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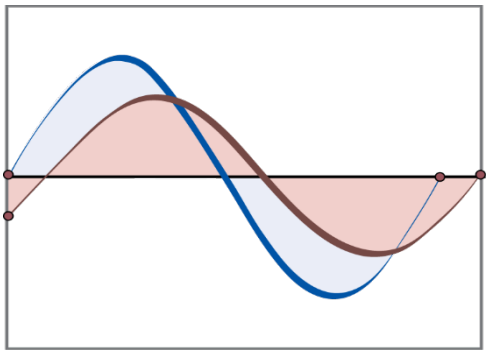

The Dynamics of the Trade Balance: An Empirical Investigation of the Marshall-Lerner Condition and J-curve Hypothesis in Trinidad and Tobago

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This paper investigates whether an exchange rate depreciation would improve the trade balance for Trinidad and Tobago, within the theoretical underpinnings of the Marshall-Lerner (ML) condition and the J-curve Hypothesis, using data from 1991 to 2020. The ML condition posits that improvement in a country's trade balance depends on the combined responsiveness of demand for imports and exports, in response to a currency depreciation. This economic concept is complemented by the J-curve hypothesis, which suggests that a depreciation in the exchange rate may not result in an immediate increase in the trade balance but rather it worsens in the short run and gradually improves thereafter. Using an Auto-regressive Distributed Lag model, cointegration analysis, and error correction testing, the validity of these theories was examined with specific emphasis on the total and non-energy bilateral trade relationships between Trinidad and Tobago and its main trading partner, the United States (US). The empirical results confirmed the existence of the ML condition for Trinidad and Tobago in the long run; however, the improvement in the bilateral total trade balance was minimal and not sustained, thereby rejecting the J-curve hypothesis. In contrast, the combined responsiveness of the bilateral non-energy imports and exports did not satisfy the ML condition and was further corroborated by the rejection of the J-curve hypothesis. Based on the findings of the J-curve hypothesis in particular, it suggests that leveraging the exchange rate will not result in significant or sustained trade balance improvements.

JEL Classification Numbers: F10, F14, F41

Keywords: Marshall-Lerner Condition, J-curve Hypothesis, Depreciation, Imports, Exports, Trade Balance

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1.0 Introduction

Trinidad and Tobago is categorised as a small, open economy where exogenous shocks could dominate developments within its external accounts. Recent economic crises impacting the global community have underscored this vulnerability, leading to a weaker performing merchandise trade balance and by extension the current account balance. In the wake of the novel coronavirus (COVID-19) pandemic, which emerged in late-2019, Trinidad and Tobago's current account balance recorded a decline of approximately 99.0 per cent over 2020, when compared to 2019, most of which was attributed to a falloff in the net goods trading position. In addition, Trinidad and Tobago's current account recorded a deficit in the third quarter of 2020- its first deficit in approximately four years.

Apart from this ongoing shock, other negative factors that have weighed on the external accounts range from volatile commodity prices in international energy markets, subdued domestic production (particularly from the energy sector), and waning foreign demand for related products due to a growing global shift to green energy sources. The amalgamation of these circumstances, against the backdrop of a steady decline in the stock of official reserves and downward pressures on the exchange rate, has fuelled renewed interest in investigating whether depreciating the domestic currency would manifest in a favourable impact on the external current account, through a reduction in the demand for imports and an increase in exports as postulated by theory.

Currency depreciation is a conventional and text-book policy anecdote to addressing balance of payments imbalances and boosting export competitiveness. Moreover, management of a country's exchange rate is another consideration as it creates a challenge for policy-makers when formulating targeted strategies for economic development and sustainability. Therefore, the question of the role of the exchange rate, in relation to the external accounts, is a pertinent consideration for an economy such as Trinidad and Tobago that is broadly described as having a stabilised exchange rate arrangement (IMF, 2018).

Particularly noteworthy is the significant contribution of merchandise trade to the overall current account position, which is primarily supported by exports of energy commodities. In fact, energy export earnings have averaged 80.0 per cent of total exports over the period 1991 to 2020. On a trading partner basis, the United States (US) accounts for a sizeable portion of Trinidad and Tobago's trade flows, making this economy a major influencer of the domestic goods balance. Over the 30-year period, exports to the US have averaged 45.5 per cent of overall export earnings, and 34.2 per cent of foreign goods demanded were imports from the US. Meanwhile, the TT-US exchange rate has ranged from TT$5.67 in the second quarter of 1993 (the rate was floated in April 1993) to TT$6.75 at the end of 2020. Despite the gradual depreciation in the currency over the reference period, it did not induce concurrent improvements in the trade balance. The deviation in occurrences could be symptomatic of a delayed response between changes in the exchange rate and the current account.

Consequently, this paper seeks to primarily explain how Trinidad and Tobago's trade balance responds to movements in the exchange rate. Theoretically, the foundation for understanding the co-movement among these variables is derived from the Marshall-Lerner (ML) condition which postulates that the improvement of a country's trade balance, upon depreciation of the currency, depends on the combined responsiveness of the demand for imports and exports. Econometrically, this means that the absolute sum of the price elasticities must be greater than unity for the trade balance to improve. This economic concept is further complemented by an analysis of the

J-curve effect, which suggests that improvements in the trade balance, in response to a depreciation, may not occur instantaneously but it deteriorates before displaying an improvement.

This research aims to build on the work of Caribbean authors by narrowing focus to the impact of exchange rate adjustments on the trade balance of solely Trinidad and Tobago using a holistic approach of complementing the ML condition with the J-curve hypothesis. Particular emphasis is also placed on examining the relationship with the country's main bilateral trading partner- the US to eliminate aggregation bias. Higher frequency data, which covers a longer time period, is employed compared to previous studies. In this vein, the paper highlights two distinct bilateral trade balance equations to provide a thorough analysis of the depreciation effects on total US trade and also a segment of this trade balance, namely, total imports and exports, and non-energy imports and exports. The results of this individual country case could provide policymakers with insights on the effectiveness of differing exchange rate and trade policies.

The structure of the paper is as follows; Section 2.0 provides an account of previous studies, conducted at both an international and regional level, on this topic. This is followed by Section 3.0 which highlights some key characteristics of the economy of Trinidad and Tobago. Section 4.0 defines the data and methodology used to examine the ML condition and J-curve hypothesis, while an examination of the empirical results stemming from the econometric techniques employed can be found in Section 5.0. This section also expounds on an analysis of the results in reference to domestic conditions. The paper concludes in section 6.0 which summarises the main findings.

2.0 Literature Review

In the late-nineteenth century, neo-classical economist, Alfred Marshall (Marshall, 1890) laid the foundation for discussing elasticities in trade economics. This work was further expounded on by Abba Lerner (Lerner, 1952) during the twentieth century, which gave birth to the Marshall-Lerner (ML) condition. Since then, this concept has become a fundamental tenet in international economics and has been widely referred to when examining international trade relationships. Further complementing this economic framework is the existence of the J-curve effect, which was first observed by Stephen Magee in 1973[1]. These concepts have been applied to country experiences both internationally and regionally due to its usefulness in devising trade policies and regulations for individual economies.

The ML condition seeks to determine the impact of a currency depreciation or devaluation on the trade balance of a country's balance of payments (BOP). The academic literature states that the ML condition is satisfied when the aggregate elasticities of a country's export and import demand is greater than one. In simpler terms, this economic concept theorises that an economy's trade will improve, following a currency depreciation, if the sum of the foreign elasticity of demand for exports and the home country elasticity of demand for imports is greater than one (Pilbeam, 2013). However, if the sum of these two elasticities is less than unity, then a depreciation will deteriorate the trade balance (Pilbeam, 2013). Research has also highlighted that the ML condition does not always hold in the short run, however evidence points to its existence in the medium to long run.

Depreciation or devaluation is one approach that can possibly strengthen the trade balance, but the impact of this exchange rate adjustment usually entails a time lag before showing any impact on the trade balance, resulting in varying effects in the short and long run. One such pattern created is referred to as the J-curve, which describes an initial worsening of the trade balance followed by a later improvement. Junz and Rhomberg (1973) identified five time lags: recognition, decision, delivery, replacement and production, while Magee (1973) further explains

[1] Magee, Stephen P. 1973. "Currency Contracts, Pass-Through, and Devaluation." *Brookings Papers on Economic Activity* 4 (1): 303-325.

that these adjustment lags arise from currency-contracts signed prior to devaluation, newer currency-contracts signed after devaluation and sluggish quantity adjustments.

The transmission channel from a depreciation or devaluation of the exchange rate to the country's trade balance has been argued in the literature. Three main approaches emerged namely, the elasticities approach (EA), the absorption approach (AA) and the monetary approach (MA). The ML condition is grounded in the EA which suggests that a nominal devaluation, by exerting a negative impact on the real exchange rate of a nation's currency, will improve the global competitiveness of its tradable goods (Rawlins, 2009). Proponents of the AA focus on how devaluation may change the terms of trade, increase production, switch expenditures from foreign to domestic goods or have some other effect in reducing absorption relative to production and thus improve the trade balance (Straughn 2003). Meanwhile, in the MA, a devaluation leads to a reduction in real balances, a fall in expenditures and improvement in the trade balance (Rawlins, 2009).

The ML condition has been econometrically tested by many researchers giving rise to a vast body of literature based on country examples. However, no consensus has been reached. Among the international literature, empirical work conducted by Boyd, et al. (2001) focused on the applicability of the ML condition for eight[2] Organisation of Economic Co-operation and Development (OECD) countries employ structural cointegrating vector autoregressive distributed lag (VARDL) modelling techniques. Econometric evidence point to mixed results for the countries, with five of the eight showing statistically significant responses to exchange rate effects in the long run, while J-curve effects were observed for six of the eight countries. Moreover, strong evidence was presented to establish that the real exchange rate has a significant impact on the trade balance which also supports a case for currency depreciation by policy makers.

Boyd, et al (2001) expounded on the use of aggregate trade data, however a strand of studiesalso utilised bilateral trade data. For instance, Bahmani-Oskooee and Brooks (1999) postulated that a country's trade balance could show signs of improvement with one trading partner while simultaneously deteriorating with another. Furthermore, this contradiction can also be the result of the use of the real exchange rate as opposed to the bilateral exchange rate. Therefore, an analysis on the bilateral data level would contribute positively to the topic by reducing aggregation bias. In the 1999 study by Bahmani-Oskooee and Brooks, the trade relationships between the US and six partner countries were examined and revealed varied findings. The ML condition was satisfied between the US and Japan, United Kingdom, France and Italy, while no evidence was found to support the existence of the condition for US trade with Canada and Germany. In such an instance, a depreciation of the domestic currency would favourably impact on trade balances with particular economies, therefore a blended policy response would be appropriate.

