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Structural Change in Resource Abundant Economies: A Case of Trinidad and Tobago, Guyana and Suriname

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INTRODUCTION

The purpose of this inaugural working paper series is to examine the socio-economic and political implications of petroleum extraction in Guyana. On its own, the prospect of petroleum extraction is worthy of extensive academic examination, due to its promise of economic prosperity, its environmental ramifications and the political disruption within which its arrival is ushered. These issues are compounded when played out in a society such as Guyana's characterized by stark racial and ethnic cleavages, age-old political tensions and entrenched socio-economic problems. Further to this, is the question of external influence in the form of supranational governmental agencies, foreign financial corporations upon the process of petroleum industrialisation in this developing state.

In recognition of the complex nature of this topic, the authors in this series explore the question of a petroleum Industry in Guyana from a sociological, political and economic perspective. These papers not only seek to make academic inferences but also to provide recommendations and suggestions as to how the current and potential issues can be approached to prevent political and socio-economic failure in Guyana

Structural Change in Resource Abundant Economies: A Case of Trinidad and Tobago, Guyana and Suriname

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ABSTRACT

This paper analyses the export competitiveness structure of three resource abundant economies of the Caribbean - Trinidad and Tobago, Guyana and Suriname. The comparative advantage structure of each economy was shown to be relatively different. In terms of Suriname, the commodities with the highest comparative advantage were classified as either primary products or resource-based manufactures. As for Guyana, the majority of exports with high comparative advantage were primary commodities while Trinidad and Tobago has the strongest comparative advantage in some medium technology manufactures along with resource-based and primary exports. The general trend shows low export diversity as well as minimal structural changes in the export sector of all countries in the study. This is especially highlighted by each 'economy's low Harmonic Weighted Mass Index and the high degree of persistence noted in their Transition Probability matrix.

Keywords: Comparative Advantage, Balassa Index, Harmonic Mass Index, Dynamic Revealed Comparative Advantage, Export Specialization

Introduction

In small open economies, economic performance and export sophistication are inextricably linked via numerous avenues, mainly foreign exchange accumulation, technological and knowledge diffusion and increased capacity utilisation. Export sector development is, therefore, pivotal in creating a competitive sector which facilitates economic growth. Even before the export-led growth paradigm, the importance of innovation with respect to competitiveness was semphasised by Schumpeter (1942, p.32) who noted, *"possibilities of gains to be reaped by producing new things or by producing old things more cheaply are constantly smaterialising and calling for new investments. These new products and new methods compete with the old products and old methods not on equal terms but at a decisive advantage that may mean death to the latter. This is how "progress" comes about…"*

In the natural process of economic development, industrialisation and structural change is seen as pivotal for both domestic production and exports (Rodrik, 2016). In relation to the export-led growth hypothesis, one of the most noted examples of structural change and economic growth are the four Asian Tigers (Singapore, Hong Kong, Taiwan and South Korea). Coupled with the ability to expand their export sector and indulge in export-led growth policies through industrialisation and increasing trade openness, the economies were able to improve overall economic growth rapidly. In terms of Caribbean economies, a large percentage of GDP for most countries is attributed to the services sector, especially in terms of tourism. Guyana, Suriname and Trinidad and Tobago, however, are least dependent on service as a source of GDP and relative to other Caribbean states are

dependent on natural resources as a source of revenue (as shown by the bubble size in Figure 1).[1]

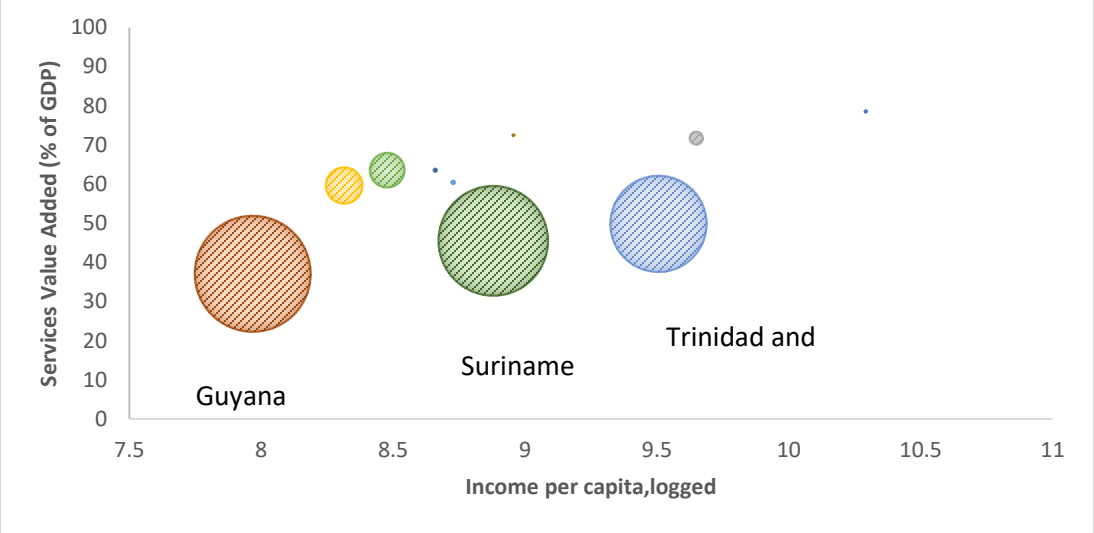
Figure 1 also indicates that Trinidad and Tobago's per capita GDP is substantially higher than that of Guyana and Suriname. The Trinidad and Tobago economy benefitted from two substantial energy booms, the first occurred between 1972 and 1982 and was mainly attributed to increased oil production, while the second = occurred between 2002 and 2015 and was mainly attributed to increased natural gas production. The extent to which such increases in GDP have affected the export structure of the economy, as compared to Suriname and Guyana is the focus of this study. Furthermore, since de Ferranti (2002) noted that intra-industry trade is a significant source of export diversification, exports are disaggregated according to the degree of sophistication required in the manufacturing industries. The literature with regard to the detailed export structure of these economies, in particular, is generally sparse. The paper, therefore, investigates whether the export structure of these economies has changed given each country's unique economic performances over time.

Trinidad and 'Tobago's economy essentially transformed from a crude oil exporter to a natural gas exporter in the early 1990s. 'Guyana's export basket, however, is mainly dominated by mineral resources and agriculture, including gold, aluminum ore, sugar and rice. However, in May 2015, Exxon Mobil discovered vast offshore reserves of oil in Guyana. Since then, additional discoveries have increased the overall estimated reserve to approximately 6 billion barrels (OilNow, 2019). This discovery is expected to bring in massive windfall revenue for the economy, which currently imports all its oil and gas.

[1] The other countries in the graph are, Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Jamaica, St. Lucia, St. Kitts and Nevis and St. Vincent and the Grenadines.

