ESSAYS ON THE IMPACT OF EXPORT EARNINGS INSTABILITY ON GROWTH, INVESTMENT, THE BALANCE OF PAYMENTS AND EXTERNAL DEBT IN THE CARIBBEAN

By

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ABSTRACT

This thesis contains four essays that investigate export earnings instability in the Caribbean. The investigation of this topic begins by exploring the causes of export earnings instability and extends to the impact this has on key macroeconomic variables in the economies of Caribbean countries, namely growth; investment; the balance of payments, and external debt.

The first essay focuses on calculating the level of export earnings instability, exploring which group of exports contribute most to the level of instability and investigating the causes of export earnings instability for 15 Caribbean countries. The main findings of the study indicate that export earnings instability in the Caribbean is relatively stable when compared to other small island developing countries. In addition, the analysis produces results that are consistent with the literature on the causes of export earnings instability in developing countries. Specifically, the results show that the share of raw material exports in total exports and commodity concentration are the main causes of export earnings instability in the region.

The second essay examines whether in addition to the conventional determinants of economic growth, export earnings instability affects economic growth in the region. The findings of the essay show that while investment and export growth are positive contributors to economic growth, export earnings instability reduces economic growth in the region. The study estimates that a one standard deviation increase in export earnings instability reduces economic growth by an average of 0.035 percentage points. This result underlines the importance of addressing export earnings instability in the Caribbean in order to foster economic growth and development.

The third essay studies the determinants of private investment in the region and tries to ascertain whether export earnings instability makes a difference to the behaviour of private investment in the Caribbean. The findings in this essay show that the level of investment in the Caribbean is driven by real GDP growth and the availability of credit (credit to the private sector). In addition, contrary to the relationship outlined in the theoretical literature, the real interest rate is insignificant. Export earnings instability does not seem to have a statistically significant effect on private investment at the regional level.

The fourth essay uses conventional export and import demand functions to ascertain the drivers of the balance of payments and the effect of export earnings instability on the balance of payments. In addition, the essay tries to assess the determinants of external debt and the influence of export earnings instability on the level of external debt. The main findings are: (i) the current account and trade balance are negatively related to domestic income growth and positively related to world income growth, as theory predicts; (ii) the real exchange rate has a positive and significant effect on the current account balance but no statistically significant effect on the trade balance; (iii) the current account has a negative effect on external debt, while the debt service ratio has a positive relationship effect on external debt; and (iv) export earnings instability does not seem to have a statistically significant effect on the balance of payments or external debt in the Caribbean.

DECLARATION

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Finally, I would like to dedicate this thesis to my parents who have always valued education and who have gone above and beyond in assisting me to get this far in my academic pursuits.

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CHAPTER 1: INTRODUCTION

Considerable research has been devoted to the topic of export earnings instability. In fact, studies of export earnings instability dominated the trade and development literature from the 1930s to 1970s. However, despite the plethora of studies that exist, there is a gap in the literature on the causes and effects of export earnings instability in the Caribbean. In addition, previous studies that examine the causes and effects of export earnings instability focus on the instability in merchandise exports. However, Caribbean countries also rely heavily on the export of services. This study therefore aims to fill this gap by exploring instability in the earnings of exports of goods *and* services in the Caribbean. The main objective is to ascertain the causes of export earnings instability and to study its effects on economic growth, investment, the balance of payments and external debt.

Like many developing countries, especially small open economies, Caribbean countries depend on foreign exchange from export earnings to import capital goods, equipment and other inputs that it does not produce domestically. The dependence of Caribbean countries on the earnings from exports for the acquisition of capital goods used in domestic industries implies that the performance of their economies, to a large extent depends on the performance of the export sector. In fact, for the period we are investigating, that is, from 1980 to 2013, export of goods *and* services constitute approximately 30 percent of GDP in the region.

In addition, it is a commonly held view that export earnings of developing countries fluctuate widely, which adds to the complexities of economic planning. However, studies on the macroeconomic effects of export earnings instability are generally inconclusive. The literature shows contradictory results depending on the region and the time periods studied. This has highlighted the limitations of the reliance on generalized results for policy formulation purposes at the regional and individual-country level.

Given the role of exports in the Caribbean, and the inconclusive findings from previous studies, there is increasing interest in elucidating more comprehensively the behaviour of export earnings instability in the region. This thesis therefore seeks to contribute to our understanding of the causes, and macroeconomic effects, of export earnings instability in the Caribbean. The

nature of the thesis is empirical. Empirical models and data are used to explore each question that has been raised regarding export earnings instability. The relationships are investigated at the regional as well as the country level. In addition, to investigating the impact of export earnings instability on economic growth, investment, the balance of payments and external debt; the thesis also aims to ascertain the determinants of each of these economic indicators, given their importance in maintaining macroeconomic stability and achieving economic development. The information gained from this thesis may provide new insights that can inform new dialogue and improve policy design for the countries of the Caribbean.

The first essay contributes to the literature by examining the causes of export earnings instability in 15 Caribbean countries[1]. In this essay we calculate the level of instability in export of goods *and* services for each country; decompose the contribution of each component of export of goods *and* services to total export earnings instability; decompose the contribution of price and quantity to the level of instability in merchandise exports; and assess the causes of instability using panel data analysis. Establishing the factors that drive export earnings instability in the Caribbean is important because it is generally taken for granted that the factors that cause export earnings instability are the same across developing countries. As a result, proposals for stabilization policies in the Caribbean are typically based on results from studies on a sample of other developing countries.

The conventional arguments on the causes of export earnings instability propose that concentration (geographic and commodity) are the main causes of export earnings instability. Thus, the more highly concentrated a country's exports, the lower is the probability that fluctuations in one direction, in some of its exports, will be offset by counter fluctuations or stability in others. However, this generalization may not be true and as such will have implications for policy recommendations and implementation in the Caribbean. Based on these criticisms and shortcomings of previous studies, this essay examines the causes of instability in export of goods *and* services for the Caribbean.

[1] Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname and Trinidad and Tobago

In the first essay the results indicate that in the Caribbean export earnings is relatively stable over the period 1980 to 2013, especially when compared to other small island developing states. This stability in total export of goods *and* services is due to the stability in export of services which is found to be more stable that merchandise exports. In addition, the results show that instability in merchandise exports is due to the instability in the price of exports from the region. The findings on the causes of export earnings instability in the Caribbean are in-line with the theoretically predictions and the findings for other developing countries; where it is found that the share of raw material exports in total exports and commodity concentration are the main drivers of export earnings instability.

The second essay explores the effect of export earnings instability on economic growth. The aim of this chapter is to examine the determinants of economic growth and to determine whether export earnings instability hampers economic growth in the region. For the last 50 years both cross-country research and country case studies have shown that economic growth is the most effective way to reduce poverty and improve the quality of life in developing countries. Winters et al. (2004) finds that economic growth 'creates the resources to raise incomes, and provide the scope for stronger redistributive measures'. In addition, the literature shows that exports are an important engine for economic growth and for many developing countries including the Caribbean that have a low domestic demand for their output, export earnings is the main source of their economic growth. In this regard, fluctuations in export earnings may generate major disturbances in the domestic economy of these countries and is often considered as a major source of macroeconomic instability that is welfare costly. Given the perceived importance of exports for economic growth in the Caribbean, ascertaining the effect of export earnings instability on economic growth is crucial to understanding the impediments to economic growth and development and aids in addressing the difficulties of economic planning.

In line with theoretical predictions and other empirical findings for the Caribbean, the results of the second essay show that economic growth in the Caribbean is driven by investment and export growth. In addition, the results indicate that export earnings instability has a negative and significant effect on economic growth, thereby implying that instability in export earnings hampers economic growth in the region. This result indicates the need for policy to address instability in export earnings.

The third essay empirically investigates the performance of private investment in the region and examines whether investment performance has been affected by export earnings instability from 1980 to 2013. Development economists have recognized the importance of private investment for successful economic growth in the Caribbean. Worrell (1993) in his review of the investment literature in the Caribbean noted the connection between investment and economic growth when he remarked that "a critical factor in the disappointing economic performance of Caribbean countries in the 1980's has been the failure to invest sufficiently in new activities so as to adjust to changing economic circumstances" [Worrell (1993) p. 243]. In addition, our finding in the first essay demonstrates the role of investment in economic growth in the region. Thus, understanding the determinants of private investment is crucial to improving economic growth and fostering development. With regards to the influence of export earnings instability on private investment, the empirical literature is sparse. However, since many Caribbean countries use a substantial part of their export earnings to import capital goods, instability in export earnings makes it difficult to facilitate the import of capital goods and therefore inhibits expansion of the export industry, which might also affect the level of private investment.

In order to assess fully the determinants of private investment and the effect of export earnings instability we specify an econometric model that includes the factors that are likely to influence the level of private investment and augment this model with export earnings instability. The empirical results reveal that private investment in the Caribbean is determined by real GDP growth and credit to the private sector. The finding that real GDP growth is a determinant of private investment in the Caribbean is in line with the accelerator and flexible accelerator theories of Clark (1917), Samuelson (1939), Chenery (1952) and Koyck (1954) which outlines the positive influence of output changes on investment. Similarly, credit to the private sector has a positive relationship with private investment. This is primarily because in countries such as the Caribbean that are heavily dependent on imported machinery and equipment, and where advance import deposits are requested, credit availability will facilitate imports and exercise a positive impact on private investment. However, the results indicate that export earnings instability does not have a statistically significant effect on private investment in the Caribbean. Therefore, the performance of private investment is not altered by instability in export earnings.

The final essay of the thesis investigates the relationship between export earnings instability and the balance of payments (trade and current account balances) and external debt. The objective of this essay is to ascertain the main determinants of the balance of payments and external debt in the Caribbean as well as to explore the effects of export earnings instability on the balance of payments and external debt. Instability will affect the balance of payments negatively if instability is stronger on the downswing than the upswing. The essay uses conventional export and import demand functions that include real GDP growth, world income growth and the real exchange rate to ascertain the drivers of the balance of payments and adds export earnings instability to establish whether this variable contributes to imbalances in the balance of payments of countries in the Caribbean. A review of the literature did not reveal any precedent for investigating the relationship between export earnings instability and the balance of payments. However, this relationship is important because fluctuations in export earnings have implications for the ability of countries to maintain balance of payments equilibrium.

For external debt we develop a model of external debt that includes factors from the theoretical and empirical literatures that are identified as determinants of external debt. This relationship is important because instability in export earnings makes it difficult for countries to fund imports of essential goods and thus they borrow externally to pay these import bills. With regards to the relationship between export earnings instability and external debt, the author came across two studies that spoke about the effect in developing and developed countries. However, export earnings instability was not the primary interest in these studies. Thus, this thesis is the first to explore the relationship between export earnings instability and the balance of payments and external debt.

The results of this essay show that the current account balance and the trade balance are negatively related to real domestic GDP growth and positively related to world income growth. In addition, the results show a statistically significant positive relationship between the real exchange rate and the current account balance; but there is no statistically significant relationship between the real exchange rate and the trade balance. Thus the Marshall-Lerner condition holds for the current account balance but not for the trade balance. As it relates to the determinants of external debt in the Caribbean, the results indicate that there is a negative relationship between external debt and the current account and a positive relationship between external debt and the debt service to export ratio. Export earnings instability does not seem to

have a statistically significant effect on either the balance of payments or external debt. This suggests that export earnings instability is symmetrical around its trend.

CHAPTER 2: CAUSES OF EXPORT EARNINGS INSTABILITY IN THE CARIBBEAN

2.1 Introduction

Like most developing countries, exports from the Caribbean are concentrated on a few commodities and services. This increases their vulnerability to adverse fluctuations and constrains their export earnings potential. In addition, the reliance on a few products is often cited in the literature as one of the main causes of export earnings instability in developing countries. In fact, policies promoted by the International Monetary Fund (IMF), the World Bank and other development institutions often encourage diversification into manufacturing and other non-agricultural goods with supposedly more stable demand conditions. These policy recommendations emphasize diversification as a means of promoting stability.

Despite the popularity of policies aimed at diversification. The view that less concentration in exports will lead to more stable export earnings has often been challenged in the empirical literature. This is due to a lack of empirical findings supporting the argument that commodity concentration is a major source of export earnings instability in developing countries. As a result, the issue 'what causes export earnings instability' has been at the centre of the debate on export earnings instability for many years. This issue has remained an important one in the economic literature because understanding the factors that drive export earnings instability is important to aid economic planners in designing appropriate policies.

Thus, this chapter contributes to the literature by examining the causes of export earnings instability for the Caribbean. Previous studies that examine export earnings instability focuses on the instability in merchandise exports. However, Caribbean countries also rely heavily on the export of services. As a result, the focus of this study will be the instability in exports of goods *and* services. Instability in the exports of goods *and* services will be examined for 15 Caribbean countries, these include Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname and Trinidad and Tobago.

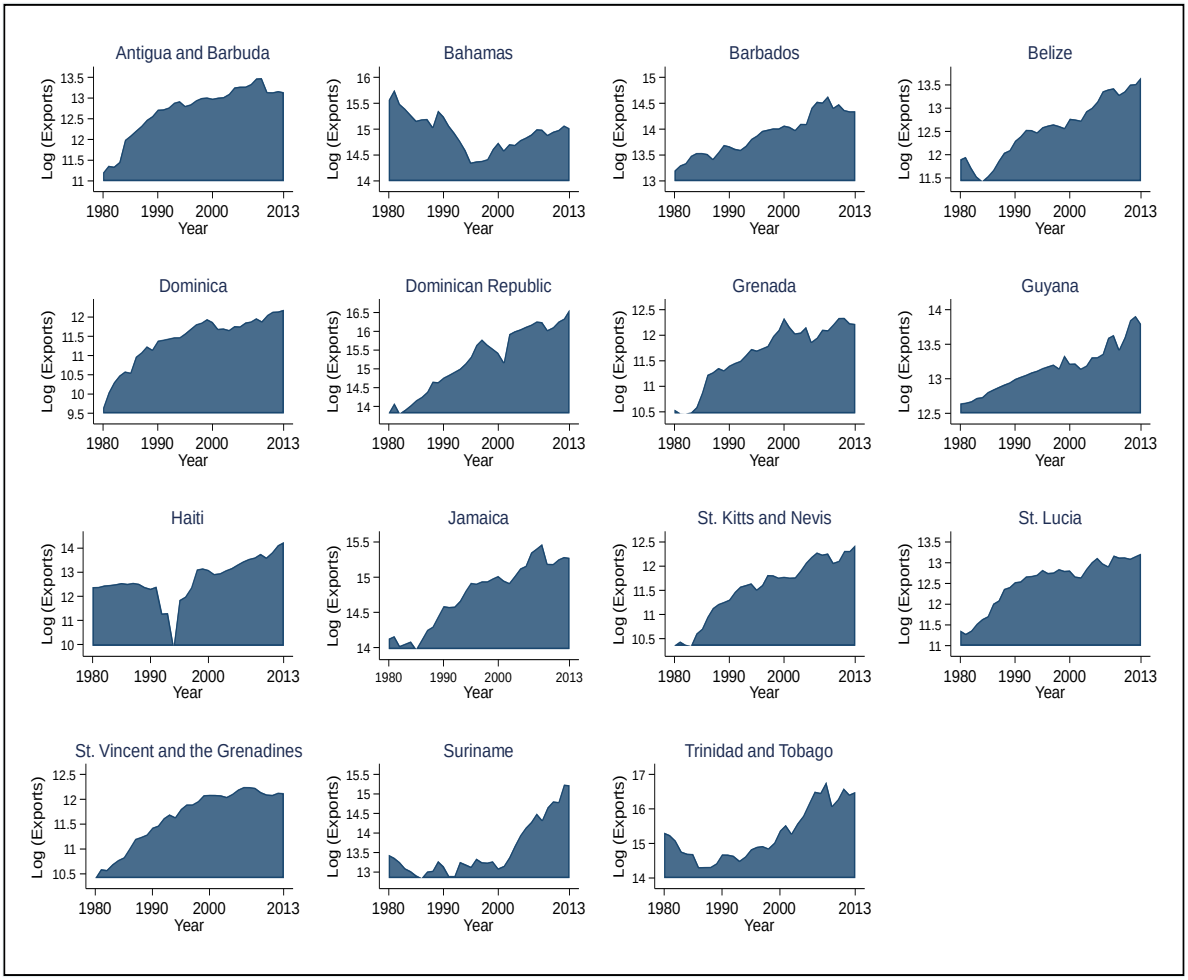
This chapter uses two methodologies to examine the causes of export earnings instability. The first methodology is the portfolio variance decomposition analysis which finds that raw material export is the most unstable category of export from the Caribbean. In addition, it shows that in the countries that have a high level of instability, raw material and manufacture exports are the main source of export earnings instability. In the countries where food exports and travel receipts are found to account for most of the instability, the level of instability is usually low. The second methodology is panel data analysis, this analysis confirms that the share of raw material exports in total exports is indeed a source of instability in the region. In addition, panel data analysis shows that commodity concentration leads to greater instability. The rest of the chapter is organized as follows: The next section looks at trends in exports of goods *and* services from the Caribbean. Section 2.3 contains a sketch of the theoretical literature, which is followed by an empirical review in Section 2.4. Section 2.5 describes the methodological approach; Section 2.6 discusses the estimation procedures and results; and Section 2.7 presents some concluding remarks.

2.2 Stylized Facts of Exports of Goods *and* Services

2.2.1 Evolution of Exports of Goods *and* Services

Figure 2.1 depicts the evolution of exports of goods *and* services for the sample of 15 Caribbean countries. The graphs show that earnings from exports of goods *and* services have exhibited increasing trends over the past three decades for all the Caribbean countries except the Bahamas. In the Bahamas there is a significant downward trend in exports from 1980 to 1995 and an increasing trend from 1996 to 2013. The decline in exports in the Bahamas for the period 1980 to 1995 reflects a decline in raw material exports during that period. In addition to the increasing trends observed in most of the Caribbean countries, there are noticeable swings in the data in some of these countries. In Grenada, Jamaica, Suriname and Trinidad and Tobago, there are significant fluctuations in exports of goods *and* services compared to the other Caribbean countries. Slight fluctuations are observed in the Belize, Barbados and Guyana; while in Antigua and Barbuda, Dominica, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines, earnings from exports of goods *and* services show relative stability over the three decades examined.

Figure 2.1: Exports of Goods and Services in the Caribbean



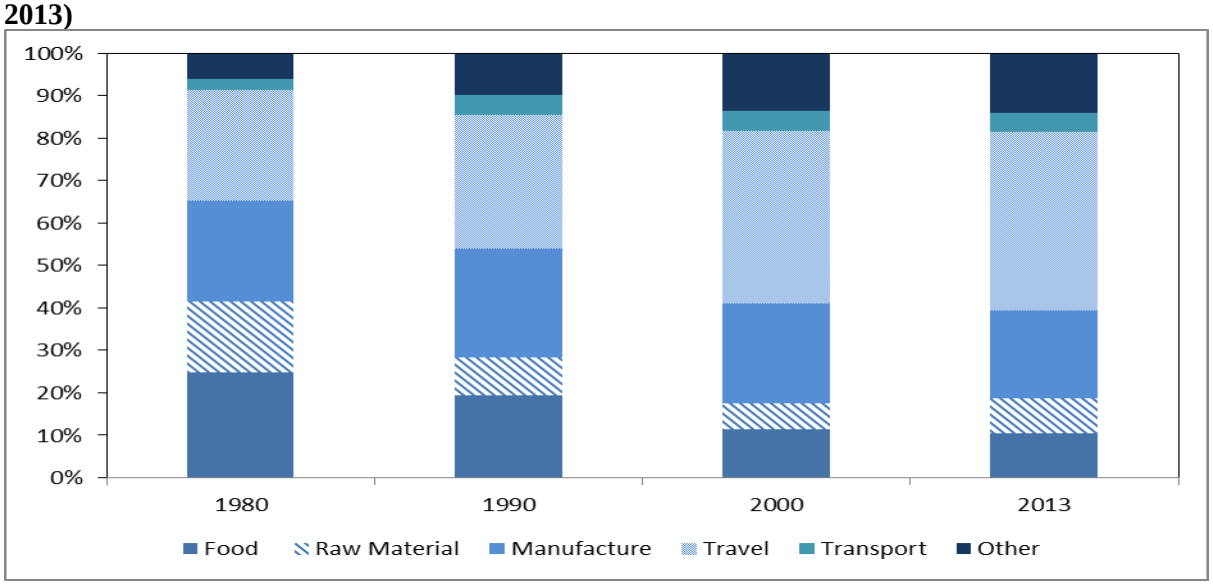
Source: UN Comtrade

2.2.2 Composition of Exports of Goods *and* Services

In the 1980s exports in the Caribbean consisted mainly of merchandise exports. Merchandise exports accounted for 65 percent of exports of goods *and* services, while services exports accounted for 35 percent (see Figure 2.2). However, the share of merchandise exports in total exports of goods *and* services declined between 1980 and 2013. In fact, by 2013 merchandise exports represented 37 percent of exports of goods *and* services from the region. However, this statement does not apply to all countries in the region, for some countries merchandise exports remain their major source of export earnings. For example, in the Dominican Republic, Guyana, Haiti, Suriname and Trinidad and Tobago, merchandise exports remain their dominant export.

Merchandise exports from the region in 1980 consisted mainly of food and manufacture exports. Food exports represented 25 percent of total exports of goods *and* services and manufacture exports accounted for 23 percent of total exports of goods *and* services. Since 1980, the share of food in exports has been declining, reflecting a decline in the agricultural sector due primarily to preference erosion. Exporters of agricultural products (sugar and banana) have relied heavily on preferential access to the markets of the European Union and the United States of America for these products. Under preferential access, Caribbean sugar and banana producers received approximately two to three times world market prices for quota exports. As preferences have eroded, earnings from these traditionally and preferentially accessible goods have also eroded. Notwithstanding, agriculture remains an important share of exports in a few countries, including Belize, Dominica, Grenada, Guyana and St. Vincent and the Grenadines. Although the share of manufacture exports in total exports of goods *and* services has declined overtime, manufacture exports remain a significant share of exports from the region. Manufacture exports consist mainly of light manufacturing industries such as garments, and small metal and wood manufacturing, all of which are highly labour intensive.

Figure 2.2: Composition of Exports of Goods *and* Services in the Caribbean (average for 1980 - 2013)



Source: UNCTAD

By 2013 exports from the Caribbean consisted mainly of services. Services export was only 35 percent of total export of goods *and* services in 1980 but by 2013 it was 63 percent of total exports. Services export in the Caribbean is concentrated in travel receipt and transportation

export. Travel receipt was 27 percent of exports from the region in 1980 but by 2013 travel receipts accounted for half of all export of goods and services from the region.

Table 2.1: Share of Goods and Services in Total Exports (Average for 1980-2013)

Country	Food	Raw Material	Manufactures	Travel	Transportation	Other Services
			Share in Exports			
Antigua and Barbuda	0.002	0.035	0.100	0.631	0.139	0.093
Bahamas	0.025	0.250	0.122	0.524	0.019	0.061
Barbados	0.047	0.053	0.159	0.544	0.018	0.179
Belize	0.371	0.059	0.103	0.266	0.043	0.158
Dominica	0.250	0.009	0.212	0.350	0.032	0.146
Dominican Republic	0.154	0.015	0.395	0.346	0.021	0.069
Grenada	0.194	0.000	0.093	0.526	0.038	0.149
Guyana	0.478	0.173	0.132	0.079	0.028	0.109
Haiti	0.063	0.023	0.533	0.291	0.017	0.072
Jamaica	0.086	0.074	0.302	0.379	0.086	0.073
St. Kitts and Nevis	0.117	0.010	0.185	0.498	0.048	0.141
St. Lucia	0.151	0.014	0.144	0.583	0.033	0.075
St. Vincent and the Grenadines	0.296	0.003	0.079	0.435	0.040	0.146
Suriname	0.101	0.147	0.611	0.023	0.044	0.075
Trinidad and Tobago	0.029	0.581	0.246	0.042	0.049	0.052

Source: Author's Calculation. The calculations represent the average for the sample period 1980 to 2013.

Table 2.1 shows the share of each category of export in total exports of goods *and* services for each country in our sample for the period 1980-2013. The table shows that food is the main export for Belize and Guyana. In Belize food export consist of banana and raw sugar, while food exports for Guyana comprise of rice and raw sugar. Food is also a major export in Dominica, Grenada and St. Vincent and the Grenadines, where it is the second largest export group. Raw materials export is a major source of export earnings for the Bahamas, Guyana, Suriname and Trinidad and Tobago. Manufactures constitute a major export for the Dominican Republic, Haiti, Jamaica, Suriname and Trinidad and Tobago. The share of travel receipt to total export earnings is significant for most of the Caribbean countries, contributing more than 20 percent to total exports in these countries, with the exception of Guyana, Suriname and Trinidad and Tobago, where the share of travel receipt to total exports is 8 percent, 2 percent, and 4 percent, respectively.

2.3 Magnitude of Instability in the Caribbean

The calculation of export earnings instability relies on measuring deviations from a trend. This entails estimating the trend value of the export series and then separating/eliminating the trend from the export value[2]. Measuring instability around the trend separates the growth of export over the entire sample period from year-to-year deviations from the growth path. Various methods of trend estimation exist in the literature. Some studies such as MacBean (1966) use a moving average, while others use a linear or exponential trend, (Kingston, 1973). In this study, the trend of export earnings is estimated by applying an exponential trend to the data. The exponential function is chosen because this specification fits the data for the Caribbean best[3]. The estimation of the trend is specified as:

$$y = \alpha e^{\beta t} \tag{2.1}$$

Taking the natural log of both sides of the equation, we have the following equivalent equation:

$$\log(y) = \log(\alpha) + \log(\beta t) + \varepsilon_t \tag{2.2}$$

Where $\log(y_t)$ is the logarithm of exports of goods *and* services; $\log(\alpha)$ is the logarithm of the constant; t is the trend component and ε_t is a zero mean error term.

Once the functional form is estimated, export earnings instability is calculated by summing the deviations from trend. This could be done using two methods. The first method is calculated as the average of the absolute annual deviation between the observed and estimated trend value divided by the estimated trend value *(I)*. This is represented as follows:

[2] Instability could also be measured using an ARCH/GARCH approach on the growth of exports. However, this method is usually used on high frequency data such as quarterly or monthly data. In addition, to facilitate a comparison with the earlier literature, the methodologies applied in the export earnings instability literature was used.

[3] Policy makers usually plan in terms of growth rates rather than actual export values. In addition, an exponential trend is associated with constant growth rates.

$$I = \frac{1}{T}\sum_{i}^{T}\frac{\left|x_i - \hat{x}_i\right|}{\hat{x}_i} \qquad (2.3)$$

where x_i is the observed data; $\hat{x}_i$ is the estimated trend value[4] and $T$is the number of years.

The second method that will be used is the standard deviation of export earnings. This is calculated as follows:

$$II = \sqrt{\frac{1}{T}\sum_{t}\frac{(x_i - \hat{x}_i)^2}{\hat{x}_i}} \qquad (2.4)$$

where x_i is the actual/observed value of exports of goods *and* services; $\hat{x}_i$ is the reference/trend value of exports of goods *and* services and T is the number of observation periods. Both measures of instability are scalars, the higher the value of the instability index, the greater is the fluctuation in export earnings. Thus, the more unstable will be the earnings from exports of goods *and* services.

[4] Because the trend was estimated using the log exponential trend, the trend value used in the calculation of instability is the antilog of the estimated trend.

Table 2.2: Instability Index for the Caribbean, Latin America and Small Island Developing States (Average for the period 1980-2013)

Country	I	II	Country	I	II
Caribbean			Mexico	0.12	0.12
Antigua and Barbuda	0.22	0.19	Nicaragua	0.33	0.26
Bahamas	0.24	0.21	Panama	0.16	0.14
Barbados	0.09	0.09	Paraguay	0.33	0.35
Belize	0.13	0.13	Peru	0.31	0.25
Dominica	0.23	0.21	Uruguay	0.18	0.16
Dominican Republic	0.16	0.17	Venezuela	0.29	0.26
Grenada	0.20	0.19	*Small Island Developing States*		
Guyana	0.07	0.06	Cabo Verde	0.17	0.19
Haiti	0.39	0.34	Comoros	0.15	0.17
Jamaica	0.12	0.11	Fiji	0.11	0.11
St. Kitts and Nevis	0.15	0.15	Kiribati	0.23	0.26
St. Lucia	0.21	0.19	Maldives	0.14	0.13
St. Vincent and the Grenadines	0.18	0.16	Marshall Islands	0.47	0.40
Suriname	0.36	0.28	Mauritius	0.16	0.16
Trinidad and Tobago	0.42	0.37	Micronesia (Federated States of)	3.18	2.90
Latin America			Nauru	0.65	0.61
Argentina	0.15	0.14	Palau	0.26	0.17
Bolivia	0.37	0.29	Papua New Guinea	0.19	0.19
Brazil	0.17	0.16	Samoa	0.11	0.10
Chile	0.16	0.15	Sao Tome and Principe	0.21	0.18
Colombia	0.14	0.12	Seychelles	0.11	0.10
Costa Rica	0.13	0.13	Solomon Islands	0.31	0.29
Ecuador	0.22	0.19	Timor-Leste	0.14	0.12
El Salvador	0.17	0.16	Tonga	0.17	0.18
Guatemala	0.18	0.14	Tuvalu	0.20	0.17
Honduras	0.17	0.16	Vanuatu	0.14	0.14

Source: Author's Calculation. *I* represents instability calculated using the absolute deviation of exports from its trend value and *II* represents instability calculated as the standard deviation of export earnings from its trend value.

Table 2.2 shows the indices of export earnings instability for the 15 Caribbean countries in our sample as well as for other Small Island Developing States (SIDS) and Latin America countries (LAC). These Small Island Developing States and Latin American countries are included to facilitate a comparison of the level of instability in the Caribbean with these countries. The absolute deviation measure of export earnings instability (*I*) shows that export earnings instability in the Caribbean is highest in Haiti, Suriname and Trinidad and Tobago. Notably, these countries have a significant share of their exports in merchandise exports; specifically, raw material and manufacture exports. The lowest level of instability is observed in Barbados (0.09) and Guyana (0.07) where the major exports are food and travel, respectively. The relative stability of export earnings observed in the Caribbean reflects the declining share of merchandise exports in total exports of goods *and* services in majority of the countries in the region. These observations made using the absolute deviation measure of export earnings instability are confirmed by the standard deviation measure.

When compared to other developing countries, the average level of total export earnings instability in the Caribbean (0.21) is the same as the level of instability in Latin America (0.21)

but is lower than the average level of export earnings instability in other Small Island Developing States (SIDS) which has an index of 0.37.

2.4 Theoretical Review of the Causes of Export Earnings Instability

The theoretical literature suggests that export earnings instability in developing countries is driven by changes in demand and supply factors, (Massell, 1970). Shifts in export supply are usually associated with fluctuations in output or domestic demand for the exported good or service. However, fluctuations in supply are more severe for some goods than for others. For example, agricultural exports are thought to be more affected by the variability of the weather, crop diseases etc. (Naya, 1973) than raw material or manufacture exports.

In addition to supply factors, individual countries are also affected by fluctuation in foreign demand. Factors that may affect the foreign demand curve include changes in the prices of competing goods and cyclical changes/fluctuations in incomes of export partners. However, the impact of shifts in the demand curve depends on the short-run income elasticity of each item. On the one hand, food exports are thought to have relatively low income elasticity and as such tend to be less affected by the purchasing power of export partners than are other goods, making their export revenue relatively stable. On the other hand, the demand for raw material, travel and manufacture exports are often considered to be income elastic because they depend on the income of the importing country for their demand and are therefore highly unstable. This implies that countries that have a high share of their earnings in raw material, manufacture and travel tend to experience an above average degree of export instability. In contrast, food-exporting countries may experience greater stability.

Given the above discussion, it is clear that the relationship between export earnings instability, the food ratio, raw material ratio, manufacture ratio and travel ratio will depend on whether export earnings instability results from shifts in the demand or supply curves. If export earnings instability is due to shifts in the demand for its exports, the food ratio will have a negative relationship with export earnings instability, while the raw material ratio, manufacture ratio and travel receipt ratio will have a positive relationship. On the other hand, if fluctuations in export earnings are due to shifts in the supply curve, the food ratio will have greater fluctuations and therefore will be positively related to export earnings instability.

In addition to the type of goods *and* services exported by a country, export earnings instability also depends on the correlation between different pairs of goods. If the goods exported by a country are affected by similar market forces then export earnings instability is usually high. However, when the export basket is diversified, that is, when goods are dissimilar, they tend to fluctuate independently and in some cases offset each other, Massell (1970). Thus, countries with dissimilar exports or a diversified export basket will experience less fluctuation in export earnings. In this regard, commodity concentration is theorized to have a positive relationship with export earnings instability.

Export earnings instability also tends to be higher if countries rely on a few export markets for the export of their goods *and* services. This is known as geographic concentration. High geographic concentration leads to higher instability because the demand for exports depends on the economic condition of a few countries. As such, any fluctuation in demand in these countries will have a pronounced effect on export earnings. This implies that the more diversified the export market, the lower instability will be.

Trade openness is also purported to be a determinant of export earnings instability. Brundell et.al (1981) purport that the degree to which a country chooses to rely on foreign trade may relate to the instability of its export proceeds. It has been claimed in the literature that export earnings instability can be reduced by lessening the dependence on trade; others have alleged that the opposite relationship holds. The relationship between export earnings instability and trade openness[5] like the other assumed causes of exports is induced through both demand and supply factors. When the instability is induced through shifts in demand, greater openness tends to stabilize export earnings. However, when instability is induced through supply shifts, the result is theoretically indecisive. Thus, greater openness may produce more or less instability depending on the size of the elasticities involved. Based on this analysis, it stands to reason that the type of goods exported, the reliance on a narrow range of products (commodity concentration), a narrow range of export markets (geographic concentration) and trade openness may determine the level of export earnings instability in a country or region.

