_1+NBT_1+NT_1)$

$\Delta L^{se} = \Delta BT_2 + \Delta NBT_2 + \Delta NT_2$

$$0 = \Delta BT_2 + \Delta NBT_2 + \Delta NT_2$$

Or

$\Delta NT_2 = -\left(\Delta BT_2 + \Delta NBT_2\right)$, which illustrates that the non-tradable sector expands at the expense of the BT and NBT sectors.

The eventual distribution of labor in the economy because of the Dutch Disease (L^{DD}) can be represented as:

$$L^{DD} = L^{Rm} + \Delta L^{se} = BT_2 + NBT_2 + NT_2$$

So that the distribution of labor in a Dutch Diseased environment is given by:

$$L^{DD} = L + \Delta L^{RM} + \Delta L^{se}$$

And the total change in the distribution of labor is:

$$L^{DD} - L = \Delta L^{RM} + \Delta L^{se} = BT_2 - BT_0 + NBT_2 - NBT_0 + NT_2 - NT_0$$

Given that

$$\Delta L^{RM} = \left(BT_1 - BT_0\right) + (NBT_1 - NBT_0) + (NT_1 - NT_0)$$

And

$$\Delta L^{se} = \left(BT_2 - BT_1\right) + (NBT_2 - NBT_1) + (NT_2 - NT_1)$$

Then we can express L^{DD}-L as:

$$L^{DD} - L = BT_2 - BT_0 + NBT_2 - NBT_0 + NT_2 + NT_0$$

The change in the labor market as a result of the Dutch Disease given by $L^{DD} - L$ is shown in Figure 3.
Assuming a fixed stock of capital in each sector, we would expect that:

a. Employment in the NT sector increases,
b. Employment in the BT sector rises,
c. Employment in the NBT sector falls. These labor market changes are illustrated in the Table 1.

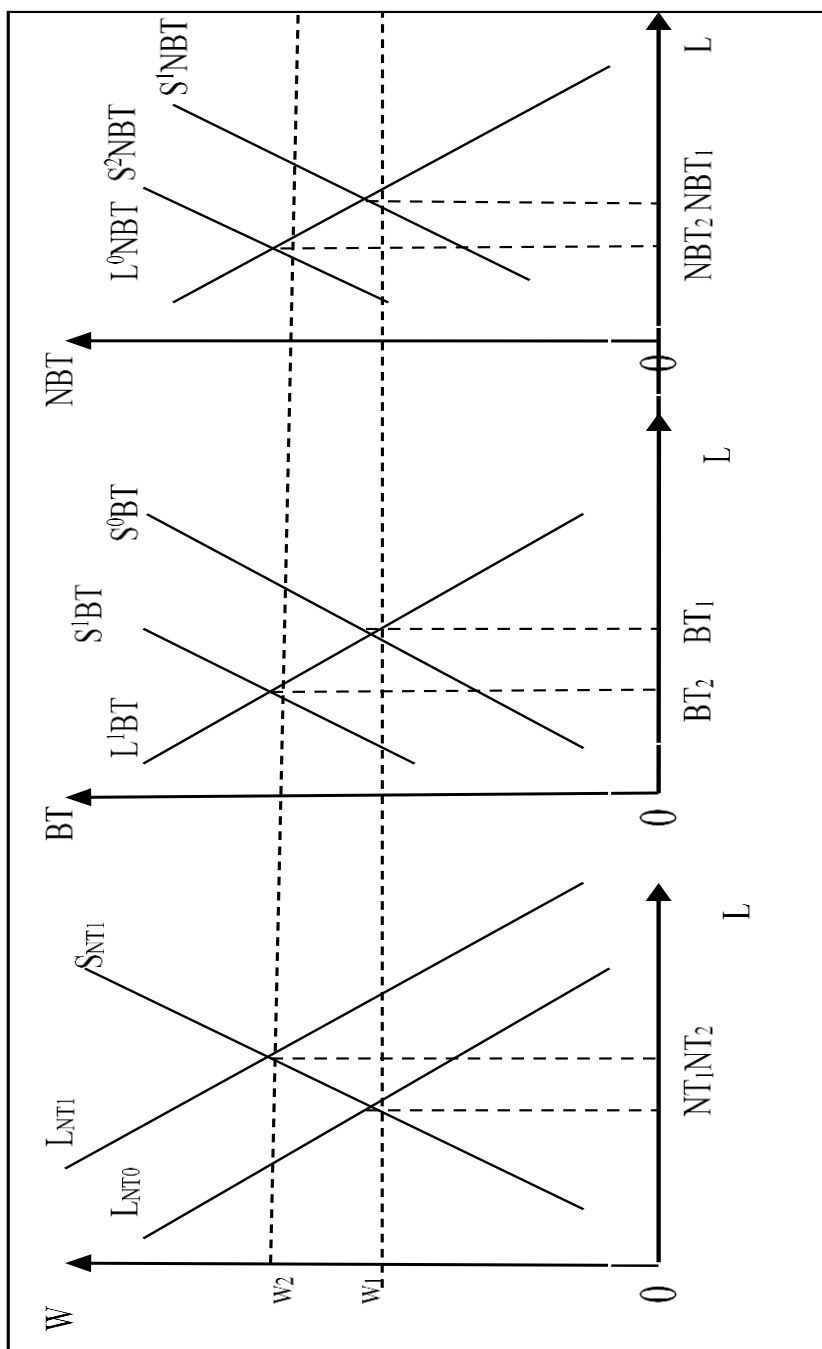**Figure 2: The Spending Effect ($e) of the Dutch Disease**
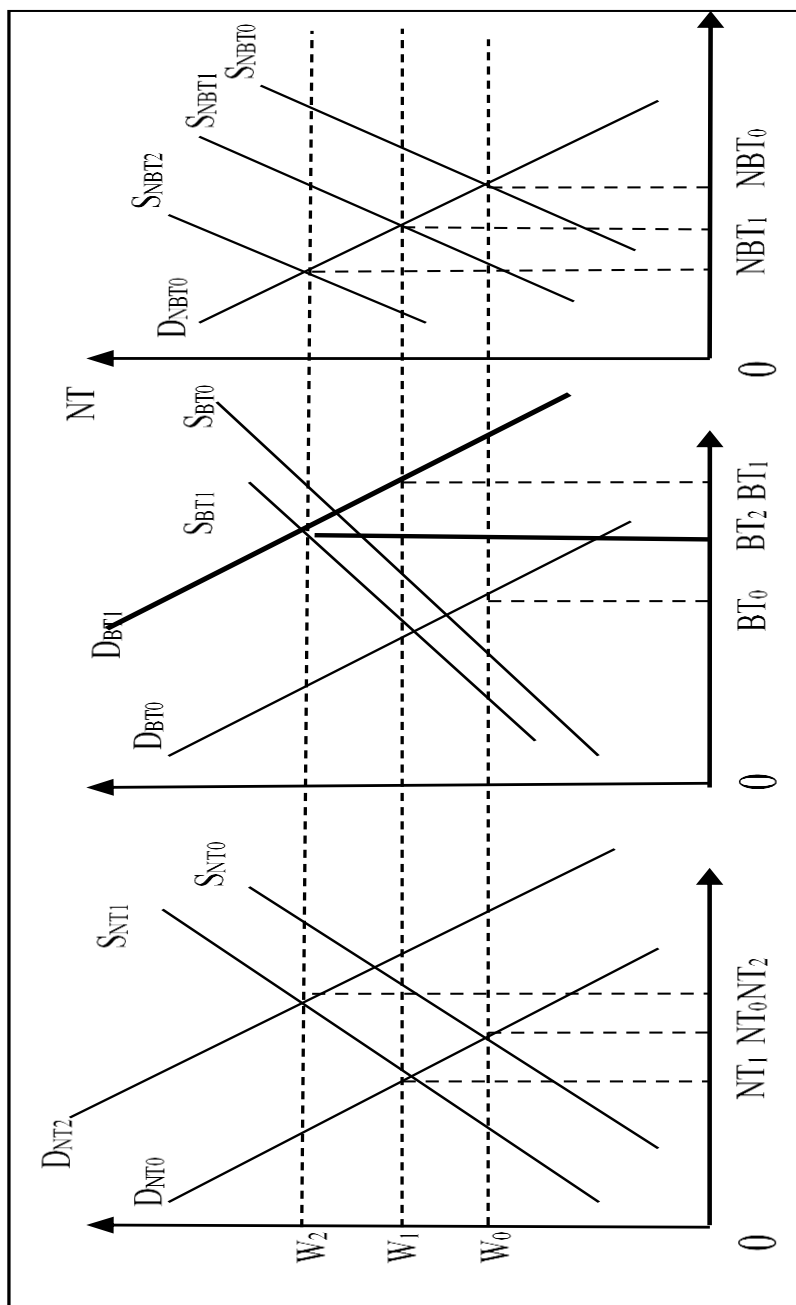
Figure 3: Combined R^e and S^e of the Dutch Disease