Among studies of the ML condition and J-curve hypothesis is an extensive statistical investigation conducted by the International Monetary Fund (IMF) in 2006 into the exchange rate and trade balance adjustment policies of 46 middle-income and emerging market economies. An important *a priori* expectation stated that the responsiveness of exporters to an exchange rate depreciation will depend on the nature of the economy's main export, therefore countries were categorised according to their dominant export; oil, non-oil commodities, or manufacturing (IMF, 2006). Results highlighted that the sensitivity of the trade balance to a depreciation in the nominal exchange rate differed among the varying exporter groups. In the short run, countries with an export-to-gross domestic product (GDP) ratio of 40.0 per cent experienced the following movement in their trade balance: a 10.0 per cent nominal exchange rate depreciation led to a 0.3 per cent of GDP improvement in the trade balance of manufactured goods exporters, compared to a 1.5 per cent of GDP improvement for commodity exporters. Over the medium term, a 10.0 per cent depreciation will result in an improvement in the trade balance of 1.5 to 2.0 per cent of GDP depending on the class of exporter. It should be noted that most of the improvement in the trade balance occurred over a 3 to 5-year period after the exchange rate depreciation. These findings indicate that the sensitivity of an economy's

[2] The eight countries included in the study are: Canada, France, Germany, Italy, Japan, the Netherlands, UK and US.

trade balance dynamics to an exchange rate depreciation depends on the market structure of its exports. There is also merit in examining exchange rate policy to achieve an improved current account position.

Investigations on the ML condition were also performed on developing economies such as India (Pandey, 2013) and Pakistan (Hussain and Bashir, 2013), which both incorporated error correction models. Empirically tested conclusions drawn from both papers suggest that the ML condition held for both India and Pakistan. It should be noted that the latter tested the applicability of the ML condition and J-curve effect on disaggregated bilateral trade data between Pakistan and two prominent trading partners, the US and UK. Ultimately, the short-run and long-run period analysis pointed to the existence of both concepts with these trading partners. Meanwhile, Narayan and Narayan (2004) tested for the J-curve in Fiji using long run elasticities estimated from an ARDL, dynamic ordinary least squares (DOLS) and Fully Modified Ordinary Least Squares (FM-OLS) approaches. Similar to Pakistan, the authors found evidence of a J-curve for Fiji. In addition, the trade balance was negatively affected by domestic income and positively related to foreign income.

On the African continent, research was conducted on the import-dependent, petroleum exporting country of Nigeria by Loto (2011) and Danmola et al (2013). For the former, which used non-oil trade balance, the ML condition did not hold as the sum of the demand elasticities for imports and exports was less than unity at 0.7851, concluding that a depreciation in the Nigerian naira does not improve the trade balance. Furthermore, Loto (2011) inferred that import-dependent economies, like Nigeria, can hardly benefit from a depreciation of its currency. Meanwhile, the latter study investigated the J-curve hypothesis and confirmed its existence as the Granger causality test indicated a short-run relationship between the exchange rate devaluation and the trade balance. These authors concluded that trade needs to diversify the sources of foreign exchange apart from the petroleum sector so as to benefit from the initial devaluation. For Uganda, Kamugisha and Assoua (2020) devaluation only had a significant effect on the trade balance in the short run and thus concluded that devaluation may not be appropriate to sustainably improve its trade balance.

Regionally, Hsing (2008) studied the J-curve for seven Latin American countries using bilateral trade data and found evidence supporting its effect in Chile, Ecuador and Uruguay while evidence for Argentina Brazil, Colombia and Peru was lacking. As such, the author determined that conventional theory that supports the pursuit of real depreciation to improve the trade balance may not apply to some countries. These countries may need to exert caution in determining exchange rate policy. However, a previous study on Colombia by Rincon (1999) indicated that there was evidence of a J-curve and devaluation does improve its trade balance, which is consistent with the ML condition, and is enhanced if accompanied by reduction in the money stock and/or an increase in income. Rawlins (2009) investigated the relationship between bilateral currency depreciations, income levels and trade balance for a panel of 12 countries in Central America and the Caribbean[3] and four industrialised countries: US, UK, France and Japan. Results from the Ordinary Least Squares and the Fisher-Johansen Panel Cointegrating techniques were generally mixed. All of the contemporaneous real exchange rates carried positive coefficients indicative of improvement in the trade balance in the year the devaluation was implemented, except US and the UK. However, results were tempered by insignificant t-statistics. Moreover, his study suggests that domestic and foreign income have a greater impact on the trade balance than the real exchange rate.

In terms of exclusively Caribbean studies, Boyd and Smith (2003), despite using several econometric techniques, found little satisfaction for a cointegrating BOP equation or for the ML condition in 10 Caribbean countries over the period 1980 to 2001. Countries that fulfilled the ML condition were Belize, and Trinidad and Tobago via the ARDL technique, however only at the 10.0 per cent level, and Barbados and Belize in the cointegrating Vector Auto-Regression (VAR). It must be noted that the J-curve was demonstrated for St. Kitts, Jamaica and Trinidad and Tobago. The authors allude to the import and export structures of the various countries under investigation, and the combination of the short time series and noisy measures as possible reasons why improvements in the BOP

[3] The 12 Central American and Caribbean economies are: Barbados, Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Jamaica, Nicaragua, Panama, St. Kitts and Nevis, and Trinidad and Tobago.

due to devaluations may have been undetected. Meanwhile, Straughn (2003), in his estimation for a long-run relationship between the trade balance and terms of trade, narrowed his investigation to three CARICOM countries: Barbados, Jamaica, and Trinidad and Tobago over the period 1970 to 2000. Although the results indicated the existence of a long-run equilibrium, evidence to support the ML condition was not forthcoming. Of particular mention was the AA being held for Trinidad and Tobago, that is, a negative shock to the terms of trade is accompanied by a decline in the trade balance, while the negative shock affects the real money stock equation positively. It is suggested that a combination of both monetary and/or fiscal policies should be used to improve the trade balance.

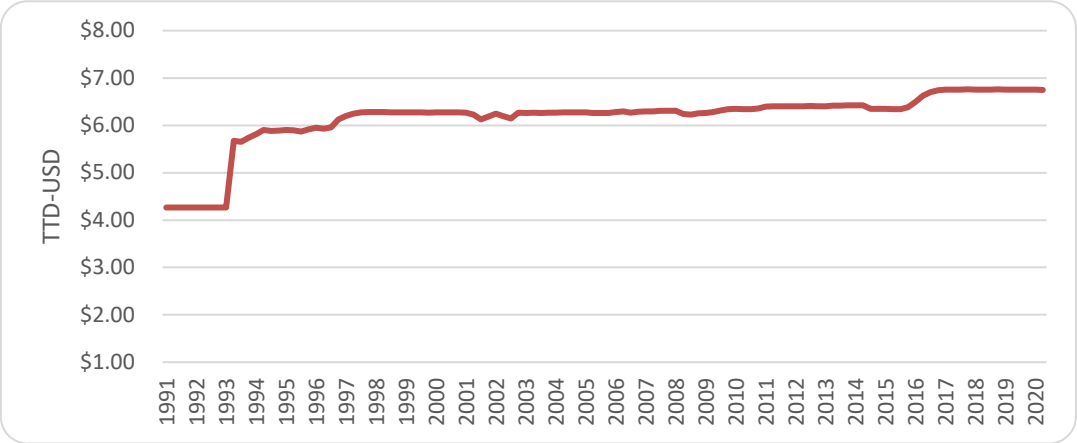
More recently, in 2014, Wilson and Mclean investigated the impact of exchange rate adjustment on the bilateral trade balances between five Caribbean economies[4] with their main trading partner, the US, using a VARDL model. Analysis showed mixed results among the countries in the short run. Exchange rate movements over the period 1980 to 2012 did not impact on trade flows for Barbados, Trinidad and Tobago and Dominican Republic, therefore the ML condition was not satisfied. This finding is in line with other studies that indicate the short-run adjustment period to an exchange rate depreciation does not align with any specific pattern (Bahmani- Oskooee and Ratha, 2004). In terms of the long-run relationship, the findings were consistent for all countries where any improvement in the trade balance, following a currency depreciation, was not sustainable as the trade balance eventually weakens (Wilson and McLean 2014). According to the authors, this observation follows an L-effect, which is indicative of a converse relationship to the typical J-curve effect. Given these findings, it was suggested that exchange rate policy would be ineffective.

3.0 Stylised Facts

Trinidad and Tobago's nominal exchange rate vis-á-vis the United States (US) dollar ranged from TT$4.27 in 1991 to TT$6.75 in 2020. Movements in the rate over this period amounted to a depreciation of roughly 58.0 per cent, which was heavily influenced by the removal of foreign exchange controls when the domestic currency was floated in April 1993 **(Figure 1)**. During the second quarter of 1993, the TT dollar lost one third of its value to an average exchange rate of TT$5.67 from TT$4.27 three months earlier. Subsequently, on a year-on-year basis, Trinidad and Tobago's currency registered a total of 74 minor exchange rate depreciations, which averaged 1.1 per cent against the US dollar **(Figure 2).** Amid persistent foreign exchange market tightness in the domestic economy, the local currency depreciated around 6.0 per cent, for the fiscal year 2015/2016[5]. However, it must be noted that appreciation episodes did occur, albeit to a lesser extent, with the highest appreciation of 2.4 per cent year-on-year in September 2001.

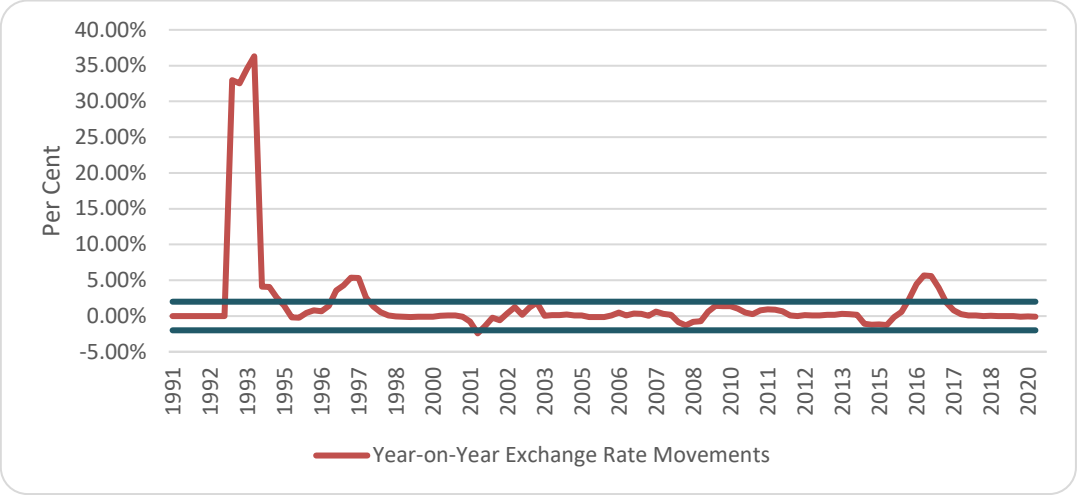
[4] The five Caribbean economies examined are: Jamaica, Guyana, Barbados, Trinidad and Tobago and the Dominican Republic.
[5] Trinidad and Tobago's fiscal year is from October 1 to September 30.