Guyana is therefore expected to become one of the major players in the Caribbean with respect to their energy exports. Suriname is currently the Caribbean's third largest oil exporter[2] and its export basket, like Guyana, also includes gold and rice. Even so, with Guyana's massive discoveries, the attention of oil companies has piqued with interest in the Guyana-Suriname Basin (Workman and Birnie, 2015; USGS, 2012). Such reliance on foreign exchange from mainly energy revenue leaves these economies susceptible to the Dutch Disease, which is expected to hinder structural change.

Figure 1: Average Income per capita, Services value added, percentage of GDP and Natural resource rents, percentage of GDP (bubble size) for 1995-2017



Source: World Development Indicators

1.1 Dutch Disease and Structural Change

Dutch Disease is usually conceptualised as a negative structural change in an economy as a result of a favourable shock (boom) in an exportable commodity (Brahmbhatt et al. 2010). In terms of natural resource-dependent economies, the Dutch Disease

[2] The first and second largest energy exporters are Trinidad and Tobago and Jamaica respectively.

phenomenon arises when the development of a natural resource-based sector occurs at the expense of a non-resource traded goods sector (Corden and Neary, 1982). Specifically, as it relates to exports, economies which experience Dutch Disease symptoms are expected to have a relatively stagnant export sector with little or no major changes over time and high dependence on mainly a few natural resource-related commodities as the main source of export revenue.

Corden and Neary (1982) in explaining the effect of Dutch Disease, divided the economy into three sectors; the booming tradable (BT), the non-booming tradable (NBT) and the non-tradable (NT) sectors. Under various assumptions about the factor markets of each sector, they presented possible structural changes expected within an economy in relation to a resource boom. Essentially, in the presence of Dutch Disease, factors of production migrate away from the non- booming tradeable sector (usually the manufacturing sector) towards the booming tradeable and non-tradeable sectors, eventually leading to direct and indirect de-industrialisation. The expansion of the non-tradeable sector prompts the appreciation of the real effective exchange rate, which decreases the export competitiveness of the manufacturing sector, therefore, limiting the potential for export expansion. Under the assumption that the manufacturing sector allows for forward and backward linkages and positive externalities, de-industrialisation which occurs as a result of the Dutch Disease, is expected to lower economic growth (Sachs and Warner, 1999; Matsuyama, 1992).

In relation to comparative advantage in the neo-classical sense, such trade specialisation would be welcomed. However, Prebisch (1950) noted that specialisation according to comparative advantage tends to lock developing economies into exporting

mainly primary commodities with low-income elasticity of demand, eventually leading to a deteriorating term of trade and lower than desired levels of economic growth. Referring to Latin American and Caribbean economies, de Ferranti (2002) noted that the correlation between export concentration and macroeconomic volatility explains only a small fraction of the negative relationship between export revenue concentration and economic growth. Further, de Ferranti (2002) states, *"it is likely that the remaining negative effect of concentration on growth is due to the negative relationship that exists between concentration and the incidence of intra industry trade"*. The industrial sector is of importance at this juncture, since the growth of intra-industry trade is mainly attributed to increased trade within the manufacturing sector (Caves, 1981). De-industrialisation in the context of Dutch Disease will therefore also impede the ability of an economy to diversify its exports base effectively.

1. Literature Review: Diversification and Comparative Advantage

A vast range of empirical studies exists on positively linking export diversification with economic development, especially since the natural development process is expected to cause structural change (or vice versa). One study, by Hesse (2008), noted, "the process of economic development is typically a process of structural transformation where countries move from producing 'poor-country goods' to 'rich-country goods.' Export diversification, therefore, plays an important role in this process. The ease at which economies undertake this structural transformation, however, depends on their comparative advantage structure. Hidalgo et al. (2007) developed a concept of product proximity which essentially shows that some products tend to be exported in tandem with other products, for example, electronics. Furthermore, in relation to comparative advantage, Hidalgo et al. (2007) also

noted, "it is quite difficult for production to shift to far-away products in the [product] space, and therefore policies to promote large jumps are more challenging". Applying this concept to resource abundance economies, this insinuates that countries with a comparative advantage in the natural resource sector are generally constrained not only by factor endowments but also by the ease to which "product specific factors" can be put to an alternative use.

Cadot et al. (2011), in a similar notion, investigated diversification according to extensive and intensive margins. Extensive margins capture diversification by adding new products while intensive margins capture diversification among already active product lines. Using the decomposable property of the Theil index, the between characteristic maps the extensive margins and the within component maps the intensive margins. On investigating the relationship between export diversification and per capita GDP, Cadot et al. noted a "Hump Shaped" relationship. Hence, as GDP per capita increases, naturally 'economies' exports tend to change from being concentrated, then diversified and eventually, at high-income levels, re-concentrated. However, for natural resource exporters, in terms of the Dutch Disease, a boom in the respective resource sector is expected to increase per capita income, but also increase export concentration as a result of de-industrialisation.

Applying the decomposable property of the Theil index, it is possible to examine export diversification from an industry perspective rather than by intensive and extensive margins only. In relation to the product proximity concept, which implies that an 'economy's ability to produce and export a given product depends on its ability to produce

other products, it is useful to investigate whether diversification occurs within or across sectors with comparative advantage.

Lall (2000) divided the Standard International Trade Classification (SITC) by industries according to their technological requirement, including Primary, Resource-Based, Low Technological Manufactures, Medium Technology Manufactures and High Technology Manufactures. The Theil index can, therefore, be used in determining whether diversification occurs within each classification or between the classifications. This type of decomposition, when examining resource-rich economies, is important since the natural resource sector is often referred to as an enclaved sector which causes little spillover growth to the rest of the economy. Humphreys, Sachs and Stiglitz (2007) noted, "Since it is not a result of a production process, the generation of natural resource wealth can occur quite independently of other economic processes that take place in a country". The degree to which the natural resource sector has caused diversification in other sectors can, therefore, be determined using this property of the Theil index.

Apart from using the Theil Index to examine export diversification, this paper analyses the export competitiveness structure of Trinidad and Tobago, Guyana and Suriname over the time period 1991-2015, 1997-2018 and 1995-2017 respectively. Using the United Nations' SITC classification of commodities, the comparative advantage of the economies is analysed using the Balassa (1965) Revealed Comparative Advantage (RCA) index. The changes in comparative advantage structure are evaluated using the Harmonic Mass index, which essentially calculates any deviation in the production and export composition of the economy over time. A dynamic comparative advantage matrix is then constructed using the RCA index as a measure of competitiveness and market positioning.

Lastly, Markov transition probability matrices and the associate mobility indices are calculated as a mean of determining the degree of persistence or mobility in each 'country's exports.

2. Methodology

3.1 Revealed Comparative Advantage

The Balassa (1965) index of Revealed Comparative Advantage (RCA) index does not aim at determining the causes of comparative advantage but simply 'reveals' whether or not the country of interest experiences comparative advantage in trading a particular good/service in a given time period. The RCA is formulated as:

$RCA_{ij} = \frac{X_{ik}}{X_{it}} \Big/ \frac{X_{jk}}{X_{jt}}$ Where: X_{ik} – refers to country i's exports of commodity k, X_{it} – refers to country i's total exports, X_{jk} – refers to the world (j) exports of commodity k and X_{jt} – refers to the world's (j) total exports.