Table 1: Labor Market Changes Associated with the Dutch Disease					
	L	L^R	L^S	$L^{DD} - L$	Overall
NBT	NBT_0	NBT_1	NBT_2	$NBT_2 - NBT_0$	-
BT	BT_0	BT_1	BT_2	$BT_2 - BT_0$	+
NT	NT_0	NT_1	NT_2	$NT_2 - NT_0$	+

Table 2: Summary of Dutch Disease Symptoms		
	Output	**Price**
Resource Movement Effect		
Booming Tradable (Oil Sector)	+	Given
Non Booming Tradable (Manufacturing Sector and Export Agriculture)	-	Given
Non-tradable (Services Sector)	-	+
Spending Effect		
Booming Tradable (Oil Sector)	-	Given
Non Booming Tradable (Manufacturing Sector and Export Agriculture)	-	Given
Non-tradable (Services Sector)	+	+
Combined Effect		
Booming Tradable (Oil Sector)	Indeterminate but likely to rise	Given
Non Booming Tradable (Manufacturing Sector and Export Agriculture)	-	Given
Non-tradable (Services Sector)	Indeterminate but likely to rise as the income elasticity of demand for services is typically greater than unity)	+

Table 2 provides a summary of the changes that will take place in output and prices in the BT, NBT and the NT sector as a result of the R^e and S^e. Output in the BT sector with an inflow of workers as a result of the R^e will increase. With the S^e there will be a small contraction (potential) at most in the size of the BT sector's output but overall compared to

the initial conditions, the combined R^e and S^e will lead to an expansion in the size of the output from the BT sector.

In the NBT sector, output contracts with both the R^m effect and the S^e. The contraction in output as a result of the R^e is known as direct de-industrialization and in terms of the S^e is known as indirect de-industrialization. In the NT sector, the R^e leads to a fall in the size of the NT sector but with the S^e and the increased demand for labor in this sector, there is likely to be an overall increase in output, as the income elasticity of demand for services tends to be in excess of unity. In terms of prices, the increase in the size of the NT sector pushes the price level in the sector upwards while the price level in the NBT and the BT sectors are determined by the external sector and so remain exogenously determined.

If the factor endowments of an economy remain constant, then in the purview of the Heckscher-Ohlin theory the bundle of commodities a country produces would remain the same, that is, there will be persistence in the pattern of production. With the Heckscher-Ohlin model, the perspective is that the pattern of production changes only when there is a change in the factor endowment bundle[1].

2. 1. Why Diversify if the Country is Producing and Exporting on the Basis of its Comparative Advantage Good?

Table 3 below outlines the revealed comparative advantage (RCA) structure of the Trinidad & Tobago economy in 2009. Using the Balassa (1966) methodology, goods starting with a code three (3) or five (5) are linked to the economy's petroleum sector. The obvious question one may want to ask is, given that Trinidad & Tobago is indeed producing its comparative advantage good, why should economic diversification be high on the agenda for the Trinidad & Tobago economy?

The first and obvious response is that we have no real choice in the matter since the quantity of reserves in the Trinidad & Tobago economy is being rapidly depleted. Specifically, Table 4 shows that the time to exhaustion of crude oil and natural gas is less than 15 years, with gas reserves being less than 10 years.

Table 3: RCA Scores of CARICOM Economies, 2009	
Master List	**2009**
46	1.27
48	1.92
59	1.9
91	1.93
111	5.83
122	2.98
333	1.8
334	4.39
342	5.12
343	24.53
344	2.38
512	12.58
522	9.62
554	1.31
562	3.62
642	1.56
671	5.24
676	1.32
Source: Own Computation	

Table 4: Time to Exhaustion for Oil and Gas in Trinidad & Tobago		
	Oil Time to Exhaustion	**Gas Time to Exhaustion**
1990	9.38	47.5
2000	17.5	40
2010	13.8	10.1
2011	13.3	9.1
Source: Handbook of Key Economic Financial Statistics and Ryder Scott reports (various years).		

The second argument is that more diversified economies tend to provide empirical evidence of growth (See Hesse, Leiderman and Maloney, 2008). Narrow specialization in primary goods tends to make an economy vulnerable to external shocks and with potentially adverse effects on economic growth due to the deterioration in the terms of trade. When a country exports a large number of goods, then there is the likelihood that movements in the prices of individual goods will offset each other and keep the economy's export price level stable.

Even more, the Dutch Disease tends to compromise the size of the NBT sector, which is typically the manufacturing sector. De-industrialization occurs naturally in developed economies as they go through a trajectory of growth in which the agriculture sector dominates, followed by the manufacturing sector, and then the tertiary sector (Saeger, 1997). To illustrate some of the fundamental economic attributes of de-industrialization, Let A_0: share of agriculture in total output, M_0: share of manufacturing in total output, S_0: share of services in total output; and let Y_L: low income, Y_M: middle income, and Y_H: high income.

Prototypically, in:

Y_L, $A_0 > [M_0, S_0]$ ....(1) i.e. in low-income economies the agriculture sector dominates

Y_M, $M_0 > [A_0, S_0]$ ....(2) i.e. in middle income economies the manufacturing sector dominates

Y_H, $S_0 > [M_0, A_0]$ ....(3) i.e. in high-income economies the services sector dominates.

De-industrialization itself is not a major problem when it occurs naturally. However, when it occurs unnaturally because of, say, the Dutch Disease, then the affected economy is deprived of all the attendant learning by doing and backward and forward linkages that manufacturing promotes (Hirshman, 1957).