Figure 1: Quarterly Bilateral TT-US nominal exchange rate 1991-2020



Source: Central Bank of Trinidad and Tobago

Figure 2: Volatility in the TT-US exchange rate 1991-2020



Source: Authors' calculations

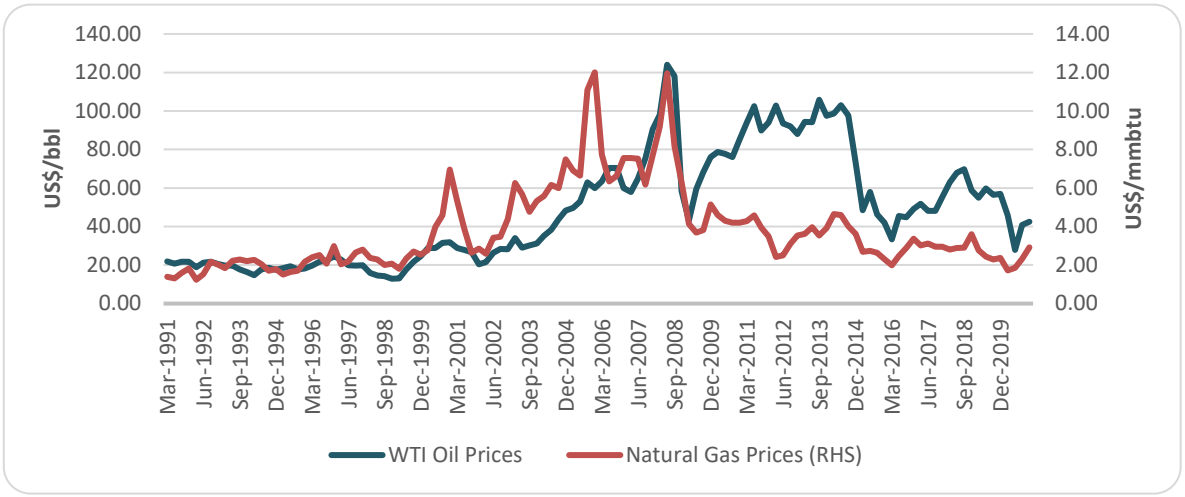
Trinidad and Tobago operates a managed float that has been generally stable, not depreciating more than 2.0 per cent against the US dollar in most quarters following the shift in the exchange rate regime. The International Monetary Fund (IMF) has classified the country's exchange rate regime as a "de facto stabilised arrangement" (IMF 2016)[6]. Moreover, the relative stability of the exchange rate over the last decade (2011 to 2020) has been a by-product of the Central Bank's intervention in the domestic foreign exchange market to mostly offset the net sales gap. The Central Bank has recommended that authorised dealers prioritise trade-related demand. The Central Bank was also instrumental in capitalising a special foreign exchange window which was launched in May 2018 using the Export-Import Bank of Trinidad and Tobago (EXIMBANK). The facility provides access to certain manufacturers whose exports exceed a minimum of 30.0 per cent of its production.

The stock of foreign exchange is very important for a small, open economy such as Trinidad and Tobago as it represents the primary financing vehicle for international trade. In particular, the main trade invoicing currency for Trinidad and Tobago is the US dollar. A significant portion of inflows into the country's stock of international reserves stems from taxation of the domestic economy's energy sector and this industry continues to represent the main source of foreign exchange earnings. However, more recently, US dollar foreign exchange inflows to the

[6] International Monetary Fund Annual Report on Exchange Rate Arrangements and Exchange Restrictions 2016, pgs. 6, 66.

domestic economy have been stymied by lower international oil and gas prices **(Figure 3),** and weaker domestic energy sector activity, which is underpinned by the closure of several downstream companies, particularly in the petrochemical industry, and the adverse effects of the COVID-19 pandemic. This, coupled with domestic consumers' continued appetite for imported goods, places the country in a vulnerable position amid deteriorating international reserves.

Figure 3: Quarterly International Oil and Gas Prices

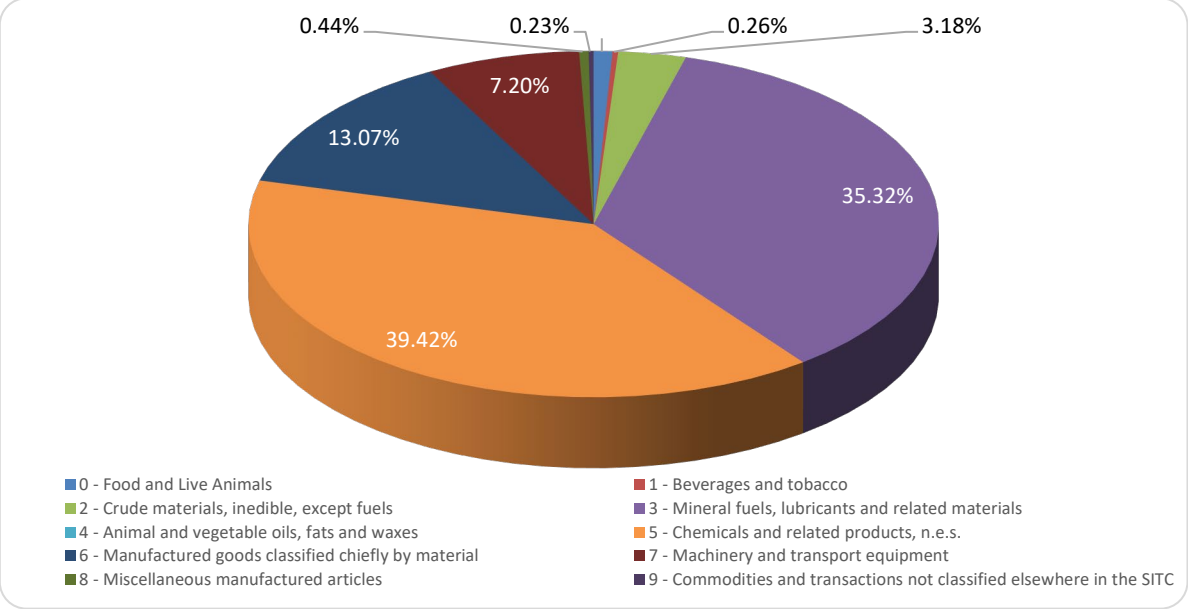


Source: Central Bank of Trinidad and Tobago and Bloomberg

A significant percentage of Trinidad and Tobago's trade flows is concentrated with the US, when compared to other trading partners, making the US a major contributor to the country's merchandise trade balance**.** As a destination market, the US has accounted for 45.5 per cent of Trinidad and Tobago's exports, while imports from the US have averaged 34.2 per cent over the 30-year period. Over the most recent decade (2011 to 2020), the US made up a quarterly average of 38.5 per cent of Trinidad and Tobago's total export market and 29.0 per cent of its total imports. In terms of the composition of imports from the US, some of the main categories are: capital goods (38.7 per cent), food and live animals (15.6 per cent), chemicals and related products (13.6 per cent), and manufactured goods (11.5 per cent) **(Figure 4)**, while Trinidad and Tobago's exports destined for the US mainly consisted of energy products[7] (74.7 per cent) and manufactured goods (13.0 per cent) **(Figure 5)**.

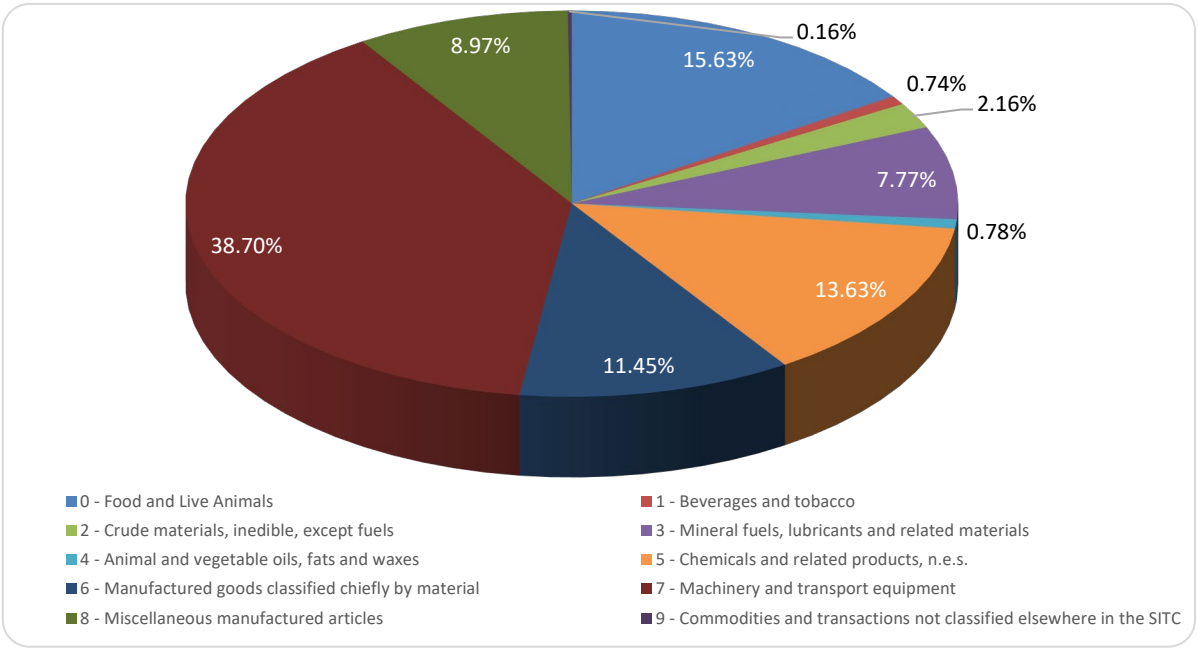
[7] Energy products are classified as mineral fuels, lubricants and related materials (35.3 per cent) and chemicals and related products (39.4 per cent).

Figure 4: Trinidad and Tobago's Exports to the US (2011-2020)



Source: Central Statistical Office

Figure 5: Trinidad and Tobago's Imports from the US (2011-2020)



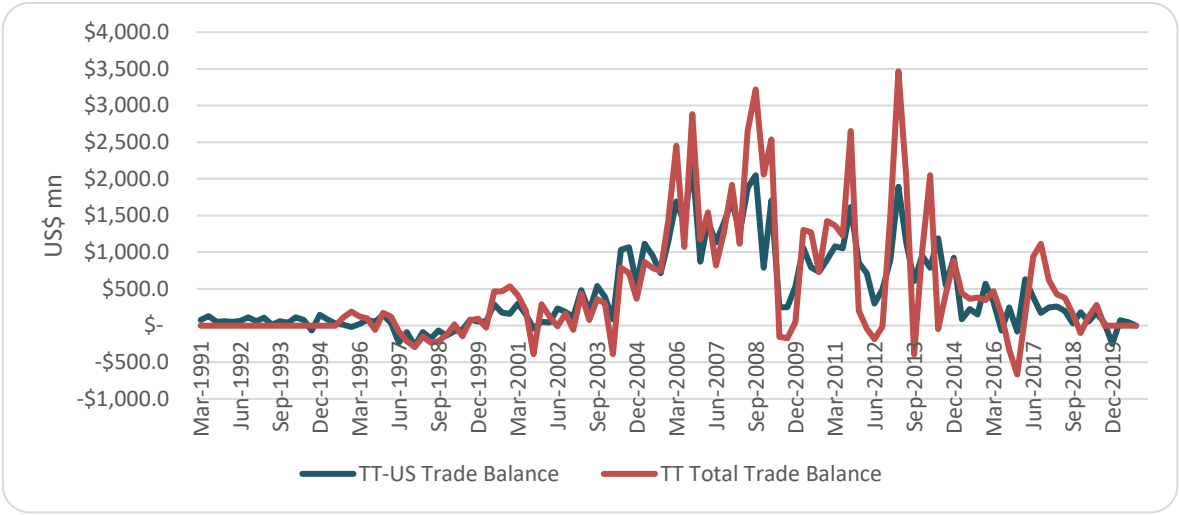
Source: Central Statistical Office

Correlation analysis revealed that changes in the domestic exchange rate had a negative correlation of 0.15 to the country's overall trade balance over the 30- years and a negative correlation of 0.18 with the US trade balance. This indicates the existence of a weak inverse relationship between the variables. When there is an increase in the exchange rate (a depreciation), there is a decrease in the trade balance (deterioration). However, correlation does not imply causation.