The RCA index, in this case, relates the export shares of Trinidad and Tobago, Guyana and Suriname for commodity k to the world's export share of the same commodity. The intuition is that if these economies are competitive exporters of commodity k, then the share of k in their exports would be larger relative to the share of k in total exports of the world. The RCA index has a theoretical range from zero (0) to infinity (∞) such that: $0 < RCA_{ij} < 1$ – the country of interest has a comparative disadvantage in commodity j and $1 < RCA_{ij} < \infty$ – the country of interest has a comparative advantage in the commodity j.

The index range was further decomposed by Hinloopen and van Marrevijk (2001) to show four classes of comparative advantage.

Table 1: Classes of Comparative Advantage

Class	Range of Index	Result
State A	0-1	Industries with comparative disadvantage
State B	1-2	Industries with weak comparative advantage
State C	2-4	Industries with medium comparative advantage
State D	Greater than 4	Industries with strong comparative advantage

Source: Hinloopen and van Marrevijk (2001)

3.2 Harmonic Mass Index and RCA

Hinloopen and van Marrewijk (2004) building on the work of Holmgren (1995) extended the concept to international trade using probability distribution frequencies. The objective was mainly to determine the extent to which *"the probability mass of one distribution function is in harmony with another distribution function*", hence the name Harmonic-Mass (HM) index.

The HM index essentially compares the Empirical Distribution Function of the two samples over their entire domain.[3] Holmgren (1995) applied the concept as a method of comparing the effects of medical treatments while Hinloopen and van Marrewijk (2004, 2005) used this intuition as a means of analysing the changes in comparative advantage structures of an economy between two specific time periods. In terms of analysing the distribution frequency of a data set, two methods are typically used; the quantile-quantile (qq) plots and probability-probability (pp) plots. According to Hinloopen and van Marrewijk (2004), the pp plots possess numerous advantages over the qq plots in this type

[3] This concept is usually applied in determining the closeness of statistical distribution of a dataset in relation to the normal distribution using the probability plots of both

of analysis.[4]

To elaborate, consider two data sets (F_1 and F_2), as the PP-plot coincides with the diagonal if, and only if, the two underlying distributions F_1 and F_2 are identical. The P-P plot is given by the function

$$p_2 = F_2\left(F_1^{-1}(p_1)\right), \quad 0 \leq p_1 \leq 1$$

Given n_i ordered observations for two functions F_i (i=1,2), the p-p plot can be derived. Here the functions are the RCA scores for year 1 and year 2. To create the p-p plot, the probability of the RCA index being a certain value (p_{ij}=p(RCA_{ij}=X) must be calculated. Therefore, the percentile rank of each RCA score is determined. Plotting the percentile distribution of F_1 and F_2 against each other gives the P-P Plot. Hence, it depicts all combinations p_1 and p_2 for $p_1 \in (0,1)$

According to Hinloopen and van Marrewijk (2005) calculating the HMI is much in the same spirit as the Gini coefficient for Lorenz curves since the HMI measures the absolute value of the total deviation between the diagonal and the PP-plot. The greater the deviation of the pp plot away from the 45-degree line, the greater the difference between the cumulative distributions of the two data sets. To normalise this measure to an index value between 0 and 1, the surface is multiplied by 2, that is:

$$HM(F,G) \equiv 2\int_0^1 |p - F(G^{-1}(p))|\, dp$$

[4] First, comparisons between distributions are always available in compact space as PP-plots are scale-invariant. Second, they are little obscured by outlying observations. Third, and most importantly, PP-plots contain all necessary information to make scale-invariant comparisons between distributions (Holmgren, 1995).

An index of 0 indicates that both distributions are identical while an index of 1 indicating that they are completely different. In terms of the comparison of comparative advantage, an index close to zero implies an almost identical structure of comparative advantage while an index closer to one implies a diversified export structure. The Harmonic Weighted Mass index (HMWI) weighs the size of the shaded areas by the number of observations of two data sets and is defined as:

$$HWM(F,G) \equiv \sqrt{\frac{n_1 n_2}{n_1 + n_2}} \int_0^1 |p - F(G^{-1}(p))|\, dp$$

The index has a critical value in the limit of 0.5. Hence any value above 0.5 is indicative for structural change between the two time periods.

3.3 Dynamic RCA

Edwards and Schoer (2002), developed the Dynamic RCA index to analyse the changing comparative advantages over time. It is built by decomposing the growth in RCA into several component. Edwards and Schoer (2002) decomposed the growth in the RCA index as follows:

$$\frac{\Delta RCA_{ijw}}{RCA_{ijw}} = \frac{\Delta\left(\frac{X_{ij}}{X_i}\right)}{\frac{X_{ij}}{X_i}} - \frac{\Delta\left(\frac{X_{wj}}{X_w}\right)}{\frac{X_{wj}}{w}}$$

Where: RCA_{ijw} refers to the RCA index of country i with respect to commodity j, where the rest of the world (w) is the bilateral trade partner, X_{ij} – refers to country i's exports of commodity k, X_{it} – refers to country i's total exports, X_{wj} – refers to the world (w) exports of commodity j and X_w – refers to the world's total exports.

In this formula, the first term on the right-hand side reflects the growth in the share of commodity j in the total trade of the country i, and the second term reflects the growth

in the share of commodity j in the world trade. Observing the relative trends in the share of commodity j in the country i and the world exports, Edwards and Schoer (2002) analyse the dynamics of market positioning. That is, whether the exports patterns of an economy are aligned with the demands of the rest of the world. Commodities are categorised as rising stars if the countries' export shares of those products are increasing simultaneously with the world's export shares. In terms of declining stars, export shares of these are increasing for the economies and falling in the rest of the world. Retreats include commodities which demonstrate a decline in both the countries' and the rest of the world export shares. While lost opportunities capture commodities which has a falling export share in countries and a rising share in the rest of the world.

Table 2: Classification of commodity market positioning

	Share of commodity j in the total trade of the country i	**Share of commodity j in the world trade**
Rising Star	Increasing	Increasing
Declining Star	Increasing	Decreasing
Retreat	Decreasing	Decreasing
Lost Opportunity	Decreasing	Increasing

Source: Edwards and Schoer (2002)

3.4 Transition Probability Matrix and Mobility Indices

In further analysing the comparative advantage structure, Markov Chains and Transition Probability Matrices can be utilised. This type of analysis also allows for a dynamic measure of RCA as it shows the changing structure from one time period to another. Given a finite set of states such that S= (s_a, s_b, s_c, s_d,) where the respective states are defined in table 1 above, the probability of the chain to move from the state s_i to s_j is denoted as p_{ij}. The probabilities p_{ij} makes up the transition probability matrix which is a

square matrix that illustrates the probability of discrete random process to either move from one state to another or to stay in the same state.