It is significant also for policy makers in the Trinidad & Tobago economy to recognize that the composition of the country's exports is important and that there is a much-improved probability of moving onto goods in a similar range and class, for example, moving from producing drill bits to pliers. In this regard, it may make sense to produce these types of goods since they offer considerable externalities. Some sectors such as the petroleum sector do use a sophisticated level of technology, and while some of the learning by doing and technology in the upstream sector can find spillover roots in the downstream sector, their relationship with other goods in the manufacturing sector may be too distant. Some proponents of an economic diversification effort away from primary goods to manufacturing suggest that it has a relatively

secularly deteriorating price level. This, however, has not borne itself out over time (Hausmann and Klinger, 2006).

Diversification may offer an economy the capacity to reduce the magnifying effects of external shocks which can occur with dependence on a narrow export base (Bachetta, Jansen, Piermartini and Amurgo-Pacheco 2007). In a recent paper, Samen (2010) investigated the role of export diversification as a shock absorber. The author found that for lower income countries the greater the degree of product differentiation, the lower the degree of income volatility. Significantly, these researchers found that as countries become richer, geographic diversification plays a more dominant role than product diversification in reducing income volatility.

Another obviously salient reason for diversifying is to reduce the likelihood and entrenchment of the resource curse, as this in turn affects the quality of institutions and the governance structure in the economy. It is well established that resource booms promote rent seeking and this in turn can compromise the level and quality of the institutional strength in an economy.

The world price for oil has been fluctuating over the last two decades, with the main reason being supply shocks. Thus from US$23.7 in 1990 crude oil prices fell to US$12.73 in 1998, a decline of 46.4 percent. However, by 2008, the price of oil accelerated to US$99.67 per barrel (US$147 in July 2008) and by the very next year it fell to an annual average of US$61.9, 37.8 percent lower than in 2008 and with prices in March 2009 averaging US$34 per barrel or just 23.13 percent of the July 2008 price level. Volatility of this nature in an export product is harmful to growth. Cavalcanti, Mohaddes and Raissi (2011) in a recent paper entitled *Commodity Price Volatility and the Sources of Growth* investigated the impact of the level of the commodity terms of trade on economic growth. These researchers, using annual data from 1970-2008 in five year non-overlapping observations, found that the commodity terms of trade favorably enhanced real output per capita but volatility had a negative impact on the economic growth process by lowering the accumulation of physical capital.

Other researchers such as Imps and Wacziarg (2003) established empirically that both production and employment tend to be

characterized by an inverted relationship with per capita income. Export diversification follows a similar tendency.

3. Dutch Disease and Sectoral Trade Performance

To transcribe the Dutch Disease and Heckscher Ohlin effects into sectoral trade performances, we can proceed as follows. Starting from first principles and dividing as before the T sector into NBT and BT components, it was established that the BT sector improves as a result of the resource movement effect, in particular, and that the NBT sector gets a double slam of contractionary effects from both the resource movement and spending effects[2].

In this regard, let F(t) show the density function of an initial index of sectoral trade performance. With the Dutch Disease, there is an emergent dichotomous pattern in the sectoral trade performance leading to distinct areas of comparative advantage (the BT sector expands in size) and the comparative disadvantage area also expands in size as the NBT sector collapses. Since the number of product lines representing the BT sector (here the petroleum sector) as an area of the comparative advantage is small, there is a crowding out of the manufacturing sectors in the new distribution F(T+S) and areas of intermediate comparative advantage disappear.

Four key changes take place in terms of the RCA structure in an economy with a pronounced boom in one of its exportable goods.

1. Distribution becomes more bi modal as the NBT sector dissolves and two almost distinct distributions emerge: one with RCA > 1 and the other with RCA <1.
2. Median value of RCA > 1 increases while the median value of RCA < 1 falls. This is intuitive as resources flow towards the BT sector because of the resource movement sector and out of the NBT sector due to a resource movement effect that takes place in favor of the BT sector and a spending effect that causes resources to drift to the NT sector.
3. Standard deviation of RCA >1 scores fall and of RCA <1 increases.
4. Overall distribution becomes more skewed as there is a crowding out of the NBT sector by the NT and BT sectors.

Figure 4: Distribution Associated with Differing Evolution of RCA Indices
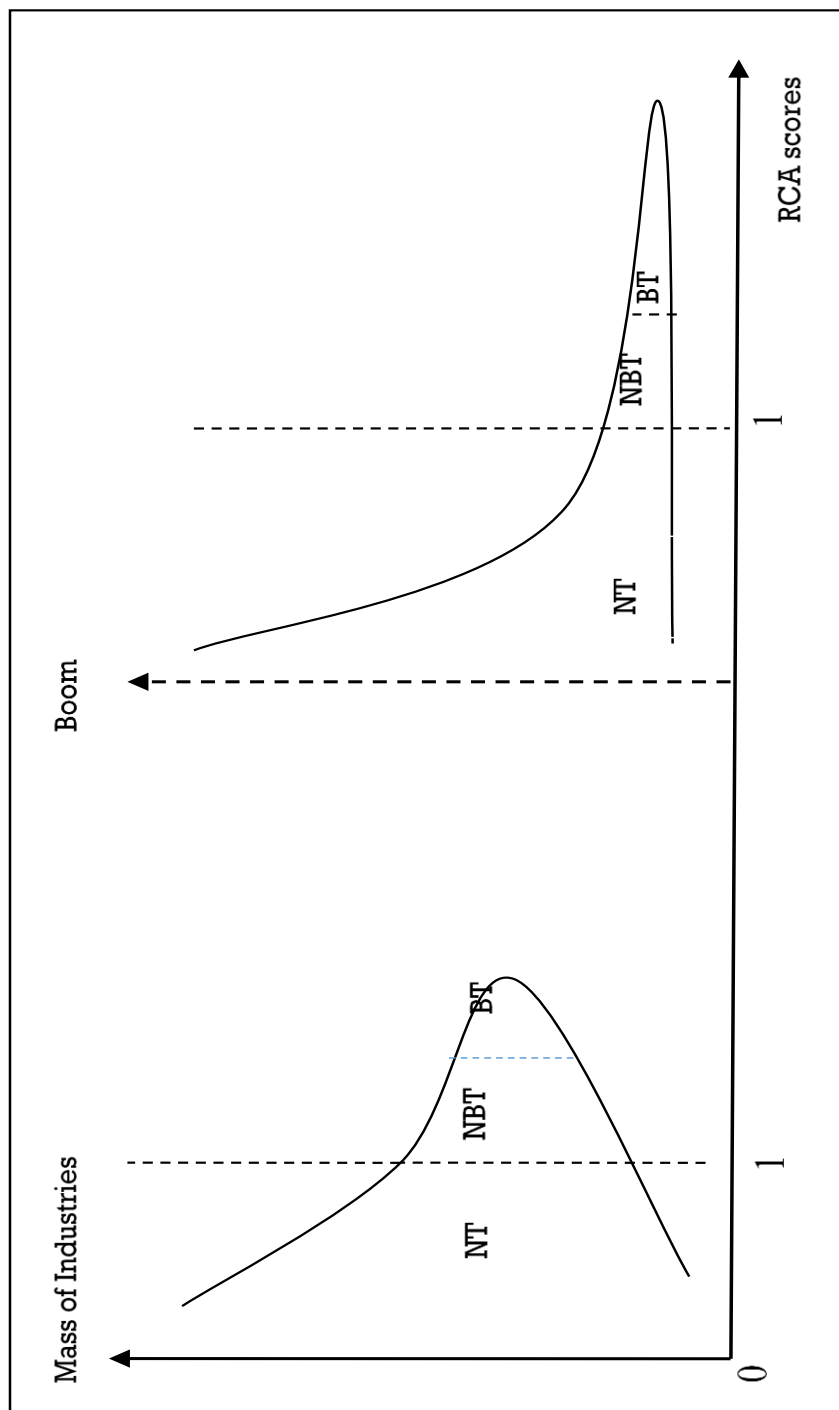
Table 5: Diversification and Competitiveness in Trinidad &Tobago		
Year	HHI	RCA > 1
1990	0.4809	21
1991	0.466	24
1992	0.4517	22
1993	0.3667	28
1994	0.3297	29
1995	0.313	27
1996	0.3261	28
1997	0.2965	33
1998	0.2817	32
1999	0.3499	34
2000	0.4657	26
2001	0.3307	26
2002	0.4072	29
2003	0.4836	23
2004	0.4298	20
2005	0.5321	19
2006	0.6084	17
2007	0.4832	22
2008	0.5262	18
2009	0.5883	23
2010	0.4252	21