Although the gradual depreciation of the domestic currency over the reference period did not induce concurrent improvements in the trade balance, lagged changes were noted in some quarters **(Figure 6)**. Consecutive quarterly

depreciations in the exchange rate occurred during two distinct periods: 1) December 1995 to September 1998, within which the bilateral trade balance improved six times[8] and 2) September 2002 to March 2005, within which the bilateral trade balance improved nine times[9] and correspondingly, the overall trade balance improved nine times. These improvements were characterised by either export earnings outpacing the simultaneous growth in demand for imports, or increased export earnings with a simultaneous reduction in the demand for imports. During, and in the aftermath of the Global Financial Crisis[10], Trinidad and Tobago's currency lost 0.8 per cent of its value and recorded seven quarterly improvements in its bilateral trade with the US (December 2007, June 2008 to September 2008, March 2009, and June through December 2010). During this period, export earnings outweighed the movement in imports due to the peak in the commodity super-cycle where energy commodities traded above the long-term price trend. Over the three- years 2016 to 2018, it was observed that while the currency depreciated by some 6.0 per cent, five improvements were recorded on the bilateral trade balance and four improvements on the overall trade balance.

Figure 6: Correlation between Bilateral and Total Trade Balances

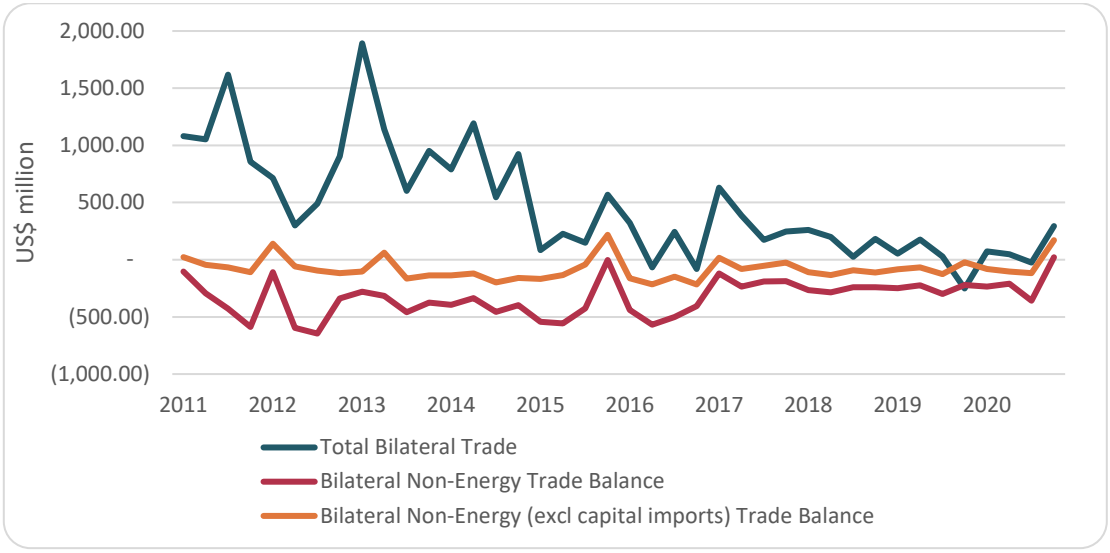


Source: Central Bank of Trinidad and Tobago

Over the most recent decade (2011 to 2020), Trinidad and Tobago recorded a trade surplus with the US suggesting that the domestic economy is a net exporter of goods to the US. However, when trade in energy commodities was excluded, there was a general reversal of the trade surplus to a deficit over the period, making the country a net importer of US non-energy related goods **(Figure 7).** This implies that the country's bilateral trade surplus was inflated by the energy exports, which is not surprising as Trinidad and Tobago's energy exports dominate its export landscape. Moreover, the domestic economy imports more non-energy goods from the US relative to its exports of non-energy goods to this country. Further, when excluding capital imports from the non-energy trade, the trade balance improves, although remained in deficit over the period.

[8] The six quarterly improvements in the bilateral trade balance occurred between June 1996 and March 1997, and then between June 1998 to September 1998.
[9] The nine quarterly improvements in the bilateral trade balance occurred between September 2002 to March 2003, September 2003 to December 2003, and June 2004 to March 2005, while the nine quarterly improvements in the overall trade balance occurred on September 2002, and between March 2003 to December 2003, and June 2004 to March 2005.
[10] The Global Financial Crisis occurred between mid-2007 and early 2009. Thus, the time period referred to here is September 2007 to December 2010.

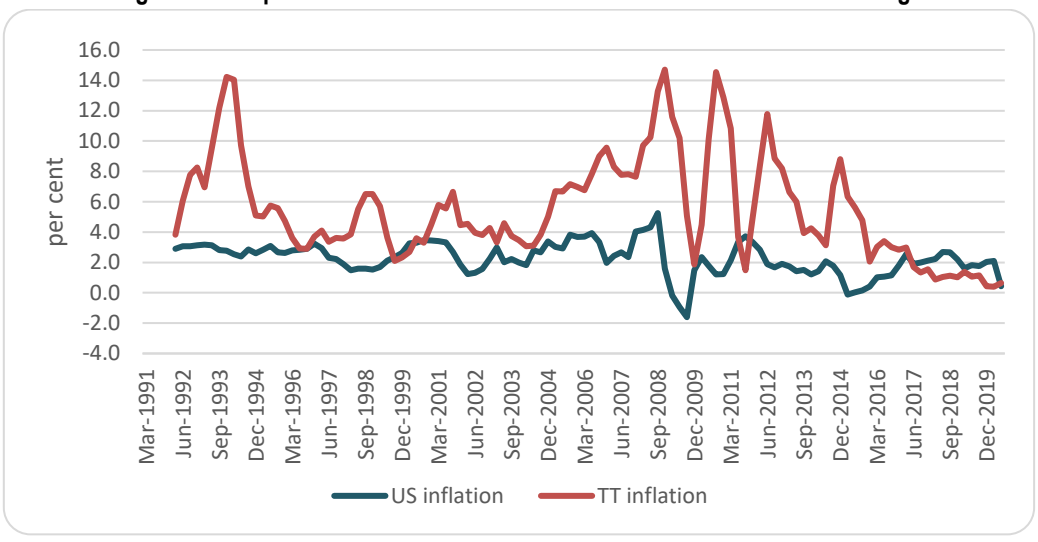
Figure 7: Bilateral Total and Non-Energy Trade Balances



Source: Central Statistical Office and Central Bank of Trinidad and Tobago

In terms of relative prices - a contributing factor in consumers' decision-making process of purchasing local or foreign products - US inflation has been less volatile than Trinidad and Tobago's rate over the reference period **(Figure 8).** This could be attributed to the relative success of the inflation targeting policy implemented by the US Federal Reserve. Trinidad and Tobago's inflation rate has been mainly dictated by fluctuations in food inflation, particularly after 2001. Domestic food inflation contained a large import component partially owing to declines in domestic agricultural activity over the period. Furthermore, there is a relatively quick (around two quarters) exchange rate pass through to domestic food inflation (Bobb and Sonnylal, 2018) which further explains the volatility of food inflation.

Figure 8: Comparative Inflation Rates- United States and Trinidad and Tobago



Source: The Federal Reserve Bank of St. Louis and Central Statistical Office

4.0 Data and Methodology

4.1. Data

The econometric models employed for the investigation of the ML condition and J-curve hypothesis utilise quarterly time-series data over the period 1991:1 to 2020:4. The dataset contains Trinidad and Tobago's exports to, and imports from its main trading partner- the United States (US) using select Standard International Trade Classification (SITC), real domestic income (proxied by Trinidad and Tobago real GDP 2012=100), real US income (proxied by real US GDP 2012=100), domestic retail and US consumer price indices (2015=100), bilateral TT-US nominal exchange rate and Henry Hub (HH) natural gas prices. The dataset is compiled from multiple sources such as the Central Bank of Trinidad and Tobago (CBTT), Central Statistical Office (CSO), Bloomberg and the Federal Reserve Bank of St. Louis' databases. It should be noted that historical bilateral non-energy imports and exports were approximated by retroactively applying the average TT-US share of the SITC to Trinidad and Tobago's total SITC to previous years[11]. Similarly, historical data for quarterly domestic real GDP was interpolated using 2020 quarterly real economic activity estimates obtained from the CBTT and the historical real GDP growth rates obtained from the CSO[12].

4.2 Econometric Model

Preliminary data checks were conducted on the variables prior to undertaking the empirical investigation. Stationarity tests were performed on the individual variables to determine whether a variable is stationary or non-stationary[13]. Separate estimations of import and export demand functions are required to derive the price elasticities of imports and exports, respectively. This is necessary as the ML condition stipulates that for a depreciation of a country's currency to improve the trade balance, the sum of price elasticities of the import and export demand functions must be greater than one. Econometrically, this means that the absolute sum of the estimated coefficients obtained from the individual demand functions would confirm or reject the ML condition. Two separate combinations of the ML condition are examined concerning Trinidad and Tobago's bilateral trade with the US; total imports and exports, and non-energy imports and exports[14].

The regression equations for import and export demand mirrored traditional models which include income and relative prices. Since Trinidad and Tobago mainly exports energy goods to the US and is a price taker on the international market, natural gas prices would be included in the export demand function. The variables are expressed in logarithmic form to infer elasticities of the estimated coefficients.