From the transition probability matrix, the mobility of the economy's RCA can be assessed using the mobility indices presented in Table 3.

Table 3: Mobility Indices

Literature	Index	Description
Shorrocks (1978)	$\frac{m - tr(P)}{m - 1}$	m denotes the number of states (here m=4) and tr(P) is the trace of the transition probability matrix
Shorrocks (1978)	$1 - \det(P)$	det(P) is the determinant of the transition probability matrix
Sommers and Conslisk (1979)	$1 - \lambda_2$	λ_2 is the second largest eigenvalue of the transition probability matrices

Source: Compiled

3.5 Theil Index as a measure of export diversification

The Theil Index has been applied in numerous papers as a measure of the degree of export diversification whereby the "ideal" state is total diversification. An index value of zero indicates that total exports are fully diversified (perfect equality) while an index that is closer to its maximum point, lnN, (where N is the number of sectors evaluated) indicates high levels of export concentration. Following Cadot et al. (2011), the index is formulated as:

$T = \frac{1}{n}\sum_{i=1}^{n} \frac{X_{ij}}{\mu} \ln\left(\frac{X_{ij}}{\mu}\right)$, where $\mu = \frac{X_{ij}}{n}$ and X_{ij} is the country's export of commodity i to trading partner j

The Theil index has a decomposition property which can be used to analyse "between" and "within" group components. The between component of the Theil index is formulated as:

$T_b = \sum_{j=1}^{j} \frac{n_j}{n}\frac{\mu_j}{\mu} \ln\left(\frac{\mu_j}{\mu}\right)$, while the within index, which analyse the degree of inequality within or inside each group is shown to be: $T_w = \sum_{j=1}^{j} \frac{n_j}{n}\frac{\mu_j}{\mu}\left[\frac{1}{n_j}\sum_{k=0}^{k}\frac{x_k}{\mu_j} \ln\left(\frac{x_k}{\mu_j}\right)\right]$

The summation of both gives the overall Theil index: $T = T_b + T_w$

1. Data

Data on exports using the Standard International Trade Classification (SITC), at three-digit disaggregation, was collected for the United Nations Commodity Trade (UNComtrade) database for Trinidad and Tobago, Guyana and Suriname. This data was used in calculating the various indices presented in the subsequent section.

2. Results

The Balassa (1965) RCA index was calculated for Suriname, Guyana and Trinidad and Tobago for the years 1995-2017, 1997-2018 and 1991-2015 respectively[5]. The commodity groups with the highest comparative advantage index are presented in Table 4 below for the three countries. In terms of Trinidad and Tobago, one of the major changes noted is the switch from crude oil to natural gas as one of the 'economy's major exports. The products ranked highest according to RCA however remained generally the same and the number of commodities which were characterised as having comparative advantage remained exactly the same in 1991 and 2015. Guyana also exhibited a similar export pattern over the two years of analysis, with seven out of the top ten product groups maintaining high RCA values over between 1997 and 2018. Suriname's export structure changed significantly between 1995 and 2017, with "Rice" being the only product with a high comparative advantage in both years.

[5] The years with the most available data between 1991-2019 was chosen according to each country.

Table 4: Product lines with highest RCA index values

Suriname					
1995			2017		
SITC code	Commodity	RCA Index	SITC code	Commodity	RCA Index
285	Aluminium ores/concs/etc	612.36	247	Wood in rough/squared	43.18
042	Rice	48.84	971	Gold non-monetary ex ore	40.25
245	Fuel wood/wood charcoal	41.88	042	Rice	21.18
036	Crustaceans molluscs etc	24.04	334	Heavy petrol/bitum oils	2.79
684	Aluminium	12.25	273	Stone/sand/gravel	1.84
971	Gold non-monetary ex ore	7.55	111	Beverage non-alcohol nes	1.79
Guyana					
1997			2018		
SITC code	Commodity	RCA Index	SITC code	Commodity	RCA Index 2018
285	Aluminium ores/concs/etc	139.15	285	Aluminium ores/concs/etc	145.58
042	Rice	99.34	786	Trailers/caravans/etc	91.97
061	Sugar/mollasses/honey	92.26	042	Rice	26.31
971	Gold non-monetary ex ore	51.56	061	Sugar/mollasses/honey	21.63
634	Veneer/plywood/etc	14.29	035	Fish,dried/salted/smoked	13.67
036	Crustaceans molluscs etc	9.46	971	Gold non-monetary ex ore	10.50
Trinidad and Tobago					
1991			2017		
SITC code	Commodity	RCA Index	SITC code	Commodity	RCA Index
522	Elements/oxides/hal salt	27.64	522	Elements/oxides/hal salt	57.32
334	Heavy petrol/bitum oils	14.71	512	Alcohols/phenols/derivs	48.00
512	Alcohols/phenols/derivs	12.98	671	Pig iron etc ferro alloy	21.33
676	Iron/steel bars/rods/etc	10.40	343	Natural gas	18.68
562	Manufactured fertilisers	9.48	342	Liquid propane/butane	17.37
333	Petrol./bitum. oil,crude	9.03	562	Manufactured fertilisers	14.45
111	Beverage non-alcohol nes	4.52	344	Petrol./hydrocarbon gas	4.82

Source: Calculated using UN Comtrade data

5.1 Harmonic Weighted Mass Index

The Harmonic Weighted Mass index was calculated at three-year intervals for each economy. Trinidad and 'Tobago's analysis started in 1991, hence, the distribution of the Balassa Index for 1991 was compared with 1994, 1997, 2000, 2003, 2006, 2009, 2012 and 2015 (in three-year intervals so as to capture any minor structural changes). Further, the distribution for every third year was also compared in three-year intervals. For instance, 1994 was also compared with 1997, 2000, 2003, 2006, 2009, 2012 and 2015. The results are presented below. The general trend indicates that no significant structural changes in the export structure of Trinidad and Tobago, as all calculated HWM indices, are below the critical value of 0.5.

In terms of comparison, the same three-year intervals were applied with respect to Guyana and Suriname. Guyana's analysis started in 1997; however, when comparing the RCA distribution for 1997 at each interval, no significant structural change was observed. Even so, significant differences were observed only when comparing the RCA distribution for 2003 with that of 2012. Suriname's export data for this study began in 1995, and there proved to be some significant structural changes in the economy throughout the analysis. There were four instances of the HWM index crossing the threshold value of 0.5; 1995 compared2011, 1999 compared 2011, 1999 compared to 2011, 1995 compared to 2017 and 1999 compared to 2017.

Note that structural can change can entail a 'country's export pattern improving in terms of gaining a comparative advantage or worsening in terms of losing comparative advantage. In relation to Suriname, while the number of commodity lines with RCA values more than one improved marginally between 1995 and 2017 (from 11 product lines to 12),

the number of active product lines also increased from 111 to 164 between 1995 and 2017. As a result, the percentage of commodities with comparative advantage fell from 9.9% to 7.3% of total exports over this time period. Hence, this HWMI may not be indicative of a positive structural change for Suriname.