Thus, while the Trinidad & Tobago economy continues to produce the Heckscher Ohlin comparative advantage goods, the resource movement and spending effect of the Dutch Disease crowds out the NBT sector as a matter of natural process during a booming period. To empirically observe this, consider the Hirschman Herfindahl index (HHI), which range from 0 to 1, (with a value of zero indicating perfect diversification and of 1 indicating perfect commodity concentration) in the Table 5. Observe that the HHI improves from 0.2817 in 1998 to 0.4252 in 2010 and indicating that the Trinidad & Tobago economy is becoming less diversified. Table 5 also shows output from the revealed comparative index calculated using the Balassa (1966) methodology. In terms of revealed comparative advantage (RCA) areas with scores above unity, these improved from 21 in 1990 to 34 in 1999 but thereafter declined to 21 in 2010 (17 in 2006). Indeed, the RCA > 1 variable (not surprisingly) corresponds well with the trend in the HHI variable.

The polarization and dichotomous split in the distribution of the RCA scores is perhaps most clearly reflected in Table 6 below where

the number of sectors with RCA scores above unity plunged from 34 to 21 between the snapshot years 1999 and 2010.

Table 6: Display of Gain or Loss in RCA from 1999 to 2009					
Master List	1999	2009	Change	Gain or Loss	State to State
17	1.11	0.38	-0.73	loss	b to a
46	2.24	1.27	-0.97	loss	b to b
48	4.46	1.92	-2.54	loss	d to b
58	1.81	0.9	-0.9	loss	b to a
59	2.66	1.9	-0.76	loss	c to b
61	5.96	0.16	-5.8	loss	d to b
62	3.28	0.62	-2.66	loss	d to b
72	1.04	0.26	-0.78	loss	b to a
73	1.1	0.58	-0.52	loss	b to a
75	1.11	0.37	-0.74	loss	b to a
91	4.27	1.93	-2.34	loss	d to b
98	1.26	0.5	-0.76	loss	b to a
111	15.12	5.83	-9.29	loss	d to d
112	1.81	0.87	-0.94	loss	b to a
122	1.11	2.98	1.88	gain	b to c
333	3.54	1.8	-1.74	loss	c to b
334	17.63	4.39	-13.24	loss	d to d
342	14.53	5.12	-9.41	loss	d to d
343	6.17	24.53	18.37	gain	d to d
344	41.9	2.38	-39.51	loss	d to c
512	23.67	12.58	-11.08	loss	d to d
522	37.1	9.62	-27.48	loss	d to d
554	3.35	1.31	-2.04	loss	c to b
562	6.19	3.62	-2.57	loss	d to c
635	1.43	0.18	-1.24	loss	b to a
642	3.64	1.56	-2.07	loss	c to b
661	3.8	0.79	-3	loss	c to a
665	1.89	0.48	-1.41	loss	b to a
671	10.36	5.24	-5.12	loss	d to d
676	14.81	1.32	-13.49	loss	d to b
691	1.03	0.12	-0.92	loss	b to a
693	1.24	0.24	-1	loss	b to a
723	1.04	0.49	-0.55	loss	b to a
741	1.22	0.09	-1.13	loss	b to a
Source: Computed form COMTRADE data.					

Note that the Balassa index (BI) has a theoretical range from 0 to infinity and is based on post-trade and not on pre-trade data.

This index carries a fixed demarcation value of 1, a variable upper bound and a lower bound of zero. Hinloopen and Marrewijk (2001) have argued that the widely used criterion, RCA>1 to select industries which carry a comparative advantage, selects about one third of an economy's exports. To provide a more even distribution of the RCA

scores, Hinloopen and Van Marrewijk (2001) have divided the theoretical range of the Balassa RCA values into four classes. These classes are as listed in Table 7 below.

Table 7: RCA Classifications		
Class a	0 < RCA < 1	Industries with a comparative disadvantage
Class b	1< RCA < 2	Industries with weak comparative disadvantage
Class c	2 < RCA < 4	Medium comparative advantage
Class d	4 < RCA	Strong comparative advantage

On this basis, there were thirteen instances of a movement from class b to a, one case of a movement from class c to a, and one case of a movement from class d to a. These class-to-class migrations are by all standards alarming and a manifest consequence of strong Dutch Disease processes at work. If we identify section three and section five as the economy's BT sector, then 22 of the sectors in the NBT sector would have migrated to lower states, and this is alarming by every standard.

3. 1. Intra distribution dynamics: Transition Probability Matrices and Markov Chains

To analyze the mobility of different sectors in a specialization index, one can use transition probability matrices. A transition probability matrix may be defined as a square array of non-negative numbers such that the rows tally to unity and represent a discrete Markov chain[3]. The estimated transition matrices are based on the time interval 1999 (the initial time period) and 2009 (the new time period) and show the probability of moving from one state in the first time period to another state in the final time period.

The first diagonal element of the transition probability matrix (TPM) Table 8 below shows the probability of starting in a state of comparative disadvantage in 1999 and remaining in that state in 2009. Likewise, note that the other diagonal elements are also high. Ideally, policy makers would like the elements in the upper triangular part of the TPM to be high, but it is clear that the elements in the first row, for example, have very low values. In contrast, policy makers would want the values

in the lower triangle part of the matrix to be very low, but unfortunately, some of the probability values are non-trivial. Overall, the transition probability matrix points to a sorry state of affairs in terms of the capacity to translate comparative disadvantage into strong, moderate, or even weak comparative advantage, even over the medium to long term period defined above. Even more, the probability of moving from weak or moderate comparative advantage to a state of comparative disadvantage is non-trivial. In the aggregate, this means that we need to rethink our approach to economic diversification. It is against this backdrop that the next section of this article discusses a two-pronged approach to the economic diversification effort. Prior to this, though, a brief contextualized review of the macroeconomic landscape in which this new economic diversification effort is set to be established is briefly outlined.