[5] Trade openness is measured as the share of exports plus imports in GDP.

2.5 Empirical Review of the Causes of Export Earnings Instability

The literature on the causes of export earnings instability is well established. The primary causes identified in the literature are the ratio of food and raw material exports to total exports, commodity concentration, geographical concentration and trade openness. However, the empirical evidence in support of these causes identified in the theoretical literature is inconclusive and generally differs based on the time period and the sample of countries. One of the first studies to empirically investigate the causes of export earnings was done by the United Nations Secretariat (1952). In this study they investigate the relationship between export earnings instability and the type of commodities exported by developing countries. The main finding of this study is that there is a high level of instability among the traded commodities of developing countries and thus a high level of instability in the export earnings of developing countries.

A decade later, Coppock (1962) examined the relationship between export earnings instability and commodity and geographic concentration as well as the association between export earnings instability and the proportion of exports to the United States.[6] The study shows a low and positive correlation between export earnings instability and commodity concentration and a negative correlation with geographic concentration. They also find a negative correlation between export earnings instability and the proportion of exports to the United States. The results obtained from Coppock should be viewed with caution, however, because his analysis is conducted on world trade. As a result, his findings may be distorted by the exports from developed nations, which the literature finds to be generally more stable than exports from developing countries.

Massell (1970) examines the relationship between export earning instability and nine variables. These variables include; commodity concentration, geographic concentration, export market share, per capita income, food ratio, raw material ratio, size of exports, share of domestic consumption in exports and dummies for developed countries (DC) and least developed countries (LDC). His analysis includes 55 countries (developed and developing countries) from

[6] Commodity and geographic concentration are calculated using the Gini-Hirschman index, where this is measured as $C = \sqrt{\sum (x_i / x)^2}$, x_i is the share of commodity i in total exports and x is the sum of x_i .

1950 to 1966. His findings show a negative and significant relationship between export earnings instability and the food ratio and a positive and significant relationship between export earnings instability and commodity concentration.

MacBean (1966) use the data from Coppock (1962) to analyse the relationship between export earnings instability and three variables, these are; the primary product ratio, commodity concentration and geographic concentration. Cross-sectional analysis shows no correlation/association between commodity concentration and export earnings instability and a low negative association is found between export earnings instability and geographic concentration. Knudsen and Parnes (1975) and Soutar (1977) find that commodity concentration is a significant cause/contributor to export instability. Soutar (1977) find a positive relationship between commodity export earnings instability for 48 less developed countries for the period 1957 to 1969 and Knudsen and Parnes (1975) find a positive relationship between product concentration and export earnings instability for 53 countries (developed and developing) for the period 1959 to 1962. Knudsen and Parnes also find a positive and significant relationship between geographic concentration and export earnings instability.

Brundell et al. (1981) examine the causes of export earnings instability in developing countries using the same nine variables as Massell (1970) but adding three additional variables and an updated data set (i.e. 1965 to 1977 vs Masell's data from 1950 to 1966). The three new variables added by the authors are trade openness (measured as exports plus imports as a share of GDP), size of exports and the share of manufactures in exports. Of the twelve variables examined, the authors find that the size of exports, the share of manufactures in exports and trade openness are the only variables that have a significant impact on export earnings instability. All three variables had a stabilizing impact (negative and significant relationship) on the level of export earnings instability. Therefore, the results imply that countries with a large volume of exports, pursuing open-trade policies, and that have promoted manufactured exports, had experienced less instability in export earnings than have other countries.

Later studies on the causes of export earnings instability, investigate the determinants for specific countries and regions. These studies also include services export (in most cases tourism

export) in their analysis. The study done by Rao (1986) analyses the level of instability in merchandise and tourism exports and examines the causes of instability in tourism receipt for Fiji. In particular, the study calculates the level of instability for total commodity exports, tourism exports and sugar exports for the period 1963 to 1981. The main findings of the study are that earnings from tourism are the most stable source of foreign exchange in Fiji. In addition, the study concludes that tourism has a stabilizing effect on total export earnings, while earnings from the sugar industry have a destabilizing effect.

Sinclair et. al (1990) explores the role that diversification in tourism exports play in reducing the instability of export earnings using a sample of industrialised and developing countries. The results of the study show that travel receipt is a relatively unstable source of export earnings. In addition, instability for travel receipts by developing and intermediate income countries exceeded those for merchandise exports. The study also finds that rather than offsetting the instability of earnings from more traditional merchandise exports, receipts from travel amplifies net export earnings instability in some developing island economies and some intermediate economies. The study concludes that diversification into tourism generally fails to stabilise export earnings.

Wilson (1994) investigates the relationship between instability in exports of goods *and* services and instability in receipts from tourism for Singapore for the period 1972 to 1988. The results of this study indicate that instability in export of goods *and* services is positively correlated with tourism instability over time. In addition, the study shows that the development of the tourism sector in Singapore has exerted a net destabilizing effect on total exports of goods *and* services. Thus, diversification of export into tourism has not reduced net instability in Singapore.

The empirical literature of the causes of export earnings instability is generally inconclusive. Earlier studies in the literature typically used cross-country analysis which implicitly assume a unique relationship between a given explanatory variable and the degree of export earnings instability across the countries being analyzed. Thus, estimates using cross-section data to find the average relationships does not provide much information on the behavior of specific commodities in the chosen countries. There are a few studies such as Love (1992), Wilson

(1994), Sinha (1999) that used time series analysis on an individual country basis but most of the available time series studies do not address the issues of non-stationary nature of the data. Hence it could not be ruled out that these estimates are estimated from spurious regressions. This study will take advantage of the time series and cross section properties of the data by applying panel data analysis. In addition, Mullor-Sebastian (1988) argue that studies which lump together the exports of all goods are misleading because export earnings instability of a given product is influenced by the characteristics of the individual product. Thus, in this study we seek to address this issue by decomposing export earnings instability by major commodity group and by price and quantity to determine which of these factors are driving the level of export earnings instability in each country.

2.6 Data

To explore the causes of export earnings instability in this study, two methods will be employed. The first method is the portfolio variance method which is used to decompose total export earnings instability into the major categories of goods *and* services exports and to decompose merchandise exports into price and quantity. In addition, panel data analysis is employed to determine the causes of export earnings instability. The data being used in the study are obtained from the United Nations COMTRADE database (reported at the three-digit Standard International Trade Classification (SITC) code). Also, some data are retrieved from the World Bank's Commodity Price database, the World Development Indicators (WDI), and the International Monetary Fund's (IMF) Direction of Trade Statistics (DOTS).

2.7 Methodology and Results

2.7.1 Portfolio Variance Analysis

The portfolio variance method was originally developed in finance by Markowitz in the 1950s and later applied in the export earnings instability literature by Murray (1978), Love (1983) and Stanley (1999).[7] The portfolio variance method decomposes the contribution of each

[7] This methodology has also been applied to different areas of economics. For example, employment instability in Canada (Postner and Wesa, 1985) and (Macaspac, (2007).

category of exports to total instability of export earnings and to decompose the contribution of price and quantity instability to instability in merchandise exports.

To ascertain the contribution of the major categories of exports to an individual country's export earnings instability, total export earnings is expressed in terms of the sum of the earnings from each export group. Total export earnings (E) is, by definition, the sum of the earnings from a number of export groups, i.e.

$$E_t = \sum_{i=1}^{T} X_{it} \tag{2.5}$$

where X_{it} represents each export group.

Therefore, total export earnings instability is $I_t = \sum_{i=1}^{T} w_{it} I_{it}$.

where I_{it} is instability of each export group and $w_{it} = \overline{X}_{it} / \bar{X}_t$ is the weight of the export group in total export earnings for the period 1980-2013.

The variance of export earnings is

$$\text{var}(E) = \sum_{i=1}^{T} w_{it}^2 \sigma_{it} + \sum_{i=1}^{T} \sum_{j=1}^{T} w_{it} w_{jt} \,\text{cov}(u_{it} u_{jt}) \tag{2.6}$$

Squaring the weights in equation (2.6) emphasizes the contribution of the instability in each export group to total export earnings instability. The covariance term captures the relationship between the major export groups.

The proportionate contribution of an export group to total instability is calculated as $cn / \text{var}(E)$ where:

$$cn = X_n^2 \sigma_n + \sum X_n X_s \, \text{cov}(ns) \tag{2.7}$$

where X_n^2 is the square of the share of each component of exports of goods *and* services in total exports of goods *and* services; σ_n is the variance of the export group; X_n and X_s are the share of two groups of export in total exports of goods and services and $cov(ns)$ is the covariance between these two export groups.

To decompose merchandise exports instability into price and quantity instability, we first express export earnings as the product of price and quantity, which yields:

$$E = P \times Q \tag{2.8}$$

Taking the log of equation (6) gives:

$$\log(E) = \log(P) + \log(Q) \tag{2.9}$$

The variance of export earnings is therefore:

$$\text{var}(\log E) = \text{var}(\log P) + \text{var}(\log Q) + 2\,\text{cov}(\log P, \log Q) \tag{2.10}$$

where E, P and Q are the instability in export earnings, price and quantity, respectively[8].

The proportional contribution of price to merchandise export earnings instability is calculated as:

$$CP = 100 \ \text{var}(\log P) / \lfloor \text{var}(\log P) + \text{var}(\log Q) + 2\,\text{cov}(\log P, \log Q) \rfloor \tag{2.11}$$

[8] The variance of price and quantity instability is $\frac{1}{T}\sum_{i=1}^{T}\left(\frac{x_i - \hat{x}_i}{\hat{x}_i}\right)^2$

Quantity contribution is calculated in a similar way as:

$$CP = 100\ \text{var}(\log Q) / \lfloor \text{var}(\log P) + \text{var}(\log Q) + 2\,\text{cov}(\log P, \log Q) \rfloor \quad (2.12)$$

To calculate the price of exports for each country, a country specific real commodity price index as proposed by Deaton and Miller (1996) is used. The commodity price index combines international prices and country level data on export volume for individual commodities. Although Deaton and Miller argue for using fixed weights to construct the index, we allow the weight to vary since the mix of goods traded by many of the Caribbean countries has changed over the last three decades.

$$\text{Commodity price index} = \sum_{i=1}^{K} (W_k P_k) \quad (2.13)$$

where:

$$W_k = ((P_{jk} Q_{jk}) / (\sum_{k} P_{jk} Q_{jk})) \quad (2.14)$$

In equation (2.14) P_k is the world price of commodity k (i.e. each commodity included in this study) from the World Bank's Commodity Price database; W_k is the weighting item, which is the value of exports of commodity k in the total value of all K commodity exports for the period j; and Q is the quantity of exports of commodity k taken from the WITS database. Quantity is calculated by dividing merchandise export proceeds by the calculated national price index.

2.7.2 Results of the Decomposition of Export Earnings Instability

2.7.2.1 Decomposition of Commodity Groups

The contribution of each category of goods *and* services to export earnings instability depends on a number of connecting factors. This includes the share of each export group in total export earnings, the variance of the export group and the covariance (see table 2.1 in the appendix)

between pairs of export groups. Greater instability may be seen in countries whose exports have large and positive covariance or very small negative covariance. An export group contributes disproportionately to instability if its variance is greater than its weight in total export earnings (Stanley, 1999).

The results of the decomposition analysis show that food export is a major source of instability in Belize, Dominica, Guyana and St. Vincent and the Grenadines. Instability in food exports contribute approximately 37 percent to total export earnings instability in Belize, 30.2 percent in Dominica, 26 percent in Guyana and approximately 30 percent in St. Vincent and the Grenadines. In the Belize, Dominica, Guyana and St. Vincent and the Grenadines the covariance between food exports and the other categories of exports is either negative or very low when the values are positive (see Table A2.1 in appendix 2). In addition, the variance of food exports indicates that food exports from these countries is relatively stable (see Table 2.3). Given these observations as well as the fact that food represents an average of approximately 35 percent of total exports in these countries, total export earnings instability is low in these countries.

Table 2.3: Decomposition of Export Earnings Instability by Commodity Group

Country	Food	Raw Material	Manufactures	Travel	Transportation	Other Services
			Variance			
Antigua and Barbuda	0.20	2.78	0.28	0.26	0.11	0.56
Bahamas	0.28	1.15	0.73	0.09	0.15	0.20
Barbados	0.18	0.60	0.28	0.12	0.32	0.18
Belize	0.24	1.52	0.85	0.23	0.29	0.25
Dominica	0.39	0.73	0.19	0.21	0.28	0.54
Dominican Republic	0.27	1.40	0.44	0.18	0.34	0.25
Grenada	0.31	1.16	0.58	0.21	0.31	0.72
Guyana	0.08	0.27	0.14	0.68	0.54	0.27
Haiti	0.19	0.62	0.26	0.47	0.14	0.44
Jamaica	0.16	0.52	0.24	0.12	0.22	0.30
St. Kitts and Nevis	0.67	2.15	0.20	0.33	0.09	0.40
St. Lucia	0.41	2.29	0.35	0.29	0.16	0.23
St. Vincent and the Grenadines	0.25	1.48	0.25	0.21	0.15	0.40
Suriname	0.36	0.90	0.34	0.97	0.63	0.63
Trinidad and Tobago	0.23	0.62	0.19	0.28	0.10	0.98
Country			**Contribution to Instability**			
Antigua and Barbuda	0.00	22.23	2.33	71.53	1.58	2.33
Bahamas	0.05	86.57	2.05	11.10	0.16	0.07
Barbados	0.27	43.59	7.95	40.64	0.04	7.51
Belize	37.31	32.53	10.45	14.61	0.27	4.82
Dominica	30.32	5.09	12.21	34.07	0.90	17.40
Dominican Republic	6.34	5.83	63.69	23.39	0.14	0.61
Grenada	14.07	0.27	8.25	58.80	0.57	18.04
Guyana	26.39	59.55	4.15	4.15	0.46	5.30
Haiti	1.36	6.11	60.18	31.49	0.34	0.52
Jamaica	1.74	45.34	27.17	21.59	1.73	2.44
St. Kitts and Nevis	5.80	5.86	6.52	74.11	0.07	7.64
St. Lucia	7.58	6.91	5.70	78.74	0.08	0.98
St. Vincent and the Grenadines	29.77	1.98	1.77	52.87	0.49	13.13
Suriname	2.79	23.09	67.37	2.24	1.42	3.08
Trinidad and Tobago	0.10	89.08	5.16	1.42	0.83	3.40

Source: Author's Calculation

Raw materials exports account for a large share of export earnings instability in the Bahamas, Barbados, Belize, Guyana, Jamaica and Trinidad and Tobago. The variance for raw material exports indicates that raw material is the most volatile category of export in the Caribbean. Although raw material export accounts for 43, 32, 59 and 45 percent of export earnings instability in Barbados, Belize, Guyana and Jamaica respectively, export earnings instability is low in these countries with indices of 0.07, 0.13, 0.09 and 0.12, respectively. The low export earnings instability in these countries reflects the low and often negative covariance between raw material exports and the other export groups in these countries (see table A2.1 in appendix 2) and the low share of raw material export in total exports. In the Bahamas and Trinidad and Tobago, where the index of instability is high compared to the other countries (0.21 and 0.42 respectively); raw material exports account for 86 and 89 percent of export earnings instability, respectively. In these countries the share of raw material exports in total exports for 1980 to 2013 is high and the covariance between raw material exports and the other groups of exports are positive and high especially in Trinidad and Tobago.

Manufacture export contributes significantly to the level of instability in the Dominican Republic, Haiti, Jamaica and Suriname. In the Dominican Republic manufacture export is 64 percent of export earnings instability. For Haiti manufacture accounts for 60 percent of export earnings instability. Manufacture export is the second highest contributor to export earnings instability in Jamaica (30 percent). In Suriname, manufacture export is 67 percent of total export earnings instability. Manufacture export displays significant volatility in these countries, in most cases representing the second most unstable export group. Thus, the contribution of manufacture to export earnings instability reflects the volatility in manufacture export as well as the share of manufacture in export.

Of the categories of service exports, travel receipt is the main contributor to export earnings instability in Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines. However, travel receipt is one of the most stable categories of exports as well as transportation exports. The contribution of transportation export and other services export to instability is very small and thus does not play a significant role in the level of instability in these countries.

2.7.2.2 Decomposition of Price and Quantity

The result of the decomposition of merchandise export instability into price and quantity instability shows that instability in earnings from merchandise exports in the Caribbean is driven by prices (see table 2.4). Using the method outlined in section 2.7.1, the results show that for all the countries in the region price instability has contributed more to the instability in merchandise exports than quantity instability. The results of the decomposition analysis are in line with the general thought regarding the behaviour of export prices for small open economies. For Caribbean countries merchandise exports are predominantly primary commodities and the supply of primary commodities is often regarded as relatively inelastic. As a result, the primary source of variation in the value of primary commodity export is often cited in the literature to be the variations in prices. This implies that it is demand shifts that drive instability in merchandise exports.

In addition, Caribbean countries have historically enjoyed preferential treatment from the European Union, the United Kingdom, the United States and Canada. Typically, countries given preferential access to a highly protected market gain a price premium over the normal rate of return that is required to encourage investment in the domestic economy. Protectionist measures in the economies of the export partners of Caribbean countries are usually based on quota on the quantity of exports to those countries, which in turn leads to higher prices in the domestic market (see Milner, 2004 for a more detailed discussion). With preferential agreements, exporters who have access to the restricted markets are then able to sell their output at a higher price, thus generating profits above those that would exist in a more competitive, unrestricted market structure. This will partly explain the low level of variation in export quantity for Caribbean countries and the high variation in prices.

Table 2.4: Decomposition of Earnings by Price and Quantity (Average 1980-2013)

Country	Instability		Contribution to Total Export Earnings Instability		
	Price	Quantity	Price	Quantity	Cov(P,Q)
Antigua and Barbuda	0.36	0.13	77.64	27.93	-5.57
Bahamas	0.37	0.22	71.36	41.58	-12.94
Barbados	0.17	0.06	78.12	28.51	-6.63
Belize	0.36	0.15	77.30	32.72	-10.03
Dominica	0.78	0.14	103.00	18.91	-10.96
Dominican Republic	0.72	0.11	91.68	14.51	-6.19
Grenada	0.25	0.27	55.90	51.80	-7.68
Guyana	0.32	0.05	91.11	13.76	-4.87
Haiti	0.39	0.12	79.84	25.23	-5.07
Jamaica	0.27	0.19	65.21	45.84	-11.05
St. Kitts and Nevis	0.47	0.07	91.15	14.07	-5.22
St. Lucia	1.09	0.23	95.83	20.15	-7.99
St. Vincent and the Grenadines	0.22	0.23	52.20	51.10	-3.30
Suriname	0.74	0.22	107.14	31.06	-19.10
Trinidad and Tobago	0.46	0.22	71.04	34.82	-5.87

Source: Author's Calculation

2.7.3 Panel Data Analysis

To investigate the causes of export earnings instability in this study, a panel regression framework is employed. Panel data allows for variability of individual countries while still preserving the dynamic adjustment within countries. To facilitate the use of panel estimation, export earnings instability is recalculated using a five average as is standard in panel estimation analysis (see Cameron and Trivedi, 2005).

With panel data the export earnings instability regression model can be specified as:

$$I_{it} = \beta' X_{it} + \alpha_i + \varepsilon_{it} \tag{2.15}$$

where I_{it} is the index of export earnings instability for country i at time t[9] , X_{it} is a vector of explanatory variables, α_i is the disturbance or country specific component associated with each country, and ε_{it} is the standard i.id disturbance term for country i at time t. The vector of explanatory variables X_{it} contains the food ratio, raw material ratio, manufacture ratio, travel receipt ratio, commodity concentration, geographic concentration and trade openness. We also include a natural disaster dummy to capture the weather conditions in the region. These

[9] The instability index used in the panel estimation is calculated as a five-year average of the data, resulting in 7 observations for each country across the sample period 1980 to 2013.

variables used in the model represent some of the conventional factors identified by researchers as the main catalysts behind export earnings instability.

Panel estimation model usually takes three forms; pooled cross-section, random effects and fixed effects. Pooled analysis combines time series for several cross-sections and is usually used with long panels, that is, panels that have more time periods than cross sectional components (in this case countries). However, pooled cross-section data do not control for "fixed unobserved differences" between the observations. In the literature it is often cited that the omission of fixed effects in pooled cross-section may result in omitted variable bias. In addition, not accounting for differences across panels may cause the disturbance terms to be correlated with groups. To account for the shortcomings of pooled data, the fixed effects model was developed. The fixed effects estimator assumes that something within the individual/country may impact or bias the predictor or outcome variables and therefore the model implicitly introduces dummy variables to control for this (Torres-Reyna 2007). As a result, the intercept for each panel/country is allowed to vary. In addition, the fixed effects model assumes that those time-invariant characteristics are unique to the individual and should not be correlated with other individual characteristics. This individual-specific effect makes it possible to identify and control for unobserved heterogeneity among the countries. Each entity is different therefore the entity's error term and the constant (which captures individual characteristics) should not be correlated with the others. If the error terms are correlated, then fixed effect is not suitable since inferences may not be correct.

Random effects models are seen as a mid-point on a continuum from pooled cross-section and fixed effects estimators. The random effects estimator attempts to improve upon the fixed effects model by controlling for the correlation among the disturbances. Notwithstanding the improvements captured by the random effects model, like the pooled cross-section estimators it may risk omitted variable bias. Omitted variable bias occurs in the random effects model if the country effects are correlated with other independent variables. Green et al., (2001) demonstrates that if omitted variable bias is present in the model, the coefficients of the regressors will be biased.

2.7.4 Results of Panel Regression Analysis

With the previous discussion in mind two sets of panel regressions are used; the Pooled Ordinary Least Square regression (long panel analysis) and short panel analysis (random or fixed effects). To decide between the fix and random effects models the Hausman's specification test (Hausman, 1978) is employed. The Hausman test compares the fixed and the random effects models to determine whether the errors (ui) are correlated with the regressors. The null hypothesis of the Hausman tests is that the errors are not correlated (Green, 2008). This means that if the null cannot be rejected the random effects regression stands. To apply fixed and random effects estimation, five-year averages of the data is calculated. The Hausman test chose the random effects estimator over the fixed effects method. Thus, the result of the random effects model is presented below.

Cameron and Trivedi (2010) states that for long panel data analysis, that is when T is greater than N, it is necessary to specify a model for serial correlation in the error. They suggest that the best estimator in this case is to use pooled feasible generalized least squares estimator (PFGLS) or the Pooled OLS method with an AR(1) process for the error term. Thus, to estimate the pooled OLS we use the command xtpsce in STATA. The xtpsce command calculates panel corrected standard error (PCSE) estimates for linear cross-sectional time-series models where the parameters are estimated by pooled OLS. An AR(1) model for the error term is specified. The xtpcse command assumes that the disturbances are, by default, heteroskedastic and contemporaneously correlated across panels when computing the standard errors and the variance-covariance estimates. This assumption works well in our study as our tests for heteroscedasticity and autocorrelation in all the models shows the presence of both (see table 2.2 in the appendix 2).

Both the standard deviation and absolute deviation measures of export earnings instability are used in the analysis. The standard deviation measure used in the pooled OLS regression is a rolling 5 year standard deviation[10]. Thus, the regression analysis for the standard deviation covers the period 1984 to 2013. Also, three different variations of the model are presented. The

[10] A four year rolling standard deviation was also tried for the Pooled OLS and the fixed effects estimators. The results for the Pooled OLS were similar using the four year average, however for the fixed effects the five year average out-performed the four year average (more significant variables). Thus, the five year average is used.

first model contains the food ratio, raw material ratio, manufacture ratio, travel receipt ratio, commodity concentration and geographic concentration. The second model contains all the variables in the first model plus trade openness and the fourth model has all the variables in the two previous models and a natural disaster dummy. This allows us to check for robustness of the findings to the different measures of export earnings instability and variations in the model.

The results of the pooled OLS and the random effects estimation techniques are presented in tables 2.5 and 2.6 and show that export earnings instability in the Caribbean is determined by the share of the raw material in total export of goods and services and commodity concentration. The raw materials ratio exhibits a positive and significant relationship with export earnings instability across both measures of instability. This result is in line with the findings of other studies such as Brundell (1981) that finds a positive and significant relationship between the raw material ratio and export earnings instability. This finding reflects the fact that raw materials exports are very income elastic. The result implies that export earnings instability in the region is due to shifts in the demand for raw materials exports. The significance of the raw material ratio across all the estimated equations and across both measures of export earnings instability implies that the result for the raw material ratio is very robust.

Commodity concentration has a positive and significant relationship with export earnings instability in both estimation techniques using both measures of export earnings instability. The results indicate that the positive coefficient for commodity concentration is robust, since the relationship is significant across both measures of instability and across both estimation techniques. The positive relationship between export earnings instability and commodity concentration indicates that the reliance of countries in the region on a few exports increases the instability of export earnings. This result supports the theorized relationship between instability and commodity concentration.

The food ratio and travel ratio both exhibit negative and insignificant relationships with export earnings instability. This implies that neither of these variables are significant contributors to export earnings instability in the region. Similar to the food and travel receipt ratio, trade openness exhibit an insignificant negative relationship with export earnings instability in both

estimation techniques as well as across both measures of export earnings instability. In addition, the result is consistent across all estimated equations. Thus, from the results, trade openness does not appear to affect the level of export earnings instability in the Caribbean.

The results for geographic concentration are mixed. In the pooled OLS analysis, geographic concentration is observed to have a positive but insignificant relationship with export earnings instability for both measures of export earnings instability and in all three variation of the model. However, in the random effects model, the coefficient on geographic concentration is positive and significant in all variations of the model, except the one that includes a natural disaster dummy. Given the non-robustness of the results for geographic concentration we cannot conclude that geographic concentration is a determinant of export earnings instability in the Caribbean.

Similar to the findings for geographic concentration, there are mixed results for the manufacture ratio, the results for the pooled OLS shows a negative and insignificant relationship in all three variations of the model for the absolute deviation measure of export earnings instability. For the standard deviation measure of export earnings instability, the pooled OLS results show a negative and insignificant relationship between the manufacture ratio and export earnings instability in the first model (see table 2.5, column 4) and positive and insignificant relationship in the last two models. In the random effects model, the coefficient on the manufacture ratio is negative and insignificant in the first model for both measures of instability and positive and significant in the last two models for both measures of instability. In addition to the inconsistency in the sign for the variable in the models, the variable is significant in all models and across both measures of export earnings instability. Thus, it is fair to conclude that the manufacture ratio is not a cause of export earnings instability in the region.

The result for the natural disaster dummy shows positive and insignificant coefficients for both measures of export earnings instability in the pooled OLS estimation and negative and insignificant coefficient for both measures of instability in the random effects estimation. These findings indicate that natural disaster does not contribute to the level of export earnings instability in the Caribbean. This finding is surprising given the frequency of natural disaster

in the Caribbean, their reliance on primary exports that are affected by weather conditions and the damage that is usually reported following episodes of natural disasters.

Table 2.5: Pooled OLS Results

	Pooled OLS					
	Absolute Deviation			Standard Deviation		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Export Earnings Instability	Export Earnings Instability	Export Earnings Instability	Export Earnings Instability	Export Earnings Instability	Export Earnings Instability
Food Ratio	-0.0386	-0.0346	-0.0325	-0.0158	-0.0144	-0.0134
	(0.0465)	(0.0464)	(0.0468)	(0.0219)	(0.0229)	(0.0235)
Raw Material Ratio	0.245*	0.261*	0.263*	0.160**	0.194***	0.195***
	(0.141)	(0.144)	(0.144)	(0.0692)	(0.0715)	(0.0714)
Manufacture Ratio	-0.0378	-0.0324	-0.0297	-0.0142	0.00888	0.00966
	(0.110)	(0.108)	(0.108)	(0.0623)	(0.0617)	(0.0615)
Travel Receipt Ratio	-0.116	-0.136	-0.133	-0.0665	-0.0682	-0.0675
	(0.0934)	(0.0947)	(0.0946)	(0.0658)	(0.0644)	(0.0644)
Commodity Concentration	0.460***	0.497***	0.497***	0.369***	0.418***	0.418***
	(0.172)	(0.173)	(0.172)	(0.102)	(0.0976)	(0.0975)
Geographic Concentration	0.105	0.108	0.107	0.0187	0.0443	0.0441
	(0.0691)	(0.0691)	(0.0695)	(0.0360)	(0.0383)	(0.0389)
Trade Opnenness		-0.0442	-0.0449		-0.0287	-0.0292
		(0.0555)	(0.0554)		(0.0385)	(0.0385)
Natural Disaster Dummy			-0.00265			-0.00119
			(0.0112)			(0.00517)
Constant	-0.0796	-0.0897	-0.0908	0.0172	-0.0329	-0.0336
	(0.116)	(0.114)	(0.114)	(0.0712)	(0.0677)	(0.0676)
Observations	479	479	479	427	427	427
R-squared	0.127	0.132	0.132	0.225	0.259	0.260
Number of id	15	15	15	15	15	15

Note: Standard errors are in parentheses. ***, ** and *denote significance at the 1%, 5% and 10% level of significance. Instability as measured by the standard deviation is a 5 year rolling standard deviation, thus the data point starts at 1984 for each country. The data is an unbalanced panel.

Table 2.6: Random Effects Results

	Random Effects					
	Absolute Deviation			Standard Deviation		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Export Earnings Instability	Export Earnings Instability	Export Earnings Instability	Export Earnings Instability	Export Earnings Instability	Export Earnings Instability
Food Ratio	-0.0189	-0.00446	-0.0239	-0.0227	-0.0611	-0.0779
	(0.142)	(0.104)	(0.105)	(0.155)	(0.109)	(0.110)
Raw Material Ratio	0.258*	0.299**	0.289**	0.323**	0.312**	0.304**
	(0.144)	(0.150)	(0.144)	(0.163)	(0.152)	(0.146)
Manufacture Ratio	0.0202	-0.000564	-0.00679	0.0456	-0.0234	-0.0331
	(0.147)	(0.179)	(0.179)	(0.161)	(0.213)	(0.214)
Travel Receipt Ratio	-0.0247	-0.106	-0.134	-0.0153	-0.183	-0.211
	(0.158)	(0.174)	(0.169)	(0.178)	(0.197)	(0.193)
Commodity Concentration	0.558***	0.621*	0.622*	0.612**	0.716*	0.718*
	(0.212)	(0.353)	(0.347)	(0.239)	(0.430)	(0.422)
Geographic Concentration	0.221**	0.240*	0.240	0.259**	0.285*	0.277
	(0.108)	(0.144)	(0.169)	(0.119)	(0.159)	(0.183)
Trade Opnenness		-0.118	-0.124		-0.134	-0.138
		(0.0885)	(0.0910)		(0.108)	(0.110)
Natural Disaster Dummy			0.00720			0.0142
			(0.0322)			(0.0326)
Constant	-0.256*	-0.246	-0.233	-0.308**	-0.261	-0.246
	(0.140)	(0.151)	(0.146)	(0.151)	(0.184)	(0.178)
Observations	103	103	103	103	103	103
Number of id	15	15	15	15	15	15

Note: Standard errors are in parentheses. ***, ** and *denote significance at the 1%, 5% and 10% level of significance. In the random effects estimation 5 year averages of the data are used. The data is an unbalanced panel.

2.8 Conclusion

This chapter has provided an empirical examination of the causes of export earnings instability in the Caribbean. The study is motivated in part by the need to ascertain the main drivers of export earnings instability in the region. Two methods are used to determine the causes of export earnings instability, the portfolio variance method and panel data analysis. In addition, export earnings instability is measured using the absolute deviation and the standard deviation of export earnings from it trend value. The calculation of export earnings instability shows that export in the Caribbean is relatively stable. The highest level of instability is observed in countries that have a large share of their export in raw materials or manufactures.

The variance decomposition analysis shows that raw material export is the most unstable export from the Caribbean. In addition, it shows that in most of the Caribbean countries, raw material and manufacture exports are the main source of export earnings instability. In the countries where food export and travel receipts are found to account for most of the instability in exports, the level of instability is low. The results of this exercise calls into question the conventional view that increasing exports of manufacture will result in greater export earnings stability. One caveat here is that the manufacturing industry in the Caribbean is very young and as such this might explain the high level of fluctuation in export earnings instability.

Results from the panel data analysis confirm that raw material export is indeed a source of instability in the region. Both the pooled OLS and random effects results show positive and significant coefficient for the raw material ratio. In addition, the panel data analysis shows that commodity concentration leads to greater instability. Thus, commodity concentration has a destabilizing relationship with export earnings in the region. The results obtained in this study indicate that instability in export earnings is driven by fluctuations in the demand for exports from the region. No statistically significant relationship was found for the food ratio, travel receipt ratio, geographic concentration, trade openness and natural disaster.

The empirical results presented here have strong policy implications. These results imply that diversifying export products may reduce instability in the region, at least in the short-run. Although the results unequivocally support commodity diversification rather than export

market diversification, diversifying export market as well as export product may have beneficial effects on the stabilization of export earnings for the Caribbean.