The Auto-regressive Distributed Lag (ARDL) Model approach to cointegration by Pesaran, Shin and Smith (2001) was used to determine the short- and long-run relationships among the explanatory variables of the individual import and export demand functions. More specifically, the ARDL's bounds test of cointegration determines if there exists a long-run relationship among the variables using the F-test. The criterion of the F- test is that if the computed F statistic is less than the lower bound of the critical values, then the null hypothesis of no cointegration cannot be rejected. In contrast, if the F statistic is higher than the upper bound of the critical values, then the null hypothesis of no cointegration is rejected in favour of the alternative of the existence of cointegration. However, if the F statistic falls within the lower and upper bounds, the test is inconclusive. Generally, the ARDL framework does not require

[11] Historical data on SITC by country is available only for 2007 to 2020 from the CSO.
[12] The robustness of the data quality was confirmed by a 100.0 per cent correlation between the sum of the computed quarters and the annual data obtained from the CSO.
[13] In time series analysis, a series is said to have a unit root, or be integrated of order one I (1) when the series has to be differentiated only once to become stationary (Granger and Engle, 1991). Unit root tests such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were used to determine the order of the variables.
[14] Non-energy exports were calculated as total exports minus SITC 3 (which comprises mineral fuels, lubricants and related materials) and SITC 5 (which comprises chemicals and related products, n.e.s). Meanwhile non-energy imports were calculated as total imports minus SITC 3 only.

the order of integration of the variables, number of endogenous and exogenous variables to be included or the optimal number of lags to be specified. Trinidad and Tobago's import demand functions for US goods (total and non-energy) are given by Equation 1.0 and 2.0 below, respectively.

$$\Delta LM_t = \alpha_0 + \sum^{n}_{i=1} \alpha_{1i} \Delta LM_{t-I} + \sum^{n}_{i=1} \alpha_{2i} \Delta LY_{t-i} + \sum^{n}_{i=1} \alpha_{3i} \Delta LCPI^*_{t-i} + \beta_1 LM_{t-i} + \beta_2 LY_{t-i} + \beta_3 LCPI^*_{t-i} + \varepsilon_{1t} \quad \textbf{1.0}$$

$$\Delta LM\_NE_t = \delta_0 + \sum^{n}_{i=1} \delta_{1i} \Delta LM\_NE_{t-i} + \sum^{n}_{i=1} \delta_{2i} \Delta LY_{t-i} + \sum^{n}_{i=1} \delta_{3i} \Delta LCPI^*_{t-i} + \zeta_1 LM_{t-i} + \zeta_2 LY_{t-i} + \zeta_3 LCPI^*_{t-i} + \varepsilon_{1t} \quad \textbf{2.0}$$

Where LM and LM_NE denote the log of total and non-energy imports from the US respectively, LY denotes the log of real domestic income, LCPI* represents the log of relative prices between the US and the domestic economy and the Δ operator represents first difference. The parameters α and δ represent the short-run coefficients, while the β and ζ represent the long-run coefficients of the variables.

The literature postulates a positive relationship between income and imports which reflects the marginal propensity to import. It is expected that for a small developing economy, such as Trinidad and Tobago, growth in domestic income would increase imports for both consumption and intermediate goods. In contrast, a negative relationship is expected between relative prices and imports, as consumers and producers substitute domestic products for imports when the price of imports decreases. A similar estimation was conducted for Trinidad and Tobago's export demand functions for total and non-energy goods to the US, which are given by Equation 3.0 and 4.0, respectively.

$$\Delta LEX_t = \varphi_0 + \sum^{n}_{i=1} \varphi_{1i} \Delta LEX_{t-i} + \sum^{n}_{i=1} \varphi_{2i} \Delta LY^*_{t-i} + \sum^{n}_{i=1} \varphi_{3i} \Delta LCPI_{t-i} + \sum^{n}_{i=1} \varphi_{4i} \Delta LGP_{t-i} + \theta_1 LEX_{t-i} + \theta_2 LY^*_{t-i} + \theta_3 LCPI_{t-i} + \theta_4 LGP_{t-i} + \varepsilon_{1t} \quad \textbf{3.0}$$

$$\Delta LEX\_NE_t = \mu_0 + \sum^{n}_{i=1} \mu_{1i} \Delta LEX\_NE_{t-i} + \sum^{n}_{i=1} \mu_{2i} \Delta LY^*_{t-i} + \sum^{n}_{i=1} \mu_{3i} \Delta LCPI_{t-i} + \sum^{n}_{i=1} \mu_{4i} \Delta LGP_{t-i} + \lambda_1 LEX\_NE_{t-i} + \lambda_2 LY^*_{t-i} + \lambda_3 LCPI_{t-i} + \lambda_4 LGP_{t-i} + \varepsilon_{1t} \quad \textbf{4.0}$$

Where LEX and LEX_NE denote log of Trinidad and Tobago's total and non-energy exports to the US, respectively, LY* denotes the log of US real income, LCPI is the log of relative prices between domestic economy and the US and LGP denote HH natural gas prices. Meanwhile, the Δ operator represents first difference. The parameters φ and μ represent the short-run coefficients, while the θ and λ represent the long-run coefficients of the variables.

Similar to the *a priori* signs for the import demand function, for the export demand function a positive relationship is expected between US income and export demand, and a negative relationship between relative prices and export demand. Econometrically in order for the ML condition to hold, the absolute sum of the relative price coefficients for the combination of import and export demand should exceed one. To ensure the models' stability, tests for heteroskedasticity, serial correlation and CUSUM tests were conducted.

Meanwhile, the J-curve hypothesis focuses on the time pattern for the improvement of the bilateral trade balance arising from a depreciation of the currency. While the sum of the price elasticity coefficients may exceed unity and indicate improvement in the trade balance, the J-curve considers the evolution of the trade balance - an initial deterioration before the improvement occurs. From a policy standpoint, a natural question would be, how many periods would it take for improvement to manifest?

Similar to the ML condition, two estimations of Trinidad and Tobago's trade with the US were estimated using the balances for total bilateral trade and the non-energy trade balance. In order to conduct the investigation, a

logarithmic specification was also used to model the bilateral trade balances (Equation 5.0). Moreover, the estimation of the trade balance model is intended to complement the findings of the ML condition.

$$TB_t = f(LTB_{t-i}, LY_{t-i}, LY^*_{t-i}, LER_{t-i}, LGP_{t-i}) \quad \textbf{5.0}$$

Equation 5.0 indicates that the dependent variable- bilateral trade balances are a function of its own lags and the lags of the independent variables; nominal exchange rate (LER), domestic income (LY), US income (LY*), and natural gas prices (LGP). Of particular note, the trade balances are represented by the ratio of exports to imports as it is invariant to unit measurements, for instance real or nominal, domestic or foreign currency, for exports and imports. The graphical representation provided by the model's impulse response functions will either confirm or reject the J-curve hypothesis.

In order to confirm the J-curve hypothesis for Trinidad and Tobago, with regard to its trade association with its main trading partner the US, the exchange rate must display a negative relationship with the trade balance (deterioration) in the short run and a positive relationship with the trade balance (improvement) in the long run. Here, an increase in the exchange rate is interpreted as a depreciation in the domestic currency. To verify and confirm the stability of the model, residuals tests such as the serial correlation LM test, heteroskedasticity tests and inverse AR Roots tests were conducted.

5.0 Results and Analysis

5.1 Marshall-Lerner Condition

The ARDL model was employed to estimate the short- and long-run relationships of the respective equations. Based on the bounds test of cointegration, the null hypothesis of no cointegration was rejected in favour of the alternative indicating the existence of a cointegrating (long-run) relationship for three of the four models estimated, the exception was the non-energy imports equation which was inconclusive **(Table 1).** The stability and robustness of the models were conducted and satisfied **(Appendix 1).**

Table 1: Bounds Test of Cointegration

		Bounds Critical Value (10%)			
Dependent Variable	**Calculated F Statistic**	**I(0)**	**I(1)**	**ARDL Specification**	**Conclusion**
Total Imports (LM_t)	4.18	3.17	4.14	(4,4,0)	Reject the null hypothesis of no cointegration
Total Exports (LEX_t)	3.32	2.37	3.20	(3,5,7,6)	Reject the null hypothesis of no cointegration
Non-Energy Imports (LM_NE_t)	3.24	3.17	4.14	(4,5,0)	Inconclusive
Non-Energy Exports (LEX_NE_t)	11.26	2.72	3.77	(1,0,0,0)	Reject the null hypothesis of no cointegration

Source: EViews 11

Results from the cointegrating equations revealed negative and significant error correction terms **(Table 2.1 and Table 2.2),** suggesting that the speed of adjustment to restore equilibrium to the model is non-explosive and attainable. Most of the estimated coefficients followed apriori positive relationships for the income variables for the total import and export demand equations over the short and long run, with the exception of the coefficient in the short run for non-energy imports which indicated a negative relationship. Meanwhile, the signs for the relative price coefficients differed to apriori expectations, particularly for the total and non-energy exports. Despite this, focusing on the absolute sum of the price elasticities, results found that for the combination of the total bilateral imports and exports were greater than one, satisfying the ML condition, in both the short run **(Table 2.1 and Table 2.2)** and long run **(Tables 3.1 and Table3.2).** More specifically, in the short run the absolute sum was ***2.45*** (0.25 +2.2) while the absolute sum in the long run was ***1.53*** (0.73 +0.80). In contrast, the absolute sum of the price elasticities for the combination of bilateral non-energy imports and exports was less than one, thereby rejecting the ML condition in the short run with ***0.31*** (0.24 +0.07) **(Table 2.1 and Table 2.2).** Consequently, the results indicated that a depreciation in the domestic currency would improve Trinidad and Tobago's total trade with the US in both the short and long run whereas for the non-energy trade, a depreciation would deteriorate its performance in the short run as a long-run relationship for non-energy exports could not be ascertained.

Table 2.1: Short-Run Results - Import Demand

Dependent Variable ΔLM_t			Dependent Variable ΔLM_NE_t		
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
C	0.0615	0.8818	C	0.1841	0.6812
Δ LY	0.5109	0.1380	Δ LY	-0.3017	0.5456
Δ LCPI*	**-0.2507**	**0.1044***	**Δ LCPI***	**-0.2442**	**0.1513**
ECM_{t-1}	-0.3412	0.0009***	R^2	0.8495	
R^2	0.8632				

Source: EViews 11

*,**,*** denote statistical significance at 10%, 5% and 1% respectively.

Table 2.2: Short-Run Results - Export Demand

Dependent Variable ΔLEX_t			Dependent Variable ΔLEX_NE_t		
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
C	-0.6063	0.9365	C	-5.0568	0.5752
Δ LY*	2.2053	0.3156	Δ LY*	0.8470	0.4997
Δ LCPI	**-2.2343**	**0.3191**	**Δ LCPI**	**0.0709**	**0.9286**
Δ LGP	0.1301	0.4260	Δ LGP	0.4166	0.0375**
ECM_{t-1}	-0.2377	0.0396**	ECM_{t-1}	-0.5570	0.0000***
R^2	0.9258		R^2	0.5237	

Source: EViews 11

*,**,*** denote statistical significance at 10%, 5% and 1% respectively.

Table 3.1: Long-Run Results - Import Demand

Dependent Variable LM_t		
Variable	**Coefficient**	**P-value**
LY	0.6857	0.0318**
LCPI*	**-0.7348**	**0.0446****

Source: EViews 11

*,**,*** denote statistical significance at 10%, 5% and 1% respectively.

Table 3.2: Long-Run Results - Export Demand

Dependent Variable LEX_t			Dependent Variable LEX_NE_t		
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
LY*	0.5999	0.8942	LY*	1.5206	0.4999
LCPI	**0.8042**	**0.7590**	**LCPI**	**0.1272**	**0.9285**
LGP	1.7231	0.0150***	LGP	0.7478	0.0276**

Source: EViews 11

*,**,*** denote statistical significance at 10%, 5% and 1% respectively.