Table 8: Transition Probability Matrix for Movement Among States, 1999 – 2009					
		To			
		a	b	c	d
From	a	0.913	0.0031	0.014	0.099
	b	0.314	0.487	0.09	0.101
	c	0.213	0.118	0.593	0.112
	d	0.113	0.228	0.065	0.618

3. 2. Benefiting from Existing Comparative Advantage: Maximizing Economic Rents

A basic tenet of international trade theory is that economies should specialize in those commodities they can better produce — more efficiently — than other competitors. Given that we have an industry which is over 100 years old and that we are already producing commodities of world class standard and in high international demand, then we should continue to intensively pursue this sector in order to maximize the rent the sector affords us. For completeness, economic rents refer to the difference between actual price and transfer earnings; it is calculated as the actual price of oil less transfer earnings multiplied by the level of production, as indicated by the formula below:

$$ER_t = TP_t * (AP_t - TE_t)$$

where ER_t: economic rents for period t, TP_t: total production of crude oil in period t, AP_t: actual price of crude oil in period t and TE_t: transfer earnings of crude oil in period t, the price of crude oil declined to US$14.4 per barrel in 1998, the lowest in the period 1990-2011. This study treats this price as the transfer earnings of a barrel of crude oil (see Table 9). In this regard, the hydrocarbon sector prospered from an increase in economic rent in the crude oil subsection of the economy of US$373.46 millon in 1991 to US$2,680.3 million in 2011. Some amendments proposed in the 2012 budget would probably influence these shares and allowing a larger size of the pie to companies.

Table 9: Determining Resource Rents and Oil Windfalls in Trinidad & Tobago, 1991-2011.					
	Production (000 barrels)	Actual Price of Oil	Budgeted Price of Oil	Oil Rents (millions)	Oil Wind-fall (millions)
1991	52,423.00	21.6	22	377.45	-20.97
2000	43,680.50	30.2	16	690.15	620.26
2010	35,854.90	79.48	65	2,333.44	519.18
2011	33,551.60	94.88	75	2,700.23	667.01
Source: Annual Economic Survey (various years) and own computations.					

Indeed, it is rents and windfall of this nature during the past that led to a very heavy dependence of the economy on the petroleum sector as reflected by the various macroeconomic indicators shown in the Table 10 below.

As the data reflects, the contribution from the petroleum sector in both absolute and relative terms is certainly not trivial and therefore there is need to obtain the maximum returns from this sector to sow elsewhere, *preferably into areas with productive activity built around reproducible capital* (this is the Hartwick rule). In this regard, this article emphasizes a twofold strategy: maximizing the current value of the energy sector while simultaneously trying to strengthen the energy sector. Given the importance of the petroleum sector, it may be necessary

for the Trinidad & Tobago economy to consider several interventions, some of which are discussed below.

Table 10: Indicators of Petroleum Dependence				
	Petroleum FDI as % of Total FDI	**Petroleum GDP as % of Total GDP**	**SITC 3+5 exports as % of Total Exports**	**Oil revenues as a % of Total revenues**
1991	86.8	32.79	82.14	44.84
2000	90.3	31.29	82.61	40.06
2010	91	42.86	84.4	51.51
2011p	90	43.47	87.2	55.03
Source: Central Bank of Trinidad & Tobago Annual Economic Survey, (various years)				
*In 2008, the Total inflow of FDI was US$2800.8mn an increase as compared to US$830 million in the previous year. This was due to the purchase of the RBTT Ltd by the Bank of Canada. This accounts for the fall in the relative proportion attributed to Petroleum.				

In the petroleum sector, plants often have to impose shutdowns in order to undertake maintenance work on the machinery and other types of physical capital. As an industry, these shutdowns should be undertaken while avoiding disruption **of** the supply chains between the various companies and industries. Shutdowns should be planned and communicated with stakeholders. For example, the Energy Chamber (2012)[4] noted: "since mid-2011, there have been significant production constraints in the upstream gas sector, which were especially pronounced in October and November 2011. This decline in production was as a result of maintenance work and safety upgrades of natural gas production platforms, which resulted in cutbacks in natural gas supply—feedstock for these products." Another key example of this is the impact of bpTT shutdowns for inspection and maintenance. In particular Zoworski (2012)[5] quotes the president of NGC as having said, "the natural gas curtailments to chemical producers in the Point Lisas Industrial Complex will continue for the foreseeable future as bpTT continues to systematically perform safety maintenance procedures on its well plat-

forms." What is needed, and indeed the Ministry of Energy and Energy Industries seems to be proceeding along this line, is a better management of the whole supply chain from the Ministry level to reduce the friction associated with maintenance work in the upstream sector.

The authors of this article are of the firm view that the Trinidad & Tobago petroleum taxation regime is relatively uncompetitive.[6] Whereas the existing fiscal system worked in the past, given that most of the commercially easy hydrocarbon resources have already been found, the fiscal regime may need to be adjusted in order to attract investors to engage in exploration of the more high risk areas such as in the deep water offshore blocks[7]. One immediate and related concern is how should a country go about raising its oil and gas wealth? Russell and Bertrand (2012) have argued that: (a) fiscal changes are required at each stage of the depletion process in the life cycle of a field; (b) investors should be allowed reasonable time frames to recover their investments; (c) as production peaks and levels off, government's take from a field should be at its peak; and (d) fiscal relief for mature fields would limit the closure possibilities of these fields.

Indeed, one of the ways in which the fortunes of the sector as a whole can be reversed is through the active engagement of joint ventures. Industry experts allude to the fact that globally the industry is on the rise especially with the emerging industries in Africa. Opportunities for joint ventures, especially given the fact that Trinidad & Tobago has a long history in oil production, in these emerging international markets can help to improve the strength of the sector. Regionally, Trinidad & Tobago can also engage joint ventures with companies operating in emerging energy producers such as Belize, Guyana, and Suriname.[8] Joint venture activities are also a possibility with local firms joining forces with foreign firms to enter into bids for exploration acreage.

To improve the prospects and outcomes in the energy sector, the Trinidad & Tobago economy needs to consider engaging more activities along the value chain. Given declining reserves to production ratio, engaging spin off industries has the potential to improve the sustainability of the sector. For example, downstream production using natural gas can foster industries producing commodities such as Acetic

Acid, Formaldehyde, Polyethylene, and Polypropylene, which can provide a wider market base for Trinidad & Tobago's exports.[9]

Opportunities also exist for exploration in the deep horizon on land. In an interview with the *Trinidad Guardian*, Mr. Anthony Ramlakhansingh (2012),[19] former lecturer in geosciences at the University of the West Indies noted, "with oil production continuing to decline, there should be moves to immediately increase production out of Petrotrin's mature fields by infill drilling and enhanced recovery techniques. ....These should be done solely through Petrotrin's initiatives using high-quality 3D seismic....These initiatives would stem the decline and keep the country's indigenous crude production hovering around 85,000 to 90,000 bopd (barrels of oil per day) over the next six to 20 years, in spite of possible declines in the Angostura and TSP fields." Petroleum reserves will eventually be exhausted and the economy at some point will definitely need a stronger NBT sector.