APPENDIX 2

Table 2.1: Covariance of Categories of Goods and Services in total Exports (1980-2013)

	Covariance														
Country	Food,Raw	Food, Man	Food, Trav	Food,Tran	Food,Other	Raw ,Man	Raw, Trav	Raw ,Tran	Raw , Other	Man, Trav	Man, Tran	Man,Other	Trav, Tran	Trav, Other	Tran, Other
Antigua and Barbuda	0.01	0.00	0.00	0.00	-0.01	0.38	-0.46	-0.03	-1.01	-0.01	0.00	-0.02	0.00	0.03	0.00
Bahamas	0.01	-0.03	0.00	0.00	-0.01	-0.22	0.02	0.08	-0.01	0.02	-0.02	-0.04	0.00	0.00	0.00
Barbados	-0.03	0.00	0.00	0.00	0.00	0.00	0.02	-0.05	0.06	0.00	0.01	0.00	0.00	0.01	-0.01
Belize	0.10	0.07	-0.01	0.00	0.00	0.03	-0.04	-0.06	-0.13	-0.03	-0.07	-0.04	0.00	0.01	0.02
Dominica	0.03	0.00	0.02	0.01	0.02	0.05	0.04	0.09	0.16	0.01	0.01	0.04	0.01	0.03	0.05
Dominican Republic	0.21	-0.01	0.01	0.01	-0.01	-0.16	0.09	0.06	-0.05	0.02	-0.01	0.00	0.00	-0.01	-0.01
Grenada	0.14	0.09	0.00	0.02	0.01	-0.02	0.03	-0.07	0.40	0.00	0.00	0.09	0.00	0.00	0.00
Guyana	0.02	0.00	-0.01	0.00	0.00	0.01	-0.08	-0.01	0.00	0.03	-0.02	0.00	-0.04	0.02	0.05
Haiti	-0.16	0.05	-0.03	0.02	-0.04	-0.10	-0.01	-0.07	0.09	-0.01	0.04	-0.04	0.00	-0.01	-0.02
Jamaica	-0.01	0.00	0.00	-0.01	0.01	0.01	0.01	0.01	0.02	0.00	-0.01	0.00	0.00	0.01	0.00
St. Kitts and Nevis	-0.68	-0.02	-0.01	0.01	-0.05	0.32	-0.15	-0.14	0.12	0.00	0.00	0.00	0.00	0.02	0.00
St. Lucia	-0.24	0.01	0.00	0.02	0.00	-0.10	-0.04	-0.11	0.08	0.00	-0.01	-0.02	-0.01	0.00	0.01
St. Vincent and the Grenadines	-0.02	0.00	-0.01	-0.01	0.02	0.01	0.02	0.01	0.02	-0.01	-0.01	-0.01	0.01	0.01	0.01
Suriname	0.14	0.01	-0.05	-0.04	-0.01	0.18	0.17	-0.04	0.13	0.24	0.07	0.04	0.41	0.17	0.00
Trinidad and Tobago	0.01	0.00	0.00	0.00	0.03	0.03	0.14	-0.01	0.24	0.00	0.00	0.01	0.00	0.15	-0.03

Source: Author's Calculation

Table 2.2: Autocorrelation and Heteroskedasticity Test

	Woolridge Test for Autocorrelation Ho: No Fist Order Autocorrelation		
	Model 1	**Model 2**	**Model 3**
Absolute Deviation	267.64 0.000	279.51 0.000	292.17 0.000
Standard Deviation	1251.44 0.000	1097.19 0.000	1049.68 0.000
	Breusch-Pagan/ Cook-Weisberg Test of Heteroskedasticity Ho: Constant Variance		
Absolute Deviation	390.31 0.000	455.63 0.000	454.84 0.000
Standard Deviation	88.08 0.000	135.82 0.000	137.28 0.000

CHAPTER 3: THE IMPACT OF EXPORT EARNINGS INSTABILITY ON ECONOMIC GROWTH IN THE CARIBBEAN

3.1 Introduction

Fluctuations in earnings from exports have long been of concern to policy-makers because of their effects on economic stability and growth. A plethora of studies have examined the effect of export earnings instability on economic growth in developing countries. Yet, previous studies have not reached a general consensus. As Mullor-Sebastian (1988) remarks, "Three decades of research on export earnings instability have resulted in a consensus on only one of the main areas of study, namely, that export earnings instability is higher for least developed countries (LDCs) than for developed countries (DCs). Consensus has not been achieved on the other areas such as the impact of export earnings instability on growth and investment," (p. 217). Given the lack of research in this area for the Caribbean, this chapter assesses the impact of export earnings instability on economic growth in the Caribbean.

The premise underlying research on this topic for the Caribbean is that Caribbean countries are geographically small and open economies that specialize in the export of a few primary products (some countries are manufacture exporters) and lack the capacity to diversify; this exposes them to substantial export earnings instability. Thus, fluctuations in export earnings affect the degree of macroeconomic stability and ultimately have implications for economic growth. Export of goods *and* services is a large component of aggregate demand. Thus, export earnings instability affects the country's ability to import capital goods which is used to facilitate investment which is also an important component of aggregate demand. Since these capital goods are used in domestic industries, the ability to import is crucial for sustained economic growth.

This chapter contributes to the literature by examining the effects of export earnings instability on economic growth in a select group of Caribbean countries. There are a number of reasons for choosing to investigate these issues in the context of the Caribbean. First, the region is highly dependent on the earnings from export of goods *and* services. Second, the Caribbean is very heterogeneous, with countries that have different economic structures. For example, there are countries that are predominantly commodity exporters, some that are services dependent

and others that belong to a currency union. Thus, export earnings instability may affect each country differently. The presence of heterogeneity often renders the use of OLS estimation invalid. Third, there is a dearth of empirical studies for the Caribbean, and thus policy recommendations tend to be based on research conducted on other regions or groups of developing countries. Unfortunately, drawing implications from these studies, though insightful, is somewhat limited from a policy perspective given that the literature suggests that country-specific factors are also critical.

The main results can be summarized as follows. First, panel data estimation shows that export earnings instability does have a negative and significant effect on the growth in real GDP per capita. Second, time series analysis for individual countries shows mixed results for the impact of export earnings instability on economic growth for the sample of 15 Caribbean countries examined. Export earnings instability exhibits a negative relationship with per capita GDP growth in 13 of the 15 Caribbean countries, including 5 of the 6 ECCU[11] countries, the Bahamas, Barbados, Belize, Dominican Republic, Guyana, Jamaica, Suriname and Trinidad and Tobago. Of the 13 countries for which the effect of export earnings instability is negative, the effect is statistically significant in the Bahamas, the Dominican Republic, Grenada, Jamaica and St. Kitts and Nevis. Insignificant positive effects are observed in Dominica and Haiti. Third, economic growth in the Caribbean is mainly determined by investment and the growth of export of goods *and* services.

The remainder of this chapter is organised as follows. The next two sections review the theoretical and empirical literature on the effects of export earnings instability on economic growth. Section 3.4 presents an overview of models of economic growth. Section 3.5 discusses the data. Section 3.6 discusses the methodology that is used in the estimation of economic growth. Section 3.7 to 3.9 presents the estimation techniques and results, and the final section concludes the chapter by summarising its main findings and assessing the policy implications of these findings.

[11] The ECCU consist of Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines.

3.2 Theoretical Review of the Impact of Export Earnings Instability on Economic Growth

Economic theory offers two possible scenarios regarding the impact of export earnings instability on economic growth. First, there is the possibility of a negative relationship which is mainly based on the work of Ghirmaya et. al. (1999) which states that export earnings instability induces short-run domestic uncertainty that affects the efficiency of investment and leads to lower growth. That is, export earnings instability affects factors in the economy that lowers the productivity of investment and thus leads to lower growth. In addition, export earnings instability adversely affects the level of capital accumulation (investment) by affecting the flow of imports into the domestic economy (by creating import instability)[12]. Thus, export earnings instability creates uncertainty in the liquidity position of agents in the economy, which discourages them from making productivity enhancing investments. As a result, the outcome is lower economic growth.

Secondly, export earnings instability may affect economic growth positively because of the opportunity cost or intertemporal substitution argument. This argument states that productivity-improving activities such as reorganizations or training often take place during times of economic downturn at the expense of directly productive activities (such as manufacturing). Since the return to the latter is lower during periods of recessions due to lower demand for the manufactured goods, the opportunity cost in terms of foregone profits of "reorganization activities" will be lower in recessions than in expansions. Further, Aghion and Saint-Paul (1993) also explain that the sign of the relation between export earnings instability and economic growth depends on whether the activity that generates growth in productivity is a complement or a substitute to production. In the case where they are substitutes, since the opportunity cost of productivity-improving activities falls in recessions, a larger amplitude and frequency of export earnings instability may have a positive effect on long-run productivity and growth. In the case of complementarity, they state that a positive (negative) shock will have a positive (negative) long-term impact on productivity. Another reason that may explain a positive relationship between export earnings instability and economic growth is that during downturns the government borrows to finance the balance of payments which increases

[12] This will be explored in chapter 4 examining the relationship between exports earnings instability and the balance of payments (BOP).

economic growth in the long-run (if the productivity of capital inflows is greater than the rate of investment).

As mentioned previously, export earnings instability may affect economic growth through its effect on investment as well as the productivity of investment. In chapter 4 of the thesis, the investment channel will be explored directly. As such, in this chapter, investment is controlled for in the growth equation, so that we can ascertain the direct effect of export earnings instability on economic growth. Including investment in the equation also implies that the effect of export earnings instability affects economic growth through its effect on the efficiency/productivity of investment because by definition, growth is the product of investment as a proportion of GDP and the productivity of investment (Harrod, 1939; Domar 1946).

3.3 Empirical Review

The findings for the impact of export earnings instability on economic growth varies in the literature. There are studies that show a negative impact and some that show a positive effect. Studies that find a negative relationship between export earnings instability and economic growth include Gyimah-Brempong (1991) who investigates the effect of export earnings instability on economic growth for a sample of 34 Sub-Saharan African countries for the period 1960 to 1986. The study investigates the relationship using a neoclassical production function augmented to include export growth and a measure of export earnings instability. In addition, the study uses three measures of export earnings instability to assess its effects on economic growth. The three indices used are; (i) the average of the absolute deviation of export earnings from its trend value; (ii) the coefficient of variation of export earnings, and (iii) the average of the squared ratio of the deviation of actual export earnings from its trend value. With the use of ordinary least squares the results show that export earnings instability has a negative and significant effect on economic growth using all three measures of export earnings instability. Also, the study finds that investment to GDP ratio; export growth, and population growth have positive and statistically significant effect on economic growth.

Dawe (1996) examines the effect of export earnings instability on economic growth by applying three stage least squares to a neoclassical production function augmented with export

earnings instability for a sample of 85 countries (developed and developing) from the early 1970s to the mid-1980s. The study finds that export earnings instability has a negative and significant impact on the growth of GDP per worker. In addition, he finds a positive and statistically significant relationship between growth in GDP per worker and the investment to GDP ratio. The coefficient on initial GDP per worker is negative and statistically significant and as such is consistent with the conditional convergence of high and low-income economies. Human capital, while found to have a positive relationship with economic growth, is statistically insignificant.

Similar results are reported by Gaskari et al. (2011) who examined the effect of export earnings instability on economic growth for seven Organization of the Petroleum Exporting Countries (OPEC). The study estimates a neoclassical production function augmented to include government expenditure to GDP, foreign direct investment, oil export growth and export earnings instability using panel data analysis. The results show that export earnings instability adversely affects economic growth, and that investment, population growth and oil export growth have a significant positive relationship with economic growth. Government expenditure as a share of GDP is also found to have a significant negative affect on economic growth in these countries.

Gholamreza et al. (2010) use panel data analysis to explore the relationship between export earnings instability and economic growth for a sample of twenty-two East Asia and Pacific countries using panel co-integration analysis. The model used in the study is an augmented neoclassical production function that includes the investment to GDP ratio, growth in export of goods *and* services, population growth and export earnings instability. They find that export earnings instability, which is measured as the absolute deviation of export earnings from its five year moving average, has a negative and statistically significant effect on economic growth. In addition, they find that population growth and the investment to GDP ratio are positive and significant. Export growth is also positive and highly significant.

Rashid et.al (2012) analyzes the effect of export earnings instability on economic growth for four members of the South Asian Association for Regional Cooperation (SAARC); Pakistan, India, Nepal and Sri-Lanka. In the study the authors use an augmented neoclassical aggregate

production function, with export earnings instability and export growth as the additional variables. The results using cointegration analysis shows that export earnings instability has a negative and significant effect on economic growth for the four SAARC countries. The magnitude is highest for Sri Lanka. In addition, the study shows that economic growth in these countries is driven by investment and export growth which are both found to have positive and significant effects on economic growth for all countries except Nepal where export growth has a negative but insignificant effect on economic growth.

In contrast, there are studies that show a positive relationship between export earnings instability and economic growth. Knudsen and Parnes (1975) find that export earnings instability positively affects economic growth using a cross-sectional regression for a sample of 28 developing countries for the period 1958 to 1968. The effect of export earnings instability is examined using permanent income theory, which analyzes the reaction of economic agents to the instability in export earnings. The model assumes that when export earnings fluctuate households reduce their propensity to consume in order to compensate for future income shortcuts (buffer stock). As a result of the decline in consumption, there is an increase in the propensity to save and consequently an increase in investment which increases economic growth[13]. The study finds that export earnings instability positively impacts economic growth. The regression also includes population growth, which is found to have a negative and significant relationship with growth in per capita income.

Yotopoulos and Nugent (1976) also find a positive relationship between economic growth and export earnings instability using a sample of 38 developing countries for the period 1949 to 1967. This study also uses the permanent income hypothesis and regresses growth in real GDP per capita on an index of export earnings instability. The results indicate that export earnings instability has a positive effect on economic growth. In addition, the study finds that there is a positive relationship between consumption and economic growth.

[13] It's important to note that the theory underpinning the results here assume that savings is equal to investment. However, as was explained in Keynes (1936) this is not the case because savings and investment are demanded by different agents and there is one price which equilibrates the two.

In addition to the studies that show an unambiguous significant negative and positive effect, some studies find that export earnings instability does not have a statistically significant effect on economic growth. One such study is Moran (1983) which uses a sample of 38 developing countries, of which 18 were from Latin America, for the time period 1954 to1975. The study applies two stage least squares to an augmented production function using cross-sectional data and finds that export earnings instability has a negative but insignificant effect on economic growth. In addition to export earnings instability, the growth regression also includes the ratio of foreign savings to income (which captures the effect of a current account deficit), the ratio of domestic savings to income, the rate of growth of labour services and export growth. The results of the study show that export growth is the main determinant of economic growth in this group of countries. However, export earnings instability does not have a statistically significant impact on economic growth over the long-run because internal adjustments are made so as to cope with fluctuations.

Sinha (1999) using time series analysis to examine the relationship between export earnings instability and economic growth for a group of nine Asian countries (India, Japan, Malaysia, Myanmar, Pakistan, Philippines, South Korea, Sri Lanka and Thailand) find mixed results. The effect of export earnings instability on economic growth is examined using an augmented neoclassical production function with population growth, investment to GDP ratio, export growth and export earnings instability. The study shows that there is a negative and insignificant relationship between export earnings instability and economic growth in India, Japan, Malaysia, Philippines and Sri Lanka and a positive and insignificant relationship for South Korea, Myanmar, Pakistan and Thailand. In most of the countries the investment to GDP ratio is found to be a positive and significant determinant of economic growth.

Overall, the evidence suggests that the effect of export earnings instability on economic growth has yielded mixed results. Furthermore, the effect on growth in developing countries remains debatable and appears to depend on the country's initial economic conditions and the state of its institutions. In addition, the literature on the effect of export earnings instability on economic growth is dated and the results are based on the region, methodology and the measure of export earnings instability used in the analysis. While some studies used more than one measure of instability to assess the impact of export earnings instability on economic growth with some conclusive results, one of the drawbacks of the current studies is that they did not

assess the robustness of the findings by using more than one methodology. Another critique of the literature is that the methodologies used to assess the impact of export earnings instability on economic growth is dated. Therefore, in this study, in addition to focusing on the Caribbean as a new sample of countries, we will also assess the merit of the findings of the literature by using the two most prominent measures of export earnings instability used in the literature (absolute and standard deviation) and use the most recent methodology applied in the growth literature.

3.4 Model

This section explains the model that will be used to estimate the impact of export earnings instability on economic growth in the Caribbean. This section first begins with a brief survey of modern economic growth theories and ends with an explanation of the model that will be used in the chapter.

At the center of all modern theory of economic growth is investment, not only the stock or amount of investment but also the productivity of investment. For example, the early growth model of Harrod (1939) emphasized the aggregate-demand creating effects of investment while Domar (1946) emphasized the productive-capacity creating effects of investment. In his paper Harrod (1939) defines the rate of growth of income by the relationship between the country's savings-to-income ratio and the actual incremental capital-output ratio. Thus:

$$g = \frac{s}{c} \tag{3.1}$$

where $g = \Delta Y/Y$ is the rate of growth of income; $s = S/Y$ is the fraction of income saved, and $c = I/\Delta Y$ is the actual investment-output ratio (or the increment of capital stock[14] in the period divided by the increment of total output), which depends on the state of technology and the nature of the goods constituting the increment of output. Equation (3.1) is an identity because in the national accounts, savings and investment are equal.

Domar (1946) takes the analysis further by assuming that the economy has achieved an initial level of full employment and that there is a rate of investment and productive capacity that

[14] Including changes in the stock of goods

allows the economy to remain in this continuous state of full employment. Domar also assumes that productive capacity can be optimally utilised only if there is equivalent demand for the goods produced. That is, for a state of equilibrium in the economy, it is required that total supply (or productive capacity) equals total demand (or income). Thus in Domar's model, economic growth is:

$$g = \sigma s \tag{3.2}$$

where, $g = \Delta Y/Y$ is economic growth, σ is the productivity of investment (output to investment ratio) and s is the propensity to save. This implies that for the economy to be in a continuous state of full employment, output must grow at the same rate as the product of the productivity of investment and the propensity to save. Thus, Domar's model of economic growth depends on the investment to GDP ratio and the productivity of investment. The similarity between Harrod and Domar is readily apparent.

Neoclassical growth theory (Solow (1956) and Swan (1956)) challenged the work of the Harrod-Domar model by emphasizing the importance of labour (through population growth), and technology in economic growth, in addition to the importance of capital (through savings and investments). Neoclassical growth theory models output using a Cobb-Douglas production function, which is specified as:

$$Y_t = {K_t}^{\alpha}(A_t L_t)^{1-\alpha} \tag{3.3}$$

where Y is total output, K is capital accumulation, L is labour, A is the level of technology, α is the elasticity of output with respect to capital and lies between 0 and 1, and $1 - \alpha$ is the elasticity of output with respect to labour. Thus, the Solow model introduces diminishing returns to labor and capital separately and constant returns to both factors jointly. Technology is assumed to grow at a constant exogenous rate and all savings is invested. In addition, the Solow growth model believes that economic growth is determined by a rise in capital accumulation and labour force, but only temporarily, because of diminishing returns. Once the steady-state is reached and the resources in a country are used up, long run economic growth can only be achieved through innovation and improvements in technology. Also, the Solow model predicts that the gap between rich and poor countries will narrow, because poor countries

have less capital to start with and as such each additional unit of capital will have a higher return than in a rich country. Thus, if there are diminishing returns to capital, the productivity of capital should be higher in poor countries than rich countries and therefore for the same savings ratio should converge.

Similar to the neoclassical model of economic growth, new growth theory or endogenous growth theory uses an augmented Cobb Douglas production function to model economic growth. With variables that affect the productivity of capital and in particular human capital (research and development expenditure), new growth theorists state that investments in knowledge creation result in sustained economic growth because knowledge can be reused at zero additional cost and may spillover to other firms/producers[15]. In addition to human capital, new growth theory promotes the role of government and public policies to complement investments in physical and human capital. New growth theorists note that technological improvements (research and development) are encouraged by public investment spending. Thus, policy intervention is necessary to influence economic growth in the long-run. With these inclusions, the Cobb Douglas production function can be written as:

$$Y_t = {K_t}^{\alpha} {H_t}^{\emptyset} G_t^{\theta} (A_t L_t)^{1-\alpha-\emptyset-\theta} \qquad (3.4)$$

where H is human capital, $\emptyset$ is the elasticity of output with respect to human capital, G is government policy/intervention and θ is the elasticity of output with respect to government policy.

These models all consider growth from the supply side in which demand does not matter for long-run growth. These are also closed economy models. But in an open economy, there is trade to consider and particularly export growth which increases demand and also can improve the supply capacity of the economy. Grossman and Helpman (1991) note that exports contribute to economic growth on the supply side through different means such as facilitating

[15] New growth theorists such as Romer (1986), Lucas (1988) and Aghion et.al (1992) emphasize that economic growth results from increasing returns to the use of knowledge, and constant returns rather than diminishing returns to capital.

the exploitation of economies of scale or promoting the diffusion of technology (technical knowledge).

Thirlwall (2013) further explains the importance of export growth for economic growth by highlighting that export growth is essential for a country to maintain a healthy balance of payment and for this reason is important for economic growth. He states that if a country is able to expand demand up to the level of existing productive capacity, without balance of payments difficulties arising, the pressure of demand upon capacity may well raise the capacity growth rate. This he states is achieved through: (i) the encouragement to investment which would augment the capital stock and bring with it technological progress; ii) an increase in the supply of labour by the entry into the workforce of people previously outside or from abroad; (iii) the movement of factors of production from low productivity to high productivity sectors; and the ability to import more. In addition, he notes that export growth is important for economic growth because it allows all other components of demand to grow faster. Exports pay for the import content of consumption, investment, government expenditure and exports themselves, allowing other components of demand to grow faster.

In addition, intra-industry trade theory purports that increased demand for exports creates incentives for specialization in the export sector, leads to scale economies and facilitates a reallocation of resources from the less efficient non-trade sector to the efficient export trade sector. This increases productivity and output growth. In particular, it has been argued that higher exports enhance access to advanced technologies, skill improvement, learning by doing, management techniques and entrepreneurial activity.

The Cobb Douglas production function for the open economy is:

$$Y_t = {K_t}^{\alpha} {H_t}^{\emptyset} G_t^{\theta} X_t^{\rho} (A_t L_t)^{1-\alpha-\emptyset-\theta-\rho} \quad (3.5)$$

where X is export of goods *and* services and ρ is the elasticity of output with respect to export of goods *and* services.

From the brief review of modern growth theory presented above, a growth equation can be derived. This is done by transforming equation 3.5[16]. This yields the following:

$$y_{it} = \alpha + \beta y_{it-1} + \gamma X_{it} + \varepsilon_{it} \quad (3.6)$$

Where y_{it} is the growth of real GDP per capita, α is the intercept, y_{it-1} is initial GDP per capita and X_{it} is a vector of growth determinants discussed above.

To facilitate the analysis of the impact of export earnings instability on economic growth, equation 3.6 is augmented by including export earnings instability. Thus equation 3.6 becomes:

$$y_{it} = \alpha + \beta y_{it-1} + \gamma X_{it} + \delta I_{it} + \varepsilon_{it} \quad (3.7)$$

where I is export earnings instability and γ is the elasticity of output with respect to export earnings instability.

3.5 Data

In this section the variables that are included in the growth equation are discussed. These control variables that are discussed are determined by the growth models discussed in the previous section and are the most significant in the growth literature. These variables include: investment (measured as the share of investment in GDP); government consumption expenditure to GDP; human capital (measured as secondary school enrollment) and growth in exports of goods *and* services. In addition to being an important determinant of economic growth, including the investment to GDP ratio controls for any effect that export earnings instability might have on economic growth through the investment channel (see section 3.1 for a more detail explanation). Data for this chapter are taken from the World Bank's World Development Indicators, International Monetary Fund's (IMF) World Economic Outlook, Penn World Table 8.1 and individual country data sources.

[16] See the work of Mankiw, Romer and Weil (1992) or Barro and Sal-i-Martin (1995) for a detailed demonstration.

Initial GDP per capita

Initial GDP per capita tests the conditional convergence theory that has been reported in various studies, such as Barro (1991), Mankiw, Romer, and Weil (1992) and Barro and Sala-i-Matin (1997). The argument for convergence is one of the properties of the neoclassical growth theory and derives from the diminishing returns to capital assumed in the model. This property states that the lower the starting level of real per capita gross domestic product (GDP) the higher is the predicted growth rate. Thus, if all countries have the same intrinsic characteristic (such as savings rate and technological progress) except for their starting level of income, then absolute (unconditional) convergence will occur. This means that poor countries will grow faster in per capita terms than rich countries. However, if countries differ in various respects including propensities to save, the growth rate of population, access to technology, and government policies, then convergence will occur only in a conditional sense. In this case, the growth rate of real GDP per capita tends to be high if the starting/initial per capita GDP is low in relation to its own steady state (long-run) position. Thus, this implies a negative relationship between initial per capita GDP and economic growth.

Investment (Investment as a share of GDP)

The theoretical literature has placed a lot of emphasis on the role that investment plays in economic growth. Modern growth theories identify investment as the most fundamental determinant of economic growth. The importance attached to investment by these theories has led to an enormous amount of empirical studies examining the relationship between investment and economic growth. Levine and Renelt (1992) like Domar (1946) argues that increases in investment enhance the productive capacity of an economy and increases aggregate demand. De Long and Summers (1995) notes that higher investment boosts economic growth directly by increasing physical capital and indirectly through technological spillovers. Thus, in any growth model investment captures the accumulation of physical capital while the other variables in the equation capture the efficiency/productivity of the investment. Investment in this study is measured as gross fixed capital formation as a share of GDP.

Government Consumption Expenditure as a share of GDP

Government policy (government consumption expenditure as a share of GDP) is often cited in the literature as having a statistically significant impact on economic growth. However, the

direction/sign of its effects on economic growth continue to be debated. On the one hand, government consumption expenditure as a share of GDP is argued to have a negative effect on economic growth. Proponents of this view, argue that because government consumption expenditure includes expenditures that do not directly affect productivity but entail a distortion of private decision-making (such as distortionary taxes); this leads to a slower growth rate. On the other hand, through the provision of public and merit goods such as education and health, government consumption complements private investment and therefore makes a positive contribution to economic growth.

Human Capital

Human capital distinguishes the endogenous growth model from the basic neoclassical growth model of Solow (1956), with the former emphasizing the role of human capital in economic growth. Indeed endogenous growth theory suggests a positive relationship between education and economic growth. Romer (1986) and Lucas (1988) explain that technological change is a consequence of the accumulation of knowledge acquired by forward-looking and profit-maximizing firms' production and research activities. The explanation by Romer (1986) builds on the "learning by doing" concept of Arrow (1962) which states that technology is a product acquired by firms by means of a "learning by doing" process. Lucas (1988) argues that the 'engine' of growth is human capital, as human capital accumulation raises the productivity of both labour and physical capital[17]. Ozturk (2001) sought to explain this relationship even further by providing four main links between human capital and economic growth. These are: (i) education advances the efficiency of labor and thus production through scientific and technological developments; (ii) education develops the potential skills of individuals; (iii) education enhances the ability to adapt to emerging business opportunities and (iv) educational institutions provide knowledge to be transferred to future generations. This implies that policies to enhance investment in human capital promote economic growth. The most common measure of human capital is education, which is often proxied by school enrollment or years of schooling. In this study, human capital is measured using secondary school enrollment, given the absence of data on average years of schooling for the majority of the Caribbean countries.

[17] Lucas (1988) provided the first human capital approach to endogenous growth. The basic idea of the model is that people divide their time between work and training. So, there is a trade-off, since when taking on training people give up part of their work income, but raise their future productivity, and therefore their future wages.

There are some missing data for school enrollment. Therefore, we follow the World Bank (1994) procedure of extrapolating the measures of secondary school enrollment.

Growth in Exports of Goods and Services

Growth in export of goods and services is expected to have a positive relationship with growth in real GDP per capita. As discussed in the previous section there are strong theoretical and empirical grounds supporting this hypothesis. The literature argues that export of goods *and* services stimulates demand and total factor productivity growth through its positive impact on higher rates of capital formation. Further, emphasis on exports helps to concentrate investment in the more efficient sectors of the economy. Profitable export industries stimulate additional investment, encourage an increased flow of new technology and managerial skills, stimulate increased consumption and as a result increase economic growth.

3.6 Methodology

This section explains the techniques that will be used to ascertain the determinants of economic growth in the Caribbean and estimate the impact of export earnings instability on economic growth. A brief review of the estimation procedures is presented below to highlight the advantage of using each as well as the issues involved in their estimation.

Cross-sectional and panel data analysis are the most commonly used methodologies applied to the study of economic growth. In cross-sectional regressions it is usually assumed that the rate of technological progress is the same for each country, and as such unobserved dynamics/changes are reflected in the error term. However, the model estimates become biased when the rate of technological progress is reflected in the error term because other included regressors are correlated with the level of technology[18]. Further, Pesaran and Smith (1995) explained that the assumption that the error term is uncorrelated with the explanatory variables is implausible because of the dynamic nature of growth regressions. Using cross-sectional regression is also limited because of the issue of endogeneity, where it is highly probable that

[18] See Grossman and Helpman (1991) and Temple (1999) for a more detailed discussion

some of the determinants of growth, such as investment, are jointly determined with economic growth. This would make causal inferences invalid without the use of appropriate instruments.

Panel data estimation such as the fixed and random effects estimators work to remove omitted variable bias that is present in cross-sectional analysis by measuring change within a group (in our case within a country). Fixed effects models have become popular in economic growth theory because the researcher can add variables of interest to the regressors without having to worry about omitted variables bias. However, this may lead to a trade-off between bias and efficiency as fixed effects estimation not only removes the unobserved between-country variation in technology but lose all between-country variation (Durlauf et al., 2004)[19]. The main disadvantage of using the random effects estimator is that unlike the fixed-effects model, the error component remains in the model. This may cause the coefficients to be biased if the error is correlated with any of the regressors. Wacziarg (2002) provides a cogent critique of using panel estimation estimators to solve the weaknesses of cross-country growth regressions. He notes that: (i) fixed and random effects estimations encourage researchers to construct panels from their data, effectively reducing the focus from the long-run to the short- and medium-term[20]. (ii) Because a number of growth determinants are persistent over time, fixed and random effects estimations worsen measurement errors since it transforms the data used in the estimation by taking the differences from means.

The Generalised Method of Moments (GMM) approach developed by Arellano and Bond (1991) is used in the economic growth literature as an alternative to the fixed and random effects method as it significantly reduces biases related to measurement error and endogeneity. In GMM the economic growth model is first differenced to remove the potential biases induced by country specific effects. GMM is also employed to deal with any correlation between the differenced lagged dependent variable and the error term. However, criticisms often arise regarding the use of the lagged level of the series as instruments. In particular, it is argued that in the presence of highly persistent explanatory variables, the lagged levels can be weak

[19] Durlauf et al. (2004) comment that too often panel data studies report a variable as having no effect when the more accurate interpretation is that its effect cannot be identified using the data at hand (pp. 108).

[20] As a result, the selection of the time intervals over which to average the observations is arbitrary.

instruments and the GMM estimator is likely to be heavily biased, especially in short panels (Bond et al., 2001; Durlauf et al., 2004).

GMM estimator also relies on the assumption that there is an absence of serial correlation in the error terms of the growth regression prior to differencing. However, the estimates from dynamic panels will be inconsistent even with the use of GMM when there is slope parameter heterogeneity across countries (Robertson and Symons, 1992; Pesaran and Smith, 1995; Lee et al., 1997 and 1998). Consequently, Islam (1995) and Lee et al. (1997) advocate for the use of time-series methods applied to individual countries' series, noting that "estimating cross-section regressions, or regressions using observations based on data averaged over long periods, makes it impossible to consider either the complex dynamic adjustments involved in the countries' output processes or the heterogeneity of growth rates across countries" (Lee et. al (1997), pp. 359).

Based on the above discussion a time series approach may be preferable, as this would allow: (i) one to take advantage of the information retained in the data by using time series estimation; (ii) a more detailed exposition of the effect of instability on economic growth, since uncertainty is best measured over the business cycle; and (iii) the use of a data set unconstrained by the need for measurement consistency across countries. In addition, because Caribbean countries are fundamentally different, with different economic structures, the assumption of parameter homogeneity may be inappropriate. For example, Barbados, Bahamas and the ECCU countries are primarily tourism and services-based economies; Trinidad and Tobago is driven by the oil and energy sector; Guyana depends mainly on agriculture and mining; the Dominican Republic and Haiti depend on their Manufacturing sector; and Jamaica relies on bauxite and tourism exports.

Taking the above discussion into consideration, both panel regression and time series estimation are used to investigate the impact of export earnings instability on economic growth. Using several estimation techniques allows one to assess the robustness of the findings. Also, with panel data one can take advantage of the extra information and overcome the problem of missing information in the dataset. Time series analysis allows for the assessment of the impact of export earnings instability in each country. In this regard, we use the autoregressive

distributed lag (ARDL) approach to study the determinants of economic growth in the individual countries and to take account of the endogeneity that is usually present in growth equations. Compared to other cointegration methods or distributed lag methods, this methodology has four advantages. First, it allows for the estimation of the model without testing for the order of integration of the variables. That is, this procedure yields consistent estimates of the long-run coefficients irrespective of whether the underlying regressors are I(0) or I(1). Secondly, ARDL methodology can be conducted even if the sample size is small. Thirdly, the ARDL approach facilitates the exploration of the data to ascertain the correct dynamic structure and clearly distinguish between long run and short run relationships. Fourthly, it provides valid test statistics even when some of the regressors are endogenous (see Pesaran et al. 2001).

3.7 Panel Estimation and Results

3.7.1 Panel Estimation Analysis

Further to the discussion in section 3.6, we have decided to use fixed effects, random effects and the generalized methods of moments (GMM) estimation techniques for the panel data analysis to facilitate a comparison of the methodologies and ascertain the robustness of the results. The fixed effects, random effects and GMM estimation are usually applied to short panel, that is, when N is larger than T. Thus, as is now standard in the literature, a panel dataset is constructed by transforming the time series data into non-overlapping five year averages. This is a standard procedure in the empirical growth literature with panel data, to abstract from business cycle effects; see Aghion et al. (2009). The panel comprises five year averages from 1980 to 2013 (so that each country have 7 data points). The regression model for the panel estimation is specified as follows:

$$y_{it} = \alpha + \gamma X_{it} + \delta I_{it} + \varepsilon_{it} \quad (3.8)$$

where y_{it} is growth rate of GDP per capita; X_{it} includes initial GDP per capita measured as the logarithm of real per-capita GDP at the beginning of each 5 year period; the investment to GDP ratio, government consumption expenditure to GDP, human capital measured as secondary school enrollment, and growth in exports of goods *and* services and I_{it} is export earnings instability.