Figure 2: Harmonic Weighted Mass Index at three-year intervals

Source: Calculated

5.2 The HWMI by Sector

The Harmonic Weighted Mass Index was also used in this case to compare the distributions of each classification of manufactured exports.[6] Table 5 below presents the calculated HWMI and the percentage of active commodity lines with a Balassa index that is more than one, for each classification of exports. In all cases, as expected, the percentage of commodities with RCA more than one was highest in terms of resource-based manufactures.[7]

As for Trinidad and Tobago, while the majority of commodities with comparative advantage were within the resource-based manufactures, between 1991 and 2015 the export structure of these commodities generally remained the same given by the low value of the HWMI. The HWMI is highest with respect to the category of "High Technology Manufactures" particularly due to the increase in the number of active product lines. In terms of Guyana, the comparison was made between 2003 and 2018, due to the significant HWMI as shown above for this period only. The value of the HWMI for all classifications in the manufacturing sector were generally low, indicating that no major changes in the export structure of manufactured goods. With respect to Suriname, a significant HWMI was observed for "Medium Technology Manufacture". This is particularly as a result of a drastic increase in the number of active product lines in this sector.

[6] These classifications are according to Lall (2000)

[7] This is directly related to Hidalgo (2007) statement that it is difficult for countries to shift to “far away” products. This is discussed further in the subsequent sections.

Table 5: HWMI by industrial classifications

Trinidad and Tobago		
	Percentage of active commodities with RCA>1 (2015)	**HWMI value (1991-2015)**
Resource Based Manufactures	22.810	0.035
Low Technology Manufactures	2.500	0.014
Medium Technology Manufactures	7.810	0.137
High Technology Manufactures	0.000	0.330
Guyana		
	Percentage of active commodities with RCA>1 (2018)	**HWMI value (2003-2018)**
Resource Based Manufactures	18.000	0.010
Low Technology Manufactures	0.000	0.001
Medium Technology Manufactures	4.348	0.099
High Technology Manufactures	0.000	0.012
Suriname		
	Percentage of active commodities with RCA>1 (2017)	**HWMI value (1995-2017)**
Resource Based Manufactures	10.530	0.201
Low Technology Manufactures	0.000	0.034
Medium Technology Manufactures	1.786	0.737
High Technology Manufactures	0.000	0.383

Source: Calculated

5.3 Theil Index

The Theil Index was calculated for Trinidad and Tobago, Guyana and Suriname as a measure of export diversification. The Index was decomposed into between and within components and is presented in Table 6 below. The general trend indicates that the within component outweighs the between component. Hence, the majority of diversification occurs inside industries rather than across industries. These results are not surprising, as according to Hidalgo et al. (2007) it is difficult for economies to expand production across industries, especially away from those industries with high comparative advantage. This matter is further complicated by the fact that these economies are mainly natural resource exporters. Therefore, the space for diversification along margins of comparative advantage is relatively small. In this case, the index was calculated using SITC 3-digit data, hence the total number of product lines was 259. Resource-based manufacturing consisted of only 69 product lines while the other manufacturing sectors made up 53 percent of the total export lines. There is, therefore, limited room for economic growth through the expansion and diversification of the resource-based industry only.

Table 6: Theil Index, decomposed and total

	Trinidad and Tobago			Guyana			Suriname		
Year	**Within**	**Between**	**Total**	**Within**	**Between**	**Total**	**Within**	**Between**	**Total**
2000	2.72	0.32	3.04	2.02	0.71	2.74	2.06	0.60	2.66
2001	2.54	0.18	2.72	1.52	0.68	2.19	1.96	0.48	2.44
2002	2.55	0.25	2.80	1.68	0.63	2.31	2.35	0.49	2.83
2003	2.68	0.34	3.01	1.88	0.53	2.41	2.05	0.25	2.30
2004	2.74	0.33	3.07	1.57	0.68	2.24	2.34	0.28	2.63
2005	2.87	0.36	3.24	1.97	0.58	2.55	2.36	0.10	2.46
2006	2.94	0.45	3.39	2.52	0.55	3.07	2.74	0.20	2.94
2007	2.66	0.39	3.05	1.76	0.64	2.40	2.79	0.26	3.06
2008	2.81	0.40	3.22	2.54	0.53	3.07	3.25	0.37	3.62
2009	2.86	0.55	3.42	2.53	0.65	3.18	2.36	0.31	2.68
2010	2.79	0.39	3.18	2.77	0.60	3.37	3.24	0.50	
2011	2.81	0.36	3.17	2.81	0.68	3.50	2.62	0.33	2.95
2012	2.67	0.31	2.99	2.85	0.74	3.59	2.53	0.43	2.96
2013	2.89	0.36	3.25	2.69	0.79	3.48	2.76	0.32	3.07
2014	2.83	0.34	3.17	2.55	0.72	3.27	2.81	0.33	3.14
2015	2.75	0.30	3.05	2.53	0.57	3.10	-	-	-
2016	-	-	-	2.47	0.97	3.44	2.27	0.32	2.58
2017	-	-	-	2.61	0.58	3.20	2.83	1.35	4.18
2018	-	-	-	2.34	0.65	2.99	-	-	-

Source: Calculated

Table 7 below shows the Theil Index by industry, classified according to technological requirements. Across all economies, the index is relatively close to the maximum, especially in the primary and resource-based industries. This indicates that there is generally a high level of export concentration within industries. Referring to the natural resource sector, Humphreys, Sachs and Stiglitz (2007) stated, "*it is in a number of ways, enclaved … without major linkages to other industrial sectors*". Therefore, the low observed level of diversification mainly in the primary and resource-based sectors, especially for Suriname, is expected to further enclave the economies and reduce the potential to expand exports across other industries.