4. Policy Interventions to Boost Competitiveness of the NBT Sector

The appreciation of the REER would have no doubt eroded the external competitiveness of the firms operating in the NBT sector of the Trinidad & Tobago economy. This weakened the economy's competitiveness, and indeed it must be acknowledged that it is difficult to have a competitive company in an uncompetitive economy. As a reflection of the adverse impact of the appreciation of the real effective exchange rate on the economy, consider the following equation.

$$tourist\ arrivals_t = 59 + 2.2712\ ipi_t^* - 1.054\ reer_t + 0.2521\ xm_t$$

This equation shows a long run cointegrating relationship between the real effective exchange rate (REER) and tourist arrivals (tourist arrivals)[10] and indicates in particular that the real effective exchange rate has a significantly negative impact on tourist arrivals. The model was regressed using quarterly data for the time period 1995 to 2010). This provides a basis on which policy makers need to aggressively review, assess, and address the external competitiveness position of the Trinidad & Tobago economy. Against this backdrop, Table 11 below illustrates data for the GCI rank[11] for Trinidad & Tobago, and two com-

parator economies, Barbados and Costa Rica. The Table indicates the relative backwardness of the Trinidad & Tobago economy in relation to these two comparator economies.

Table 11: Global Competitiveness Index (GCI) for Selected Economies			
Year	Country	Rank	Total Number of Countries
2009/2010	Trinidad & Tobago	86	133
	Barbados	44	133
	Costa Rica	55	133
2010/2011	Trinidad & Tobago	84	139
	Barbados	43	139
	Costa Rica	56	139
2011/2012	Trinidad & Tobago	81	142
	Barbados	42	142
	Costa Rica	61	142
2012/2013	Trinidad & Tobago	84	144
	Barbados	44	144
	Costa Rica	57	144
Source: Global Competitiveness			

Under the GCI some of the alarming statistics out of 144 countries that stand out as deterring factors in making Trinidad & Tobago a more globally competitive economy are: (a) business cost of crime and violence, 139; (b) reliability of the police service, 117; (c) tertiary level enrolment, gross percent, 106; (d) number of days to start a business, 123; and (e) burden of custom procedures, 133.

Table 12 below, which provides data from the *Ease of Doing Business Survey* (2012), listed three procedures to start a business in Singapore but seven in Trinidad & Tobago. Even more alarmingly in T&T, it takes 43 days to start a business but in Singapore it takes three days. To receive electricity, the EODB Survey lists Singapore as taking 36 days and Trinidad & Tobago 61 days. To register a property in Trinidad & Tobago, it takes 162 days compared to five days in Singapore. In a recent statement the President of the Point Lisas Industrial Port Development Corporation (Plipdeco) said that there was an urgent need to improve productivity at ports in Trinidad & Tobago. He noted that there was a need for a greater degree of productivity in terms of movement of containers in particular. Point Lisas achieves around 23 moves per hour

when compared to an international benchmark of 30, but POS achieves a mere 15 moves per hour.[12]

Table 12: Doing Business Indicators 2012		
Economy	**Singapore (2012)**	**Trinidad and Tobago (2012)**
Ease of Doing Business Rank	1	68
Starting a Business – Rank	4	74
Starting a Business - Procedures (number)	3	9
Starting a Business - Time (days)	3	43
Getting Electricity – Rank	5	24
Getting Electricity - Time (days)	36	61
Getting Electricity - Cost (% of income per capita)	31.1	7.9
Registering Property – Rank	14	175
Registering Property - Time (days)	5	162
Paying Taxes - Payments (number per year)	5	39
Paying Taxes - Time (hours per year)	84	210
Trading Across Borders – Rank	1	52
Trading Across Borders - Cost to export (US$ per container)	456	843
Trading Across Borders - Cost to import (US$ per container)	439	1,260
Source: Ease of Doing Business Survey (various years).		

To corroborate the difficulty of doing business in Trinidad & Tobago as reflected in the EODB Survey and the GCI, this study draws on the International Property Rights Index (IPRI). In this study, Trinidad & Tobago is ranked 57 out of an aggregate 130 countries. This study is a comparative study that measures and gauges the importance of legal, physical, and intellectual property in an economy and associated protection of these rights. In terms of registering property, Trinidad & Tobago was ranked 122 out of 130 countries in the world and a paltry 21 out of 22 in the region. This is absurd by every standard. One area according to this IPRI study in which serious improvements are needed is the control of corruption, which this study ranked Trinidad & Tobago at 109 out of 130.[13]

Even more, a 2005 Cabinet appointed Steering Committee for land adjudication and registration listed the cost of registering land in Guyana, St Lucia, and Trinidad & Tobago as shown in the Table 13 below.

Table 13: Cost of Registering Land	
Guyana	US$ 107
St Lucia	US$ 240
Trinidad & Tobago	US$ 1042

The policymaking guidelines here are both simple and obvious. Policy makers in Trinidad & Tobago should undertake a careful mapping of the steps which an economy like Singapore adopted in the last 15 years to improve its business environment and the ease of trading across borders, and implement the appropriate gap changing policies.

Against the backdrop of weaker petroleum sector and the understanding of the need to strengthen the non-petroleum sector is the need to boost the level and extent of entrepreneurial dynamism in the economy. Entrepreneurship represents the process of acting on an opportunity which was previously unnoticed. Where entrepreneurs act on these types of insights, the economy's capacity improves. Using these insights, entrepreneurs can reduce their cost of production. Entrepreneurial insights usually build on the experiences of other entrepreneurs so that in a society where the free market is promoted, entrepreneurial insights are the backbone of economic growth. In this context, rebuilding and where necessary building the culture of entrepreneurship is also paramount to diversify and widen the level of economic activities in the NBT sector. Indeed, some geographic blocs such as Mayaro and Point Fortin are really badly affected by the Dutch Disease and in need of urgent policy attention. Policy makers can rebuild the culture of entrepreneurship by increasing and enhancing the amount of funds or soft loans to set up small businesses.

Small and medium sized enterprises have gained a prominent position in the quest for rekindled growth by many economies. Since these companies are small, they can help promote economic growth by

"dynamizing the industrialization process". One recent newspaper article notes, "there are about 18000 SME's, employing approximately 200,000 people or close to 35 percent of the workforce of the gross domestic product."[14] However, it is well-known that small businesses are usually starved for finance and in this regard the experiment of stimulating the various growth poles identified by the government in the Budget Speech of 2011 should proceed perhaps by facilitating, for example, the development of Southwest Trinidad or Northeast Tobago by encouraging MNCs to replicate the MIPED experience.[15] The Mayaro Initiative for Private Enterprise Development (MIPED) is the 'first microfinance lending organization sponsored by a private non-financial company'[16]. Commencing in 2002, MIPED is a non-profit organization that is guided by a voluntary Board of Directors. With an initial investment of US$1.2 million from its sponsor, bpTT, the program aims to increase the sustainability of self-employment as well as creating entrepreneurial opportunities. According to bpTT, the MIPED program is now extremely successful in that it controls a portfolio of nearly TT$15 million without further cash injections from the company. Over the years, MIPED has led to the success of many entrepreneurs in Mayaro. These suggestions should find favor with MNCs, as a recent study, T*he View from the Boardroom - CEO Study on Corporate Social Responsibility (CSR) in Trinidad and Tobago*, illustrated that "the practice of CSR in T&T remains trapped in an often ad hoc administered financial support for good causes instead of making corporate responsibility a key component of a company's organizational structure and using it as a tool for increasing its competitiveness."