To estimate the effects of export earnings instability on economic growth four different panel estimation techniques are used to check for consistency across the techniques. In particular, we use fixed effects, random effects, Difference-GMM and System-GMM estimations. The GMM estimation technique of Arellano and Bond (1991) solves the inconsistency problem caused by endogeneity in the data caused by the correlation of real GDP per capita growth with a few of the regressors. This correlation leads to inconsistent estimates under the fixed effect and random effect estimation. In addition, GMM resolves problems that may arise from bias due to the inclusion of the lagged dependent variable Nickell (1981). There are also additional efficiency gains that accrue to GMM, which is important given the relatively small size of the cross-section. GMM methodology involves eliminating the fixed effects, by applying the first difference operator to equation (3.8) and adding a lag of the dependent variable. Thus equation (3.8) is transformed into a dynamic reduced form equation of the form:

$$\Delta y_{it} = \alpha \Delta y_{it-1} + \gamma \Delta X_{it} + \delta \Delta I_{it} + \Delta \varepsilon_{it} \qquad (3.9)$$

The resulting equation is then estimated using Generalized Method of Moments (GMM), with lags of the explanatory variables as instruments. Within the GMM approach, one may choose the first-differenced estimator, which considers regression equations in first-differences instrumented by lagged levels of explanatory variables or the System-GMM approach, which combines into one system regression equations in first-differences and in levels. Taking first-differences eliminates country-specific fixed-effects, thus solving the problem of the potential omission of time invariant country specific factors that may influence growth. However, the first-differenced GMM estimator (Arellano and Bond, 1991) is not suitable when time series are persistent and the number of time series observations is small (Bond et al., 2001). Under these conditions, lagged levels of explanatory variables tend to be weak instruments for subsequent first-differences, thus producing biased estimates. Therefore, Arellano and Bover (1995) and Blundell and Bond (1998) suggest using the System-GMM approach where a "forward orthogonal deviation" is used rather than taking the first-differences. Thus, instead of subtracting the previous observation from the contemporaneous one, the average of all future available observations of a variable is subtracted. This way of dealing with heterogeneity preserves the sample size in an unbalanced panel, as is the case in this study, while still being able to use past values of explanatory variables as instruments (Arellano and Bover, 1995; Roodman, 2006).

Once the GMM estimation is done, the appropriateness of the retained instruments is tested using two specification tests. The first one is the Hansen test of over-identification for which the null hypothesis is that the chosen instruments are valid. The validation of the instruments is obtained when this hypothesis is not rejected. The second one examines whether the idiosyncratic disturbance term ε_{it} is serially correlated. The test is performed on the first differenced error term (that is, the residual of equation (3.9)) and the null hypothesis is that the latter is second-order uncorrelated. In both cases, failure to reject the null hypothesis gives support to the retained specification. To detect serial correlation in the disturbances, Arellano and Bond (1991) proposed a test. To test serial correlation of order 1 in levels, we must check for correlation of order 2 in differences. When the null hypothesis of this test (no serial correlation) is not rejected, validation of the instrumental variables is obtained.

3.7.2 Panel Estimation Results

Table 3.1 presents the results of the panel data estimation techniques. The results presented are for the random effects, fixed effects and GMM models. While the results for all four panel estimation techniques are presented, it is important to highlight that the Hausman test[21] chose the fixed effects model over the random effects model. Also, for the GMM results, both the Difference-GMM and the System-GMM results are presented, although the empirical literature shows that System-GMM works best for small samples as is the case in this study. The autocorrelation test from both the Difference-GMM and the System-GMM estimations show that there is no second-order autocorrelation among the variables (see Table 3.1).[22] In addition, the Hansen statistics indicate that the instruments used in the analysis are valid[23]. The coefficient on initial GDP per capita is negative and insignificant in the fixed effects and Difference-GMM estimation, across both measures of export earnings instability and positive and insignificant in the random effects and System-GMM models across both measures of instability. The insignificance of the coefficient on initial GDP per capita indicates that the

[21] The F-stastistic for the Hausman test for the estimations using the absolute deviation as a measure of export earnings instability is 38.12 with a p-value of 0.000. For the estimations using the standard deviation as a measure of export earnings instability the Hausman test is 35.82 with a p-value of 0.000.

[22] The test is performed on the first differenced error term (that is, the residual of equation (3.7)). To test serial correlation of order 1 in levels, we must check for correlation of order 2 in differences.

convergence theory does not hold in the Caribbean for the period investigated (i.e. 1980 to 2013).

The results show that investment to GDP ratio and export growth are positive and significant determinants of real GDP per capita growth across all four estimation techniques. This result is also robust across both measures of instability. The impact of investment on economic growth is consistent with the findings of previous studies done on the Caribbean such as Thacker et.al (2012) and is in line with theoretical predictions that the investment to GDP ratio is a major determinant of economic growth. The results indicate that a one percentage point increase in the investment to GDP ratio increases real GDP per capita growth by an average of 0.087 percentage points across all four estimation techniques and across both measures of export earnings instability. With regard to export growth, the results show that a one percentage point increase in the growth of export of goods *and* services increases economic growth by an average of approximately 0.138 percentage points and 0.132 percentage points, in the models using absolute deviation and standard deviation, respectively. This result is not surprising for the Caribbean as these countries rely on the exports of goods *and* services for a large portion of national output. In fact, exports of goods *and* services represent an average of approximately 30 percent of real GDP in the Caribbean for the period 1980 to 2013.

Government consumption as a per cent of GDP has a negative and significant coefficient in the Difference and System-GMM estimations and the fixed effects estimation technique, for both the absolute deviation and standard deviation measure of instability. However, the coefficient while negative is not significant in the random effects technique. The results suggest that government consumption does not have a robust relationship with growth in real GDP per capita in the Caribbean, thus a conclusive statement cannot be made about its effects on economic growth in the region.

Secondary school enrollment exhibits a positive and significant relationship with real per capita GDP growth in the Difference-GMM and fixed effects models and a negative and insignificant relationship in the System-GMM and random effects models. The results suggest that secondary school enrollment is not a robust determinant of economic growth in the region.

Export earnings instability has a negative and significant impact on growth in real GDP per capita for both the absolute deviation and the standard deviation as measures of export earnings instability. In addition, the result for the effect of instability on economic growth is robust across all four estimation methods. The negative and significant relationship between export earnings instability and economic growth means that export earnings instability indeed has a harmful effect on economic growth in the Caribbean. Specifically, the results show that uncertainty associated with export earnings instability lowers the efficiency of investment, and hence lowers economic growth.

Table 3.1: Panel Estimation Results of the Determinants of Real GDP Per Capita Growth (1980 to 2013)

	Absolute Deviation				Standard Deviation			
VARIABLES	DIFF-GMM	System GMM	Random Effects	Fixed Effects	DIFF-GMM	System GMM	Random Effects	Fixed Effects
	Real GDP per Capita Growth				Real GDP per Capita Growth			
Initial GDP per Capita	-0.00444	0.00309	0.000839	-0.00453	-0.00458	0.00299	0.000722	-0.00423
	(0.00688)	(0.00368)	(0.00382)	(0.00697)	(0.00689)	(0.00366)	(0.00378)	(0.00730)
Investment/GDP	0.123***	0.0595**	0.0473*	0.122**	0.117***	0.0573**	0.0453*	0.113**
	(0.0406)	(0.0268)	(0.0271)	(0.0433)	(0.0412)	(0.0254)	(0.0256)	(0.0429)
Government Consumption/GDP	-0.158***	-0.0344*	-0.0254	-0.150***	-0.157***	-0.0350*	-0.0264	-0.149***
	(0.0218)	(0.0203)	(0.0180)	(0.0226)	(0.0225)	(0.0196)	(0.0173)	(0.0230)
Secondary School Enrollment	0.0263***	-0.00405	-0.00395	0.0249**	0.0255***	-0.00389	-0.00381	0.0234**
	(0.00894)	(0.00391)	(0.00350)	(0.00971)	(0.00900)	(0.00390)	(0.00347)	(0.0101)
Growth Export of Goods and Services	0.136***	0.139***	0.136***	0.139***	0.133***	0.136***	0.133***	0.127***
	(0.0337)	(0.0327)	(0.0353)	(0.0368)	(0.0330)	(0.0326)	(0.0349)	(0.0317)
Export Earnings Instability	-0.0361**	-0.0395**	-0.0454***	-0.0367**	-0.0256*	-0.0318*	-0.0383**	-0.0299*
	(0.0144)	(0.0160)	(0.0172)	(0.0158)	(0.0149)	(0.0163)	(0.0165)	(0.0148)
Time Dummy		0.00857*	0.0115*			0.00794*	0.0110*	
		(0.00478)	(0.00595)			(0.00476)	(0.00598)	
Constant		-0.00387	0.0117	0.0564		-0.00319	0.0128	0.0552
		(0.0342)	(0.0363)	(0.0581)		(0.0336)	(0.0356)	(0.0602)
R-squared				0.362				0.359
Hansen Test	13.4(0.147)	12.1(0.584)	NA	NA	13.3(0.150)	12.1(0.595)	NA	NA
1st-order autocorrelation	-2.86(0.004)	-2.35(0.019)	NA	NA	-2.76(0.006)	-2.37(0.018)	NA	NA
2nd-order autocorrelation	0.27(0.788)	0.55(0.584)	NA	NA	0.06(0.949)	0.47(0.641)	NA	NA
Number of Observations	75	90	90	90	75	90	90	90

Notes: Standard errors are in parentheses. Statistical significance at the: *** 1 percent level, ** 5 percent level, * 10 percent. A time dummy is included in the Random Effects and the System GMM estimations. The data set in the panel data analysis is reduced to 90 data points in the system GMM, random effects and the fixed effects estimation because a lag of the dependent variable was included in the estimation methodology (as required in estimating GMM, this was also done for the random and fixed effects methodology to facilitate a comparison. This is not shown in the table since it is not a variable of interest. With difference GMM we lose one additional data point because the data is transformed using first difference.

3.8 Time Series Estimation and Results

3.8.1 Time Series Estimation

The autoregressive distributed lag (ARDL) bounds testing procedure to cointegration initiated by Pesaran et al. (2001) will be used to explore the time series properties of the data. Compared to other cointegration methods or distributed lag methods, this methodology has four advantages. First, it allows for the estimation of the model without testing for the order of

integration of the variables. That is, this procedure yields consistent estimates of the long-run coefficients irrespective of whether the underlying regressors are I(0) or I(1). Secondly, ARDL methodology can be conducted even if the sample size is small. Thirdly, the ARDL approach facilitates the exploration of the data to ascertain the correct dynamic structure and clearly distinguish between long run and short run relationships. Fourthly, it provides valid test statistics even when some of the regressors are endogenous (see Pesaran et al. 2001).

The ARDL bounds testing approach requires that an unrestricted error correction model of equation 3.8 be estimated, using OLS. The unrestricted error correction model (ECM) proposed by Pesaran et al. (2001) follows the fundamental principles of the Johansen error correction multi-variance VAR:

$$\Delta y_t = \alpha_0 + \beta y_{t-1} + \varphi \sum_{i=1}^{p-1} \Delta y_{t-i} + \gamma X_{t-1} + \pi \sum_{i=1}^{p-1} \Delta X_{t-i} + \delta I_{t-1} + \theta \sum_{i=1}^{p-1} \Delta I_{t-i} + \varepsilon_t \quad (3.10)$$

In equation 3.10, y represents the log of real GDP per capita, β is the speed of adjustment or error correction term, X represent a vector of explanatory variables, I represents export earnings instability and d_0 represent the intercept and ε_t represents the error term. The symbol Δ signifies the first difference of the variables. Equation 3.10 can be estimated under a number of cases as outlined in Peasaran et. al. (2001). These include: (i) estimating without an intercept and/or a trend; (ii) estimating with a restricted intercept and no trend; (iii) estimating with an unrestricted intercept and no trend; (iv) estimating with an unrestricted intercept and a restricted trend and (v) estimating with an unrestricted intercept and unrestricted trend.

The first step of the ARDL model is to test the variables for a unit root. This is done to ensure that none of the variables are I(2). If any of the variables are I(2), the computed F-statistics provided by Pesaran, et al. (2001) become invalid. Once the variables are confirmed to be I(0) or I(1), the ARDL approach to cointegration is applied, which consists of two stages.

In the first stage, equation 3.10 is estimated and the appropriate lag length of the models chosen using the Akaike Information or Schwartz Bayesian information criteria. In addition, the standard diagnostic tests such as serial correlation, heteroscedasticity etc. are done. Once the

model is econometrically sound, the bounds test for a long-run relationship between the variables is done. This is done by computing the Wald or F-statistic for the joint significance of the coefficients of the lagged variables. F-statistics are computed to compare the upper and lower bounds critical values provided by Pesaran et.al. (2001). In addition to the F-statistic, the T-statistic is also used in the ARDL analysis. The T-statistic is used to validate the existence of cointegration. Specifically, for cointegration to hold, the results of the F-statistic need to be complemented by the T-statistic.

The null hypothesis of the bounds test is that there is no cointegration among the variables, while the alternative supports the existence of cointegration. If the computed F-statistic is greater than the value of the upper bound of the corresponding critical value of Peasaran et. al.(2001), then there exist a long-run relationship among variables. Alternatively, if the computed F-statistic is smaller than the lower bound of the critical values, then the null of no-cointegration is not rejected. A value that lies within the upper and lower bounds of the critical values indicates that the results are inconclusive, that is, a conclusion cannot be made regarding the existence of a long-run relationship. The interpretation of the T-statistic is similar to that of the F-statistic using the absolute value of the computed statistic.

In the second stage, once the outcome of the F-statistic and the T-statistic confirms a long run relationship among the variables, the long-run equilibrium relationship between the variables is assessed.

3.8.2 Time Series Results

Although the bounds test for cointegration does not require that all variables be integrated of the same order, it is important to conduct the stationarity tests in order to ensure that the variables are not integrated of order 2. The unit root properties of the variables were tested using the augmented Dickey-Fuller Test and the Philips-Perron test. The stationarity tests (Table A3.1, in Appendix 3) indicates that all the variables, are stationary in first differences.

Based on the results of the unit roots test, the ARDL estimation is conducted. One lag is used in the estimation of the ARDL model for each of the 15 countries in our sample. One lag was chosen because of the limited number of observations in our sample. Before the model is tested

for a long-run relationship, it is checked to ensure that it passes the autocorrelation, heteroscedasticity, functional misspecification and normality tests[24]. Once the model satisfies these tests the bounds test is carried out. Table 3.2 shows the coefficients of the calculated F-statistics and T-statistics based on equation 3.10, as well as the critical values from Pesaran and Shin (2001).

Table 3.2: Bounds Test Results for Growth Equations (1980 to 2013)

Bounds Test			Pesaran and Shin (Critical Values)					
Country	**F-Statistics**	**T-Statisitcs**	**No Intercept and No Trend**		**Intercept and No Trend**		**Intercept and Trend**	
Antigua and Barbuda	7.96	-3.93	F-Statistic					
Bahamas, The	6.70	-4.12	**0.1**		**0.1**		**0.1**	
Barbados	7.45	-5.54	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Belize	5.73	-4.70	1.81	2.93	2.26	3.35	2.75	3.79
Dominica	6.61	-5.49	**0.05**		**0.05**		**0.05**	
Dominican Republic	6.67	-4.53	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Grenada	4.16	-4.70	2.14	3.34	2.62	3.79	3.12	4.25
Guyana	5.63	-4.23						
Haiti	11.04	-4.25	T-Statistic					
Jamaica	4.57	-4.80	**0.1**		**0.1**		**0.1**	
St. Kitts and Nevis	6.44	-4.46	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
St. Lucia	4.63	-4.45	-1.62	-3.49	-2.57	-3.86	-3.13	-4.21
St. Vincent and Grenadines	15.33	-4.58	**0.05**		**0.05**		**0.05**	
Suriname	6.13	-4.97	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Trinidad and Tobago	6.43	-4.55	-1.95	-3.83	-2.86	-4.19	-3.41	-4.52

To estimate the effects of export earnings instability on economic growth in the times series analysis the absolute deviation measure is used. This is used because it provides a longer time series. In addition, the panel data estimation results show similarity across both measures of instability. Thus, the results using the absolute deviation should be similar to those that would be obtained using the standard deviation as the measure of instability. The specification of equation 3.10 is different across countries. Equation 3.10 is estimated with an unrestricted intercept and a trend for Barbados, Dominica, the Dominican Republic, Grenada, Guyana, and Suriname. For the Bahamas, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia and Trinidad and Tobago, it is estimated with an unrestricted intercept and no trend. While for Antigua and Barbuda, Belize and St. Vincent and the Grenadines the equation is estimated without a trend and an intercept. With k=5, the results show that the computed F-statistics and T -statistics for all 15 Caribbean countries are greater than the upper bound of the critical value of Pesaran et

[24] Dummies were included in the equation for some countries to account for breaks in real GDP per Capita.

al. (2001). This confirms the existence of a cointegration relationship between real GDP per capita, investment to GDP, government consumption to GDP, human capital, export of goods *and* services and export earnings instability in these countries. Thus, evidence of a long-run relationship among the variables is not rejected.

Given the existence of a long–run relationship among the variables in our model, the short-run dynamics of the variables are estimated. Since we are mainly interested in the effect of export earnings instability on economic growth, we will only discuss the results of the short-run equations (that is, the growth equation for each country). The short-run estimates are presented in Tables 3.3a to 3.3c. The lag structure of the equations is simplified by removing stepwise the most insignificant lags of the first differences for each variable. The results of the long–run estimates are in tables A3.2a to A3.2b of appendix 3.

For all 15 countries, the coefficient on the error correction term is negative and significant, confirming that there is indeed a long-run relationship between real GDP per capita and the independent variables. The speed of convergence varies among the countries, ranging from a value of -0.122 in St. Vincent and the Grenadines to -0.988 in Grenada. Thus, approximately 12 to 98 percent of the short-run deviations in the region are being corrected towards the long-run equilibrium each year. The findings of the determinant of economic growth differ across countries. Below we discuss the importance of each variable to economic growth in the region.

Lag Real GDP per Capita Growth

The results from the growth equations show that growth in real GDP per capita in the previous period is positively related with growth in the current period for all countries except St. Vincent and the Grenadines. However, the relationship is not significant in every country. The coefficient on lag per capita real GDP growth is significant in the Bahamas, Barbados, Dominican Republic, Grenada, Guyana, Jamaica, St. Kitts and Nevis and Trinidad and Tobago. The positive coefficient indicates that economic activity in the previous period influences the activities of the next year in these countries. In St. Vincent and the Grenadines, the relationship is negative and insignificant.

Investment to GDP Ratio

The investment to GDP ratio is positive and highly significant in each of the 15 Caribbean countries that we analyze. For the countries of the Eastern Caribbean Currency Union, the average contribution of investment to economic growth is approximately 0.469. This implies a one percentage point increase in the investment to GDP ratio in these countries leads to an average increase of approximately 0.469 percentage point in real GDP per capita growth. In the predominantly services dependent countries of the Bahamas, Barbados, Belize and Jamaica, a one percentage point increase in the investment to GDP ratio leads to an average increase of 0.50 percentage point in growth of real GDP per capita. For the predominantly commodity exporting countries of the Dominican Republic, Guyana, Haiti, Suriname and Trinidad and Tobago; a one percentage points increase in the investment to GDP ratio increases growth of real GDP per capita by an average of 0.459 percentage point. The positive and significant coefficient for the investment to GDP ratio is consistent with the findings in the literature and indicates the investment to GDP ratio plays an important role in economic growth in the region.

Government Consumption Expenditure to GDP Ratio

Government consumption expenditure to GDP shows mixed results for the countries in our sample. For the ECCU countries, the results show that the ratio of government consumption to GDP is negative and significant in Dominica and St. Kitts and Nevis. In Grenada and St. Lucia a positive and significant relationship is observed. In Antigua and Barbuda and St. Vincent and the Grenadines, the relationship is positive and insignificant. The positive and significant relationship observed in Grenada and St. Lucia shows that on average an increase in this ratio leads to an increase of 0.323 percentage point in real per capita GDP growth. This may reflect the significance of government spending in providing productive services. In addition, it implies that the benefits of government spending outweigh any distortionary effects it may have on the tax side. For the predominantly services exporting countries of the Bahamas, Barbados, Belize and Jamaica, the ratio of government consumption expenditure to GDP has a negative and significant relationship with growth of real GDP per capita in all four countries. This negative and significant relationship indicates that an increase in government consumption reduces per capita real GDP growth. Specifically, the results indicate that a one percentage point increase in the ratio of government consumption to GDP reduces per capita growth by 0.27 percentage point. The relationship for the predominantly commodity exporters in the

region is mixed. In the Dominican Republic and Guyana the relationship is positive. However, the relationship is significant for the Dominican Republic only. In Haiti, and Suriname the relationship is negative and insignificant, while in Trinidad and Tobago the relationship is negative and significant.

Human Capital: Secondary School Enrollment

Secondary school enrollment has a positive relationship with growth of real GDP per capita in the Caribbean. However, the effect is not significant in all 15 countries. The positive relationship supports the theory that higher educational inputs increase productivity and so produce higher levels of economic growth. For the ECCU countries, a significant relationship is observed between secondary school enrollment and real GDP per capita growth in 2 of the 6 countries, Grenada and St. Kitts and Nevis. In the predominantly service exporters, human capital is significant in Barbados and Belize. For the predominantly commodity exporting countries, secondary school enrollment has a positive and significant relationship with real GDP per capita growth in Guyana and Suriname. For the countries in which the relationship is significant, a one percentage point increase in the ratio of secondary school enrollment to total enrollment increases real GDP per capita growth by an average 0.464 percentage points.

Table 3.3a: Growth Equation for the ECCU

VARIABLES	Antigua and Barbuda	Dominica	Grenada	St. Kitts and Nevis	St. Lucia	St Vincent and the Grenadines
	Growth Real GDP per Capita					
ecm_{t-1}	-0.523***	-0.751***	-0.988***	-0.396***	-0.855***	-0.122***
	(0.158)	(0.149)	(0.169)	(0.112)	(0.163)	(0.0398)
Growth Real GDP per $Capita_{t-1}$	0.143	0.0794	0.223**	0.291***	0.0208	-0.146
	(0.127)	(0.0852)	(0.103)	(0.0957)	(0.127)	(0.125)
Δ Investment/GDP	0.531***	0.207**	0.794***	0.354***	0.435**	0.498*
	(0.182)	(0.0774)	(0.123)	(0.103)	(0.157)	(0.265)
Δ Government Consumption/GDP	0.229	-0.0823***	0.214***	0.0369	-0.180	0.226
	(0.427)	(0.0283)	(0.0454)	(0.0319)	(0.137)	(0.386)
Δ Government $Consumption/GDP_{t-1}$				-0.0788**	0.433***	
				(0.0316)	(0.128)	
Δ Human Capital (Education)	0.0160	0.0226	0.398***	0.379***	0.194	0.101
	(0.576)	(0.0473)	(0.133)	(0.0903)	(0.202)	(0.0784)
Growth Export of Goods and Services	0.159***	0.120***	0.147***	0.247***	0.314***	0.200***
	(0.0562)	(0.0220)	(0.0454)	(0.0450)	(0.0566)	(0.0384)
Δ Export Earnings Instability	-0.0857	0.00853	-0.204***	0.0663	-0.0783	-0.0951
	(0.0770)	(0.0319)	(0.0583)	(0.0410)	(0.0578)	(0.0614)
Δ Export Earnings $Instability_{t-1}$				-0.0901**		
				(0.0383)		
Dummy	-0.0774***	0.0206*	0.0564**	0.0855***		0.0266***
	(0.0172)	(0.0120)	(0.0241)	(0.0242)		(0.00925)
Constant	0.0311***	0.0195***	0.0115*	0.0134**	-0.00214	0.0222***
	(0.00913)	(0.00388)	(0.00579)	(0.00537)	(0.00854)	(0.00620)
Observations	32	32	32	32	32	32
R-squared	0.786	0.817	0.841	0.864	0.734	0.735
Breusch-Godfrey AR Test	0.38(0.5371)	0.08(0.7731)	0.74(0.3909)	0.88(0.3497)	1.77(0.1831)	0.61(0.4336)
ARCH	1.57(0.4559)	3.53(0.1713)	3.37(0.1852)	3.23(0.1994)	0.43(0.8084)	1.03(0.5989)
Hettest	6.97(0.0083)	1.45(0.2285)	0.08(0.7828)	0.00(0.9703)	0.02(0.8954)	0.14(0.7121)
Ramsey Reset Test	2.20(0.1197)	2.20(0.1192)	2.60(0.0802)	0.21(0.8880)	1.03(0.4004)	0.91(0.4540)
Jarque-Bera Normality Test	0.99(0.6084)	2.29(0.3185)	1.12(0.5704)	0.12(0.9396)	1.20(0.5482)	1.80(0.4063)

Notes: Standard errors are in parentheses. Statistical significance at the: *** 1 percent level, ** 5 percent level, * 10 percent.

Growth of Exports of Goods and Services

The impact of export growth on real GDP per capita growth is positive and significant in all 15 countries. In the ECCU the average effect of export growth on real GDP per capita growth is 0.197. Thus, a one percentage point increase in export growth leads to a 0.197 percentage point increase in economic growth. Export growth increases real GDP per capita growth by an average of 0.131 percentage point in the predominantly service exporting countries. For the predominantly commodity exporters, export growth leads to an increase of 0.119 percentage points in real GDP per capita growth. These results highlight the importance of export growth in achieving economic growth in the Caribbean. Export growth allows imports of capital goods which in many Caribbean countries aid in the productivity of domestic capital. In addition,

export growth has a direct effect on demand growth in an economy which helps to keep capital fully employed and lift the balance of payment constraint on domestic growth, thereby allowing all other components of demand to expand faster without causing shortages of foreign exchange.

Table 3.3b: Growth Equation for Predominantly Service Dependent Countries

VARIABLES	Bahamas, The	Barbados	Belize	Jamaica
	Growth Real GDP per Capita			
ecm_{t-1}	-0.426***	-0.461***	-0.230*	-0.334***
	(0.124)	(0.113)	(0.114)	(0.099)
Growth Real GDP per $Capita_{t-1}$	0.244*	0.358***	0.162	0.204**
	(0.131)	(0.125)	(0.122)	(0.0843)
Δ Investment/GDP	0.514**	0.668*	0.582**	0.236***
	(0.213)	(0.325)	(0.215)	(0.0819)
Δ Government Consumption/GDP	-0.137**	-0.578**	-0.135**	-0.179*
	(0.0571)	(0.232)	(0.0605)	(0.095)
Δ Human Capital (Education)	0.0307	0.0317*	0.987**	0.0133
	(0.146)	(0.0176)	(0.379)	(0.0178)
Growth Export of Goods and Services	0.0835*	0.139**	0.124*	0.178***
	(0.0435)	(0.0623)	(0.0714)	(0.0307)
Δ Export Earnings Instability	-0.0890*	-0.0982	-0.0211	-0.1203**
	(0.0444)	(0.0671)	(0.0612)	(0.0128)
Dummy		0.0308*		0.0771***
		(0.0161)		(0.0128)
Constant	0.00407	0.0128	0.00823	-0.0125
	(0.00510)	(0.00760)	(0.00745)	(0.0130)
Observations	32	32	32	32
Adj R-squared	0.528	0.748	0.761	0.8199
Breusch-Godfrey AR Test	0.93(0.3338)	0.11(0.7410)	0.33(0.0242)	2.70(0.1003)
ARCH	0.03(0.9856)	2.60(0.2723)	4.42(0.1099)	0.19(0.9072)
Hettest	0.90(0.3424)	5.16(0.0231)	2.20(0.1380)	0.15(0.7023)
Ramsey Reset Test	0.19(0.9011)	1.53(0.2378)	0.91(0.4525)	4.09(0.0204)
Jarque-Bera Normality Test	0.64(0.2602)	1.80(0.4072)	0.41(0.8135)	1.52(0.4673)

Notes: Standard errors are in parentheses. Statistical significance at the: *** 1 percent level, ** 5 percent level, * 10 percent.

Export Earnings Instability

The results for the impact of export earnings instability varies. Of the 15 Caribbean countries studied export earnings instability has a negative effect in 13. Dominica and Haiti are the two countries for which a positive and insignificant relationship is observed. For the other 13 Caribbean countries the relationship is negative. However, the relationship is significant only in the Bahamas, the Dominican Republic, Grenada, Jamaica and St. Kitts and Nevis, where the average impact is -0.119. This implies that a one unit increase in export earnings instability reduces growth of real GDP per capita by an average of approximately 0.119 percentage point in these countries. The significant negative effect of export earnings instability that is observed

in the Bahamas, the Dominican Republic, Grenada, Jamaica and St. Kitts and Nevis implies that export earnings instability is harmful for economic growth because instability in export earnings adversely affects the productivity of investment and reduces the level of economic growth.

Table 3.3c: Growth Equation for Predominantly Commodity Exporting Countries

VARIABLES	Dominican Republic	Guyana	Haiti	Suriname	Trinidad and Tobago
	Growth Real GDP per Capita				
ecm_{t-1}	-0.907***	-0.474***	-0.265**	-0.598***	-0.466***
	(0.196)	(0.123)	(0.103)	(0.117)	(0.165)
Growth Real GDP per Capita	0.419***	0.224*	0.0778	0.00263	0.490***
	(0.139)	(0.121)	(0.126)	(0.123)	(0.110)
Δ Investment/GDP	1.299***	0.265**	0.633*	0.320**	0.231**
	(0.246)	(0.0958)	(0.312)	(0.138)	(0.111)
Δ $Investment/GDP_{t-1}$	-0.450*				
	(0.219)				
Δ Government Consumption/GDP	0.167**	0.00132	-0.120	-0.000455	-0.0964*
	(0.0591)	(0.109)	(0.673)	(0.149)	(0.0511)
Δ Human Capital (Education)	0.282	0.127***	-0.0236	0.861***	0.00952
	(0.225)	(0.0328)	(0.0448)	(0.217)	(0.00735)
Growth Export of Goods and Services	0.0374**	0.107**	0.0705***	0.237***	0.141***
	(0.0167)	(0.0488)	(0.0118)	(0.0548)	(0.0474)
Δ Export Earnings Instability	0.0451	-0.115	0.0250	-0.0408	-0.0176
	(0.0347)	(0.0688)	(0.0284)	(0.0340)	(0.0228)
Δ $Export\ Earnings\ Instability_{t-1}$	-0.0905**				
	(0.0374)				
Dummy	-0.0341***	-0.0598***		-0.0705***	-0.0491**
	(0.0106)	(0.0141)		(0.0156)	(0.0188)
Constant	0.0181***	-0.0759***	0.00239	-0.00163	-0.00321
	(0.00604)	(0.0244)	(0.0258)	(0.00848)	(0.0127)
Observations	32	32	32	32	32
R-squared	0.824	0.827	0.674	0.738	0.851
Breusch-Godfrey Test	0.00(0.9765)	0.01(0.9256)	0.72(0.3958)	0.95(0.3292)	0.84(0.3592)
ARCH	0.95(0.6231)	0.56(0.7556)	0.23(0.8904)	5.03(0.0810)	1.29(0.5240)
Hettest	1.58(0.2093)	0.01(0.9183)	2.05(0.1518)	0.86(0.3527)	1.04(0.30814)
Ramsey Reset Test	0.40(0.7545)	0.98(0.4199)	1.22(0.3285)	0.28(0.8357)	0.23(0.8770)
Jarque-Bera Normality Test	4.12(0.1275)	0.97(0.6156)	3.72(0.1557)	0.62(0.7334)	0.17(0.9175)

Notes: Standard errors are in parentheses. Statistical significance at the: *** 1 percent level, ** 5 percent level, * 10 percent.

3.11 Conclusion

This chapter evaluated the effects of export earnings instability on economic growth in a sample of 15 Caribbean countries using panel data and time series analysis. The analysis uses an augmented growth equation which isolates the effect of export earnings instability on real GDP per capita growth after controlling for the effects of other variables. Both the panel data and time series techniques show that the consistent drivers of real GDP per capita growth in the region are the investment to GDP ratio and export growth. These results are in line with

theoretical predictions and are consistent with the structure of Caribbean economies. Caribbean countries tend to rely heavily on investment and export growth for economic growth. Secondary school enrollment while exhibiting a positive relationship with real GDP per capita growth in all countries is not significant in all of them. In addition, the relationship between secondary school enrollment and real GDP per capita growth is not robust in the panel data analysis.

With regards to export earnings instability, the panel data analysis shows that export earnings instability is harmful for economic growth. The ARDL results show that export earnings instability have a negative effect on economic growth in 13 of the 15 Caribbean countries; although the negative effect is significant only in the Bahamas, the Dominican Republic, Grenada, Jamaica and St. Kitts and Nevis.

The findings in this chapter validate the results of the first chapter of thesis that examines the determinants of export earnings instability. In the first chapter raw material exports and commodity concentration are found to be the main determinants of export earnings instability in the region. Thus, the negative and significant relationship between export earnings instability and economic growth may be explained by the determinants of export earnings instability in these countries. In fact, of the five countries where a negative and significant relationship is observed, the Bahamas, the Dominican Republic, Jamaica and St Kitts and Nevis have significant shares of their export in manufacture and raw materials (refined petroleum, manufactures, bauxite and light manufacture, respectively), while Grenada has a narrow export basket. In addition, in chapter 2 the results showed that services export is relatively stable and is not a significant determinant of export earnings instability in the region. Thus, even in the countries which are predominantly service exporters, the negative and significant relationship might be explained by a concentration of goods export in a few commodities rather than a fluctuation in services export.