Similar results of the ML condition were also confirmed for Trinidad and Tobago by Boyd and Smith (2003) however it was not supported by Straughn (2003) and Wilson and McLean (2014). It must be noted that these studies did not explicitly test the separate price elasticities of the import and export demand functions but rather inferred the ML condition through the estimations of the long-run exchange rate coefficient from the trade balance equation. Results from the current study, particularly for the non-energy estimation, were similar to Loto's (2011) non-oil analysis for the oil-exporting economy of Nigeria, in which the absolute sum of the individual import and export price elasticities of demand was under unity, concluding in the rejection of the ML condition. In general, the disparity between the results from this study and previous studies on whether or not the ML condition does in fact hold can be attributed to the variables used, time series applied, methodology employed and aggregation bias. Aggregation bias can potentially suppress some of the patterns observed in trade at bilateral levels according to Bahmani-Oskooee, et al. (1999). Moreover, the results of the foregoing rejection of the ML condition for non-energy bilateral trade as opposed to its acceptance for total bilateral trade exposes that a depreciation would not advance a desirable outcome for non-energy trade with the US.

5.2 J-curve Hypothesis

To complement the ML condition, the investigation of the J-curve hypothesis was also applied to two separate estimations: the total bilateral trade balance and non-energy bilateral trade balance. Since Trinidad and Tobago does not influence US income and is a price-taker on the international energy market, real US income and gas prices were treated as exogenous variables to the model. The optimal lag length was informed by the Akaike Information Criterion (AIC) lag length criteria, and six lags were selected for the two models. The next stage was

to determine if there exists a long-run relationship among the variables via the Johansen Cointegration technique. The test revealed that the null hypothesis of no cointegration equation could be rejected at the 5 per cent level indicating the existence of a long-run relationship, as such, an Error Correction Model (ECM) was used to model the J-curve for both equations[15]. The estimations revealed a negative and significant error correction term (ECT) of -0.69 and -0.52 for the total bilateral trade balance and non-energy trade balance, respectively. This suggests a fairly quick convergence of its short-run dynamics to long-run equilibrium, as roughly 69 per cent and 52 per cent of the deviations in the short run are corrected each quarter **(Table 4).** The stability and robustness of the model were confirmed via the heteroskedasticity test and serial correlation LM tests. The null hypotheses of no serial correlation and homoskedasticity could not be rejected at the 5 per cent level[16].

Table 4: Error Correction Model (ECM)

Trade Balance Estimations			
Variable	**Coefficient**	**T-Statistic**	**R^2**
Total Trade Balance	-0.6992	-5.2648*	0.6107
Non-Energy Trade Balance	-0.5196	-4.0759*	0.3978

Source: EViews 11

*Denotes significance at all levels (1%, 5%, 10%).

The directional relationship also provides important information of how changes in the variables impact one another. Results from the Pairwise Granger Causality test **(Appendix 1)** revealed that there is a causal relationship between gas prices and the bilateral trade balance which could be explained by Trinidad and Tobago's high dependence on hydrocarbon exports. US income has a one-way relationship with domestic income. This follows as expansions in the US economy would have positive spillover effects for Trinidad and Tobago through higher remittances, and increased export earnings due to possibly higher external demand for domestically produced goods.

Meanwhile, a unidirectional relationship was established between the exchange rate and domestic income as the exchange rate affects domestic income through changes in the terms of trade and the country's export earnings. The granger causality test also detected that a causal relationship exists between domestic income and gas prices, however Trinidad and Tobago is a price taker on the international commodity market, therefore movements in domestic variables does not exert influence over international prices. Domestic income was also suggested to have a one-way causality with the bilateral trade balance which can be explained by the domestic economy's ability to import. The ordering of the variables was informed by the results of the Granger Causality tests which displayed a similar ordering adopted by Kamugisha and Assoua (2020) for Uganda[17].

[15] Although the non-energy trade balance was deemed to be stationary at levels, the results from an ARDL estimation of the same nature, which indicated that the null hypothesis of no cointegration can be rejected (based on the F statistic), supported the use of the ECM to derive the IRFs for the non-energy trade balance's response to a depreciation in the exchange rate.

[16] The trade balance models were also tested for structural breaks. When a dummy variable, which captured the shift in exchange rate regime from fixed to floating, was tested, it was only significant for the total trade balance equation, whereas for the non-energy trade balance it was insignificant at the 5% level. Consequently, the dummy variable was excluded from the non-energy trade balance equation.

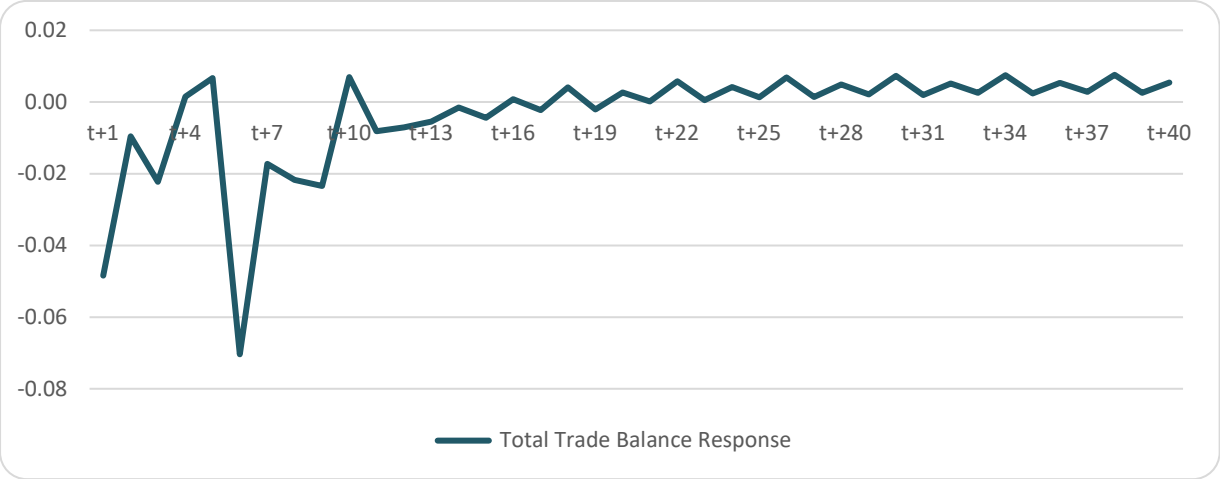
[17] Other studies reviewed utilised Generalised Impulse Response Functions as opposed to the Cholesky ordering of variables.

5.2.1 Impulse Response Functions

The Impulse Response Functions (IRFs) provide the dynamic response of the dependent variable from a one standard deviation shock to each independent variable. It measures the time profile of effects of shocks on future values of the variables (Hussain and Bashir, 2013). From the IRF, the strength, direction and persistence of the trade balance to variations in exchange rate and income can be ascertained. The time horizon chosen for the study is 40 quarters or 10 years and were delineated as the short run (4 quarters or 1 year), medium run (5 to 20 quarters or up to 5 years) and the long run (21 to 40 quarters or up to 10 years). IRFs are the most suitable way to derive evidence of a country's J-curve.

Since the key variable under investigation is the exchange rate, the response of the bilateral total and non-energy trade balances to its shock would be the main focus. Given the minimal changes in the exchange rate for the period under study, a two standard deviation shock was applied to the exchange rate in order to analyse the response of the bilateral trade balances (total and non-energy). Quarterly analysis of the total bilateral trade balance indicated that a positive two standard deviation shock to the exchange rate, which is interpreted as a currency depreciation, results in an immediate deterioration of the trade balance in the first quarter of the short run. The second and third quarters also deteriorated, however less pronounced relative to the first quarter. On average, over the short run, the total bilateral trade balance marginally worsened in comparison to its pre-shock level. However, an improvement emerged in the fifth quarter but was short lived. A somewhat consistent pattern of trade balance improvements from a depreciation only appeared after three years within the time horizon. The improvements trended above pre-shock levels marginally, on average, over the long run **(Figure 9.1).** Although the total bilateral trade balance exhibited improvements in its performance in the long run, as expected by the previously confirmed ML condition, the improvements are very minimal.

Figure 9.1: Total Bilateral Trade Balance Response to a Two Standard Deviation Shock to Exchange Rate

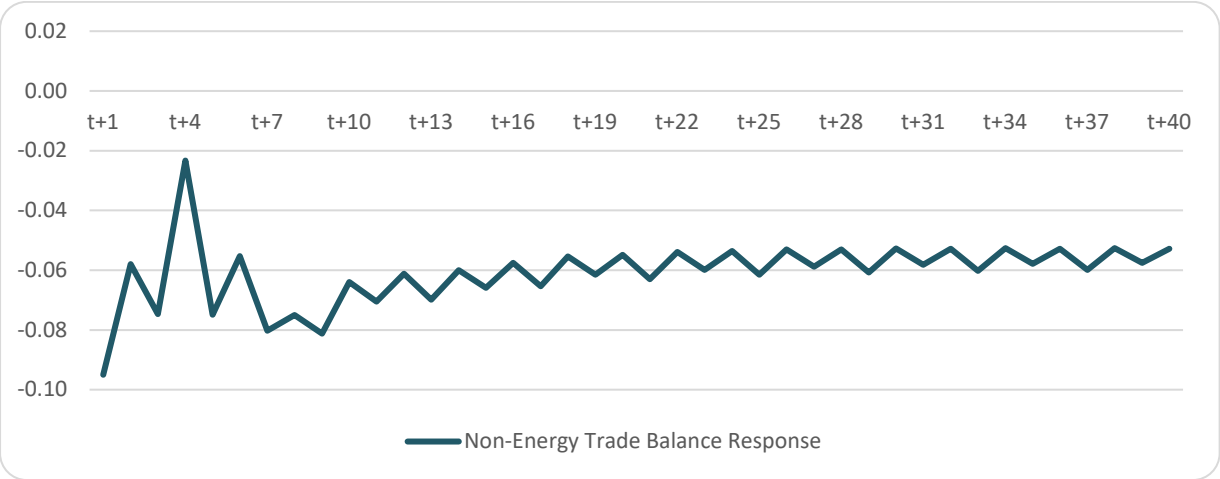


Source: EViews 11

Meanwhile, results differed for the response of the bilateral non-energy trade balance from a two standard deviation shock in the exchange rate. The depreciation in the exchange rate resulted in an immediate deterioration of the non-energy trade balance in the first quarter, which improved in the subsequent quarters, albeit below the pre-shock level. On average, the post-shock non-energy trade balance worsened in the short run, as expected from the results of the rejection of the ML condition in the previous section **(Figure 9.2).** As time progressed, the non-energy trade balance remained below pre-shock levels into the medium and long runs. However, it is expected that the exclusion of capital imports from the non-energy trade balance would improve the response of the non-

energy trade balance, from a depreciation, as Trinidad and Tobago is heavily reliant on capital imports from the US (roughly 39 per cent) for the promotion of economic activity. In addition, given the low degree of domestic substitutability for capital imports, which primarily consists of imports of machinery and equipment for use within the energy sector, this category of imports can be considered relatively inelastic in its demand.

Figure 9.2: Bilateral Non-Energy Trade Balance Response to a Two Standard Deviation Shock to Exchange Rate



Source: EViews 11

The average short run deterioration in Trinidad and Tobago's bilateral trade balances with the US can be attributed to adjustment lags, as explained by Junz and Rhomberg (1973) and Magee (1973). Based on theory, it is expected that a depreciation in the exchange rate should manifest in an improvement in the trade balance as foreign goods become more expensive to domestic consumers thereby lowering imports and vice versa. However, empirical evidence suggests that the response time by producers and consumers are not instantaneous contributing to the deterioration of the trade balance in the short run. For Trinidad and Tobago, consumers would not immediately change their consumption patterns as they may require time to find suitable or possibly cheaper substitutes. At the same time, import substitution may be difficult for businesses, especially when the alternatives are not readily available or produced domestically, particularly capital imports. Consequently, the level of imports remains relatively high. In addition, the quick pass through to domestic prices (Bobb and Sonnylal, 2018) may offset the desired effect of the depreciation due to the narrowing of price differences between Trinidad and Tobago and US goods, making comparable the originally expensive imports and the newly expensive domestically produced goods.