Table 14: Share of Employment in Manufacturing			
Share of Employment in Manufacturing			
Year	T&T	PF	N/M
1991	10.8	7.3	2.6
2000	10.9	4.3	2.2
2010	8.8	2.5	2.6
Source: CSSP, various years.			

Another way to try and boost the competitiveness of the NBT sector is to reduce crime in the economy. In a recent document, the

Caribbean Human Development Report (2012) indicated that Trinidad & Tobago spent 13.9 percent of its annual budget on security, some 5.4 percent more than the other Caribbean states listed in the study. Even so, however, the study notes that Trinidad & Tobago finds itself lagging in several key areas such as: (a) Trinidad & Tobago citizens have a 24.7 percent sense of security compared to 45.5 percent on average for the Caribbean; and (b) there is a 69.8 percent perception that the justice system is corrupt compared to a Caribbean average of 49.5 percent (see Table 15 for some crime statistics on the Trinidad & Tobago economy).

Crime levels seriously and directly affect tourism especially when travel advisories are issued in major source economies. Bridglal (2011) reported that the British High Commissioner to Trinidad & Tobago (Arthur Snell), confirmed that the Foreign and Commonwealth Office (FCO) of the United Kingdom which runs travel advisories about countries posted an advisory of the risk involved in traveling to Trinidad & Tobago in light of the attack on a British couple in Tobago[17]. Similar advisories were posted by Australia and New Zealand. Bridglal (2011) reported that, "crime continues to be a major deterrent to effectively enhancing Trinidad and Tobago's economic capacity for growth. And the negatives do not only apply to attracting foreign investors, but local investors continue to feel the constraint."

Against this type of backdrop, this article recommends that urgent action be taken to help lower the crime rate in the economy. The Trinidad & Tobago government needs to target the Trinidad & Tobago Diaspora abroad for a greater amount of trade and investment opportunities. Remittance inflows can be viewed as a Keynesian injection into the circular flow of income of the region and help to improve aggregate expenditure levels in Trinidad & Tobago. *Ceteris paribus*, an increase in net real remittances will lead to an increase in the real economic activity of Caribbean economies. Some studies also indicate that remittances can have a multiplier effect. Thus Adelman and Taylor (1998) in a study on Mexico found that remittances by Mexican migrants in the United States boosted Mexican GDP by 2.4 percent. Working through the multiplier can have a multiplier effect. Thus, Adelman and Taylor (1998) in a study on Mexico found that remittances by Mexican migrants in the

Table 15: Total crime reported and detected for the period 1990 to 2010

Period	Murder		Wounding and Shooting		Kidnapping		Robbery		Larceny in dwelling houses		Narcotic offences		Other		Total	
	Rep	Det	Rep	Det	Det	Rep	Rep	Det	Rep	Det	Rep	Det	Rep	Det	Rep	Det
1990	84	58	391	239	13	6	3115	709	299		1214	1210	302	133	16202	4857
1991	97	74	452	276	16	12	3099	746	318		1078	1076	328	176	16157	4610
1992	109	69	420	269	16	15	3786	892	390	79	968	968	17	17	17680	5240
1993	111	65	608	357	41	27	4722	935	355	79	1081	1080	7	28	19547	5202
1994	139	71	533	261	46	30	4490	777	367	79	1098	1095	13	13	18614	4898
1995	122	80	501	266	56	42	3858	706	326	53	1110	1110	19	19	16844	4590
1996	107	60	505	259	81	46	4075	839	352	66	1235	1235	52	50	18093	5025
1997	101	77	270	215	80	48	3393	719	432	61	1127	1177	74	55	17000	5156
1998	97	66	319	210	100	49	2780	630	279	81	1300	1300	205	202	15796	5324
1999	93	67	340	210	136	60	3629	812	388	71	1334	1334	209	209	16261	5375
2000	120	68	387	226	156	61	4094	767	400	76	1223	1223	92	92	17134	5289
2001	151	69	499	223	135	69	4273	689	323	72	485	485	120	118	15724	4156
2002	171	74	655	296	235	110	4675	704	403	71	509	509	70	67	16810	4366
2003	229	92	784	333	235	96	4590	758	365	80	505	505	42	53	16890	4502
2004	260	69	643	265	117	83	3885	751	429	85	589	589	83	81	16388	4428
2005	386	94	801	282	280	163	4868	911	408	53	495	495	292	291	17989	4691
2006	371	93	657	243	214	121	5633	921	452	69	543	543	204	192	19565	4790
2007	391	74	680	286	162	74	4965	849	453	56	604	604	167	167	19661	4596
2008	547	73	771	205	-	-	5043	567	446	48	537	537	116	116	20568	3367
2009	501	137	689	196	-	-	6107	753	607	58	552	552	141	127	22161	3855

Source: Annual Statistical Digest (various years)

United States boosted Mexican GDP by 2.4 percent. Working through the multiplier, remittances can have a very favorable impact on economic development. Remittances help to improve economic activity within an economy by helping to enhance the installation of new capacity. A major potential source of trade is targeting the Trinidad & Tobago Diaspora. The Trinidad & Tobago, and perhaps the Caribbean Diaspora, would present a readily available market for local products and services exported from Trinidad & Tobago. Trinidad & Tobago has a large Diaspora population in the US, UK and Canada which would recognize Trinidad & Tobago products and services and have an aligned taste profile backed by purchasing power capacity. In this regard, the Ministry of Planning should immediately undertake a major exercise of determining the size of the Trinidad & Tobago Diaspora abroad and profiling their socioeconomic habits and attributes to provide a rich pool of information for planning purposes.
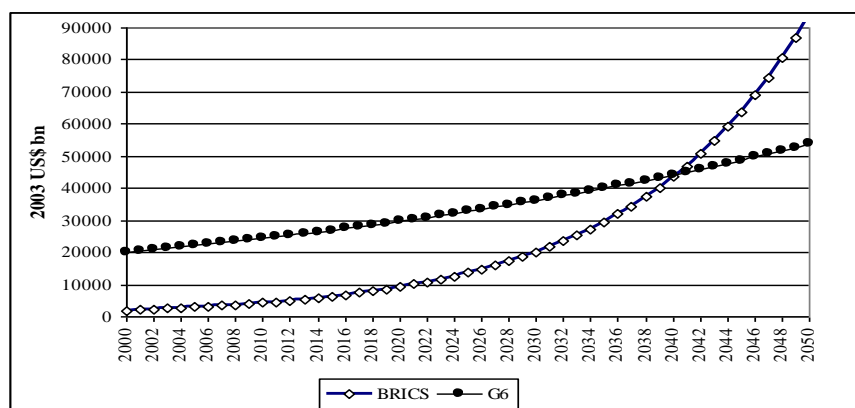
Wilson and Purushothaman (2003) used both a growth model and an exchange rate model and made forecasts of GDP, GDP growth rate, and income per capita for the BRICs and the Group of Six (G-6) (see figure 5). The simulations performed by these researchers covered the period 2005 and 2050. Based on their predictions, the combined BRICS income was likely to supersede the US$GDP of the G-6 economies by 2010. Wilson (2011) noted that the 2009-2011 period was a watershed period for the BRICS as the slowdown in the growth of the G-6 economies accelerated the pace at which the BRICS economies would overtake the G-6 economies.