For those countries in which there is a negative and significant impact, the results suggests that diversification of their exports can help them to reduce the effect of export earnings instability on economic growth. Further, although the impact of export earnings instability is not significant in majority of the countries, the results may still be used as a precautionary tale and

as such several policy implications can be drawn from the results. First, governments in the Caribbean need to strengthen resilience to economic shocks caused by export earnings instability. Second, policies need to be designed to buffer the economies in times of economic downturn. For example, the governments in the Caribbean could create a stabilization fund so that in time of economic downturn they will be able to sustain the economy. Third, diversification in the non-traditional exports may also have a positive effect in reducing export earnings instability.

Appendix: Chapter 3

Table A3.1a: Unit Root Test: Augmented Dickey Fuller

	Augmented Dickey Fuller													
	Instability		Real GDP per Capita		Investment/GDP		Government Consumption/GDP		Secondary School Enrollment		Population		Export of Goods and Services	
	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ
Antigua and Barbuda	-2.37	-4.09***	-1.70	-3.68***	-3.25**	-4.03***	-2.54	-6.07***	2.09	-3.63***	-0.786	-5.39***	-2.58*	-4.53***
Bahamas, The	-.3.53***	-4.06***	-2.23	-3.08**	-2.48	-4.21***	-0.79	-3.19**	-1.76	-3.11**	-4.46***	-2.58***	-2.44	-4.62***
Barbados	-2.61*	-4.72***	-1.83	-3.11**	-3.33**	-3.77***	-1.35	-4.37***	-2.09	-3.74***	-0.397	-3.95***	-1.29	-3.28**
Belize	-4.79***	-6.98***	-1.47	-3.55***	-2.57	-4.03***	-1.99	-6.21***	-0.44	-3.11**	-0.788	-4.24***	-0.36	-4.106***
Dominica	-2.96**	-4.32***	-2.20	-3.45***	-1.79	-4.29***	-2.04	-2.95**	-2.07	-3.83***	-3.66***	-4.441***	-2.72*	-4.62***
Dominican Republic	-3.75***	-5.25***	0.59	-4.63***	-3.11**	-4.57***	-1.77	-3.69***	-0.24	-3.11**	-3.59***	-5.65***	-0.78	-5.98***
Grenada	-3.77***	-4.41***	-2.24	-3.59***	-2.20	-4.82***	-1.37	-3.96***	-2.16	-5.12***	-1.79	-3.86***	-2.33	-4.95***
Guyana	-2.17	-8.65***	-0.03	-2.98**	-3.24**	-5.34***	-2.79*	-4.29***	-1.19	-3.03**	-1.77	-5.29***	-0.59	-4.77***
Haiti	-2.85*	-3.44***	-1.01	-3.76***	-2.81*	-6.22***	-0.81	-5.33***	-4.39***	-8.28***	-2.39	-2.57*	-1.26	-2.87**
Jamaica	-2.84*	-4.24***	-1.59	-4.16***	-2.63*	-4.55****	-2.81*	-3.76***	-0.84	-2.91**	-3.33**	-3.16**	-0.93	-4.27***
St. Kitts and Nevis	-3.69***	-6.73***	-2.21	-3.57**	-2.34	-3.42**	0.37	-3.97***	-1.74	-2.96**	1.77	-5.01***	-1.35	-3.97***
St. Lucia	-2.12	-4.79***	-3.03	-3.24*	-3.58***	-4.49***	-0.47	-5.80***	-2.06	-3.14**	-2.53	-2.91**	-2.81*	-3.54***
St. Vincent and the Grenadines	-1.84	-4.12***	-2.60*	-3.17**	-2.92**	-5.49***	-2.75	-5.35***	-0.42	-3.77***	-3.47	-4.33***	-3.69***	3.56***
Suriname	-2.49	-3.17**	0.55	-3.31**	-2.15	-5.79***	-0.05	-4.07***	-2.40	-4.09***	1.59	-2.88**	-1.31	-2.92**
Trinidad and Tobago	-4.95***	-4.20***	-0.62	-3.53***	-2.16	-4.78***	-1.54	-5.83***	0.25	-3.62***	0.15	-3.13**	-0.49	-3.26**

Table A3.1b: Unit Root Test: Phillips-Perron

Country	Phillips Perron													
	Instability		Real GDP per Capita		Investment/GDP		Government Consumption/GDP		Secondary School Enrollment		Population		Export of Goods and Services	
	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ
Antigua and Barbuda	-2.30	-4.94***	-1.79	-4.06***	-2.33	-4.01***	-2.86**	-6.58***	1.945	-3.66***	0.81	-1.36*	-2.61*	-5.089***
Bahamas, The	-2.51	-6.48***	-1.39	-3.57***	-2.37	-5.25***	-1.11	-6.78***	-2.82**	-5.23***	-7.124***	-2.59*	-1.97	-5.52***
Barbados	-3.23**	-7.56***	-2.57	-3.45***	-2.01	-4.59***	-1.54	-6.00***	-0.31	-3.19**	-0.37	-5.94***	-1.48	-5.68***
Belize	-3.94***	-6.26***	-1.15	-3.45***	-2.44	-5.63***	-1.58	-4.53***	0.19	-3.59***	0.24	-4.79***	-0.29	-7.47***
Dominica	-3.51***	-5.93***	-3.38**	-5.38***	-2.69**	-5.16***	-2.47	-5.25***	-2.21	-6.05***	-3.07**	-6.080***	-4.81***	-5.92***
Dominican Republic	-3.12**	-4.84***	0.72	-4.56***	-2.87**	-5.25***	-1.10	-4.32***	-0.41	-3.14**	-17.74***	-1.15*	-0.95	-8.16***
Grenada	-3.22**	-5.28***	-1.99	-5.19***	-2.63**	-6.41***	-1.48	-6.42***	-1.65	-5.87***	-2.95**	-2.66*	-1.98	-4.84***
Guyana	-2.89**	-6.99***	0.72	-2.87**	-2.31	-5.63***	-2.58*	-6.03***	-2.79*	-3.45***	-1.69	-6.56***	-1.23	-7.56***
Haiti	-2.18	-5.33***	-1.01	-5.37***	-3.35**	-7.29***	-1.01	-6.06***	-3.48***	-3.57***	-3.39**	-2.61*	-1.41	-5.57***
Jamaica	-3.02**	-6.29***	-1.82	-3.39**	-3.08**	-6.43***	-2.19	-4.25***	-0.94	-2.94**	-4.54***	-4.77***	-0.91	-4.86***
St. Kitts and Nevis	-3.44***	-5.76***	-2.43	-3.59***	-1.78	-4.37***	0.06	-6.08***	-1.75	-5.13***	1.99	-4.99***	-1.42	-4.60***
St. Lucia	-2.32	-7.00***	-3.48***	-3.52***	-3.32**	-5.98***	-0.56	-7.91***	-1.18	-3.56***	-2.87**	-4.76***	-2.04	-5.42***
St. Vincent and the Grenadines	-2.09	-5.56***	-2.55	-6.32***	-3.02**	-5.55***	-3.53***	-7.72***	-0.29	-5.81***	-2.89**	-4.31***	-3.60***	-6.91***
Suriname	-2.94**	-5.79***	0.90	-4.23***	-2.07	-7.77***	-0.50	-7.80***	-1.12	-7.86***	3.06	-2.61*	-1.19	-2.85**
Trinidad and Tobago	-4.66***	-6.00***	-0.15	-3.57***	-2.82*	-7.58***	-1.79	-7.01***	0.32	-5.33***	-7.56***	-3.02**	-0.37	-4.75***

Table A3.2a: Long-run Results of Economic Growth for the ECCU

VARIABLES	Antigua and Barbuda	Dominica	Grenada	St. Kitts and Nevis	St. Lucia	St Vincent and the Grenadines
	Log (Real GDP per Capita)					
Investment/GDP	0.514**	0.345***	0.883***	0.777***	0.227	1.719
	(0.207)	(0.0954)	(0.131)	(0.164)	(0.167)	(1.186)
Government Consumption/GDP	0.0436	-0.111***	0.221***	0.196***	-0.327**	0.471**
	(0.738)	(0.0251)	(0.0419)	(0.0406)	(0.125)	(0.183)
Human Capital (Education)	0.722***	-0.112*	0.299*	1.023***	0.205	1.119***
	(0.189)	(0.0618)	(0.152)	(0.192)	(0.171)	(0.105)
Export of Goods and Services	0.529***	0.203***	0.232***	0.560***	0.414***	0.690***
	(0.0159)	(0.0156)	(0.0494)	(0.0537)	(0.0407)	(0.0271)
Export Earnings Instability	-0.0818	-0.0198	-0.191**	0.109	0.0472	-0.0694
	(0.0749)	(0.0451)	(0.0700)	(0.128)	(0.0702)	(0.231)
Trend		0.0230***	0.0197***			
		(0.000817)	(0.00155)			
Constant		8.441***	7.102***	-4.584***	3.305***	
		(0.241)	(0.645)	(0.707)	(0.445)	
Observations	34	34	34	34	34	34
R-squared	1.000	0.995	0.973	0.974	0.974	1.000

Table A3.2b: Long Run Results of Economic Growth for Predominantly Service Dependent Countries

VARIABLES	Bahamas, The	Barbados	Belize	Jamaica
	Log (Real GDP per Capita)			
Investment/GDP	0.965***	0.00101	0.693	0.219
	(0.263)	(0.322)	(0.517)	(0.184)
Government Consumption/GDP	-0.283***	-1.133**	-0.387***	-0.450***
	(0.0702)	(0.464)	(0.0519)	(0.143)
Human Capital (Education)	0.107	0.0464***	1.275***	-0.00406
	(0.218)	(0.00664)	(0.288)	(0.00334)
Export of Goods and Services	-0.00272	0.380***	0.233***	0.406***
	(0.0317)	(0.1000)	(0.0199)	(0.0532)
Export Earnings Instability	-0.165***	-0.146	-0.246*	-0.0231
	(0.0569)	(0.168)	(0.130)	(0.0878)
Trend		0.0233***		
		(0.00394)		
Constant	12.41***	3.359**		6.725***
	(0.475)	(1.278)		(0.695)
Observations	34	34	34	34
R-squared	0.676	0.990	1.000	0.942

Table A3.2c: Long-run Results of Economic Growth for Predominantly Commodity Dependent Countries

VARIABLES	Dominican Republic	Guyana	Haiti	Suriname	Trinidad and Tobago
	Log (Real GDP per Capita)				
Investment/GDP	0.882***	0.224	1.251	0.684***	0.644***
	(0.221)	(0.144)	(0.870)	(0.213)	(0.161)
Government Consumption/GDP	0.242***	0.0853	-0.840	-0.119	-0.347***
	(0.0417)	(0.194)	(1.523)	(0.370)	(0.0272)
Human Capital (Education)	0.637***	0.183***	-0.0184***	0.935***	0.00656***
	(0.189)	(0.0195)	(0.00549)	(0.292)	(0.00194)
Export of Goods and Services	0.00125	0.392***	0.0575**	0.408***	0.262***
	(0.0263)	(0.101)	(0.0220)	(0.0640)	(0.0499)
Export Earnings Instability	0.0144	-0.121	0.0334	-0.0279	-0.0347
	(0.0430)	(0.191)	(0.0606)	(0.0469)	(0.0304)
Trend	0.0228***	-0.131***		-0.0258***	
	(0.00303)	(0.0168)		(0.00428)	
Constant	12.86***	5.514***	8.877***	3.757***	1.236
	(0.384)	(1.332)	(0.471)	(0.910)	(0.908)
Observations	34	34	34	34	34
R-squared	0.993	0.971	0.912	0.892	0.985

CHAPTER 4: THE IMPACT OF EXPORT EARNINGS INSTABILITY ON INVESTMENT IN THE CARIBBEAN

4.1 Introduction

Like many other developing countries, Caribbean countries use a substantial part of their earnings from exports to import capital goods. As most tradable capital goods are not produced domestically, the availability of foreign exchange plays an important role in determining the level of investment. When export earnings are high countries are likely to enjoy high investment but a decline in export earnings would lead to a reduction in foreign exchange earnings and thus lower investment. Thus, persistent fluctuations in export earnings, specifically on the downturn, imply inability to import these inputs, or inability to import them at the time when needed, during the production process. Therefore, instability in export earnings should have a negative impact on investment.

In the economic literature, the effect of export earnings instability on investment is ambiguous. On the one hand, export earnings instability is hypothesized to adversely affect the level of investment by generating uncertainty and signaling to investors the prospect of successive periods of over-and-under utilization of productive capacity. On the other hand, export earnings instability may positively affect investment by increasing productivity-improving activities such as reorganizations or training during times of increased uncertainty at the expense of directly productive activities.

The literature on the effect of export earnings instability on investment remains inconclusive. This study therefore attempts to provide an empirical examination of the relationship between export earnings instability and investment for the Caribbean. The result from the panel data estimation shows that export earnings instability does not affect investment in the Caribbean, at the regional level. In addition, panel data analysis reveals that the level of investment in the Caribbean is driven by real GDP growth and the availability of credit (credit to the private sector). The time series analysis shows mixed results for the impact of export earnings instability on investment. Export earnings instability exhibits a significant negative long-run effect in Barbados and Haiti and a positive significant effect in Suriname. In the short-run

export earnings instability have negative and significant effects in Antigua and Barbuda and Belize.

The rest of the study is organized as follows: section 4.2 presents the theoretical literature on the relationship between export earnings instability and private investment, section 4.3 discusses the empirical literature, section 4.4 is devoted to the model specification, section 4.5 discusses the data and methodology, the penultimate section focuses on the presentation and discussion of empirical results, and the final section completes the study with conclusions.

4.2 Theoretical Review of the Impact of Export Earnings Instability on Investment

The effect of export earnings instability on investment is ambiguous. Theory purports that an increase in uncertainty might either increase or decrease investment. The argument that export earnings instability reduces investment is based on the hypothesis that entrepreneurs (in the export sector) may reduce borrowing because the gloomy prospect of overbearing debt in bad years may out-weigh the glittering prospects of high returns in good ones. Another argument that is advanced in support of export earnings instability reducing investment is that export earnings instability causes balance of payments difficulties which leads to a reduction in investment[25]. As a result of the increase in the balance of payments deficit in a downturn (when export earnings falls below its trend value), the exchange rate increases/depreciates and capital leaves the country for more stable investment markets. Through the working of one or all of these effects, export earnings instability is considered to reduce investment.

The argument in support of a positive relationship between export earnings instability and investment, rest on the studies of Hartman (1972) and Abel (1983), which is based on the assumption of risk neutrality and argues that investment is a positive function of uncertainty whenever profits are a convex function of the stochastic variable (by Jensen's Inequality). They note that in good states of the world, economic agents in particular firms (with a given capital stock) take on additional labour, which raises the marginal product of capital more than linearly with price of output. Meanwhile, in bad states economic agents rid themselves of excess labour.

[25] The effect of export earnings instability on the balance of payment will be explored in chapter 4.

The profit function's convexity thus ensures that the return to capital in a good state outweighs the loss of investing in the bad state, provided the firm is able to adjust variable cost.

4.3 Empirical Review

The empirical literature on the effect of export earnings instability on investment in developing countries is sparse. Two of the earlier studies to directly examine the effect of export earnings instability on investment are Coppock (1962) and MacBean (1966). Coppock (1962) uses correlation analysis for 83 (developed and developing) countries for the period 1946 to 1958 to analyse the relationship between export earnings instability and investment (measured as the net fixed capital formation as a percentage of GNP). Using correlation analysis the study finds that export earnings instability does not have a statistically significant relationship with investment. MacBean (1966) using multiple regression analysis finds a positive and significant relationship between export earnings instability and the rate of growth of domestic investment for a group of 35 developing countries over the period 1948 to 1958.

Yotopoulos and Nugent (1976) using the permanent income hypothesis[26] as their theoretical launching pad examined the relationship between export earnings instability and investment for 38 less developed countries (LDCs) for the period 1949 to 1967. In their analysis, the authors use regression analysis to examine the relationship between export earnings instability and gross capital formation to gross national product GNP. The findings show that export earnings instability has a positive but insignificant relationship with investment. When GNP per capita is included in the regression, the results show a positive and significant relationship between export earnings instability and investment[27].

In their study Ozler and Harrigan (1988) examine the impact of export earnings instability on capital accumulation for a sample of 26 developing countries over the time period 1963 to

[26] The permanent income hypothesis while acknowledging that export earnings shortfalls could lead directly to shortages of imported capital goods, emphasizes the positive relationship between export earnings instability and the propensity to save and consequently between investment.

[27] It's important to note that the theory underpinning the results here assume that savings is equal to investment. However, as was explained in Keynes (1936) this is not the case because savings and investment are demanded by different agents and there is one price which equilibrates the two.

1982. By applying ordinary least squares regression to the data, the findings show that export earnings instability has a negative but insignificant relationship with the growth rates of capital-stock and that the negative correlation is stronger in the post-1973 period. The study also finds that trade openness is a significant determinant of investment in the 26 developing countries in the study.

Akpokodje (2000) investigates the impact of export earnings instability on investment for Nigeria and finds that export earnings instability adversely affects investment. The study explores the relationship between export earnings instability and investment (capital formation) using cointegration analysis on a reduced form equation built around the flexible accelerator model. In addition to export earnings instability, the investment equation included expected output, the real interest rate and savings. The results show that in the long-run savings and output both exhibit positive and significant relationships with investment. In the short run, expected output has a positive and significant impact on investment while the impact of savings is insignificant. Export earnings instability is shown to adversely affect investment in Nigeria in the short run but is not statistically significant in the long-run.

Aidam et.al (2014) uses the autoregressive distributed lag (ARDL) method of cointegration to investigate the effect of export earnings instability on gross fixed capital formation (total investment) in Ghana over the period 1981 to 2011. The findings of the analysis indicate that export earnings instability has a positive and significant effect on investment in the long-run but has a negative significant effect in the short-run. The long-run estimates indicate that the real interest rate has a negative impact on investment, while economic growth, merchandise trade deficit and the ratio of domestic savings to GDP positively affect the level of investment. In the short-run, a change in real interest rate negatively affects changes in investment.

The literature on the effect of export earnings instability on private investment is sparse. In addition, there are other unresolved issues relating to studies that explore the relationship between export earnings instability and private investment. These include: whether export earnings instability affects investment positively or negatively and which investment model to use to capture the effect of export earnings instability on investment. This study therefore, attempts to provide an empirical re-examination of the relationship between export earnings instability and investment focusing on the Caribbean. Investment tends to be more volatile than other

determinants of aggregate demand and has proved to be difficult to model. Thus, this study will model investment by drawing on those determinants of investment that have been proven to be most relevant in developing countries. In addition, the literature also suggest that we might need to separate the long-run effects of instability from its short-run dynamics. Therefore, we propose to deal with this issue with the use of cointegration analysis. In addition, we will employ single country estimation, to account for country heterogeneity which can be important with respect to investment.

4.4 Model

In modelling the determinants of investment a few broad approaches are generally considered. These approaches are based on the major strands of the investment literature; these include the neoclassical theory of investment, the accelerator theory, the accelerator cash-flow or liquidity theory and Tobin's Q theory. However, most applied literature, especially those that focus on developing countries use a variant of the accelerator theory known as the flexible accelerator theory plus interest rate changes. In addition, Tobin's Q theory is mostly applied to the investigation of firm level data.

According to the theory of investment, the rate of investment is determined by the speed with which firms adjust their capital stocks towards their desired level. Specifically, in deciding the desired amounts of capital to be used for production, firms are guided by the prices of these factors and the contribution they make to the production and revenue of the firms. Thus, investment, which represents the addition to the stock of capital in an economy, is determined by the marginal product of capital (MPK) and user cost of capital (also called real rental cost of capital). The marginal product of capital (MPK) measures the increase in production caused by using an additional unit of capital[28].

The desired stock of capital is derived by using the Cobb-Douglas production function typically used in neoclassical theory:

[28] Assuming labour and technology are constant. In keeping with the assumptions of the neoclassical theory, the marginal product of capital is subject to diminishing returns. In addition, firms are assumed to be profit maximizing who achieve their maximum profit when it has achieved the stock of capital at which the marginal product of capital (MPK) is equal to the user cost of capital.

$$Y = AK^{\alpha}L^{1-\alpha} \quad (4.1)$$

In equation 4.1, Y is output, K is capital, L is labour, A is a measure of technological progress and α is a parameter that measures capital's share of output. From equation 4.1, the desired stock of capital is derived by differentiating the production function with respect to labour and equating the marginal product of capital to the real rental price of capital. This yields the following equation:

$$K^{*} = \alpha \frac{p}{r} Y_t \quad (4.2)$$

In equation 4.2, K* is the desired capital stock that depends on the size of output (Y_t) and real cost of capital (r/p). The higher the rental cost of capital, the lower will be the desired capital stock by the firm and vice versa. Higher output (Y_t), leads to a greater desired level of capital stocks.

The accelerator theory of investment is considered a special case of the neoclassical theory of investment where the price variables are fixed and the firms' desired capital-output ratio is roughly constant. The accelerator theory incorporates the feedback from current output to capital and begins by assuming that a particular amount of capital is required to support a certain level of economic activity.

$$K_t = \theta Y_t \quad (4.3)$$

In equation 4.3, K_t is the stock of capital, Y_t is expected output and θ is the parameter on the estimate of the effect of output on capital (the capital-output ratio). The accelerator theory predicts that investment is proportional to the increase in expected output. Since firms expectations about future output cannot be observed, this feature of the accelerator model has proven to be difficult to implement in the empirical literature. To resolve this issue, it is assumed that firms expect the change in output in the period ahead to be equal to the change in the current period. In other words, if firms project higher demand for their products, they will expand production capacity by investing in new capital goods to the point that additional benefit from doing so is exactly offset by the cost of acquiring that extra capital.

There is another theory known as the accelerator-cash flow theory or liquidity theory of investment that adds to the conceptual framework of the accelerator model by adding liquidity as a determinant of investment. Following the work of McKinnon (1973) and Shaw (1973), it has been established that many firms in developing countries face credit rationing. This constraint occurs as a result of the different information available to creditors and debtors. However, developing countries are also often characterized by administered interest rates that are set at "low" levels and by direct allocation of credit for the benefit of some firms and sectors of the economy. The impact of these policy choices on private investment is amplified by the weakness of the capital markets in developing countries, a situation that restrains the access of firms to additional equity capital. According to this approach, in developing countries interest rate ceilings are more relevant than spreads for credit allocation. For this reason the individual firm does not face unlimited supplies of credit at a given interest rate.

Based on the three theories of investment discussed above, three determinants of investment are highlighted: the cost of capital, changes in output (investors'expectation) and liquidity constraints (often measured as credit to the private sector). However, studies for developing countries discuss at length, from a theoretical viewpoint, other determinants of private investment. Some of the determinants identified in these studies are; public investment and the exchange rate. Theory suggests that private investment may fall as a result of higher public investment when the latter rests on scarce financial resources. Further, in developing countries in which financial repression prevails, public investment may crowd out private investment due to tight credit rationing at the prevailing administered interest rate. However, public investment could also confer a positive externality on private investment in countries characterized by a lack of infrastructure or by weaknesses in the provision of public goods. In this case, government investment would be complementary to private investment. This ambiguous relationship between public and private investment presents a challenge to applied research. On the one hand, empirical estimates should provide an answer on whether or not the lack of infrastructure is important enough to give rise to a significant externality. On the other hand, these estimates should help decide whether the crowding-out effect dominates the positive externality, or the opposite. Public investment can crowd private investment in or out, depending on the extent to which it involves projects that are complementary to or substitutes for private investment.

Foreign exchange is also considered an additional constraint on private investment because developing countries must import most capital goods. This occurs if balance-of-payment difficulties (associated, for instance, with the debt crisis) lead to the use of direct foreign exchange allocation. When this occurs it places an upper bound on purchases of machinery and equipment, which are usually made abroad and cannot easily be replaced by domestic substitutes. In the empirical literature, the level of the real exchange rate is often found to play an ambiguous role as a determinant of private investment. This is because the real exchange rate may affect investment adversely through the cost of imports of capital goods and its financial repercussions, or positively through its impact on exports.

4.5 Data and Methodology

There is a plethora of literature available on the relationship between investment and other macro- economic variables. Similar to the method used in choosing the growth model, we investigate the effects of export earnings instability on investment by augmenting an investment function of the empirical literature with our measure of export earnings instability. In the context of developing countries, due to data limitations and structural constraints, a variant of the flexible accelerator model that includes variables from the literature on the determinants of private investment in developing countries has often been used in empirical research. A review of the theoretical literature (shown in section 4.3) shows that for developing countries the major determinants of investment are: the user cost of capital (often proxied by real interest rates), real GDP, private sector credit, public investment and the real effective exchange rate[29]. The dataset for the panel data investment regressions is an unbalanced panel that covers 15 Caribbean countries over 5-year periods between 1980 and 2013. All the variables used in the model are in real terms. Real variables have been calculated by deflating the series by the GDP deflator (base 2005). The data are sourced from the World Bank's World Development Indicators (WDI) as well as the IMF, International Financial Statistics Database.

The methodologies that will be used to estimate the investment equation are similar to the panel data analysis and the time series estimation used in the previous chapter (see chapter 3 for detailed review of the methodologies). In addition, to the methodologies used in chapter 3 we

[29] Levine and Renelt (1992)

also use pooled OLS estimation to ascertain whether the use of long panel analysis makes a difference in the estimation results obtained. The application of pooled OLS was discussed in detail in chapter 2.

Real Gross Domestic Product (Output)

The neoclassical flexible accelerator model theorizes that the value of the desired capital stock for a typical firm depends positively on the demand for output. Consequently, the level of investment depends on aggregate demand. In the empirical literature real GDP growth is used as a proxy for aggregate demand.

User cost of Capital

Neoclassical theory suggests that as the user cost of capital rises, firms invest less because their cost of capital increases (Jorgensen, 1963). The user cost of capital is usually captured by the rate of return on investment or the real interest rate[30]. Higher interest rates increase the cost of debt service. Although it is true that the demand for investment may fall as the real interest rate rises, the amount of investment that actually takes place (realised investment) can increase because of greater availability of funds. Thus, when countries remove controls on interest rates (which were previously kept below equilibrium levels) this will induce saving, increase the availability of loanable funds along with the more efficient allocation of such funds, thus increasing investment. The literature refers to this positive relationship between interest rate and investment as the "conduit effect", whereby a rise in interest rates increases the volume of financial saving through financial intermediation and consequently raises investable funds. The interest rate channel transmission mechanism may also depend upon the institutional set up of financial markets and whether the data support the McKinnon-Shaw hypothesis or the neoclassical model.

The real interest rate is calculated as:

[30] This study (consistent with Keynes) uses the real interest rate, defined as the prime rate minus the inflation rate.

$$ln\left[\frac{(1+nominal\ interest\ rate\ )}{1+inflation\ rate}\right] \quad (4.4)$$

Availability of Credit

The effect of credit to the private sector on private investment is expected to be positive. With financial markets being generally repressed, credit policies generally affect private sector investment via the stock of credit available. In addition, the availability of credit captures the overall tightness of credit conditions in the economy. Since the market for bank loans is a customer market, in which borrowers and lenders are imperfect substitutes; a credit squeeze rations out some bank borrowers who may be unable to find loans elsewhere and so be unable to finance their investment projects. In addition, because the capital markets in developing countries are underdeveloped, any loans (short-term and medium-term) made available for financing business operations would enable businesses to finance a larger amount of capital formation. Furthermore, in countries where a large proportion of machinery and equipment has to be imported, credit availability will facilitate imports and exert a positive impact on private investment. As a result, investment is assumed to be positively influenced by changes in the volume of bank credit in developing countries.

Public Investment

The effect of public investment on private investment in developing countries is conflicting. On the one hand, public investment may have a crowding-out effect on private investment when increases in public investment shift resources from the private sector to the public sector. This is likely to occur when there is an increase/rise in interest rates. Crowd out theorists argue that the competition between business and government for savings forces interest rates up, reducing the amounts business find profitable to borrow to invest. On the other hand, the provision of public goods and basic infrastructure such as roads and telecommunications may encourage private investment.

Real Effective Exchange Rate

The effects of the real effective exchange rate on investment are ambiguous. However, the literature argues that it is an important variable influencing the decision to invest in developing economies (see Agenor, 2000). On the one hand, since investment goods (that is capital and

intermediate goods) comprise a large share of imports in developing countries. A real depreciation may discourage private investment if it increases the real cost of imported capital and intermediate goods. This effect may also be more significant in the tradable sector than the non-tradable sector. On the other hand, a real depreciation may increase export demand and profitability in the tradeable sector, through the favourable acquisition of local assets by foreign companies at much lower prices and as a result encourage private investment in the tradable sector.

The real effective exchange rate is calculated as the weighted average of bilateral real exchange rates with trading partners of a country. Thus the real effective exchange rate is:

$$REER_{country\ i} = \sum_{j=1}^{N} trade\ weight\ (country\ j) \times Real\ Exchange\ Rate\ (country\ j) \quad (4.5)$$

Country j=1,2,…N are country i's trading partners, exchange rates in natural logarithms (geometric averages).

The real effective exchange rate in equation 4.5 is a consumer price index based REER of a country's main trading partners relative to that of the domestic currency. An increase in the REER represents a depreciation and thus an improvement in external price competitiveness. The data on the consumer price indices and nominal exchange rates are obtained from the IMF's database. The trade weights for each country are obtained from the respective UN Comtrade database.

Foreign Direct Investment

The relationship between private investment and foreign direct investment has been highly debated. The debate rests on the argument of whether FDI inflows crowd in or crowd out domestic private investment. On the one hand, foreign direct investment is theorized to crowd-in/increase private investment by creating spill-over effects. That is, foreign direct investment may lead to new or higher amounts of private domestic investment through the diffusion of new technologies and the creation/introduction of new goods through forward or backward

production linkages[31]. On the other hand, foreign direct investment is thought to crowd-out private investment due to the loss of competitiveness of domestic firms and an increase in the level of theinterest rate. Foreign direct investment may cause a loss of competitiveness since foreign companies may be more efficient or may form oligopolies and sell at cheaper prices than domestic firms. In addition, while domestic firms have to rely on domestic markets, multinational companies usually have access to global product and capital markets. Interest rates may increase due to an increase in the demand for investable funds from foreign investors on the domestic financial market, thereby crowding out investments by domestic firms.

4.6 Panel Estimation and Results

4.6.1 Panel Estimation Analysis

To estimate the effect of export earnings instability on investment a standard neoclassical model is used as our theoretical starting point.

$$Inv_{it} = \alpha + RGDP\ Growth_{it} + r_{it} + Credit_{it} + REER_{it} + FDI_{it} + Pubinv_{it} + U_{it} \qquad (4.6)$$

Inv_{it} represents the ratio of private investment to GDP, $RGDP\ Growth_{it}$ represents the growth in real GDP, r_{it} represents the real interest rate, $Credit_{it}$, represents the availability of credit measured as the credit to GDP ratio, $REER_{it}$ represents the real effective exchange rate, FDI_{it} represents the ratio of foreign direct investment to GDP, $Pubinv_{it}$ represents the ratio of public investment to GDP and U_{it} represents the error term.

The econometric analysis of equation (4.6) is performed using the GMM (Arellano & Bover 1995; Blundell & Bond 1998), which capture potential partial adjustment effects, as well as some (weak) control of potential endogeneity and is well-suited for this application since it accounts for the endogeneity in the regressors and between and within variation in the data. In addition, GMM resolves problems that may arise from bias due to the inclusion of the lagged dependent variable, which is especially important since aggregate investment is a persistent

[31] The crowding-in hypothesis is based on Romer's (1993) paper on endogenous growth, where the introduction of new goods to the economy has an important role in economic development.

series (Bond, Hoeffler & Temple 2001). There are also additional efficiency gains that accrue to GMM, which is important given the relatively small size of the cross-section. GMM methodology involves eliminating the fixed effects, by applying the first difference operator to equation (3.6) and adding a lag of the dependent variable. Thus equation (3.6) is transformed into a dynamic reduced form equation of the form:

$$\Delta Inv_{it} = \alpha \Delta Inv_{it-1} + \gamma \Delta X_{it} + \varphi \Delta I_{it} + \Delta U_{it} \quad (4.7)$$

Within the GMM approach, one may choose the first-differenced estimator, which considers regression equations in first-differences instrumented by lagged levels of explanatory variables or the System-GMM approach, which combines into one system regression equations in first-differences and in levels. Taking first-differences eliminates country-specific fixed-effects, thus solving the problem of the potential omission of time invariant country specific factors that may influence private investment . However, the first-differenced GMM estimator (Arellano and Bond, 1991) is not suitable when time series are persistent and the number of time series observations is small (Bond et al., 2001). Under these conditions, lagged levels of explanatory variables tend to be weak instruments for subsequent first-differences, thus producing biased estimates. Therefore, Arellano and Bover (1995) and Blundell and Bond (1998) suggest using the System-GMM approach where a "forward orthogonal deviation" is used rather than taking the first-differences. Thus, instead of subtracting the previous observation from the contemporaneous one, the average of all future available observations of a variable is subtracted. This way of dealing with heterogeneity preserves the sample size in an unbalanced panel, as is the case in this study, while still being able to use past values of explanatory variables as instruments (Arellano and Bover, 1995; Roodman, 2006).