Table 7: Theil Index by sectors

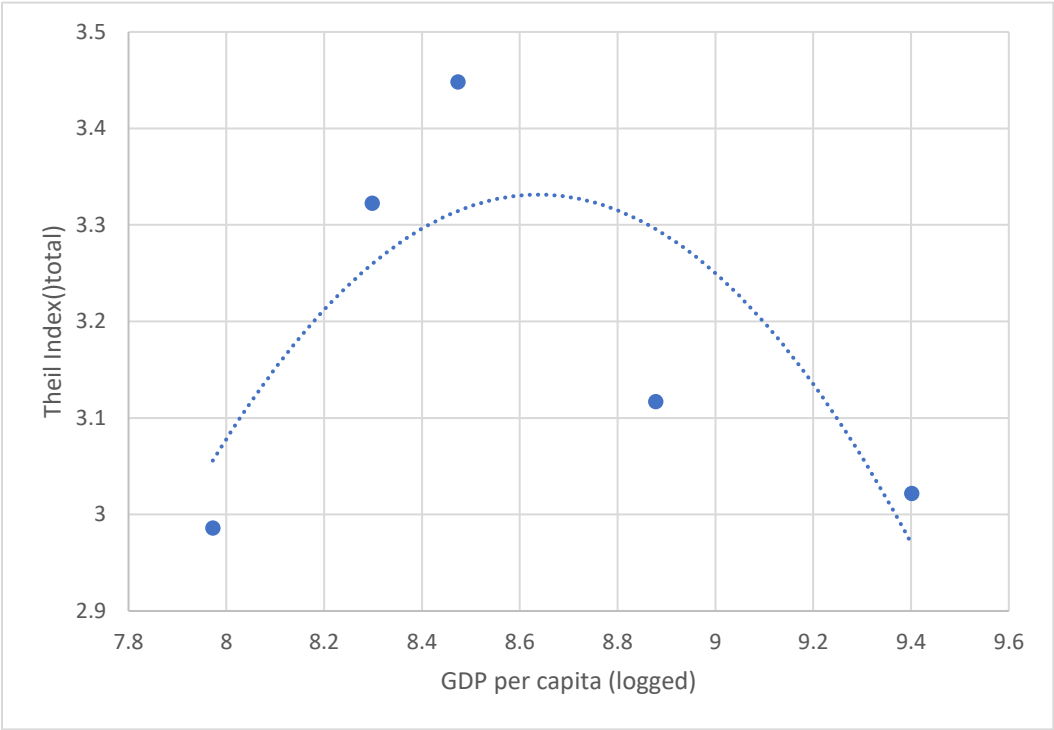
	Trinidad and Tobago	Guyana	Suriname	Average Range
Primary	2.687	2.325	2.483	0-3.97
Resource Based Manufactures	2.905	2.167	3.338	0-4.23
Low Tech Manufactures	2.202	1.725	1.398	0-3.85
Medium Tech Manufacture	2.562	1.926	1.444	0-4.26
High Tech Manufacture	1.302	1.450	0.907	0-2.94

Source: calculated

*Average 2000-2015, 2000-2018, 2000-2017 for Trinidad and Tobago, Guyana and Suriname respectively.

Figure 3, on the next page, plots the average Theil Index against GDP per capita of each economy. In these resource-rich economies, the results are contrary to Cadot et al. (2011) a hill shaped curve is observed. Guyana, the economy with the lowest average per capita income also has the lowest average Theil index.

Figure 3: Hill Shaped Curve[8]



Source: Calculated

*Average 2000-2015, 2000-2018, 2000-2017 for Trinidad and Tobago, Guyana and Suriname respectively.

5.4 Transition Probability Matrix and Mobility Indices

While the Harmonic Weighted Mass index and the Theil index uses a single number to determine whether or not there were changes in the economies' RCA and export concentration, it does not show the direction of such change or persistence. The transition probability matrices are therefore useful at this juncture in determining whether the comparative advantage structures are improving, deteriorating or remaining the same.

[8] Five Caribbean countries included are Belize, Jamaica, Suriname, Trinidad and Tobago and Guyana. These are the top natural resource exporters in the Caribbean.

The Transition Probability matrices for Trinidad and Tobago, Guyana and Suriname, are presented below. The time frame for Trinidad and Tobago is 1991 to 2015. The level of persistence is high for commodities which either have a comparative disadvantage or a strong comparative advantage. The probability for commodities to change from a state of either weak or medium comparative advantage to no comparative advantage is also relatively high (50% and 42.9% respectively). Furthermore, the tendency of commodities to move to a better state of comparative advantage is very low, as indicated the low probability values in the upper triangle of the matrix.

In terms of Guyana, the time frame chosen for the analysis is 2003 to 2012 since according to the HWM index, this time period showed significant changes in the export structure of the economy. The degree of persistence is high for commodities with no comparative advantage (98%) and commodities with high comparative advantage (63%). Further, the probability of changing from weak comparative advantage and medium comparative advantage to comparative disadvantage is also high (71% and 60 % respectively).

Suriname's transition probability matrix was calculated for the time frame 1995-2017, as there was significant structural change over this time according to the HWM index. The degree of persistence is high for commodities with no comparative advantage (96%). Furthermore, the probability of commodities moving from any state of comparative advantage to comparative disadvantage is also very high.

Table 8: Transition Probability Matrix

	From / To	No CA	Weak CA	Medium CA	Strong CA
Trinidad and Tobago	**No CA**	0.97	0.01	0.01	0.01
Guyana		0.98	0.01	0.00	0.00
Suriname		0.96	0.03	0.00	0.00
Trinidad and Tobago	**Weak CA**	0.50	0.50	0.00	0.00
Guyana		0.71	0.14	0.14	0.00
Suriname		1.00	0.00	0.00	0.00
Trinidad and Tobago	**Medium CA**	0.43	0.29	0.29	0.00
Guyana		0.60	0.20	0.00	0.20
Suriname		1.00	0.00	0.00	0.00
Trinidad and Tobago	**Strong CA**	0.18	0.00	0.18	0.64
Guyana		0.25	0.06	0.06	0.63
Suriname		0.71	0.00	0.00	0.29

Source: Calculated

The mobility indices are presented in Table 9 below. The literature does not suggest a superior measure of mobility. Therefore all indices are presented. A value of zero indicates that there is perfect immobility among the classifications, while a value of 1 indicates perfect mobility. The indices derived from the above transition probability matrix suggest a relatively high level of mobility. However, based on the matrix, this is due to the high probability of sectors with an RCA value between 1 and 4 falling into the category of no comparative advantage.

Table 9: Mobility Indices

Literature	Trinidad and Tobago	Guyana	Suriname
Shorrocks (1978)	0.537	0.75	0.91
Shorrocks (1978)	0.914	1	1
Sommers and Conslisk (1979)	0.398	0.34	0.71

Source: Calculated

5.5 Dynamic RCA

The dynamic RCA analysis examines the changes in the export pattern of Trinidad and Tobago, Guyana and Suriname in relation to the 'world's export structure over a given time frame.

In terms of Trinidad and Tobago, as shown in Table 2 below, between 1991 and 2015, the majority of T&T's exports (39.27%) were categorised as lost opportunities thereby indicating that T&T's exports are not compatible with the rest of the world's exports. One major export sector, SITC 522 (Elements, Oxides, Hal salts) is categorised as a declining star while the majority of sectors with high comparative advantage are considered rising stars. The majority of Guyana's exports (55.7%) are categorised as "retreats" hence while most of Suriname's exports (35.1%) are under the category "falling star"

Table 10: Dynamic RCA Matrix

	Rising Star	**Falling Star**	**Market Share Gain**
Guyana (1997-2018)	0.1582	0.1329	0.2911
T&T (1991-2015)	0.1885	0.2042	0.3927
Suriname (1995-2017)	0.2613	0.3514	0.6126
	Retreats	**Lost Opportunity**	**Market Share Loss**
Guyana (1997-2018)	0.5570	0.1519	0.7089
T&T (1991-2015)	0.2147	0.3927	0.6073
Suriname (1995-2017)	0.2432	0.1441	0.3874