Specifically, in 2010 China became the second largest economy ahead of Japan, with Brazil moving into the seventh position. India and Russia also moved up the ladder to become the seventh and eleventh largest economies.

In 2011, Price Waterhouse and Coopers in updating their understanding of the global economy in the aftermath of the financial crisis predicted that by 2020 the E7 TRIMBRC economies, Turkey, Russia, India, Mexico, Brazil, and China could progress beyond the G-7 economies and China could overtake the United States. Towards this end, the Trinidad & Tobago economy needs to engage these TRIMBRC economies more diligently.

Export incentives can play an important role in the development of export lines by companies. Trinidad & Tobago needs to determine an exportable product list, and this list has to be supplemented by research work that profiles the supply side limitations of firms in the domestic economy producing items on the exportable list. Ideally, when looking at particular trade partners, we should look at our degree of trade complementarity and the specific areas of actual and potential comparative advantage.

Figure 5: Projected GDP (US $billions) of the BRICS and the G-6

Source: Wilson and Purushothaman (2003)

Trade Unions, which seem to be confrontational instead of conciliatory in the Caribbean, can have severe repercussions on the workers they represent. Despite Trinidad & Tobago's economic buoyancy in times of high oil prices, all agents or actors should work in harmony to find solutions to problems without instigating conflicts. However, peacemaking measures can only be successful with the use of suitable multipartite mechanisms initiated by the government and observed by all agents concerned — government, labor, private sector and civil society. This will allow for valuable interaction of agents, leading to a consensus on common objectives and the strategies by which they can be achieved. A peaceful and healthy industrial climate will tend to nurture and not disrupt the productive activities of firms.

Table 16: GDP at PPP (Constant 2009 US $billions) Rankings					
PPP 2009 Rank	**Country**	**GDP**	**PPP 2050 Rank**	**Country**	**Project-ed GDP**
1	US	14256	1	*China*	*59475*
2	*China*	*8888*	2	*India*	*43180*
3	Japan	4138	3	US	37876
4	*India*	*3752*	*4*	*Brazil*	*9762*
5	Germany	2984	5	Japan	7664
6	*Russia*	*2687*	6	*Russia*	*7559*
7	UK	2257	7	Mexico	6682
8	France	2172	8	Indonesia	6205
9	*Brazil*	*2020*	9	Germany	5707
10	Italy	1922	10	UK	5628
11	Mexico	1540	11	France	5344
12	Spain	1496	12	Turkey	5298
13	South Korea	1324	13	Nigeria	4530
14	Canada	1280	14	Vietnam	3939
15	Turkey	1040	15	Italy	3798
16	Indonesia	967	16	Canada	3322
17	Australia	858	17	South Korea	3258
18	Saudi Arabia	595	18	Spain	3195
19	Argentina	586	19	Saudi Arabia	3039
20	South Africa	508	20	Argentina	2549
Source: PwC (2011).					

Recent industrial actions by trade unions at two debt-burdened companies, namely Petrotrin and Trinidad Cement Limited, are prime examples where a lack of conciliatory effort was displayed, as unions demanded increased wages and benefits for employment. A partial consequence of this strike was that the second quarter of 2012 registered real negative growth.

5. Conclusion

This article traced the relationship between the Dutch Disease and the RCA structure of the Trinidad & Tobago economy. The article outlined the main features of the Dutch Disease elaborating on the resource movement and spending effect and then elaborated on the effect

on the diversity structure of the revealed comparative advantage index between 1999 and 2010. The article also formulated an appropriate transition probability matrix between the two time periods and established that there was a decline in the strong element of persistence in the RCA structure with its upper triangular part showing very low off-diagonal values.

Against this backdrop and because of the high economic rents the petroleum sector earns, the study argues in favor of a two-pronged diversification thrust. The first part of this thrust recognizes that there is still an urgent need to "cream off" from the petroleum sector as much value added and economic rents as possible, while the second part emphasizes the Hartwick rule benefits of using the rents to strengthen the NBT sector of the economy. It is on this basis, therefore, that the article made a number of suggestions to strengthen the NBT sector.

ENDNOTES

1. The Product Cycle Theory (PCT) was introduced into the economics in literature 1966 by Raymond Vernon, as an explanation of comparative advantage and infers that an economy's comparative advantage is determined by the state of its technology and the extent of its learning by doing. Vernon cited that the highly educated workforce for some economies and the budgetary outlay on R&D meant that certain sets of economies were able to produce newer commodities at a faster pace than other economies. Yet other researchers see comparative advantage as occurring because of state influence and have gone so far as to infer that the state helps to create winners. Li (2002) identify South Korea and Japan as two economies in which the state picked winners and helped to create export strongholds in these economies.

2. Corden (1982) refers to the contraction of the NBT due to the resource movement effect as direct de-industrialization while contraction of the NBT sector due to the spending effect is referred to as indirect de-industrialization.

3. A Markov Chain may be simply defined as a sequence of random values whose probability values at time period t hinges on the value of the number in the time interval t-1. The overall controlling factor in a Markov Chain is the transition probability.

4. http://www.guardian.co.tt/business-guardian/

5. http://www.icis.com/Articles/2012/02/29/9537048/

6. http://www.ipaa.org/issues/international/docs

7. Interview details with Dr. Thackwray Driver and Mr. Anthony Ramlackhansingh.

8. Interview details with Mr Anthony Ramlackhansingh.

9. Presentation at a Panel on *Frontiers of Development in the Downstream Sector* at the Conference on Revenue Management held 21st June 2012 at the Hyatt Regency Hotel.

10. pi is an index of industrial production index and xm is merchandize exports

11. The Global Competitiveness Report (GCR) is published annually by the World Economic Forum. In 1979, the first report was released. From 2004, the Global Competitiveness Report ranks countries based on their Global Competitiveness Index. This index was developed by Xavier Sala-i-Martin and Elsa V. Artadi. The *Global Competitiveness Index* integrates the macroeconomic and the micro/business aspects of competitiveness into a single index.

12. Statement made by Ashley Taylor, President of PLIPDECO as quoted by Carl Bridgelal in the Business Express; September 19, 2012.

13. According to the World Governance Indicators, for 2011 Trinidad and Tobago's Control of Corruption score worsened from its 2010 position; from -0.36 in 2010 to -0.28 in 2011 where scores tending to the lower bound of the index (-0.25) indicates a weak governance performance.

14. Http://www.businessuiteonline.com/2012/03/04/a-future-for-small-business es -in-tt/

15. The Trinidad & Tobago government identified several growth poles in its 2011 budget speech, these were (1) Couva, Charlieville, Carapichaima and Chaguanas; (2) the South Western Peninsula, particularly Point Fortin; (3) East Port of Spain; (4) the North-Coast and (5) North East Tobago.

16. http://www.bp.com/genericarticle.do

17. http://www.trinidadexpress.com/news/Snell Express, June 30, 2011.

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