Once the GMM estimation is used, the appropriateness of the retained instruments is tested using two specification tests. The first one is the Hansen test of over-identification for which the null hypothesis is that the chosen instruments are valid. The second one examines whether the idiosyncratic disturbance term U_{it} is serially correlated. The test is performed on the first differenced error term (that is, the residual of equation (4.7)) and the null hypothesis is that the latter is second-order uncorrelated. In both cases, failure to reject the null hypothesis gives support to the retained specification. To detect serial correlation in the disturbances, Arellano and Bond (1991) proposed a test. To test serial correlation of order 1 in levels, we must check

for correlation of order 2 in differences. When the null hypothesis of this test (no serial correlation) is not rejected, validation of the instrumental variables is obtained. The Hansen test verifies the validity of instrument subsets. It is based on the observation that residuals should be uncorrelated with instruments (null hypothesis). When this hypothesis is not rejected, the validation of instrumentals is obtained.

In addition to the use of the GMM estimation, the fixed effects, random effects and pooled OLS estimation techniques are applied to facilitate a comparison of the methodologies and ascertain the robustness of the results. The fixed effects, random effects and GMM estimation are usually applied to short panel, that is, when N is larger than T and the pooled OLS estimation is applied to long panels where T is larger than N. For the short panel data analysis, the time series data is transformed into non-overlapping five year averages. This is a standard procedure in the literature with panel data, to abstract from business cycles effects; see Aghion et al. (2009). The panel comprises five years averages from 1980 to 2013.

4.6.2 Results of Panel Data Analysis

The results for the random effects, fixed effects, pooled OLS, Difference-GMM and System-GMM estimation techniques are presented in table 4.1. While the results for the five panel estimation techniques are presented, it is important to highlight that the Hausman test[32] chose the fixed effects model over the random effects model. Also, for the GMM results, both the Difference-GMM and the System-GMM results are presented, although the empirical literature shows that System-GMM works best for small samples as is the case in this analysis. The autocorrelation test from both the Difference-GMM and System-GMM estimations show that there is no autocorrelation among the variables. In addition, the test for the Hansen statistics indicates that the instruments used in the analysis are valid[33].

[32] The F-test for the Hausman test is 31.55 with a p-value of 0.0002 for the absolute deviation measure of export earnings instability and 32.68 with a p-value of 0.0002 for the standard deviation measure of export earnings instability.

[33] For the absolute deviation measure the AR (2) test for the system GMM is -0.53(0.599) and the Hansen test is 8.70(0.850); for the Diff-GMM for the absolute deviation the AR(2) is -0.23(0.820) and the Hansen test is 10.76(0.869). For the standard deviation measure the AR (2) test for the system GMM is -0.58(0.563) and the Hansen test is 8.64(0.854); for the Diff-GMM for the absolute deviation the AR(2) is -0.26(0.868) and the Hansen test is 10.78(0.868).

The coefficient on the lag investment variable is positive and significant across all estimation techniques and across both measures of export earnings instability. The positive relationship between private investment and its lagged value implies that previous levels of private investment influence the desire of investors to reinvest in the Caribbean. The results indicate that a one percentage point increase in the ratio of private investment to GDP in the previous period leads to an average of 0.61 and 0.60 percentage points, respectively, across both measures of export earnings instability in the current period.

Panel data estimations also support the accelerator theory, with real GDP growth having a positive and significant relationship with private investment. The results indicate that a one percentage point increase in real GDP growth increases private investment by 0.36 percentage point. This result provides evidence in support of the accelerator theory. The lag of real GDP growth is not a robust determinant of private investment.

The coefficients on the credit to GDP ratio show that the result for the Caribbean is consistent with a priori expectations on its sign. Credit to GDP exhibits a positive and significant relationship with private investment. The result is consistent across all the estimation techniques and across both measures of export earnings instability. On average the results indicate that a one percentage point increase in the credit to GDP ratio leads to an increase of 0.095 percentage point in private investment and implies that increases in credit to the private sector will boost private investment as the theory suggests.

The cost of capital as proxied by the real interest rate is statistically insignificant across all estimation techniques and across both measures of export earnings instability. This result is consistent with the broader literature such as Caballero (1999) which has struggled to establish a strong empirical relationship between the two variables. Similarly, the real effective exchange rate is insignificant across all the estimation techniques except for the System-GMM. This is the same across both measures of export earnings instability and therefore implies that the real effective exchange rate does not affect private investment.

Public investment is positive and significant in the System-GMM, random effects and pooled OLS estimation techniques. However, the coefficients are not significant in the Difference-

GMM and fixed effects estimation techniques. These results suggest that the relationship is not robust and therefore public investment does not appear to affect private investment in the Caribbean. This may reflect the inefficiency of public spending on infrastructure.

Foreign direct investment has a positive and significant relationship with private investment in the Difference-GMM, fixed effects and pooled OLS estimation techniques. Since the relationship is not significant in the random effects and System-GMM estimation techniques, the relationship is not robust. Thus, foreign direct investment does not affect private investment in the Caribbean.

Export earnings instability has a positive and insignificant impact on private investment using both the absolute deviation and the standard deviation as measures of export earnings instability. The insignificant relationship between export earnings instability and private investment means that there is no evidence that export earnings instability affects private investment in the Caribbean.

Table 4.1: Panel Data Results for Investment

VARIABLES	Absolute Deviation					Standard Deviation				
	Diff-GMM	**SYS-GMM**	**Random Effects**	**Fixed Effects**	**Pooled OLS**	**Diff-GMM**	**SYS-GMM**	**Random Effects**	**Fixed Effects**	**Pooled OLS**
	Private Investment	Private Investment	Private Investment	Private Investment	Private Investment	Private Investment	Private Investment	Private Investment	Private Investment	Private Investment
Private Investment$_{t-1}$	0.271***	0.650***	0.825***	0.447***	0.832***	0.274***	0.651***	0.828***	0.452***	0.805***
	(0.100)	(0.0591)	(0.0444)	(0.112)	(0.0294)	(0.100)	(0.058)	(0.0437)	(0.114)	(0.0316)
Real GDP Growth	0.609***	0.370**	0.297*	0.495**	0.0661*	0.612***	0.370**	0.295*	0.493**	0.0612*
	(0.186)	(0.187)	(0.162)	(0.174)	(0.0371)	(0.187)	(0.184)	(0.162)	(0.173)	(0.0365)
Real GDP Growth$_{t-1}$	0.131	-0.517**	-0.248	-0.00409	-0.0154	0.133	-0.516**	-0.250	-0.00176	-0.00589
	(0.197)	(0.240)	(0.159)	(0.213)	(0.0365)	(0.198)	(0.246)	(0.159)	(0.209)	(0.0367)
Credit/GDP	0.141***	0.0815**	0.0687***	0.115**	0.0632***	0.142***	0.082**	0.0682***	0.115**	0.0919***
	(0.0510)	(0.0351)	(0.0264)	(0.0481)	(0.0105)	(0.0510)	(0.0351)	(0.0263)	(0.0477)	(0.0135)
Real Interest Rate	-0.0174	0.0234	0.0555	-0.00433	0.00264	-0.0180	0.0239	0.0551	-0.00495	0.000538
	(0.0459)	(0.0319)	(0.0357)	(0.0474)	(0.00436)	(0.0453)	(0.0312)	(0.0352)	(0.0467)	(0.00467)
REER	0.005	0.00971*	0.00656	0.00931	0.00265	0.00560	0.009*	0.00651	0.00958	0.00576
	(0.00935)	(0.00526)	(0.00433)	(0.00808)	(0.0122)	(0.00965)	(0.00521)	(0.00432)	(0.00827)	(0.0135)
Public Investment/GDP	0.109	0.252***	0.238***	0.140	0.0401*	0.113	0.252***	0.241***	0.145	0.0393*
	(0.115)	(0.0824)	(0.0743)	(0.109)	(0.0207)	(0.114)	(0.0827)	(0.0750)	(0.107)	(0.0219)
Foreign Direct Investment/GDP	0.146*	0.0463	0.0434	0.174**	0.0575**	0.148**	0.0467	0.0425	0.176**	0.0610**
	(0.0748)	(0.0727)	(0.0765)	(0.0726)	(0.0265)	(0.0736)	(0.0722)	(0.0761)	(0.0721)	(0.0272)
Export Earnings Instability	0.0231	0.0352	0.0178	0.00994	0.000242	0.0155	0.0317	0.0113	0.00176	0.0190
	(0.0317)	(0.0322)	(0.0304)	(0.0338)	(0.0110)	(0.0326)	(0.0314)	(0.0300)	(0.0336)	(0.0144)
Constant		-0.00777	-0.0408***	0.0114	0.000698		-0.0081	-0.0399**	0.0112	-0.000485
		(0.0219)	(0.0158)	(0.0279)	(0.0205)		(0.0215)	(0.0161)	(0.0283)	(0.0216)
R-squared				0.516	0.816				0.515	0.813
Hausman Test			31.55(0.0002)					32.68(0.0002)		
Sargan Test	10.76(0.869)	8.70(0.850)								
1st Order Autocorrelation	-2.58(0.010)	-2.64(0.008)								
2nd Order Autocorrelation	-0.23(0.820)	-0.53(0.599)								
Observations	75	90	90	90	480	75	90	90	90	450

Standard errors are in parentheses. Statistical significance at the: *** 1 percent level, ** 5 percent level, * 10 percent.

4.7 Time Series Estimation and Results

4.7.1 Time Series Estimation

The autoregressive distributed lag (ARDL) approach is used to conduct the times series estimation of the investment equation for the 15 countries in the sample. Although the ARDL approach to cointegration does not require the pre-testing of the variables included in the model, for a unit root, Ouattara (2004a) argues that in the presence of I(2) variables the computed F-statistics are not valid. Thus, the implementation of unit root tests is necessary to ensure that none of the variables is integrated of order 2. To carry out the unit root tests both the Dickey- Fuller (DF) and Phillips-Perron unit root tests are used to determine the order of each series (Gujarati, D. 2002). Following the determination of the order of integration of each of the variables that will be used in the investment equation, the ARDL bounds testing approach developed by Pesaran et al. (2001) is used to derive the long-run and short-run estimates of private investment. The ARDL bounds testing approach requires that an unrestricted error correction model of equation 4.6 be estimated, using OLS. The unrestricted error correction model (ECM) proposed by Pesaran et al. (2001) follows the fundamental principles of the Johansen error correction multi-variance VAR:

$$\Delta Inv_t = \alpha_0 + \beta Inv_{t-1} + \delta \sum_{i=1}^{p-1} \Delta Inv_{t-i} + \pi X_{t-1} + \gamma \sum_{i=1}^{p-1} \Delta X_{t-i} + \mu I_{t-1} + \theta \sum_{i=1}^{p-1} \Delta I_{t-i} + \varepsilon_t \quad (4.8)$$

In equation 4.8, Inv_t represents private investment to GDP, β is the speed of adjustment or error correction term, X represent a vector of explanatory variables, I represents export earnings instability and d_0 represent the intercept and ε_t represents the error term. The symbol Δ signifies the first difference of the variables. The first step in the ARDL approach is to estimate Equation (4.8) using ordinary least square (OLS) under one of the following cases as outlined in Peasaran et. al. (2001: (i) estimating without an intercept and/or a trend; (ii) estimating with a restricted intercept and no trend; (iii) estimating with an unrestricted intercept and no trend; (iv) estimating with an unrestricted intercept and a restricted trend and (v) estimating with an unrestricted intercept and unrestricted trend. Once the appropriate case is chosen, equation 4.8 is estimated using OLS and the appropriate lag length of the models chosen using the Akaike Information or Schwartz Bayesian information criteria. In addition,

the standard diagnostic tests such as serial correlation, heteroscedasticity etc. are done. Once the model is econometrically sound, the bounds test for a long-run relationship between the variables is done.

The second step of the ARDL process is to test for the presence of a long-run relationship between the variables using the bounds test. The bounds test traces the presence of cointegration by restricting all estimated coefficients of the lagged level variables equal to zero. The null hypothesis of the bounds test is that there is no cointegration among the variables, while the alternative supports the existence of cointegration. This is done by means of a F-statistic with an asymptotic non-standard distribution. F-statistics are computed to compare the upper and lower bound critical values provided by Pesaran et.al.(2001). In addition to the F-statistic, the T-statistic is also used in the ARDL analysis. The T-statistic is used to validate the existence of cointegration. Specifically, for cointegration to hold, the results of the F-statistic need to be complemented by the T-statistic. If the computed F-statistic is greater than the value of the upper bound of the corresponding critical value of Peasaran et. al.(2001), then there exists a long-run relationship among variables. Alternatively, if the computed F-statistic is smaller than the lower bound of the critical values, then the null of no-cointegration is not rejected. A value that lies within the upper and lower bounds of the critical values indicates that the results are inconclusive, that is, a conclusion cannot be made regarding the existence of a long-run relationship. The interpretation of the T-statistic is similar to that of the F-statistic using the absolute value of the computed statistic.

4.7.2 Results of Time Series Estimation

The stationarity tests using the augmented Dickey-Fuller test and the Philips-Perron test (Table A4.1 and A4.2, in the Appendix) indicate that all the variables are stationary in first differences. Based on the results of the unit roots test, the ARDL estimation is conducted. One lag is used in the estimation of the ARDL model for each of the 15 countries in our sample. One lag was chosen because of the limited number of observations in our sample. Before the model is tested for a long-run relationship, it is checked to ensure that it passes the autocorrelation, heteroscedasticity, functional misspecification and normality tests[34]. Once the model satisfies

[34] Dummies were included in the equation for some countries to account for breaks in investment.

these tests the bounds test is carried out. Table 4.2 shows the coefficients of the calculated F-statistics and T-statistics based on equation 4.8, as well as the critical values from Pesaran and Shin (2001).

Table 4.2: Bounds Test Results for Investment

Bounds Test			Pesaran and Shin (Critical Values)					
Country	F-Statistics	T-Statisitcs	No Intercept and No Trend		Intercept and No Trend		Intercept and Trend	
Antigua and Barbuda	6.67	-4.62	F-Statistic					
Bahamas, The	4.22	-4.82	**0.1**		**0.1**		**0.1**	
Barbados	4.58	-3.76	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Belize	11.16	-3.89	1.7	2.83	2.03	3.13	2.38	3.45
Dominica	14.15	-5.21	**0.05**		**0.05**		**0.05**	
Dominican Republic	5.25	-4.69	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Grenada	6.09	-3.10	1.97	3.18	2.32	3.5	2.69	3.83
Guyana	7.6	-4.22						
Haiti	6.86	-4.22	T-Statistic					
Jamaica	13.51	-4.53	**0.1**		**0.1**		**0.1**	
St. Kitts and Nevis	7.69	-4.30	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
St. Lucia	5.03	-3.42	-1.62	-3.90	-2.57	-4.23	-3.13	-4.53
St. Vincent and Grenadines	22.80	-9.58	**0.05**		**0.05**		**0.05**	
Suriname	3.22	-3.97	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Trinidad and Tobago	7.55	-5.73	-1.95	-4.23	-2.86	-4.57	-3.41	-4.85

Similar to the chapter on economic growth, to conduct the times series analysis of the effect of export earnings instability on private investment the absolute deviation measure is used. The specification of equation 4.8 is different across countries. Equation 4.8 is estimated without an intercept and a trend for Antigua and Barbuda, Belize and the Dominican Republic (the constant was insignificant). For the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, St. Lucia, St. Vincent and the Grenadines and Suriname equation 4.8 is estimated with an unrestricted intercept and no trend. For St. Kitts and Nevis and Trinidad and Tobago, it is estimated with an unrestricted intercept and unrestricted trend. With k=7, the results show that the computed F-statistics and T-statistics for all 15 Caribbean countries are greater than the upper bound of the critical value of Pesaran et al. (2001). This confirms the existence of a cointegration relationship between private investment, real GDP growth, real interest rate, credit to GDP, the real effective exchange rate, public investment, foreign direct investment and export earnings instability in these countries. Thus, evidence of a long-run relationship among the variables is not rejected.

Given the existence of a long–run relationship among the variables in our model, both the long-run and short-run dynamics of the variables are estimated. The results are presented in Tables

4.2 to 4.8. The lag structure of the short-run equations is simplified by removing stepwise the most insignificant lags of the first differences for each variable. The tests concerning the behaviour of the errors are also included.

For all 15 countries, the coefficient on the error correction term is negative and significant, confirming that there is indeed a long-run relationship between private investment and its determinants. The error correction coefficient reveals that between 24.8 and 92.1 percent of discrepancies between the actual and the short-run level necessary for investment is corrected each year. This implies that the adjustment to equilibrium varies between countries in the region.

Lag Private Investment

The results of the short-run equations show that private investment in the previous period is positively related with private investment in the current period in four of the 15 countries in the sample. The coefficient on lag private investment is significant in Antigua and Barbuda Jamaica, Dominican Republic St. Kitts and Nevis and Trinidad and Tobago. The positive coefficient indicates that private investment in the previous period encourages investment in the current year.

Real GDP Growth

The long run equations for private investment show that real GDP growth has a positive and significant relationship with private investment in 6 of the 15 countries in the sample. The countries for which a positive and significant relationship is observed are; the Bahamas, Dominica, St. Lucia, St. Vincent and the Grenadines, Suriname and Trinidad and Tobago. The results imply that in the long-run a one percentage point increase in real GDP growth increases private investment by an average of 0.226 percentage points. This result suggests that there is evidence to support the accelerator theory of investment.

The effect of real GDP on private investment in the short-run is positive and significant in 8 of the 15 countries. The countries for which the findings are positive and significant are the Bahamas, Dominica, Grenada, Haiti, St. Lucia, St. Vincent and the Grenadines Suriname and

Trinidad and Tobago. The coefficient on change in real GDP growth in these countries is an average of 0.216 implying that a one percentage point increase in real GDP growth increases the ratio of private investment to GDP by 0.216 percentage points. Thus, an increase in economic growth brings about an increase in private investment in these countries.

Table 4.3: Long-run Result of Investment for the ECCU

VARIABLES	Antigua and Barbuda	Dominica	Grenada	St. Kitts and Nevis	St. Lucia	St. Vincent and Grenadines
	Private Investment/GDP					
Real GDP Growth	0.0175	0.0403*	0.265	0.780	0.0230**	0.214**
	(0.141)	(0.0211)	(0.188)	(0.459)	(0.00995)	(0.103)
Real Interest Rate	0.227	-0.294	-0.334*	0.317	0.0146	0.343***
	(0.325)	(0.212)	(0.195)	(0.627)	(0.204)	(0.106)
Credit/GDP	0.120*	0.242*	0.0261	0.512**	0.0438	0.121**
	(0.0697)	(0.137)	(0.0827)	(0.233)	(0.0573)	(0.0471)
REER	0.0261	0.0288	0.0704***	0.271**	-0.0145	0.0124
	(0.0431)	(0.0338)	(0.0187)	(0.113)	(0.0308)	(0.0121)
Public Investment/GDP	-0.0992	-0.459***	0.474***	0.101	-0.0840	-0.736***
	(0.136)	(0.159)	(0.103)	(0.115)	(0.140)	(0.185)
Foreign Direct Investment/GDP	0.0388	0.283	0.218	0.886***	0.389***	0.251***
	(0.115)	(0.230)	(0.231)	(0.286)	(0.110)	(0.0655)
Export Earnings Instability	-0.0340	-0.0665	0.0402	0.327	0.0740	-0.0354
	(0.0585)	(0.0761)	(0.0969)	(0.202)	(0.0450)	(0.0428)
Constant	0.198***	0.145	0.225***	-0.364	0.188**	0.0959***
	(0.0458)	(0.0900)	(0.0481)	(0.244)	(0.0785)	(0.0318)
Observations	33	33	33	33	33	33
R-squared	0.257	0.601	0.726	0.416	0.691	0.664

Real Interest Rate

Real interest rate has a significant relationship with only four countries in the long-run. In Grenada there is a negative and significant relationship with private investment and in the Bahamas, Barbados and St. Vincent and the Grenadines positive and significant relationships are observed. A significant relationship between real interest and private investment was not observed in the remaining 11 Caribbean countries in the sample (see Tables 4.3 and 4.4).

For the short-run the results are mixed. The relationship is negative and significant in Grenada and the Dominican Republic and implies that the demand for private investment falls as the real interest rate rises. A positive and significant relationship is observed in the Bahamas, Belize, Dominica, St. Vincent and the Grenadines and Suriname. The findings of a significant positive relationship implies that there is a "conduit effect" of real interest rates on private investment, that is, a rise in the real interest rate increases the volume of financial saving through financial intermediation and consequently raises the volume of investable funds. In

Antigua and Barbuda, Barbados, Guyana, Haiti, Jamaica, St. Lucia, St. Kitts and Nevis and Trinidad and Tobago there is no significant relationship between the real interest rate and private investment. The varied results for the countries in the sample confirms the hypothesis that the real interest rate channel transmission mechanism, depends upon the institutional set up of the financial markets in each country.

Table 4.4: Long-run Result of Investment for the Predominantly Service Exporting Countries

	Bahamas	Barbados	Belize	Jamaica
VARIABLES	Private Investment/GDP			
Real GDP Growth	0.764**	0.00662	0.0254	0.203
	(0.305)	(0.00615)	(0.0214)	(0.176)
Real Interest Rate	0.651**	0.438***	0.0193	0.0443
	(0.242)	(0.152)	(0.0304)	(0.0466)
Credit/GDP	0.0564	0.178***	0.998***	-0.105
	(0.179)	(0.0582)	(0.0304)	(0.0945)
REER	-0.0570	0.00840	-0.0112	-0.0123
	(0.421)	(0.0256)	(0.00752)	(0.0175)
Public Investment/GDP	0.337*	-0.235	0.0325*	-0.108
	(0.167)	(0.157)	(0.0184)	(0.325)
Foreign Direct Investment/GDP	0.230***	-0.0995	0.00193	0.593**
	(0.412)	(0.173)	(0.0293)	(0.235)
Export Earnings Instability	0.0770	-0.130*	-0.00710	-0.0113
	(0.0845)	(0.0710)	(0.00960)	(0.0745)
Constant		-0.0286	0.00325	0.262***
		(0.0393)	(0.00576)	(0.0558)
Observations	33	33	33	33
R-squared	0.932	0.500	0.985	0.495

Credit/GDP

For the credit to GDP ratio there is a significant positiverelationship with private investment for Antigua and Barbuda, Barbados, Belize, Dominica, Guyana, Haiti, St. Kitts and Nevis, St. Vincent and Grenadines, Suriname and Trinidad and Tobago. The significant relationship indicates that the availability of credit is a key driver of private investment in the long-run in these countries.

The short-run estimates show that for the countries of the ECCU, credit to GDP has a statistically significant positive relationship with private investment in all six countries (see Table 4.6). The result implies that in these countries a one percentage point increase in the credit to GDP ratio increases the ratio of private investment to GDP by an average of 0.323 percentage points. For the countries that are predominantly service exporters the relationship between the credit to GDP ratio and private investment is significant in Barbados and Belize only (see Table 4.7). The coefficient shows that a one percentage point increase in the credit to

GDP ratio in the previous period leads to an increase of 0.639 percentage points in private investment. In the predominantly commodity exporting countries the credit to GDP ratio is significant in four of the five countries (see Table 4.8). In the Dominican Republic, Guyana, Suriname and Trinidad and Tobago an increase in the credit to GDP ratio increases private investment by 0.292 percentage points. This implies that as the theory predicts, credit availability leads to higher levels of private investment.

Table 4.5: Long-run Result of Investment for the Predominantly Commodity Exporting Countries

	Dominican Republic	Guyana	Haiti	Suriname	Trinidad and Tobago
VARIABLES	Private Investment /GDP				
Real GDP Growth	0.0199	-0.0361	0.219	0.0211**	0.296***
	(0.0122)	(0.0440)	(0.194)	(0.00892)	(0.0892)
Real Interest Rate	0.0187	0.0449	-0.0479	-0.00511	-0.0705
	(0.0487)	(0.0929)	(0.0770)	(0.0351)	(0.0552)
Credit/GDP	0.171	0.182*	1.844***	0.314**	0.431***
	(0.120)	(0.0983)	(0.339)	(0.137)	(0.0627)
REER	-0.0242*	0.000469	-0.0198	-0.130*	-0.0522**
	(0.0127)	(0.0174)	(0.0256)	(0.0713)	(0.0221)
Public Investment/GDP	0.259	1.277**	-0.267*	-0.850***	0.127
	(0.168)	(0.504)	(0.138)	(0.108)	(0.201)
Foreign Direct Investment/GDP	-0.0495	0.249	0.987	-0.00843	0.508***
	(0.578)	(0.273)	(1.178)	(0.0763)	(0.136)
Export Earnings Instability	-0.0690	-0.299	-0.0646**	0.125***	-0.00631
	(0.0443)	(0.301)	(0.0272)	(0.0399)	(0.0172)
Trend					-0.00228***
					(0.000796)
Constant	0.194***		0.109	0.279***	0.180***
	(0.0558)		(0.0982)	(0.0367)	(0.0406)
Observations	33	33	33	33	33
R-squared	0.417	0.822	0.811	0.852	0.895

Real Effective Exchange Rate

The results from the long-run equations show that there is a significant positive relationship between the real effective exchange rate and private investment in Grenada and St. Kitts and Nevis. This indicates that a depreciation in the real effective exchange rate leads to an increase in private investment. In addition, the results indicate that there is a negative and significant long-run relationship between the real effective exchange rate and private investment in the Dominican Republic, Suriname and Trinidad and Tobago. This indicates that a depreciation in the real effective exchange rate in these countries negatively affects the tradeable sector by increasing the real cost of imported capital and intermediate goods. For the other Caribbean countries the relationship is insignificant.

In the short-run the relationship between the real effective exchange rate and private investment is observed to be positive and significant in Barbados and Jamaica. The results indicate that a one percentage point increase in the real effective exchange rate or a real depreciation in the exchange rate in Barbados and Jamaica increases private investment by 0.167 percentage points. In Antigua and Barbuda, St. Lucia and Suriname the relationship is negative and significant. The coefficient on the real effective exchange rate in these countries shows that on average an increase in the real effective exchange rate, that is, devaluation in the exchange rate causes a 0.073 percentage points decrease in private investment.

Public Investment to GDP

The long-run estimates show that there is a positive and significant relationship between public investment and private investment in the Bahamas, Belize, Grenada and Guyana. The results show that a one percentage point increase in public investment to GDP increases private investment by 0.530 percentage points. Thus, in the long-run in these countries public investment complements private investment. In Dominica Haiti, St. Vincent and the Grenadines and Suriname, public investment has a significant negative relationship with private investment, indicating that in the long-run public investment crowds out private investment in these four countries.

In the short-run, evidence of a crowding-in effect is found in Antigua and Barbuda, the Dominican Republic, Grenada, Haiti, Jamaica and Trinidad and Tobago where there is a positive and significant relationship between the ratio of public investment to GDP and private investment. Estimates show that a percentage point increase in the ratio of public investment to GDP increases private investment by an average of 0.342 percentage points. The results reveal crowding-out effects in the Bahamas, Barbados, Belize, Dominica, St. Vincent and the Grenadines and Suriname. In the short-run an increase of one percentage point causes an average decline of 0.390 percentage points in private investment. This suggests that in these countries, in the short-run, the public sector and the private sector are competing for resources.

Table 4.6: Short-run Result of Investment for the ECCU

VARIABLES	Antigua and Barbuda	Dominica	Grenada	St. Kitts and Nevis	St. Lucia	St. Vincent and the Grenadines
	Δ Private Investment/GDP					
ecm_{t-1}	-0.0686*	-0.661***	-0.676***	-0.356***	-0.708***	-0.754***
	(0.0383)	(0.174)	(0.167)	(0.100)	(0.160)	(0.244)
Δ Private Investment/GDP_{t-1}	0.768***	0.254	0.165	0.343***	0.0661	0.123
	(0.0560)	(0.154)	(0.114)	(0.0988)	(0.100)	(0.123)
Δ Real GDP $Growth_t$	-0.000821	0.0408***	0.281**	0.266	0.0236***	0.206***
	(0.0210)	(0.0112)	(0.120)	(0.155)	(0.00495)	(0.0555)
Δ Real Interest $Rate_t$	-0.0672	-0.196	-0.290***	-0.221	0.0420	0.242***
	(0.0423)	(0.123)	(0.0985)	(0.193)	(0.0757)	(0.0719)
Δ Real Interest $Rate_{t-1}$		0.307**				
		(0.117)				
Δ Credit/GDP_t	0.839***	0.520**	0.381***	0.386*	0.232***	0.183*
	(0.0472)	(0.229)	(0.131)	(0.194)	(0.0542)	(0.101)
Δ Credit/GDP_{t-1}	-0.711***				0.106*	
	(0.0543)				(0.0522)	
Δ $REER_t$	-0.0179***	0.00445	0.0444	0.0253	-0.0866***	-0.00179
	(0.00489)	(0.0303)	(0.0389)	(0.0453)	(0.0209)	(0.00842)
Δ Public Investment/GDP_t	0.0994***	-0.559***	0.639***	0.103	-0.00881	-0.561***
	(0.0215)	(0.172)	(0.118)	(0.0712)	(0.0848)	(0.178)
Δ Public Investment/GDP_{t-1}	0.0488**					
	(0.0191)					
Δ Foreign Direct Investment/GDP_t	-0.00611	0.221	0.0712	0.00372	0.0982	0.0641
	(0.0169)	(0.143)	(0.186)	(0.121)	(0.0822)	(0.0631)
Δ Export Earnings $Instability_t$	0.0150	-0.0393	0.0834	-0.0635	0.0474	-0.0264
	(0.0103)	(0.0693)	(0.0801)	(0.0720)	(0.0289)	(0.0398)
Δ Export Earnings $Instability_{t-1}$	-0.0384***					
	(0.0109)					
Dummy	-0.0213*		0.0335*	0.0862***	-0.0365***	-0.0209***
	(0.0103)		(0.0179)	(0.0135)	(0.00821)	(0.00706)
Constant	0.000646	-0.00158	-0.00945	0.0134**	-0.00254	0.00788**
	(0.00120)	(0.00590)	(0.00670)	(0.00636)	(0.00322)	(0.00338)
Observations	32	32	32	32	32	32
R-squared	0.984	0.775	0.808	0.870	0.924	0.843
AR Test	1.36(0.2428)	2.28(0.1308)	0.45(0.5043)	0.02(0.8882)	0.45(0.5048)	0.08(0.7816)
ARCH	0.58(0.7502)	4.82(0.0898)	2.03(0.3629)	0.53(0.7670)	3.03(0.2195)	1.01(0.6024)
Hettest	0.50(0.4776)	1.16(0.2811)	0.26(0.6102)	1.49(0.2220)	0.08(0.7794)	0.51(0.4756)
Ramsey Reset Test	0.39(0.7606)	1.66(0.2122)	2.29(0.1129)	1.57(0.2311)	0.71(0.5580)	1.85(0.1739)
Normality Test	1.88(0.3910)	1.06(0.5887)	2.34(0.3108)	0.20(0.9057)	1.28(0.5261)	0.11(0.9458)

Foreign Direct Investment to GDP

Foreign direct investment has a positive and significant long-run relationship with private investment in the Bahamas, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines and Trinidad and Tobago. This implies that in the long-run an increase in foreign direct investment leads to an increase in private investment. Specifically, a one percentage point increase in the ratio of foreign direct investment to GDP increases private investment by 0.476 percentage points.

The short-run effects indicate that foreign direct investment has a positive and significant relationship with private investment in Belize, Guyana, Jamaica and Trinidad and Tobago. The coefficients on the ratios of foreign direct investment to GDP in these countries indicate that a one percentage point increase in foreign direct investment to GDP leads to an increase of 0.314 percentage points. This result is in line with the hypothesis that foreign direct investment crowds-in/increases private investment through the diffusion of new technologies and the creation/introduction of new goods through forward or backward production linkages.

Table 4.7: Short-run Result of Investment for the Predominantly Service Exporting Countries

	Bahamas	Barbados	Belize	Jamaica
VARIABLES	Δ Private Investment/GDP			
ecm_{t-1}	-0.347***	-0.531***	-0.382**	-0.674***
	(0.0728)	(0.178)	(0.144)	(0.138)
Δ Private Investment/GDP_{t-1}	-0.109	-0.0286	-0.00410	0.321**
	(0.156)	(0.161)	(0.0148)	(0.128)
Δ Real GDP $Growth_t$	0.194**	0.00622	0.0252	0.0537
	(0.0867)	(0.00386)	(0.0177)	(0.0892)
Δ Real Interest $Rate_t$	0.232*	0.00816	0.0249*	0.0342
	(0.114)	(0.145)	(0.0137)	(0.0459)
Δ Real Interest $Rate_{t-1}$			0.0304**	
			(0.0126)	
Δ Credit/GDP_t	0.205	0.319*	0.958***	0.0232
	(0.257)	(0.173)	(0.0169)	(0.0685)
Δ $REER_t$	0.0752	-0.0142	-0.0105*	-0.00488
	(0.143)	(0.0231)	(0.00574)	(0.00958)
Δ $REER_{t-1}$	0.316**			0.0182*
	(0.137)			(0.00950)
Δ Public Investment/GDP_t	0.0610	-0.386**	-0.0363**	2.763*
	(0.130)	(0.143)	(0.0142)	(1.335)
Δ Public Investment/GDP_{t-1}	-0.223*			
	(0.108)			
Δ Foreign Direct Investment/GDP_t	0.330	-0.138	0.0239	0.310**
	(0.273)	(0.145)	(0.0143)	(0.143)
Δ Foreign Direct Investment/GDP_{t-1}			0.0631***	
			(0.0189)	
Δ Export Earnings $Instability_t$	0.0526	-0.0330	-0.0123**	-0.0248
	(0.0356)	(0.0451)	(0.00554)	(0.0444)
Dummy		0.0176*		-0.0211***
		(0.00916)		(0.00584)
Constant	0.0102**	-0.0111**	-0.000757*	0.000944
	(0.00478)	(0.00522)	(0.000418)	(0.00393)
Observations	32	32	32	32
R-squared	0.711	0.675	0.998	0.750
AR Test	0.62(0.4321)	2.80(0.1000)	1.77(0.1833)	0.64(0.4229)
ARCH	0.66(0.7194)	0.55(0.7615)	0.19(0.9057)	0.33(0.8488)
Hettest	0.14(0.7105)	0.18(0.6745)	0.15(0.6971)	071(0.3983)
Ramsey Reset Test	0.18(0.9074)	0.63(0.6052)	1.58(0.2301)	1.81(0.1836)
Normality Test	2.93(0.2314)	0.60(0.7420)	0.24(0.8877)	3.02(0.2209)

Export Earnings Instability

In the long-run export earnings instability has a negative and significant relationship with private investment in Barbados and Haiti and significant positive relationship with Suriname. While in the short run the effect of export earnings instability on private investment is negative

and significant in Antigua and Barbuda, Belize and Haiti. A negative relationship is not observed for Barbados in the short-run. The negative results indicate that a one unit change in the index of export earnings instability reduces private investment by an average of 0.032 percentage points. A significant positive relationship is observed in Suriname in the short-run. The estimation results indicate that a one unit increase in export earnings instability increases private investment in Suriname by 0.162 percentage point in the short-run. The positive relationship observed in Suriname imply that an increase in uncertainty caused by export earnings instability causes expected profit in the country to increase which leads to an increase in private investment.