Source: Calculated

Table 11: Falling Stars and Lost Opportunities, some sectors

Falling Stars					
Trinidad and Tobgao		**Guyana**		**Suriname**	
SITC product code	**SITC Product Description**	**SITC product code**	**SITC Product Description**	**SITC product code**	**SITC Product Description**
522	Elements/oxides/hal salt	247	Wood in rough/squared	247	Wood in rough/squared
278	Other crude minerals	635	Wood manufactures n.e.s.	248	Wood simply worked
122	Tobacco, manufactured	1	Live animals except fish	59	Fruit/veg juices
672	Primary/prods iron/steel	62	Sugar confectionery	22	Milk pr exc buttr/cheese
641	Paper/paperboard	778	Electrical equipment nes[9]	713	Internal combust engines
892	Printed matter	122	Tobacco, manufactured	273	Stone/sand/gravel
344	Petrol./hydrocarbon gas	851	Footwear	642	Cut paper/board/articles
34	Fish,live/frsh/chld/froz	692	Metal store/transpt cont	112	Alcoholic beverages
Lost Opportunity					
Trinidad and Tobago		**Guyana**		**Suriname**	
SITC product code	**SITC Product Description**	**SITC product code**	**SITC Product Description**	**SITC product code**	**SITC Product Description**
676	Iron/steel bars/rods/etc	42	Rice*	75	Spices
112	Alcoholic beverages	58	Fruit presvd/fruit preps	658	Made-up textile articles
642	Cut paper/board/articles	542	Medicaments include vet	553	Perfume/toilet/cosmetics

Source: Calculated

[9] Not elsewhere specified (n.e.s)

5.6 Linking HMI, Theil and Dynamic RCA

The comparative advantage structure of each economy was shown to be relatively different. In terms of Suriname, the commodities with the highest comparative advantage were classified as either primary products or resource-based manufactures. These included wood, rice, gold, heavy petrol/bitumen oil and sand/stone/gravel. As for Guyana, the majority of exports with high comparative advantage were primary commodities including rice, sugar/molasses/honey, fish, gold and crustaceans. Trinidad and Tobago's comparative advantage structure was shown to be different from that of Guyana and Suriname, with the inclusion of some medium technology manufactures along with resource-based and primary exports. These included Elements/oxides/hal salt, Alcohols/phenols/derivs, Pig iron etc ferro alloy, Natural gas and Liquid propane/butane.

The respective export structures are further also reflected in the value of the Theil index. Suriname is mainly concentrated in resource-based and primary exports. Guyana's exports are mainly concentrated in the primary product sectors while Trinidad and Tobago show a relatively consistent index across each industry, indicating that the economy's exports are generally concentrated on a few sectors. Even so, the sectors from which these economies can benefit according to market demand are classified as rising stars and lost opportunities in relation to the dynamic comparative advantage matrix. While the majority of the economies' exports with high comparative advantage fall into the rising star category, there is minimal room for improving export composition based on comparative advantage. The only exception, in this case, is Guyana, with the opportunity to expand rice production and benefit from higher market demand.

5.7 Structural Change in Trinidad and Tobago

The concept of a "natural resource curse"is linked to that of Dutch Disease in terms of natural resource abundance causing decreases in long term GDP growth.[10] One strand of the argument focusses on rent seeking and the misappropriation of resource rents (Tornell and Lane, 1999; Torvick, 2002). Table 12 below shows the Harmonic Weighted Mass Index in relation to the growth rate of Natural Resource Rents (as a percentage of GDP), the REER and the Herfindahl Hirschman index for Trinidad and Tobago.

The HWMI is shown to be highest in the period which captured the centre of the natural gas boom (2006-2009). Between 2000 and 2006, the export structure of the economy was relatively different, although not significant. The average Herfindahl Hirschman index[11], remained consistently low with negligible changes over the time frame, further indicating that the economy did not undergo any major diversification during the resource boom. Interestingly, a negative relationship exists between the HWMI and the growth rate of the REER, since as the growth rate of the REER increases, the HWMI decreases. This implies that a low growth of the REER allows for greater changes in the RCA structure of the economy

Table 12: Trinidad and Tobago HWMI and Natural Resource Rents

	HWMI	Herfindahl Hirschman Index	Growth rate of Natural resource Rents	Growth rate of REER
2000-2003	0.090	0.016	0.073	0.065
2000-2006	0.261 ↑	0.017 ↑	1.250 ↑	0.046 ↓
2000-2009	0.213 ↓	0.017	0.910↓	0.063 ↑
2000-2012	0.169 ↓	0.018 ↑	1.273 ↑	0.107 ↑
2000-2015	0.148 ↓	0.017 ↓	-0.011 ↓	0.127 ↑

Source: Calculated

[10] See Oomes and Kalcheva (2007) for details on how Dutch Disease can cause decreases in long term growth.

[11] Calculated as, ∑(Xij/Xi)^2

Out of the three economies examined in this paper, Trinidad and Tobago is the main energy exporter. The data from table 12 shows that despite benefitting from two resource booms, the country was unable to diversify or realise any significant structural change.

3. Conclusion and Policy Measures

It has been argued that Dutch Disease does not necessarily lower economic growth unless the manufacturing sector is assumed to be "special" (Magud and Sosa, 2010). However, in relation to the export-led growth hypothesis, the capacity of the manufacturing sector to generate sustainable growth, through various avenues including increased competition (based on lower concentration ratios) and technological and knowledge spillovers, cannot be overlooked (Feder, 1981; Oomes and Kalcheva, 2007).

Apart from public and private driven investment in the industrial sector, proper fiscal policies will be pivotal in curbing the expansion of the non-tradeable sector and increasing the output of the tradeable sectors. Hence effective revenue management play an important role in expanding manufacture exports and increasing potential for intra industry trade. Pro-cyclical fiscal policies, especially in resource abundant economies, tend to increase the demand for the non-tradeable good, thereby causing REER appreciation and decreasing export competitiveness. Krugman (1987) noted that even a temporary overvaluation of an economy's currency could lead to permanent loss of competitiveness in some sectors. Hence, especially as it relates to the Guyanese economy, which is expected to become one of the Caribbean's largest energy exporters, implementation of proper fiscal rules which prevents excessive spending of windfall revenue is necessary to facilitate long-run export diversification and a competitive manufacturing sector, unharmed by the Dutch Disease (Garcia-Cicco and Kawamura, 2015)

Directly in terms of this study, Trinidad and Tobago, Guyana and Suriname generally show low product export diversity as well as minimal structural changes in the export sector (in terms of comparative advantage). This is especially highlighted by each economy's low Harmonic Weighted Mass Index and the high degree of persistence noted in their Transition Probability matrix indicates. Therefore, these indicators purport that in the non-natural resource tradeable sectors of the economy, there is low supply elasticity. Consequently, any major changes in the global economy will leave these countries struggling to adapt. Diversification of their export base is, therefore, pivotal in achieving a long-run sustainable development goal. The policymakers of these resource-rich economies should focus on sectors and activities which promote spillover effects since the natural resource sector is usually seen as enclaved. Effective capital control which minimises crowding out will be imperative in achieving beneficial structural changes in these economies. Governments should consider investment not only in physical capital but also human capital of other sectors which are capable of generating export revenue (Gylfason and Nganou, 2014).