Meanwhile, on the export side, businesses may be locked into contracts in the short run prior to the depreciation, as in the case for energy sector companies. These companies trade mainly through price and volume contracts making export revenues relatively rigid in the short run. This is particularly relevant as the US has accounted for roughly 75 per cent of Trinidad and Tobago's energy exports over the most recent decade. The combination of these factors can explain the deterioration of Trinidad and Tobago's bilateral trade balance in the short run. Particularly, in the case of the bilateral non-energy trade balance, the worsening trade performance relative to total bilateral trade could be attributed to below capacity operations in the non-energy tradable sector which gives rise to the general weak and insignificant response of food and manufacturing exports to changes in price competitiveness in the short run (Bobb et al, 2018). Trinidad and Tobago's low capacity to produce tradable goods, particularly non-energy goods that could be competitive in the international market, severely hinders the ability of

the economy to respond adequately to a currency depreciation. Moreover, Meade (1988)[18] suggested that the quicker import prices respond to changes in the exchange rate and the slower import and export volumes adjust, the larger the initial worsening of the trade balance and the larger will be the delay before a net improvement.

Generally, results from other developing and regional Latin American and Caribbean studies concerning the J-curve effect have been mixed. Thus, it is not surprising that there is an irregular shape of Trinidad and Tobago's trade balance responses to a depreciation of its currency. Although evidence has suggested that depreciation of the exchange rate would lead to an improvement in the TT-US total trade balance, as purported by ML condition, upon further investigation it is observed that this improvement is not substantial in the long run. Furthermore, when energy trade, which accounts for the bulk of exports to the US, is excluded, the fallout from the depreciation in the currency is worsened in both the short and long runs. Thus, it can be concluded that the bilateral total and non-energy trade balances do not ascribe to the J-curve hypothesis as a depreciation in the exchange rate deteriorates the trade balance, on average, in the short run with very minimal improvements in the long run for total trade and below pre-shock performance for non-energy trade over the long run.

5.2.2 Variance Decomposition

The essence of a variance decomposition analysis is its ability to provide information on the proportion of variation of the dependent variable explained by each of the independent variables[19]. The following tables **(Table 5.1 and Table 5.2)** summarise the results of the variance decomposition on the effects of the trade balance and its endogenous variables; exchange rate and domestic income, on the total trade balance and the non-energy trade balance with the US.

It can be observed that for both models, a significant proportion of the variation in the trade balance forecast error can be explained by its own innovations over the short run. In particular, the dependent trade balance variables explained more than 90 per cent of itself, indicating the large dependence on its previous performance. However, its influence wanes over time to roughly 80 per cent and 69 per cent for the total bilateral trade balance and non-energy trade balance respectively. Meanwhile, for total trade with the US, over the short and medium run the exchange rate accounted for the second highest proportion of the variation in the total trade balance followed by the real domestic income. The percentages gradually increased over time reflecting its growing importance to the total trade with the US. Conversely, for bilateral non-energy trade, the exchange rate accounted for less than domestic income in the variation in the trade balance contributing less than 3 per cent and 8 per cent in the short run and medium run. Moreover, in the long run, the exchange rate became the least influential variable for both the total and non-energy trade balances.

Table 5.1: Total Bilateral Trade Balance

Period	Trade Balance	Exchange Rate	Domestic Income
Short Run (< 4 quarters)	90.45	6.55	2.99
Medium Run (5 to 20 quarters)	85.45	8.31	6.23
Long Run (21 to 40 quarters)	79.49	8.15	12.36

Source: EViews 11

[18] Meade, Ellen E. 1988. "Exchange rates, adjustment, and the J-curve." *Federal Reserve Bulletin*, 633-44.
[19] The Variance Decomposition is derived from the ECM estimated with six lags.

Table 5.2: Non-Energy Bilateral Trade Balance

Period	Trade Balance	Exchange Rate	Domestic Income
Short Run (< 4 quarters)	92.76	2.53	4.71
Medium Run (5 to 20 quarters)	80.72	7.16	12.12
Long Run (21 to 40 quarters)	68.47	11.41	20.12

Source: EViews 11

6.0 Conclusion

Since 2015, Trinidad and Tobago has been experiencing a steady decline in the stock of international reserves, compounded with downward pressures on the exchange rate, which have the potential to undermine the current account balance. These circumstances have driven research to investigate whether a depreciation of the domestic currency can represent an effective policy prescription in supporting the external accounts. Theoretical understanding of this relationship is embedded in the ML condition which states that the symptomatic improvement of a country's trade balance due to a depreciation of the currency, depends on the combined responsiveness of the demand for imports and exports. This concept can be additionally analysed through the J-curve hypothesis, which postulates that improvements in the trade balance, in response to a depreciation, may not occur instantaneously but deteriorates before recording an improvement. More specifically, empirical testing of these concepts was narrowed to the domestic economy's main bilateral trading partner- the US. Furthermore, focus was placed on examining two combinations of the bilateral trade balance: total imports and exports, and non-energy imports and exports.

In the case of Trinidad and Tobago, estimation of price elasticities of the two individual import and export demand functions via the Auto-regressive Distributed Lag (ARDL) methodology indicated that the ML condition is satisfied for the bilateral total trade as the absolute sum of the price elasticities exceeded unity at 2.45 in short run and 1.53 in the long run. In contrast, for the non-energy bilateral trade combination, the ML condition was rejected as the absolute sum did not exceed unity with 0.31 in the short run. The long-run relationship was inconclusive for the non-energy imports. In terms of the J-curve hypothesis, results for the total and non-energy trade balances corroborated the findings of ML condition as expected. For total bilateral trade, there was an, on average deterioration in the trade balance, due to a depreciation of the currency, followed by improvements in the trade balance which appeared after three years into the time horizon. However, the long-run improvement is minimal and tempered over time, indicating that the J-curve phenomenon does not exist for Trinidad and Tobago. Therefore, it can be concluded that a deprecation in the exchange rate would not have the desired impact on the total bilateral trade balance in the long run.

Meanwhile, the bilateral non-energy trade balance also deteriorated on average in the short run upon depreciation of the currency. However, although the non-energy trade balances improved, when compared to the initial depreciation, it remained below pre-shock level over the medium to long run. It is expected that an exclusion of capital imports would result in a quicker convergence path to the pre-shock level when compared to the non-energy trade balance over the same period as capital imports are largely linked to the energy sector and contribute to a significant portion of the non-energy trade balance. Moreover, it was concluded that the J-curve phenomenon does not exist for Trinidad and Tobago, and a depreciation in the exchange rate would not result in the desired impact

on the bilateral non-energy trade balance. The insight provided by the findings of the J-curve hypothesis in particular, suggests that leveraging the exchange rate will not result in trade balance improvements.

Notably, this paper is timely in execution as it provides evidence on a popular area of dialogue relating to the impact of an exchange rate depreciation in Trinidad and Tobago's domestic currency on the trade balance. Within the public domain, questions have been posed by the business community and financial institutions as to whether a depreciation of the exchange rate can in fact regulate import consumption and by extension, stymie the downward trend in the stock of foreign exchange reserves. Notwithstanding this discourse, results from the research undertaken provide an initial answer which indicates that a depreciation in the exchange rate may not have the desired long-term impact of improvements in Trinidad and Tobago's trade balance with the US.

References

Bahmani-Oskooee, Mohsen. 1985. "Devaluation and the J-curve: Some Evidence from LDCs." *The Review of Economics and Statistics* 67 (3): 500-504.https://www.jstor.org/stable/1925980.

Bahmani-Oskooee, Mohsen, and Taggert Brooks. 1999. "Bilateral J-curve between US and her trading partners." *Weltwirtschaftliches Archiv* 135 (1): 156-165. https://link.springer.com/article/10.1007/BF02708163.

Bahmani-Oskooee, Mohsen, and Artatrana Ratha. 2004. "Dynamics of US Trade with Developing Countries." *Journal of Developing Areas* 37 (2), 1-11. https://doi:10.1353/jda.2004.0020.

Bahmani-Oskooee, Mohsen, and Artatrana Ratha. 2004. "The J-curve: A Literature Review." *Applied Economics* 36 (13): 1377-1398. https://doi/abs/10.1080/0003684042000201794.

Bahmani-Oskooe, Mohsen, Ali M. Kutan, and Artatrana Ratha. 2008. "The S-curve in Emerging Markets." *Comparative Economic Studies* 50 (2): 341-351. https://www.researchgate.net/publication/5219078_The_S-Curve_in_Emerging_Markets.

Bobb, Ashley, and Lauren Sonnylal. 2018. *Assessing the Exchange Rate Pass-Through: The Case of Trinidad and Tobago*. Working Paper Series 01/2018. Central Bank of Trinidad and Tobago.

Bobb, Ashley, Lauren Sonnylal, and Kester Thompson. 2018. *Assessing the Export Price Competitiveness of Trinidad and Tobago*. [Unpublished]. Central Bank of Trinidad and Tobago.

Boyd, Derick, Guglielmo Maria Caporale, and Ronald Smith. 2001. "Real Exchange Rate Effects on the Balance of Trade: Cointegration and the Marshal-Lerner Condition." *International Journal of Finance and Economics* 6 (3): 187-200. https://doi.org/10.1002/ijfe.157.

Boyd, Derick, and Ron Smith. 2003. *Balance of Payments Adjustments in the Caribbean*. Paper prepared for 5th Annual SALISES Conference. University of the West Indies, St. Augustine Campus.

Danmola, Rasaq Akonji, Abba Mohammed Wakili, and OLadipo Kolapo Sakiru. 2013. "Dynamics of the Trade Balance: An Empirical Investigation of Nigerian J-curve Hypothesis." *IOSR Journal of Humanities and Social Science* 7 (4): 51-57. https://www.academia.edu/4254206/Dynamics_of_the_Trade_Balance_An_empirical_investigation_of_Nigerian_J_Curve_Hypothesis.

Hsing, Yu. 2008. "A Study of the J-curve for Seven Selected Latin American Countries." *Global Economy Journal* 8 (4): 1-14. https://www.researchgate.net/publication/46555044_A_Study_of_the_J-Curve_for_Seven_Selected_Latin_American_Countries.

Hussain, Muntazir, and Usman Bashir. 2013. "Dynamics of Trade Balance and the J-curve Phenomenon: Evidence from Pakistan." *The Journal of Commerce* 5 (2): 16-31. https://www.researchgate.net/publication/331833015_Dynamics_of_Trade_Balance_and_the_J-Curve_Phenomenon_Evidence_from_Pakistan.

International Monetary Fund. 2006. *Exchange Rates and Trade Balance Adjustment in Emerging Market Economies.* Accessed 2021. https://www.imf.org/external/np/pp/eng/2006/101006.pdf.