Table 4.8: Short-run Result of Investment for the Predominantly Commodity Exporting Countries

VARIABLES	Dominican Republic	Guyana	Haiti	Suriname	Trinidad and Tobago
	Δ Private Investment/GDP				
ecm_{t-1}	-0.452***	-0.268**	-0.402**	-0.808***	-0.995***
	(0.151)	(0.112)	(0.141)	(0.197)	(0.189)
Δ Private Investment/GDP_{t-1}	0.313**	0.126	0.0645	0.183	0.205*
	(0.144)	(0.131)	(0.115)	(0.140)	(0.104)
Δ Real GDP $Growth_t$	0.00675	0.0231	0.388***	0.0232***	0.163**
	(0.00577)	(0.0145)	(0.0842)	(0.00577)	(0.0659)
Δ Real GDP $Growth_{t-1}$			0.450***		
			(0.0812)		
Δ Real Interest $Rate_t$	-0.0837**	-0.00816	-0.0113	-0.00878	-0.0110
	(0.0384)	(0.0354)	(0.0481)	(0.0332)	(0.0326)
Δ Real Interest $Rate_{t-1}$				0.0564**	
				(0.0267)	
Δ Credit/GDP_t	0.115	0.127***	-0.145	0.387*	0.394***
	(0.111)	(0.0312)	(0.334)	(0.224)	(0.0735)
Δ Credit/GDP_{t-1}	0.259**				
	(0.124)				
Δ $REER_t$	0.00569	-0.0348	0.0134	-0.114**	-0.0200
	(0.0132)	(0.0280)	(0.0120)	(0.0458)	(0.0245)
Δ Public Investment/GDP_t	0.639***	0.158	-0.109*	-0.575***	0.337*
	(0.120)	(0.335)	(0.0559)	(0.162)	(0.192)
Δ Public Investment/GDP_{t-1}			0.122*		
			(0.0615)		
Δ Foreign Direct Investment/GDP_t	0.0834	0.410***	-0.343	-0.0136	0.473***
	(0.302)	(0.107)	(0.436)	(0.0548)	(0.104)
Δ Export Earnings $Instability_t$	-0.0255	0.103	-0.0464**	0.162***	-0.00684
	(0.0291)	(0.111)	(0.0185)	(0.0390)	(0.0137)
Dummy		0.0590**		-0.0490**	
		(0.0244)		(0.0204)	
Constant	-0.00232	-0.00646	0.00243	0.00868	-0.000853
	(0.00324)	(0.00787)	(0.00328)	(0.00708)	(0.00330)
Observations	32	32	31	32	32
R-squared	0.728	0.739	0.858	0.721	0.799
AR Test	0.29(0.5864)	1.50(0.2201)	5.34(0.8133)	0.05(0.8244)	0.34(0.5589)
ARCH	0.38(0.8270)	0.58(0.7488)	1.66(0.4363)	0.82(0.6644)	0.59(0.7432)
Hettest	1.77(0.1831)	0.78(0.3783)	1.42(0.2330)	1.19(0.2753)	0.01(0.9091)
Ramsey Reset Test	1.72(0.1991)	0.94(0.4402)	4.94(0.0129)	2.29(0.1150)	1.34(0.2924)
Normality Test	0.92(0.6326)	2.35(0.3086)	2.47(0.2907)	2.15(0.3417)	1.15(0.5639)

4.8 Conclusion

This chapter investigated the effects of export earnings instability on private investment for 15 Caribbean countries controlling for some standard investment determinants. In addition, the analysis uses dynamic panel data analysis and times series analysis via the use of the ARDL methodology to estimate the investment equation and to ascertain the effect of export earnings instability on private investment. The panel estimation results show that private investment in the Caribbean is determined by real GDP growth and credit to the private sector. Real interest rate and the real effective exchange rate are not found to be significant determinants of private investment in the region. In addition, public investment and foreign direct investment are not robust determinants of private investment.

The autoregressive distributed lag results indicate that real GDP growth and private sector credit appear to be the most significant determinants of private investment among the 15 Caribbean countries. The results obtained for the ARDL analysis are mixed with no one determinant being consistently significant as a determinant of private investment in all 15 countries in the long-run or the short-run. As it relates to export earnings instability, the panel data regression result reveals that export earnings instability does not have a significant effect on private investment in the Caribbean, at the regional level. The ARDL analysis shows that export earnings instability has a negative and significant effect on private investment in the long-run in Barbados and Haiti and a positive and significant effect in Suriname. In the short-run export earnings instability has negative and significant effects in Antigua and Barbuda and Belize.

The overall insignificant result that is observed in the panel data analysis, indicate that the significant negative effect of export earnings instability on economic growth observed in chapter 3 must due to the effect of export earnings instability on the productivity/efficiency of investment rather than the level of investment itself. Also, for those countries for which a negative effect of export earnings instability is observed in the long-run or short-run, the government should take measures that will encourage investment during periods of uncertainty.

Appendix 4

Table A4.1: Unit root Test: Dickey Fuller

	Augmented Dickey Fuller															
	Instability		Real GDP		Private Investment/GDP		Real Interest Rate		Real Effective Exchange Rate		Credit/GDP		Public Investment/GDP		Foreign Direct Investment/GDP	
	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ
Antigua and Barbuda	2.17	-4.93***	-2.65	-3.98***	-4.06***	-3.88***	-3.12**	-8.74***	-3.29**	-8.42***	-1.544	-5.46***	-2.01	-4.98***	-2.92**	-6.15***
Bahamas, The	-2.48	-6.59***	-2.93	-4.07***	-2.61	-3.42**	-4.26***	-10.10***	-2.89**	-6.28***	-0.46	-4.43***	-1.19	-5.89***	-1.38	-6.39***
Barbados	-3.25**	-7.52***	-3.37*	-5.44***	-3.33*	-4.72***	-2.67*	-7.95***	-1.73	-6.75***	0.433	-5.31***	-2.86*	-6.68***	-1.84	-6.05***
Belize	-3.95***	-6.24***	-2.52	-3.52**	-2.16	-6.17***	-5.65***	-7.48***	-4.01***	-10.38***	-1.33	-4.26***	-3.55***	-4.48***	-2.77*	-7.46***
Dominica	-3.49***	-5.91***	-2.11	-3.61**	-2.97	-5.28***	-5.54***	-9.37***	-3.06**	-9.43***	-1.34	-3.57***	-4.84***	-5.31***	-3.78***	-8.17***
Dominican Republic	-2.92**	-4.82***	-2.33	-3.86**	-3.02	-4.18***	-3.14**	-7.15***	-1.93	-6.43***	-1.19	-6.54***	-1.28	-6.46***	-2.29	-6.69***
Grenada	-3.04**	-5.28***	-2.11	-5.40***	-1.74	-5.15***	-6.14***	-10.35***	-0.35	-4.84***	-1.511	-5.05***	-1.83	-6.29***	-2.38	-5.53***
Guyana	-2.94**	-6.87***	-2.14	-6.79***	-3.54**	-4.79***	-3.32**	-10.54***	-1.37	-2.72*	-3.53	-8.09***	-2.69*	-6.38***	-3.52***	-8.83***
Haiti	-2.08	-5.33***	-1.74	-5.52***	-2.62	-4.28***	-1.88	-6.62***	-2.65*	-6.39***	-0.566	-6.45***	-4.03***	-5.89***	-2.49	-7.4***
Jamaica	-2.96**	-6.29***	-1.98	-3.89**	-2.44	-4.53***	-1.51	-5.27***	-2.54	-6.65***	-2.14	-4.76***	-2.55	-5.94***	-2.14	-7.35***
St. Kitts and Nevis	3.33**	-5.76***	-0.85	-4.25***	-2.64	-4.35***	-4.16***	-9.67***	-4.49***	-11.66***	-1.95	-5.44***	-1.49	-4.36***	-3.00**	-6.37***
St. Lucia	-2.38	-6.97***	-2.93	-4.27***	-4.42***	-4.04***	-5.54***	-10.15***	-2.48	-9.80***	0.127	-4.88***	-1.39	-6.49***	-3.13**	-5.02***
St. Vincent and the Grenadines	-1.98	-5.56***	-0.64	-3.74**	-1.74	-5.77***	-3.96***	-8.84***	-2.77*	-6.72***	-0.62	-5.79***	-3.30**	-5.62***	-1.96	-5.47***
Suriname	-2.92**	-5.78***	-1.62	-5.37***	-2.58	-4.96***	-2.46	-4.75***	-3.24**	-9.38***	-2.05	-6.48***	-2.88**	-7.38***	-3.79***	-7.64***
Trinidad and Tobago	-4.55***	--5.99***	-0.88	-6.05***	-2.49	-4.63***	-7.32***	-9.53***	-1.27	-5.15***	-2.58	-7.28***	-2.18	-5.49***	-2.60*	-6.95***

Table A4.2: Unit root Test: Phillips-Perron

Country	Phillips Perron															
	Instability		Real GDP		Private Investment/GDP		Real Interest Rate		Real Effective Exchange Rate		Credit/GDP		Public Investment/GDP		Foreign Direct Investment/GDP	
	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ	level	Δ
Antigua and Barbuda	-2.32	-4.89***	-1.92	-4.16***	-2.76	-4.24***	-3.03**	-11.36***	-3.36**	-9.93***	-1.53	-5.49***	-2.01	-4.94***	-2.92**	-6.29***
Bahamas, The	-2.53	-6.45***	-1.69	-5.38***	-2.81	-4.49***	-4.24***	-12.09***	-2.95**	-6.41***	-0.57	-4.43***	-1.14	-5.94***	-1.45	-6.34***
Barbados	-3.19**	-8.28***	-3.21*	-5.72***	-2.99	-5.96***	-2.55	-8.13***	-1.56	-7.09***	0.35	-5.36***	-2.82*	-6.99***	-1.93	-6.37***
Belize	-3.93***	-6.69***	-18.09**	-52.09***	-5.03***	-9.07***	-5.67***	-10.38***	-4.07***	-10.93***	-1.32	-4.19***	-3.68***	-4.51***	-2.57*	-8.45***
Dominica	-3.56***	-5.99***	-2.50	-5.07***	-2.76	-6.64***	-5.54***	-12.28***	-3.18**	-8.64***	-1.53	-3.55***	-4.77***	-5.39***	-3.79***	-8.92***
Dominican Republic	-2.90**	-4.77***	-2.27	-4.57***	-2.97	-5.01***	-3.14**	-8.17***	-2.11	-6.33***	-1.12	-6.59***	-1.22	6.49***	-2.10	-7.20***
Grenada	-3.04**	-5.35***	-19.36***	-51.22***	-3.45**	-6.63***	-6.16***	-13.36***	-0.56	-4.86***	-1.66	-5.10***	-1.94	-6.32***	-2.26	-5.63***
Guyana	-2.85**	-7.77***	-2.29	-6.68***	-2.98	-5.99***	3.40**	-10.21***	-1.52	-2.79*	-3.59***	-10.24***	-2.55	-6.77***	-3.54***	-9.21***
Haiti	-2.25	-5.34***	-1.79	-5.53***	-2.43	-5.05***	-1.89	-6.74***	-2.68*	-7.01***	-0.46	-6.42***	-3.91***	-7.04***	-2.24	-10.50***
Jamaica	-2.98**	-6.44***	-1.81	-5.17***	-2.63	-5.11***	-1.70	-5.29***	-2.56	-6.79***	-2.29	-4.70***	-2.56	-6.05***	-1.99	-7.69***
St. Kitts and Nevis	-3.19**	-6.38***	-0.84	-5.79***	-2.18	-5.17***	-4.14***	-10.36***	-4.71***	-17.99***	-2.14	-5.44***	-1.75	-4.37***	-2.93**	-6.61***
St. Lucia	-2.37	-7.06***	-2.47	-5.95***	-3.34*	-5.63***	-5.54***	-14.44***	-2.73*	-12.89***	0.12	-4.84***	-1.32	-6.53***	-3.07**	-4.99***
St. Vincent and the Grenadines	-2.24	-5.56***	-0.25	-5.93***	-3.27*	-8.72***	-3.87***	-9.95***	-2.69*	-7.96***	-0.71	-5.85***	-3.41**	-5.62***	-1.84	-5.58***
Suriname	-3.06**	-5.78***	-1.62	-5.38***	-2.29	-6.71***	-2.44	-4.69***	-3.29**	-9.57***	1.93	-6.71***	-2.85*	-7.66***	-3.78***	-8.56***
Trinidad and Tobago	-4.92***	-6.03***	-0.86	-6.04***	-2.29	-4.79***	-7.89***	-14.60***	-1.66	-5.16***	-2.59*	-7.26***	-2.29	-5.49***	-2.42	-8.19***

CHAPTER 5: THE IMPACT OF EXPORT EARNINGS INSTABILLITY ON THE BALANCE OF PAYMENTS AND EXTERNAL DEBT IN THE CARIBBEAN

5.1 Introduction

The main aim of this chapter is to examine the effect of export earnings instability on the balance of payments in a sample of 15 Caribbean countries for the period 1980 to 2013. The chapter tries to ascertain whether instability in export earnings causes the current account and trade balance to deteriorate since the impact of instability may be asymmetrical with the impact of downturn more damaging than the improvement in upturn. In addition to assessing the effect of export earnings instability on the current account and trade balance, this chapter also tries to examine empirically the determinants of the current account and trade balance of the Caribbean using conventional export and import demand functions. That is, the chapter attempts to estimate the effect of domestic income, world income and relative prices/real exchange rate on Caribbean countries' balance of payments.

In addition, this chapter examines the relationship between export earnings instability and external debt in the region. As Thirlwall (1979) aptly states "…no country can grow faster than the rate consistent with balance of payments equilibrium on the current account unless it can finance ever-growing deficits, which in general it cannot". Thus, when countries go into temporary balance of payments deficits, they will need to borrow from the international capital market or from an official source such as the World Bank or the International Monetary Fund (IMF), creating debt which has to be repaid in foreign currency.

To explore the relationship between export earnings instability, the current account balance, the trade balance and external debt, panel data estimation techniques and cross-sectional time series analysis are used. The main findings of the chapter are that at the regional level export earnings instability has a positive but statistically insignificant impact on the current account and trade

balance in the Caribbean. At the country level, the results from the pooled mean group estimator find that in the short-run, export earnings instability exhibits positive and significant relationships with the current account balance in Belize, St. Vincent and the Grenadines and Trinidad and Tobago and negative and significant relationships in Antigua and Barbuda, Barbados and Haiti. For the trade balance, there are positive and significant results in the Dominican Republic, Haiti and Trinidad and Tobago and negative and significant results in the Bahamas and Jamaica. In the long-run, the effect of export earnings instability on the current account is positive and statistically significant, implying that positive effects outweigh negative effects. The long-run estimate for the trade balance shows that export earnings has a positive relationship with the trade balance but the effect is statistically insignificant.

In addition, the panel estimation results reveal that domestic income growth has a negative effect on the current account and the trade balance, while world income growth has a positive effect on the current account and the trade balance. With respect to world income growth, the estimations show that a one percentage point increase leads to an increase of 2.11 and 2.92 percentage points in the current account and trade balance to GDP ratios, respectively. The Marshal-Lerner condition is satisfied in the current account analysis, where the rate of change in the real exchange rate is observed to improve the current account balance. However, there was no statistically significant relationship between the rate of change in the real exchange rate and the trade balance. At the country level the determinants of the current account and trade balance vary, with no general consensus on the determinants of the balance of payments among individual countries in the region.

With regards to the analysis of external debt, export earnings instability does seem to have a statistically significant effect on the external debt to export ratio. But, the current account balance is found to have a negative relationship with the external debt to export ratio and the debt service to export ratio is found to have a positive and significant relationship with the external debt to export ratio.

The rest of the chapter is organized as follows: the section that follows provides a descriptive analysis of the current account and trade balance in the Caribbean; section 5.3 discusses the model specification and data used in the chapter; section 5.4 provides the methodology; section 5.5 discusses the empirical results for the current account and trade balance; section 5.6 presents an examination of the relationship between export earnings instability and external debt and section 5.7 provides the concluding remarks.

5.2 Balance of Payments Performance in the Caribbean

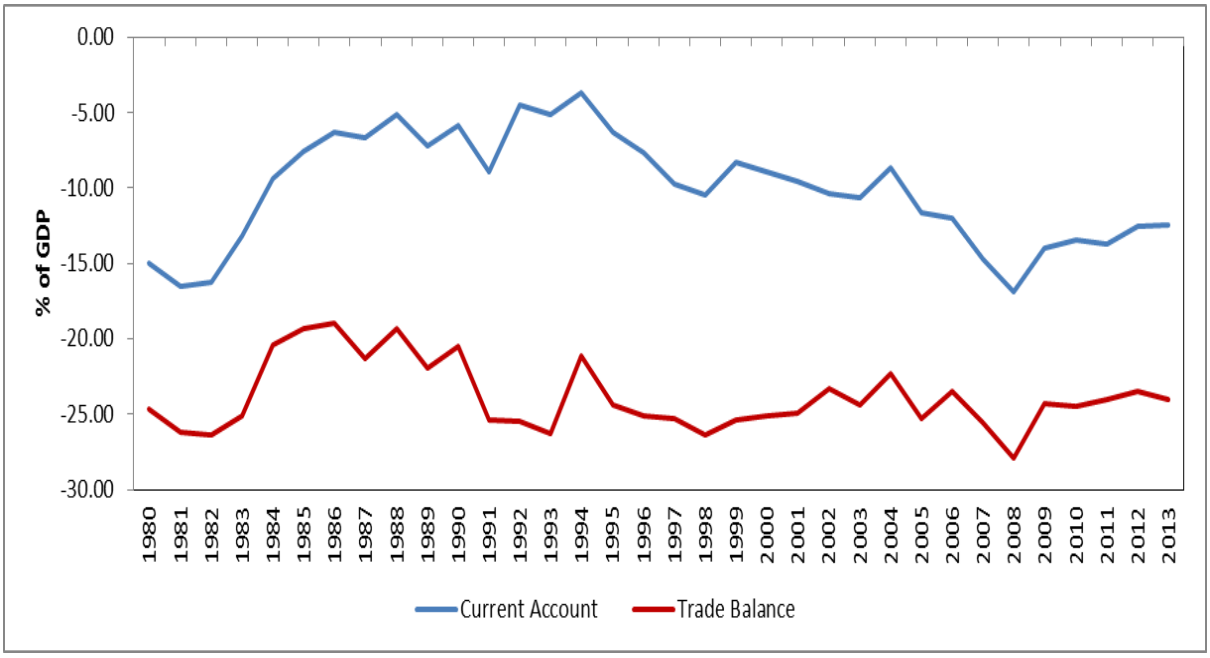
The current account balance and trade balance for the Caribbean shows that the region has experienced persistent current account and trade deficits from 1980 to 2013. There are several factors that account for the persistent balance of payments disequilibrium in the region, including among others the poor export performance.

Between 1982 and 1994 both the current account and trade deficits declined. The current account moved from a deficit of 16.24 percent of GDP in 1982 to 3.97 percent in 1994 (see Figure 5.1), while the trade deficit declined from 26.38 to 21.16 percent of GDP. This improvement in the current account and the trade balance was fuelled mainly by expansion of tourism and an increase in banana exports. In 1995 the current account and trade balance began to deteriorate, nonetheless the performance of both balance of payment indicators were not as bad as in 1982. The deterioration of the current account and the trade balance in the mid-1990s was triggered by the loss of trade preferences to European markets. Following this decline, there was a slight improvement from 2003 to 2006. However, in 2008 there was a dramatic deterioration in the current account and trade balance as a result of the global financial crisis of 2008-2009. The impact of the crisis was greatest in the non-commodity exporters of the Caribbean due to lower tourism arrivals.

An examination of the current account and trade balance for the 15 countries in the sample shows that from 1980 to 2013 most Caribbean economies experienced a deterioration in their current account balance (see figure A5.1 in Appendix 5). However, Belize, Suriname and Trinidad and

Tobago had significant improvements in their current account balance over the sample period. The deterioration in the current account balance in most of these countries reflects the deterioration of their trade balance (see figure A5.2 in Appendix 5) due to poor export performance, as the share of Caribbean exports to the world declined from 0.4% in 1980 to less than 0.2% in 2013.

Figure 5.1: Current Account and Trade Balance as Percentage of GDP, 1980-2013



Source: Author's Calculation

5.3 Theoretical Review of the Effect of Export Earnings Instability on the Balance of Payments

Maintaining a healthy and stable balance of payments is essential for countries to promote trade and propel rapid economic growth in the Caribbean. The literature suggests that the size of the current account deficits experienced in the Caribbean, coupled with inadequate foreign exchange reserves, are not sustainable. Thus, for the Caribbean, the achievement of balance of payments equilibrium is of great importance, otherwise economies may be permanently depressed.

Given the importance of a sustainable balance of payments for economic development, understanding the relationship between export earnings instability and the current account and

trade balance in the Caribbean is important. Fluctuations in export earnings could have a positive or a negative effect on the balance of payments. On the one hand, because exports of goods *and* services constitute a large share of the trade balance (goods only) as well as the current account balance (goods *and* services), any deviation of exports from its trend may result in a similar change in the trade and current account balance. Consequently, if fluctuations in export earnings are dominated by upswings (positive deviations), the current account and the trade balance may move in the same direction, thus there will be an overall improvement in both accounts. However, if the fluctuations in export earnings are dominated by negative deviations the current account and trade balance will deteriorate.

Apart from any asymmetrical relationship between upswings and downswings, there are behavioural reasons why the current account could be affected negatively by export earnings instability. The key mechanism leading from one to the other is caution about the future. Fogli and Perri (2015) explain that in response to an increase in domestic uncertainty induced by export earnings instability, economic agents increase their precautionary saving balances by investing in foreign assets. In general, an increase in export earnings instability results in an increase in the level of financial risk of domestic capital and a decrease in returns. Thus, in response, economic agents invest in foreign assets, which cause a reduction in the net income component of the current account. This would produce a negative relationship between export earnings instability and the current account.

5.4 Model Specification and Data

5.4.1 Model Specification

The model that will be used to estimate the effect of export earnings instability on the current account and the trade balance, as well as to ascertain the determinants of the balance of payments, are derived from standard export and import demand functions in which the growth of exports and imports are functions of income (world and domestic) and relative prices (see Thirlwall, 1999). In the specification of the equation, a distinction is made between the current account balance and the trade balance.

The balance of payments equilibrium is:

$$P_{dt}X_t = P_{ft}M_tE_t \tag{5.1}$$

where X_t is real exports; M_t is real imports; P_{dt} is the domestic price of exports; P_{ft} is the foreign price of goods that compete with exports; and E_t is the nominal exchange rate measured as the domestic price of foreign currency.

Differentiating equation (5.1) with respect to time for a moving equilibrium through time, where the rate of growth of real exports is equal to the rate of growth of real imports, gives:

$$p_{dt} + x_t = p_{ft} + m_t + e_t \tag{5.2}$$

The export and import demand functions are specified as multiplicative functions of the price of exports, the price of imports (to capture the effect of exchange rate changes), the price of goods that compete with exports, the price of import substitutes, the level of world income and domestic income:

$$X_{it} = A_{it}\left(\frac{P_{dt}}{P_{ft}E_t}\right)^{\eta} Z_t^{\varepsilon} \tag{5.3}$$

and

$$M_{it} = B_{it}\left(\frac{P_{ft}}{P_{dt}E_t}\right)^{\Psi} Y_t^{\pi} \tag{5.4}$$

where $\eta < 0$ is the price elasticity of demand for exports; $\Psi < 0$ is the price elasticity of demand for import; Z_t is world income; $\varepsilon > 0$ is the income elasticity of demand for exports; Y_t is domestic income; and $\pi > 0$ is the income elasticity of demand for imports.

The rate of growth of exports and imports are obtained by taking the rates of change of equations (5.3) and (5.4) and may be written as:

$$x_t = \eta(p_{dt}) - \eta(e_t) - \eta(p_{ft}) + \varepsilon(z_t) \quad (5.5)$$

and

$$m_t = \Psi(p_{ft}) - \Psi(e_t) - \Psi(p_{dt}) + \pi(y_t) \quad (5.6)$$

The current account and the trade balance are obtained by substituting equations (5.5) and (5.6) in equation (5.2). This gives:

$$\Delta B = [p_{dt} + \eta(p_{dt} - p_{ft} - e_t) + \varepsilon(z_t)] - [p_{ft} + \Psi(p_{ft} - p_{dt} - e_t) + \pi(y_t)] \quad (5.7)$$

where $(p_{dt} - p_{ft} - e_t)$ is the rate of change of the real exchange rate; z_t is the growth of world income and y_t is the growth of domestic income. Combining terms gives:

$$\Delta B = (1 + \eta + \Psi)(p_{dt} - p_{ft} - e_t) + \varepsilon(z_t) - \pi(y_t) \quad (5.8)$$

ΔB is normalized for the different sizes of countries by dividing the current account and trade balance by GDP, to give the following estimating equations:

$$CAGDP_{it} = \alpha_0 + X_{it} + I_{it} + \varepsilon_{it} \quad (5.9)$$

$$TBGDP_{it} = \alpha_1 + X_{it} + I_{it} + \varepsilon_{it} \quad (5.10)$$

where $CAGDP_{it}$ represents the current account balance as a share of GDP, $TBGDP_{it}$ is the trade balance to GDP ratio, X_{it} is a vector of explanatory variables that include the rate of change of the real exchange rate, world income growth and domestic income growth. The growth of world income is expected to have a positive effect on the current account and the trade balance; the

growth in domestic income is expected to have a negative effect and the rate of change of the real exchange rate will have a positive or negative effect depending on the sum of the price elasticities and which way the exchange rate moves. I_{it} is export earnings instability and ε_{it} represents the error term.[35] A slope dummy will also be included in the balance of payments equations to account for negative deviations of export earnings from its trend value. The premise is that total export earnings instability may not affect the long-term balance of payments because any negative deviations may be negated by positive deviations. Thus, we isolate the negative deviations using a slope dummy to ascertain whether negative deviations have a significant negative effect on the balance of payments, and on external debt.

Equations (5.9) and (5.10) will be estimated using fixed effects, random effects and the GMM estimation techniques of Arellano & Bover 1995 and Blundell & Bond (1998). GMM captures potential partial adjustment effects and accounts for the endogeneity in the regressors and between and within variation in the data. In addition, GMM resolves problems that may arise from bias due to the inclusion of the lagged dependent variable (Nickell (1981)). These estimation techniques are similar to those used in the two previous chapters (see chapter 2 for a more detailed explanation).

In addition to the short panel estimation procedures discussed above, the Pooled Mean Group (PMG)[36] estimator of Pesaran and Shin (1999) will be used. This estimator involves both pooling and averaging the data and allows the intercepts, coefficients and error variances to differ across countries in the short-run but constrains the coefficients to be the same across countries in the long-run. Assuming that the long-run coefficients are homogenous across countries is useful when there are reasons to expect that the long-run equilibrium relationships between variables are similar

[35] Net barter terms of trade were not included due to the unavailability of data for most of the countries in the region.

[36] Note that the ARDL estimation technique of Pesaran and Shin (2001) for leveled relationships could not be used in this chapter as was done in chapters 2 and 3 because all the variables used in the balance of payment estimation are I(0). Also, the methodology of Pesaran and Shin (2001) requires that at least some of the variables be I(1) and that they pass the bounds test for cointegration. We tried this methodology before using the PMG estimator; however, most of the countries failed the bounds test.

across countries or at least between a subset of the countries[37]. In the PMG estimator, the short-run coefficients are allowed to be country specific because of the different impacts of external shocks, financial crises and other effects on each economy. An alternative to the PMG estimator, is the mean group estimator (MG) proposed by Pesaran and Smith (1995) which runs separate ARDL regressions for each country and then takes an arithmetic average of the coefficients. However, for the results of the MG estimator to be consistent and valid, the cross-section (country) dimension as well as the times series of the data need to be sufficiently large (approximately 20 to 30 countries). For cross-section (country) dimensions that are smaller than 20, the average of the MG estimator becomes sensitive to outliers and small model permutations. Obtaining consistent and valid estimates from the mean group (MG) estimator might be challenging for this study since there are only 15 countries in the sample.

Both the pooled mean group (PMG) and mean group (MG) estimators are based on the autoregressive distributive lag (ARDL) model and can be used whether the variables are I(0) or I(1)[38]. The basic assumptions of the PMG estimator are (see Pesaran, Shin, and Smith 1999): i) the error terms are serially uncorrelated and are distributed independently of the regressors, i.e., the explanatory variables can be treated as exogenous; ii) there is a long run relationship between the dependent and explanatory variables; and iii) the long run parameters are the same across countries. Since it is not known beforehand whether the PMG or the MG estimator is more appropriate, (that is, whether the long-run slope coefficients are homogenous or not), the suitability of the PMG estimator relative to the MG estimator is tested based on the consistency and efficiency properties of the two estimators, using a likelihood ratio test or a Hausman test. Regardless, of whether the PMG or MG methodology is chosen, both estimation techniques allow one to take advantage of the information retained in the data by using time series estimation, rather than non-overlapping 5 year averages as is required for use with short panel analysis such as the ones listed

[37] This applies to the sample of countries used in this study, since six of the countries belong to a monetary union.

[38] Pesaran, Shin, and Smith (1999) explain that although the same algorithm can be used to estimate the PMG estimators whether the regressors are I(0) or I(1), the underlying asymptotic theories are different and their derivations require separate treatments.

above. Moreover, uncertainty is best measured over the business cycle, and so using five-year averages could underestimate the importance of instability.

5.4.2 Data

Following the discussion in the previous section regarding the model that will be used to estimate the determinants of the balance of payments and the effect of export earnings instability on the current account and the trade balance, this section discusses the expected relationship of each variable with the balance of payments.

Domestic Income Growth

The trade balance and the current account balance should both have a negative relationship with domestic income growth. Imports are a positive function of domestic income growth. Thus, as imports increase due to an increase in domestic income growth, holding exports constant, the current account and trade balance deteriorates/worsens. This implies that the trade balance and the current account balance are decreasing functions of domestic income growth. Domestic income growth will be calculated as the growth in real GDP.

World Income Growth

World income growth is expected to have a positive relationship with the current account balance and the trade balance. The relationship is expected to be positive because a rise in world income growth stimulates demand for exports. World income growth is calculated as a trade- weighted measure of the growth of each country's major trading partners. Thus, world income growth is:

$$World\ Income\ Growth_{country\ i} = \sum_{j=1}^{N} trade\ weight\ (country\ j) \times Real\ GDP\ Growth\ (country\ j) \quad (5.11)$$

Country j=1,2,…N are country i's trading partners.

Rate of Change in the Real Exchange Rate

The real exchange rate reflects the trade competitiveness of a country. Theoretically, the relationship between the balance of payments and the real exchange rate is explained by a number of frameworks including the elasticity approach. The elasticity approach uses the Marshall–Lerner condition to explain the effect of the real exchange rate on the balance of payments. This analysis states that for exchange rate devaluation to improve the balance of payments, the sum of the price elasticities of export and import demand must exceed unity starting from equilibrium and assuming all supply elasticities of domestic and foreign goods are infinitely elastic. However, short run elasticities may be smaller than long run elasticities, giving rise to the possibility of a J-curve effect, with the balance payments first deteriorating and then improving (Magee, 1973).

According to the J-curve theory, immediately after a country devalues its currency imports become more expensive in domestic currency and exports become cheaper in foreign currency, resulting in a decline in net exports if it takes time for imports to fall and exports to rise. Thus, in the short-run, the current account and trade balance are likely to decline due to the sluggishness of demand changes[39]. In the long-run, when prices have fully adjusted, the demand for imports declines because of a shift in demand from foreign goods to domestic substitutes. In addition, exports increase due to the decrease in the price of the exported goods[40]. The J-Curve theory predicts that the current account and trade balance improves in the long-run to a higher level compared to its level before depreciation provided the Marshall-Lerner condition is satisfied. The real exchange rate is calculated as follows:

$$Real\ Exchanage\ Rate = Nominal\ Exchange\ Rate \times \frac{United\ States\ Prices}{Domestic\ Prices} \qquad (5.12)$$

[39] The short-run period is commonly known as the "exchange rate pass-through period."

[40] The long-run is commonly known as the "volume adjustment period"

where the nominal exchange rate is measured at the domestic price of US currency and prices are measured using the consumer price index.