The Theil index for each country in the study shows that the diversification tends to occur within industries rather than across industries. According to Hidalgo et al. (2007) it is difficult for economies to expand production across industries, especially away from those industries with high comparative advantage. Hence, as a means of boosting exports and intra-industry trade, policymakers should consider increasing value-added within certain sectors, especially those which are considered bitumin oil missed opportunities".

References

Balassa, B. 1965. "Trade Liberalisation and ""Revealed"" Comparative Advantage." The Manchester School.

Brahmbhatt, Milan, and Otaviano Canuto. 2010. "Natural Resources and Development Strategy after the Crisis." The World Bank Poverty Reduction and Economic Management (PREM).

Cadot, Olivier, Celene Carrere, and Vanessa Strauss-Kahn. 2011. "Export Diversification: What's Behind the Hump?" Review of Economics and Statistics, Vol. 93, No. 2.

Caves, Richard E, 1981. "Intra-Industry Trade and Market Structure in the Industrial Countries," Oxford Economic Papers, Oxford University Press, vol. 33(2), pages 203-223, July.

Corden, Max, and Peter Neary. 1982. "Booming Sector and De-Industrialisation in a Small Open Economy." The Economic Journal Vol. 92, No. 368 825-848.

de Ferranti, David; Perry, Guillermo E.; Lederman, Daniel; Maloney, William E.. 2002. From Natural Resources to the Knowledge Economy : Trade and Job Quality. World Bank Latin American and Caribbean studies - Viewpoints;. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/14040 License: CC BY 3.0 IGO.

Edwards, L., and Schoer V. 2002. "Measures of Competitiveness: A Dynamic Approach To South Africa's Trade Performance In The 1990s." South African Journal of Economics.

Feder, Gershon. 1983. "On exports and economic growth." Journal of Development Economics (Journal of Development Economics) 59-73.

García-Cicco, Javier, and Kawamura Enrique. 2015. "Dealing with the Dutch disease: Fiscal rules and macro-prudential policies." Journal of International Money and Finance 55: 205-239.

Gylfason Thorvaldur and Nganou Jean-Pascal Nguessa, 2014. "Diversification, Dutch Disease, and Economic Growth: Options for Uganda," CESifo Working Paper Series 5095, CESifo Group Munich

Herfindahl, Orris. 1950. "Concentration in the Steel Industry." Colombia Univrsity PHD Dissertation.

Hesse, Heiko. 2008. "Export Diversification and Economic Growth." Commission on Growth and Development Working Paper, 21.

Hidalgo, Cesar, Bailey Klinger, Albert-Laszlo Barabasi, and Ricardo Hausmann. 2007. "The Product Space Conditions the Development of Nations." Science Vol. 317, Issue 5837, pp. 482-487.

Hinloopen, J., and C. van Marrewijk 2005 Dynamics of Chinese Comparative Advantage TI 2004-034/2 Tinbergen Institute Discussion Paper

Hinloopen, J., and C. van Marrewijk. 2001. “On the Empirical Distribution of the Balassa Index.” Weltwirtschaftliches Archiv, 137, 1- 35.

Hinloopen, J., and C. van Marrewijk.. 2005. ""Empirical Relevance of the Hillman condition and Comparative Advantage: 10 sStylised Facts"."

Hirschman, Albert O. 1945. National Power and the Structure of Foreign Trade. University of California Press.

Holmgren, E.B. (1995), ""The P-P plot as a method of comparing treatment effects"," Journal of the American Statistical Association, 90 (429), 360-365.

Humphreys, Macartan, Jeffrey D Sachs, and Joseph E Stiglitz. 2007. Escaping the Resource Curse. New York: Columbia University Press.

Krugman, Paul, 1987. "The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher : Notes on trade in the presence of dynamic scale economies," Journal of Development Economics, Elsevier, vol. 27(1-2), pages 41-55, October.

Lall, S. (2000). The technological structure and performance of developing country manufactured exports, 1985-98. Oxford Development Studies, 28(3), 337-369.

Magud, Nicolas, and Sebastian Sosa. 2010. "When and Why Worry About Real Exchange The Missing Link between Dutch Disease and Growth." IMF Working Paper (IMF Working Paper).

Mahmood, A. 2004. "Export Competitiveness and Comparative Advantage of 'Pakistan's Non-agricultural Production Sectors: Trends and Analysis ." The Pakistan Development Review.

Matsuyama, Kiminori, 1992. "Agricultural productivity, comparative advantage, and economic growth," Journal of Economic Theory, Elsevier, vol. 58(2), pages 317-334, December.

Oil Now. 2019. "Morgan Stanley pegs Guyana oil reserves at 6 billion barrels." May 28. https://oilnow.gy/featured/morgan-stanley-pegs-guyana-oil-reserves-at-6-billion-barrels/.

Oomes, Nienke and Kalcheva, Katerina, Diagnosing Dutch Disease: Does Russia Have the Symptoms? (April 4, 2007). BOFIT Discussion Paper No. 7/2007. Available at SSRN: https://ssrn.com/abstract=1001659 or http://dx.doi.org/10.2139/ssrn.1001659

Prebisch, Raul. 1950. "The Economic Development of Latin America and Its." Economic Bulletin for Latin America 7 1-12.

Rodrik, Dani. 2016. "Premature deindustrialisation." Journal of Economic Growth Volume 21, Issue 1, pp 1–33.

Sachs, Jeffrey D, and Warner Andrew. 1999. "The big push, natural resource booms and growth." Journal of Development Economics vol. 59, issue 1, 43-76.

Schumpeter, J. 1942. Capitalism, Socialism and Democracy. New York: Harper and Row.

Shorrocks, A. 1978. "The Measurement of Mobility". Econometrica Vol. 46, 1013-24.

Singer, Hans. 1950. "The Distribution of Gains between Investing and Borrowing." Papers and Proceedings, 40 473-485.

Sommers, P.S., and J. Conlisk (1973). "Eigenvalue immobility measures for Markov chains"." Journal of Mathematical Sociology Vol 6, 253-276.

Theil, Henri. 1967. Economics and information theory. Amsterdam: North Holland .

Tornell, Aaron and Philip Lane, 1999, Voracity and Growth", American Economic Review, Vol. 89, pp. 22–46.

Torvik, Ragnar, 2001, Learning by Doing and the Dutch Disease," European Economic Review, Vol. 45, No. 2, pp. 285–306.

U.S. Geological Survey (USGS). 2012. "Assessment of Undiscovered Conventional Oil and Gas."

Warren, Workman, and Birnie David J. 2015. "The Guyana-Suriname Basin: An Evolving Exploration Opportunity." Search and Discovery Article #10730.