International Monetary Fund. 2018. *Trinidad and Tobago Selected Issues*. IMF Country Report No. 18/286. Accessed 2021.

Junz, Helen B., and Rudolf R. Rhomberg. 1973. "Price Competitiveness in Export Trade Among Industrial Countries." *American Economic Review* 63 (2): 412-418. https://www.jstor.org/stable/1817104.

Kamugisha, Godwin, and Joe Eyong Assoua. 2020. "Effects of a Devaluation on Trade Balance in Uganda: An ARDL Cointegration Approach." *International Journal of Economics and Finance* 12 (7): 42-53.

Lerner, Abba P. 1952. "Factor Prices and International Trade." *Economica* 19 (73): 1-15. https://www.jstor.org/stable/2549912.

Loto, M. A. 2011. "Does devaluation improve the trade balance of Nigeria (A test of the Marshall-Lerner condition)." *Journal of Economics and International FInance* 3 (11): 624-633. https://academicjournals.org/journal/JEIF/article-full-text-pdf/4BEFF5B5788.

Magee, Stephen P. 1973. "Currency Contracts, Pass-Through, and Devaluation." *Brookings Papers on Economic Activity* 4 (1): 303-325. https://www.brookings.edu/wp-content/uploads/1973/01/1973a_bpea_magee.pdf.

Marshall, Alfred. 1890. *Principles of Economics: An Introductory Volume*. Macmillian and Co., Ltd. London. http://www.library.fa.ru/files/marshall-principles.pdf.

Meade, Ellen E. 1988. "Exchange rates, adjustment, and the J-curve." *Federal Reserve Bulletin*. 633-44. https://fraser.stlouisfed.org/files/docs/publications/FRB/pages/1985-1989/32427_1985-1989.pdf.

Ministry of Trade and Industry. 2021. "Government Committed to Resurgence in Manufacturing." https://tradeind.gov.tt/government-committed-to-resurgence-in-manufacturing/

Narayan, Paresh Kumar, and Seema Narayan. 2004. "The J-curve: Evidence from Fiji." *International Review of Applied Economics* 18 (3): 369-380. https://doi.org/10.1080/0269217042000227088.

Pandey, Ritesh. 2013. "Trade Elasticities and the Marshal Lerner Condition for India." *Global Journal of Management and Business Studies* 3 (4): 423-428. https://www.ripublication.com/gjmbs_spl/gjmbsv3n4_13.pdf.

Pilbeam, Keith. 2013. *International Finance*. Red Globe Press. Fourth Edition.

Rawlins, Glenville. 2009. "Using Currency Devaluations as a Tool to Improve the Trade Balance: The Experience of Central America and the Caribbean." *Journal of Applied Business and Economics* 10 (4).

Rincon, Hernan C. 1999. "Testing the Short-and –Long run exchange rate effects on the Trade Balance: The Case of Colombia." *Banco de la República, Subgerencia de Estudios Económicos*. https://pdfs.semanticscholar.org/bcfb/ec397aec0e0c0c5b86fa25f720277e6a1b9b.pdf.

Straughn, Ryan. 2003. *Estimating Long Run Relationships between Trade Balance and the Terms of Trade in Selected CARICOM Countries*. Central Bank of Barbados. Working Paper. http://www.centralbank.org.bb/news/article/6606/estimating-long-run-relationships-between-the-trade-balance-and-the-terms-of-tr.

Wilson, Shelly-Ann, and Esmond Mclean. 2014. *Understanding the impact of exchange rate adjustment on the Trade balance of selected Caribbean Countries.* Bank of Jamaica. Working Paper. https://boj.org.jm/uploads/pdf/papers_pamphlets/papers_pamphlets_Understanding_the_impact_of_exchange_rate_adjustment_on_the_Trade_balance_of_selected_Caribbean_Countries.pdf

Appendix 1: Diagnostic and Stability Tests for ML condition and J-curve Hypothesis

Appendix 1.1 Unit Root Tests: To determine the variable's order of stationarity (at 5 per cent level)

	Augmented Dickey Fuller			Phillips-Perron		
Variable	**Stationary**	**Non-Stationary**	**Order of Integration**	**Stationary**	**Non-Stationary**	**Order of Integration**
LEX		✓	1(1)		✓	1(1)
LEX_NE	✓		1(0)	✓		1(0)
LM		✓	1(1)		✓	1(1)
LM_NE		✓	1(1)	✓		1(0)
LTB		✓	1(1)	✓		1(0)
LTB_NE	✓		1(0)	✓		1(0)
LY		✓	1(1)		✓	1(1)
LY*		✓	1(1)		✓	1(1)
LCPI		✓	1(1)		✓	1(1)
LCPI*		✓	1(1)		✓	1(1)
LER	✓		1(0)		✓	1(1)
LGP		✓	1(1)		✓	1(1)

Source: EViews 11

Appendix 1.2: Stability Tests for ML Condition: TT-US Bilateral Trade

	Import Demand Functions		Export Demand Functions	
Stability Tests	**Total Imports**	**Non-Energy Imports**	**Total Exports**	**Non-Energy Exports**
Integration of Residuals	I(0)	I(0)	I(0)	I(0)
Serial Correlation ML Test Null hypothesis : No serial correlation	0.3897	0.8699	0.9707	0.8622
Heteroskedasticity Test Null Hypothesis : Homoskedasticity	0.7023	0.6511	0.9659	0.5353
CUSUM test at 5 per cent level	✓	✓	✓	✓

Source: EViews 11
*If p<0.05, reject the null hypothesis.

Appendix 1.3: Stability Tests: Bilateral Trade Balance Equations

Test Conducted	Total Trade Balance	Non-Energy Trade Balance
	P-value	P-value
Serial Correlation LM Test Null Hypothesis - no serial correlation at lag 6	0.6727	0.2268
Heteroskedasticity Test Null Hypothesis - Error variances are equal	0.0842	0.0723

Source: EViews 11
*If p<0.05, reject the null hypothesis.

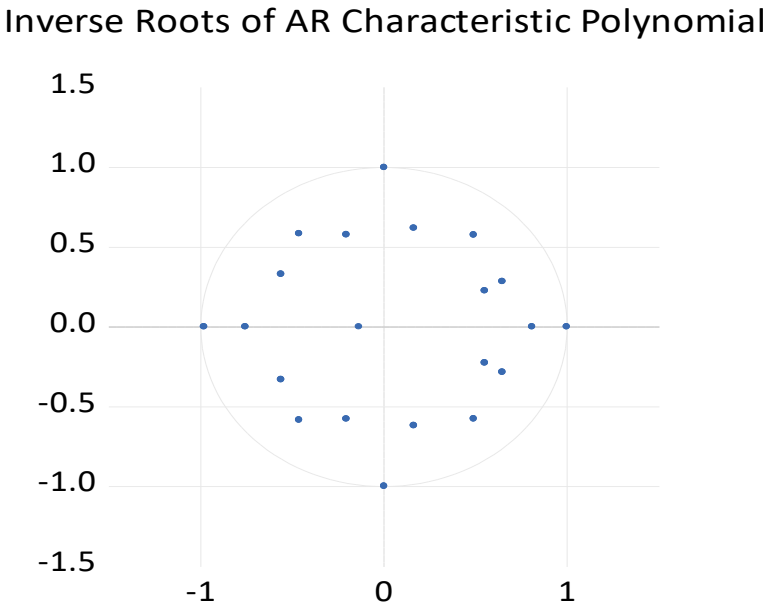
Appendix 1.4: Pairwise Granger Causality

Null Hypothesis	P-value	Decision (Accept/Reject)
LY does not Granger Cause LTB	**0.0163***	**Reject**
LTB does not Granger Cause LY	0.9671	Accept
LY* does not Granger Cause LTB	0.8833	Accept
LTB does not Granger Cause LY*	0.6589	Accept
LGP does not Granger Cause LTB	**0.0000***	**Reject**
LTB does not Granger Cause LGP	**0.0025***	**Reject**
LER does not Granger Cause LTB	0.1320	Accept
LTB does not Granger Cause LER	0.9813	Accept
LY* does not Granger Cause LY	**0.0511***	**Reject**
LY does not Granger Cause LY*	0.7307	Accept
LGP does not Granger Cause LY	0.1397	Accept
LY does not Granger Cause LGP	**0.0164***	**Reject**
LER does not Granger Cause LY	**0.0000***	**Reject**
LY does not Granger Cause LER	0.5213	Accept
LTB_ NE does not Granger Cause LY	0.9644	Accept
LY does not Granger Cause LTB_NE	0.8639	Accept
LGP does not Granger Cause LY*	0.4339	Accept
LY* does not Granger Cause LGP	0.5334	Accept
LER does not Granger Cause LY*	0.8930	Accept
LY* does not Granger Cause LER	0.5576	Accept
LTB_NE does not Granger Cause LY*	0.9968	Accept
LY* does not Granger Cause LTB_NE	0.7337	Accept
LER does not Granger Cause LGP	0.8543	Accept
LGP does not Granger Cause LER	0.1405	Accept
LTB_ NE does not Granger Cause LGP	0.5368	Accept
LGP does not Granger Cause LTB_NE	0.1378	Accept
LTB_NE does not Granger Cause LER	0.9910	Accept
LER does not Granger Cause LTB_NE	0.9761	Accept

Source: EViews 11
*If p<0.05, reject the null hypothesis

Appendix 1.5: Inverse AR Roots

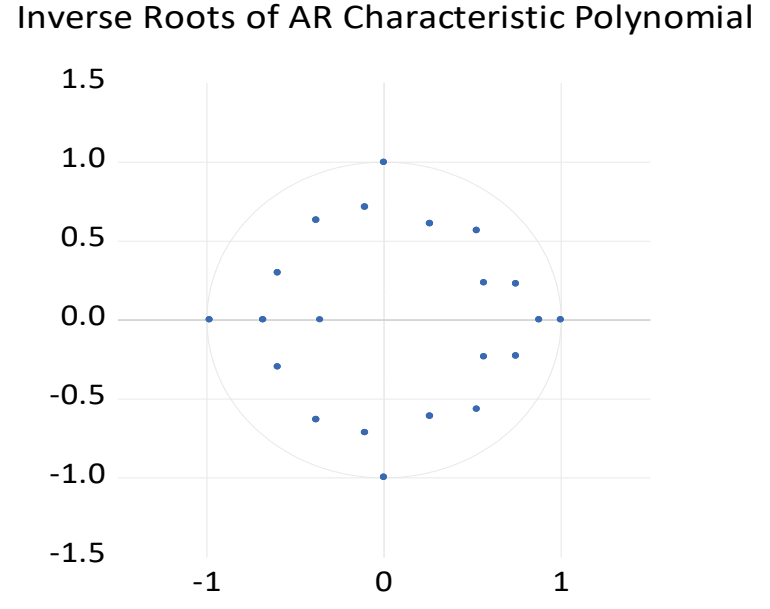
The ECM estimated for Total Bilateral Trade Balance is stable (stationary) if all roots have modulus less than one and lie inside the unit circle.



Source: EViews 11

Appendix 1.6: Inverse AR Roots

The ECM estimated for Bilateral Non-Energy Trade Balance is stable (stationary) if all roots have modulus less than one and lie inside the unit circle.



Source: EViews 11