5.5 Results for Balance of Payments Estimations

5.5.1 Panel Estimation Results

For the short panel analysis, equations (5.9) and (5.10) are estimated using fixed effects, random effects, difference GMM (DIFF-GMM) and systems GMM (SYS-GMM). In the GMM regressions, equations (5.9) and (5.10) are transformed to be:

$$\Delta CAGDP_{it} = \alpha \Delta CAGDP_{it-1} + \gamma \Delta X_{it} + \delta \Delta I_{it} + \Delta \varepsilon_{it} \quad (5.13)$$

and

$$\Delta TBGDP_{it} = \alpha \Delta TBGDP_{it-1} + \gamma \Delta X_{it} + \delta \Delta I_{it} + \Delta \varepsilon_{it} \quad (5.14)$$

where Δ represents the type of transformation done on the data. Within the GMM approach, one may choose the first-differenced estimator (DIFF-GMM), which considers regression equations in first-differences instrumented by lagged levels of explanatory variables or the System-GMM approach, which uses the "forward orthogonal deviation" and combines into one system regression equations in differences and in levels.

After the GMM estimation is done, the consistency of the GMM estimator is tested to ascertain whether lagged values of the explanatory variables are valid instruments in the balance of payments regressions. This is tested using two specification tests suggested by Arellano and Bond (1991) and Arellano and Bover (1995). The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments and the second test examines the hypothesis that the error term is not serially correlated. The test is performed on the first differenced error term (that is, the residuals of equations (5.13) and (5.14) for the DIFF-GMM and SYS-GMM. The Arellano and Bond test for autocorrelation indicates that there is no evidence of autocorrelation in

any of the models, since the AR (2) test fails to reject the null hypothesis of no autocorrelation. In addition, the Sargan test of over-identification indicates that the instruments included in both the DIFF-GMM and SYS-GMM specifications are valid (see Tables 5.1 and 5.2). In the random effects and fixed effects estimation robust standard errors are used to account for autocorrelation and heteroscedasticity.

The results of the panel estimations for the current account estimations show that domestic income growth has a negative and significant relationship with the current account balance as predicted. This result indicates that a one percentage point increase in real GDP growth causes an average decline of 0.045 and 0.041 percentage points in the current account to GDP ratio for the estimations using the absolute deviation and standard deviation measure of instability, respectively. This implies that as economic growth in the domestic economies of Caribbean countries increase, the current account balance deteriorates. This occurs because an increase in real GDP growth induces an increase in the demand for imports, resulting in current account deficits (controlling for export growth).

For world income growth, the results show that there is a positive and significant relationship with the current account balance. A one percentage point increase in world income growth leads to an average increase in the current account to GDP ratio of 2.13 percentage points for the estimations using the absolute deviation as a measure of instability and 2.09 percentage points for the estimations using the standard deviation as a measure of instability. These results imply that an increase in world income growth causes an increase in the demand for exports which results in an improvement in the current account of Caribbean countries. The coefficients on world income growth also indicates that exports in the Caribbean are highly income elastic, suggesting the important role of exports as an engine of growth in the region.

The results for the rate of change in the real exchange rate show that there is a positive and significant relationship with the current account balance to GDP ratio. The results indicate that a one percentage point depreciation of the real exchange rate causes an average increase of 0.153

percentage point (across all estimations) in the current account balance to GDP ratio. Thus real exchange rate depreciation results in an improvement in the current account balance. The Marshall-Lerner condition is met.

Export earnings instability has a positive but insignificant effect on the current account balance in the equations for all four estimation techniques when export earnings instability is measured as the absolute deviation of export earnings from its trend value. When the standard deviation is used the results for export earnings instability is positive and significant in the difference-GMM and fixed effects estimations. However, the results for the system-GMM and the random effects estimations are positive and insignificant. Given the difference in the estimation results for export earnings instability, the effect of export earnings instability on the current account is not robust and therefore has no conclusive effect on the current account.

Table A5.2 in appendix 5 show the results for the current account equations when a slope dummy is included in the equations to account for the negative deviations of export earnings from its trend value. The results indicate that when the slope dummy is included, the results for domestic income growth, world income growth and the rate of change in the real exchange rate remain the same. For export earnings instability, the results change slightly as export earnings instability becomes positive and significant in the difference GMM equation using the absolute deviation measure of export earnings instability. For the standard deviation measure of export earnings instability the result remains positive and significant in the difference GMM and fixed effects estimations. The slope dummy is negative and significant in the system GMM and the random effects estimated equations for the both measures of export earnings instability. Once again, the finding for export earnings instability is not robust given the inconsistency in the statistical significance of the variable using different estimation techniques.

Table 5.1: Panel Estimation Results for the Current Account

	Absolute Deviation				Standard Deviation			
	DIFF-GMM	SYS-GMM	Fixed Effects	Random Effects	DIFF-GMM	SYS-GMM	Fixed Effects	Random Effects
VARIABLES	CAGDP	CAGDP	CAGDP	CAGDP	CAGDP	CAGDP	CAGDP	CAGDP
$CAGDP_{t-1}$	0.393***	0.668***	0.442***	0.826***	0.340***	0.851***	0.402***	0.831***
	(0.131)	(0.133)	(0.145)	(0.114)	(0.131)	(0.106)	(0.126)	(0.118)
RGDP Growth	-0.0391***	-0.0542***	-0.0367**	-0.0510***	-0.0356***	-0.0508***	-0.0271**	-0.0501***
	(0.0133)	(0.0115)	(0.0125)	(0.0119)	(0.0131)	(0.0131)	(0.0111)	(0.0141)
World Growth	2.844**	2.022*	1.972*	1.684*	2.278*	2.256**	1.734*	2.122**
	(1.168)	(1.086)	(0.995)	(0.971)	(1.320)	(1.005)	(0.977)	(1.009)
ΔLRER	0.142*	0.159**	0.157*	0.168**	0.169**	0.147**	0.129*	0.152**
	(0.0803)	(0.0737)	(0.0799)	(0.0844)	(0.0835)	(0.0719)	(0.0617)	(0.0694)
Export Earnings Instability	0.0890	0.0983	0.0906	0.0869	0.180**	0.134	0.115***	0.132
	(0.0614)	(0.0763)	(0.0688)	(0.0855)	(0.0832)	(0.0919)	(0.0328)	(0.109)
Constant		-0.0869***	-0.106***	-0.0634**		-0.0733***	-0.101***	-0.0733**
		(0.0273)	(0.0167)	(0.0256)		(0.0262)	(0.0178)	(0.0300)
Arellano-Bond AR(1)	-1.91	-2.05			-1.86	-2.43		
	(0.056)	(0.040)			(0.063)	(0.015)		
Arellano-Bond AR2)	0.29	0.31			0.07	-0.09		
	(0.770)	(0.754)			(0.943)	(0.931)		
Sargan Test	11.35	12.05			12.24	12.57		
	(0.183)	(0.914)			(0.141)	(0.997)		
Observations	75	90	90	90	75	90	90	90
Number of id	15	15	15	15	15	15	15	15
R-squared			0.245				0.258	

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; ** signicant at the 5% level, and * significant at the 10% level. The Hansen test is of over-identifying restrictions. The tests for 1st and 2nd order serial correlation are asymptotically distributed as standard normal variables (Arellano and Bond, 1991). The p-values report the probability of rejecting the null hypothesis of serial correlation, where the first differencing will induce (MA1) serial correlation if the time-varying component of the error term in levels is a serially uncorrelated disturbance. All estimations are done in Stata-64.

For the trade balance, the results indicate that the trade balance is significantly negatively related to real GDP growth. The results indicate that when there is an increase in the growth rate of real GDP, the trade balance worsens. Specifically, the results show that a one percentage point increase in real GDP growth causes the trade balance to GDP ratio to deteriorate by an average of 0.074 percentage points for the estimations using the absolute deviation as a measure of instability and 0.073 percentage points for the estimations using the standard deviation as a measure of instability. Similar to the results obtained for the current account estimations, the results for the trade balance indicate that an increase in domestic income growth induces an increase in the demand for imports, which causes the trade balance to deteriorate, holding exports constant.

Growth in the economies of the major trading partners of Caribbean countries is shown to have a positive effect on the trade balance. This implies that as economic growth in these economies increases, the demand for exports from the region increase, resulting in an improvement in the trade balance. The coefficient on world growth indicates that a one percentage point increase in

world income growth, improves the trade balance to GDP ratio by an average of approximately 2.93 percentage points for the estimations using the absolute deviation as a measure of instability and 2.91 percentage points for the estimations using the standard deviation as a measure of instability. The real exchange rate does not have a statistically significant relationship with the trade balance.

The results of the effect of export earnings instability on the trade balance indicate that for both measures of export earnings instability and across all estimation methods, there is a positive but insignificant relationship between export earnings instability and the trade balance. Thus, uncertainty about the earnings from exports of goods *and* services does not have a significant effect on the trade balance in the Caribbean.

When the slope dummy is included in the trade balance equations to account for negative deviations of export earnings from its trend value, the coefficient for world income growth becomes insignificant in the random effects estimation for both measures of export earnings instability (see Table A5.3 in appendix 5). The results for real GDP growth, the rate of change of real exchange rate and export earnings instability remains the same as the results when the slope dummy is not included. In addition, the slope dummy although negative is not found to be statistically significant in any of the estimations for either measure of export earnings instability.

The findings for export earnings instability indicate that export earnings instability does not affect the performance of the current account and the trade balance in the Caribbean, at the regional level. This finding implies that there must be asymmetry between upswings and downswings in export earnings and that upswings are negated by downswings, and as such the overall impact is that it does not statistically affect the current account and trade balance. Furthermore, even when negative deviations are explicitly accounted for, the effect on the current account is not robust, while no statistically significant effect is found for the trade balance.

Table 5.2: Panel Estimation Results for the Trade Balance

	Absolute Deviation				Standard Deviation			
	DIFF-GMM	SYS-GMM	Fixed Effects	Random Effects	DIFF-GMM	SYS-GMM	Fixed Effects	Random Effects
VARIABLES	TBGDP	TBGDP	TBGDP	TBGDP	TBGDP	TBGDP	TBGDP	TBGDP
$TBGDP_{t-1}$	0.0568	0.393**	0.135	0.642***	0.0877	0.392**	0.142	0.625***
	(0.261)	(0.177)	(0.150)	(0.174)	(0.230)	(0.174)	(0.144)	(0.169)
RGDP Growth	-0.0609**	-0.102***	-0.0529*	-0.0813***	-0.0577**	-0.0976***	-0.0558*	-0.0820***
	(0.0269)	(0.0315)	(0.0279)	(0.0310)	(0.0238)	(0.0289)	(0.0273)	(0.0316)
World Growth	3.378**	3.859**	1.898*	2.588*	3.061*	3.241*	2.332**	3.007*
	(1.597)	(1.521)	(0.888)	(1.536)	(1.564)	(1.697)	(0.996)	(1.786)
ΔLRER	0.0115	0.0940	0.0420	0.0380	0.0122	0.142	0.0161	0.0346
	(0.134)	(0.174)	(0.0979)	(0.104)	(0.133)	(0.163)	(0.124)	(0.116)
Export Earnings Instability	0.0936	0.171	0.0541	0.0710	0.124	0.261	0.135	0.157
	(0.105)	(0.122)	(0.0964)	(0.0930)	(0.159)	(0.185)	(0.142)	(0.129)
Constant		-0.234***	-0.250***	-0.141**		-0.247***	-0.266***	-0.163**
		(0.0636)	(0.0396)	(0.0588)		(0.0630)	(0.0499)	(0.0661)
Arellano-Bond AR(1)	-1.59	-2.31			-1.51	-2.38		
	(0.113)	(0.021)			(0.131)	(0.018)		
Arellano-Bond AR2)	0.32	0.35			0.38	0.43		
	(0.752)	(0.723)			(0.702)	(0.666)		
Sargan Test	9.65	11.65			9.05	10.46		
	(0.290)	(0.900)			(0.338)	(0.941)		
Observations	75	90	90	90	75	90	90	90
Number of id	15	15	15	15	15	15	15	15
R-squared			0.101				0.159	

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; ** signicant at the 5% level, and * significant at the 10% level. The Hansen test is of over-identifying restrictions. The tests for 1st and 2nd order serial correlation are asymptotically distributed as standard normal variables (Arellano and Bond, 1991). The p-values report the probability of rejecting the null hypothesis of serial correlation, where the first differencing will induce (MA1) serial correlation if the time-varying component of the error term in levels is a serially uncorrelated disturbance. All estimations are done in Stata-64.

5.5.2 Times Series/Cross-Section Results

To use the pooled mean group estimator, equations (5.9) and (5.10) are transformed into ARDL equations of the form:

$$\Delta CAGDP_{it} = \beta CAGDP_{it-1} + \delta \sum_{i=1}^{p-1} \Delta CAGDP_{it-i} + \gamma X_{it-1} + \pi \sum_{i=1}^{p-1} \Delta X_{it-i} + \mu I_{it-1} + \theta \sum_{i=1}^{p-1} \Delta I_{it-i} + \alpha_0 + \varepsilon_{it} \qquad (5.15)$$

$$\Delta TBGDP_{it} = \beta TBGDP_{it-1} + \delta \sum_{i=1}^{p-1} \Delta TBGDP_{it-i} + \gamma X_{it-1} + \pi \sum_{i=1}^{p-1} \Delta X_{it-i} + \mu I_{it-1} + \theta \sum_{i=1}^{p-1} \Delta I_{it-i} + \alpha_0 + \varepsilon_{it} \qquad (5.16)$$

In equations (5.15) and (5.16), $CAGDP$ and $TBGDP$ represent the current account to GDP ratio and the trade balance to GDP ratio, respectively. β is the speed of adjustment or error correction

term, X represents the vector of explanatory variables, I represents export earnings instability, α_0 represents the intercept and ε_t represents the error term. The symbol Δ signifies the first difference of the variables. To estimate equations (5.15) and (5.16), the lag order should be chosen using the Schwarz Criterion (SBC), to ensure that residuals of the error-correction model are not serially correlated. However, in this chapter, one lag is used for the ARDL regression to ensure that the estimation is not overextended and excessive parameter requirements are not imposed on the data.

As explained in section 5.4.1, for the estimation of equations (5.15) and (5.16) to be valid, there are a few requirements. Firstly, the coefficient on α should be negative and statistically significant to validate the existence of a long-run relationship. Secondly, it should be proven that there is homogeneity of the long-run parameters across countries. To prove whether long-run homogeneity exists, a Hausman test is done based on the null of equivalence between the PMG and MG estimations.[41] If the null hypothesis is rejected, the homogeneity assumption on the long run coefficients across countries is invalid and the mean group estimator is deemed more appropriate for the data.

The results for the pooled mean group estimator are presented in Tables 5.3 to 5.10. Only the results of the PMG are presented and discussed because the Hausman test[42] chose the PMG estimates over the MG estimates for both the current account and the trade balance equations. This implies that the long-run homogeneity restriction is not rejected.

Short-Run Results for the Current Account

The short-run estimates for the current account of the 15 Caribbean countries indicate that the error correction term is negative and significant in all the countries except St. Vincent and the Grenadines and Trinidad and Tobago (see Tables 5.3 to 5.5). In addition, the estimation results

[41] See Pesaran, Shin and Smith et al. (1999) for details

[42] The Hausman test statistics are distributed as chi-squared examining panel heterogeneity.

indicate that real GDP growth has a positive and statistically significant relationship with the current account in Dominica, St. Kitts and Nevis and St. Vincent and the Grenadines and Grenada. The result for real GDP growth implies that economic agents in these countries do not immediately change their demand for imports as a result of an increase in domestic income growth. World income growth does not exhibit a statistically significant short-run relationship with the current account in any of the countries in the sample. The real exchange rate has a positive and significant relationship with the current account in Guyana and Suriname and a negative and significant relationship in Trinidad and Tobago. The positive and significant relationship in Guyana and Suriname implies that a depreciation results in an overall improvement in the current account, thereby the Marshall-Lerner condition is satisfied. In Trinidad and Tobago the negative relationship implies that depreciation worsens the current account in the short-run. This is in-line with the J-curve hypothesis that states that in the short-run depreciation may worsen the current account before improving it in the long-run.

Table 5.3: Current Account Short-Run Results for the Eastern Caribbean Currency Union.

Dependent Variable: Current Account/GDP	Antigua and Barbuda	Dominica	Grenada	St. Kitts and Nevis	St. Lucia	St. Vincent and the Grenadines
Error Correction Term	-0.571***	-0.719***	-0.162*	-0.428***	-0.334***	-0.0954
	(0.141)	(0.148)	(0.0943)	(0.124)	(0.121)	(0.0947)
Real GDP Growth	0.0270	0.552**	-0.177	0.520**	0.120	0.421**
	(0.278)	(0.225)	(0.166)	(0.243)	(0.106)	(0.195)
World Growth	-0.992	0.678	0.834	0.765	0.458	-0.251
	(0.688)	(0.579)	(0.838)	(0.755)	(0.784)	(0.701)
Δ LRER	1.065	0.375	0.142	0.0933	-0.0277	0.151
	(0.907)	(0.428)	(0.441)	(0.440)	(0.358)	(0.436)
Export Earnings Instability	-0.280*	-0.0694	-0.0328	-0.0219	0.0996	0.248*
	(0.144)	(0.0857)	(0.0822)	(0.119)	(0.101)	(0.150)
Constant	-0.0697***	-0.118***	-0.0318*	-0.0664***	-0.0417**	-0.0256
	(0.0237)	(0.0286)	(0.0186)	(0.0226)	(0.0199)	(0.0170)
Observations	480	480	480	480	480	480

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; ** signicant at the 5% level, and * significant at the 10% level.

Table 5.4: Current Account Short-Run Results for Predominantly Service Exporters.

Dependent Variable: Current Account/GDP	Bahamas	Barbados	Belize	Jamaica
Error Correction Term	-0.193*	-0.305***	-0.231**	-0.220**
	(0.115)	(0.0999)	(0.0996)	(0.0928)
Real GDP Growth	0.0232	0.0264	-0.0311	-0.0561
	(0.167)	(0.195)	(0.225)	(0.187)
World Growth	0.128	0.533	0.290	0.590
	(0.433)	(0.504)	(0.590)	(0.392)
Δ LRER	0.533	0.0738	0.159	-0.0370
	(0.562)	(0.206)	(0.236)	(0.0380)
Export Earnings Instability	-0.0976	-0.145**	0.194***	-0.118
	(0.0595)	(0.0721)	(0.0706)	(0.0853)
Constant	-0.0210*	-0.0124*	-0.0106	-0.0172*
	(0.0120)	(0.00742)	(0.00925)	(0.0100)
Observations	480	480	480	480

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; ** signicant at the 5% level, and * significant at the 10% level.

Table 5.5: Current Account Short-Run Results for Predominantly Commodity Exporters.

Dependent Variable: Current Account/GDP	Dominican Republic	Guyana	Haiti	Suriname	Trinidad and Tobago
Error Correction Term	-0.395***	-0.130**	-0.347***	-0.307**	-0.114
	(0.122)	(0.0569)	(0.105)	(0.129)	(0.0879)
Real GDP Growth	-0.0580	0.0344	0.177	-0.0415	0.590**
	(0.0973)	(0.156)	(0.154)	(0.198)	(0.268)
World Growth	0.289	0.863	-0.0776	-0.0174	1.224
	(0.245)	(0.746)	(0.255)	(1.066)	(0.844)
Δ LRER	-0.00457	0.0539**	-0.00936	0.131***	-0.196*
	(0.0147)	(0.0214)	(0.0219)	(0.0456)	(0.100)
Export Earnings Instability	0.0110	0.0532	-0.0532**	0.0310	0.118***
	(0.0285)	(0.128)	(0.0244)	(0.0541)	(0.0401)
Constant	-0.0119	-0.0123	-0.0245***	-0.0141	0.00869
	(0.00784)	(0.0118)	(0.00770)	(0.0126)	(0.0112)
Observations	480	480	480	480	480

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; * signicant at the 5% level, and * significant at the 10% level.

With regards to the effect of export earnings instability, the results show that export earnings instability has a statistically significant positive relationship with the current account in Belize, St. Vincent and the Grenadines and Trinidad and Tobago and a statistically significant negative relationship in Antigua and Barbuda, Barbados and Haiti. The positive and significant effect of export earnings instability in Belize, St. Vincent and the Grenadines and Trinidad and Tobago implies that export earnings instability is dominated by positive deviations and as a result an increase in instability leads to an improvement in the current account in these countries. The negative effect of instability on the current account in Antigua and Barbuda, Barbados and Haiti implies that instability is dominated by negative deviations and this causes the current account balance to deteriorate.

Long-Run Current Account Results

The long-run results for the current account show that the coefficient for the error correction term is negative and highly significant, confirming the existence of a long-run relationship between the current account and the independent variables (see Table 5.6). The results also indicate that in the long-run real GDP growth has a negative and significant effect on the current account. This implies that as economic growth in the Caribbean increases in the long-run, import increases, which leads to a deterioration of the current account balance. World income growth has a positive and significant relationship with the current account and therefore meets a priori expectations. Thus, an increase in world income growth increases export demand and improves the current account balance. The rate of change in the real exchange rate is positive but insignificant, which indicates that based on the estimates from the pooled mean group estimator, the real exchange rate does not have a statistically significant effect on the current account in the long-run. Export earnings instability has a positive and significant relationship with the current account in the long-run; this is different from the findings in the panel estimation analysis in which the relationship is positive but statistically insignificant. The different results obtained using the pooled mean group estimator might be linked to the data properties, where the panel data analysis uses 5 year averages and the pooled mean group estimator uses the full times series data (34 years). Thus, the pooled mean group estimator might be better at accounting for the instability in export earnings than is the panel

data analysis. The positive and significant effect of export earnings instability on the current account implies that export earnings instability is dominated by positive deviations in the long-run and therefore as instability in export earnings increase, the performance of the current account improves.

Table 5.6: Long-Run Results for the Current Account

Dependent Variable:	Current Account/GDP
Error Correction Term	-0.303***
	(0.0450)
Long - Run Estimates	
Real GDP Growth	-0.721***
	(0.202)
World Growth	0.745*
	(0.428)
Δ LRER	0.0243
	(0.0610)
Export Earnings Instability	0.105**
	(0.0426)
Constant	-0.0312***
	(0.00818)
Hausman Test	1.76
	(0.9979)
Observations	480

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; * significant at the 5% level, and * significant at the 10% level. The data set is 480 because of the inclusion of the variable ΔLRER which reduces the time period by a year.

Short-Run Results for the Trade Balance

With regard to the trade balance, the results indicate that the error correction term is negative and significant in all countries except in Guyana, Haiti, Jamaica and St. Vincent and the Grenadines (see Tables 5.7 to 5.9). Similar to the estimation results obtained for the current account, the results show a positive relationship between real GDP growth and the trade balance in a few countries. The countries for which there are positive and significant relationships are Haiti, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines. This positive relationship between the trade balance and real GDP growth may reflect the adjustment period in which the demand for imports does not immediately increase as a result of an increase in domestic income. World income growth

shows a negative and statistically significant relationship with the trade balance in Antigua and Barbuda and the Bahamas. The results for world income growth are contrary to the predictions of the theoretical literature. Real exchange rate is shown to have statistically significant positive relationship with trade balance in the Bahamas, Guyana and Suriname. Thus, depreciation in the real exchange rate improves the trade balance in these countries in the short-run.

The relationship between the trade balance and export earnings instability is negative and statistically significant in the Bahamas and Jamaica, which implies that an increase in export earnings instability in the Bahamas and Jamaica causes the trade balance to deteriorate. Positive and significant relationships are observed in the Dominican Republic, Haiti and Trinidad and Tobago. The positive relationship observed in these countries implies that as export earnings instability increases the trade balance improves. This positive and significant effect of export earnings instability on the trade balance could be that instability in export earnings in these countries are dominated by positive deviations rather than negative deviations.

Table 5.7: Trade Balance Short-Run Results for the Eastern Caribbean Currency Union.

Dependent Variable: Trade Balance/GDP	Antigua and Barbuda	Dominica	Grenada	St. Kitts and Nevis	St. Lucia	St. Vincent and the Grenadines
Error Correction Term	-0.332***	-0.300***	-0.259**	-0.449***	-0.359***	-0.0372
	(0.105)	(0.116)	(0.116)	(0.122)	(0.104)	(0.0744)
Real GDP Growth	-0.00357	0.174	-0.0597	0.399***	0.258***	0.506***
	(0.159)	(0.243)	(0.113)	(0.136)	(0.0895)	(0.158)
World Growth	-1.533***	0.875	0.193	0.317	-0.399	-0.0570
	(0.385)	(0.625)	(0.519)	(0.420)	(0.668)	(0.573)
Δ LRER	0.120	0.288	0.213	-0.289	0.372	0.418
	(0.508)	(0.479)	(0.271)	(0.236)	(0.305)	(0.356)
Export Earnings Instability	0.119	-0.00774	-0.00199	-0.0432	0.106	0.0740
	(0.0759)	(0.0952)	(0.0524)	(0.0632)	(0.0856)	(0.113)
Constant	-0.125***	-0.0626**	-0.0831**	-0.113***	-0.0938***	-0.0127
	(0.0423)	(0.0267)	(0.0384)	(0.0319)	(0.0308)	(0.0188)
Observations	480	480	480	480	480	480

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; * signicant at the 5% level, and * significant at the 10% level.

Table 5.8: Trade Balance Short-Run Results for Predominantly Service Exporters.

Dependent Variable: Trade Balance/GDP	Bahamas	Barbados	Belize	Jamaica
Error Correction Term	-0.284**	-0.371***	-0.500***	-0.0930
	(0.113)	(0.0961)	(0.128)	(0.0719)
Real GDP Growth	-0.0361	0.0137	0.123	-0.265
	(0.0831)	(0.165)	(0.203)	(0.210)
World Growth	-0.436**	0.0243	0.619	0.179
	(0.200)	(0.417)	(0.471)	(0.442)
Δ LRER	0.526**	0.252	0.125	0.00889
	(0.252)	(0.170)	(0.181)	(0.0429)
Export Earnings Instability	-0.0643**	-0.0627	0.00134	-0.165*
	(0.0270)	(0.0591)	(0.0527)	(0.0961)
Constant	-0.0681**	-0.0780***	-0.0665***	-0.0210
	(0.0273)	(0.0220)	(0.0194)	(0.0135)
Observations	480	480	480	480

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; * signicant at the 5% level, and * significant at the 10% level.

Table 5.9: Trade Balance Short-run Estimates for Predominantly Commodity Exporters.

Dependent Variable: Trade Balance/GDP	Dominican Republic	Guyana	Haiti	Suriname	Trinidad and Tobago
Error Correction Term	-0.341***	-0.117	0.00873	-0.337***	-0.197*
	(0.0893)	(0.0751)	(0.0606)	(0.127)	(0.107)
Real GDP Growth	-0.00536	-0.0929	0.420**	0.175	0.439
	(0.0870)	(0.161)	(0.213)	(0.275)	(0.282)
World Growth	0.289	-0.0125	-0.0703	0.0276	1.508
	(0.220)	(0.745)	(0.334)	(1.530)	(0.942)
Δ LRER	-0.000268	0.0353*	-0.0268	0.243***	-0.162
	(0.0161)	(0.0214)	(0.0280)	(0.0655)	(0.107)
Export Earnings Instability	0.0461*	-0.144	0.0938***	0.0518	0.127***
	(0.0270)	(0.128)	(0.0317)	(0.0788)	(0.0428)
Constant	-0.0342***	-0.00649	-0.00473	0.0272	0.0290*
	(0.0104)	(0.00787)	(0.0111)	(0.0183)	(0.0172)
Observations	480	480	480	480	480

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; * signicant at the 5% level, and * significant at the 10% level.

Long-Run Trade Balance Results

The long-run estimates for the trade balance shows that the error correction term is negative and significant and therefore indicates the presence of a long-run relationship between the variables (see Table 5.10). Real GDP growth has a statistically significant negative relationship with the trade balance, once again implying that an increase in the growth of real GDP causes imports to rise and the trade balance to deteriorate, holding exports constant. World income growth, while positive, is statistically insignificant. The real exchange rate has a negative and insignificant relationship with the trade balance. Export earnings instability is positive and statistically insignificant. Thus, export earnings instability does not affect the behaviour of the trade balance in the long-run. Further the results for the effect of export earnings instability on the trade balance in the long-run imply that there may be asymmetry in upswings and downswings of the fluctuation of export earnings and as a result the overall effect is null. According to the results of the pooled mean group estimator only real GDP growth has a statistically significant relationship with the trade balance in the long-run.

Table 5.10: Long-Run Results for the Trade Balance

Dependent Variable:	**Trade Balance/GDP**
Error Correction Term	-0.265*** (0.0384)
Long - Run Estimates	
Real GDP Growth	-0.842*** (0.160)
World Growth	0.647 (0.403)
Δ LRER	-0.0968 (0.0799)
Export Earnings Instability	0.0325 (0.0434)
Constant	-0.0475*** (0.0125)
Hausman Test	6.1 (0.8068)
Observations	480

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; * significant at the 5% level, and * significant at the 10% level. The data set is 480 because of the inclusion of the variable ΔLRER which reduces the time period by a year.

5.6 Export Earnings Instability and External Debt

5.6.1 Stylized Facts on External Debt in the Caribbean

The Caribbean, historically, has been plagued by excessively high debt burdens. In fact, a few of the countries in the region are ranked among the most indebted developing countries in the world. The high debt levels faced by these countries are due to a number of factors. These factors include both domestic and external factors that adversely affect these economies. Domestic factors are dominated by the high frequency of natural disasters, especially hurricanes and floods, and public spending on social programmes. External factors include the erosion of preferential trade agreements for agricultural exports (sugar and bananas), and a highly concentrated export base.

Exports represent a large source of foreign currency for Caribbean countries[43]. However, the reliance of Caribbean countries on earnings from a few goods and services make their external accounts susceptible to external shocks which cause fluctuations in export (foreign exchange) earnings and affect their external liquidity position. Thus, export earnings instability adds to the difficulties in maintaining a sustainable domestic and external public debt path. In this section of the chapter the relationship between external debt and export earnings instability is explored.

Most of the countries in the Caribbean have experienced persistent current account deficits from 1980 to 2013. This has translated into increased external financing needs, which has in turn been filled by external borrowing. Figure 5.2 shows the evolution of the external debt to export ratio along with the current account to GDP ratio for the region. The graph shows that over the period 1990 to 2013 as the current account deficit increased the external debt to export ratio also increased. The adverse relationship between these two variables is more prominent between 2000 and 2013 where there was a clear deterioration in the average current account to GDP ratio for the region and a simultaneous increase in the external debt to export ratio.

[43] In some countries migrant remittances and tourism also provide substantial extra foreign exchange resources.

Figure 5.2: Evolution of External Debt to Export Ratio for Caribbean Countries 1990-2013

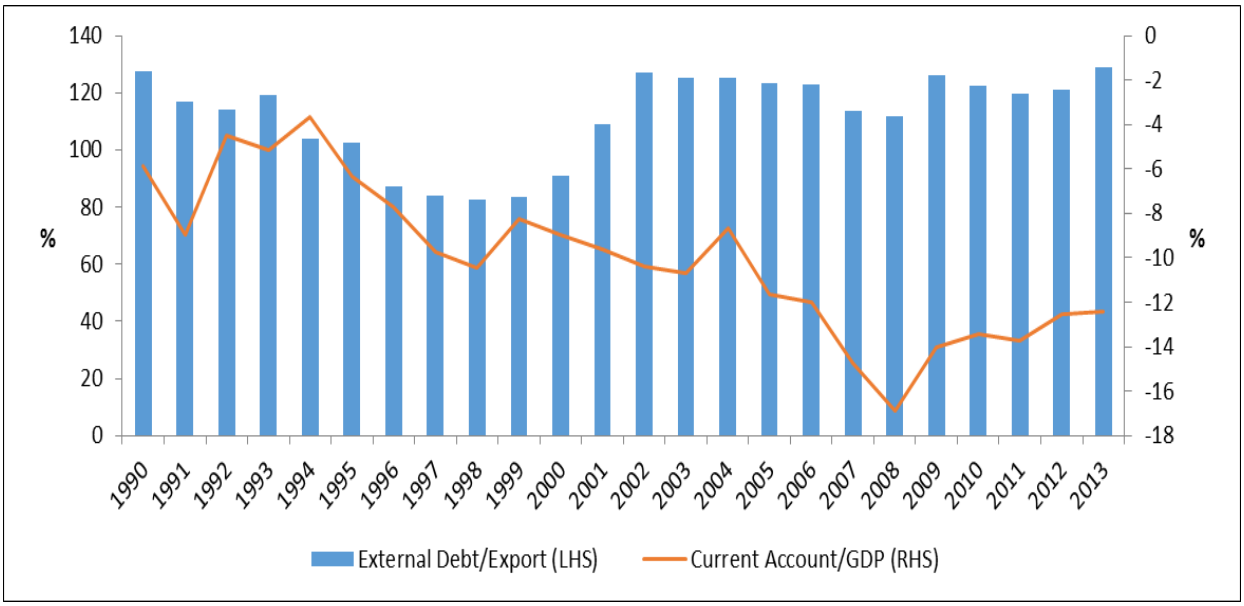


Figure 5.3 shows the external debt to export ratio for the 15 Caribbean countries for 2013. The graph shows that the external debt to export ratio is highest in the ECCU and Jamaica which are predominantly service exporting countries and lowest in the predominantly commodity exporting countries. Figure 5.4 shows the evolution of the ratio of external debt to export ratio for the 15 Caribbean countries. Each period in the analysis represents the average over five years from 1990 to 2013. The data on debt for the Caribbean are obtained from the IMF database and begins in 1990. The calculated 5 year averages for the external debt ratio indicates that there is an increasing trend in the external debt to export ratio for nine of the 15 countries in the region. The countries for which there is a clear increasing trend are the Bahamas, Barbados, Dominica, Dominican Republic, Grenada, Jamaica, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines. Significant decline in the external debt to export ratio occurred in Guyana, Haiti and Trinidad and Tobago.

Figure 5.3: Total External Debt to Export Ratio for Caribbean Countries in 2013

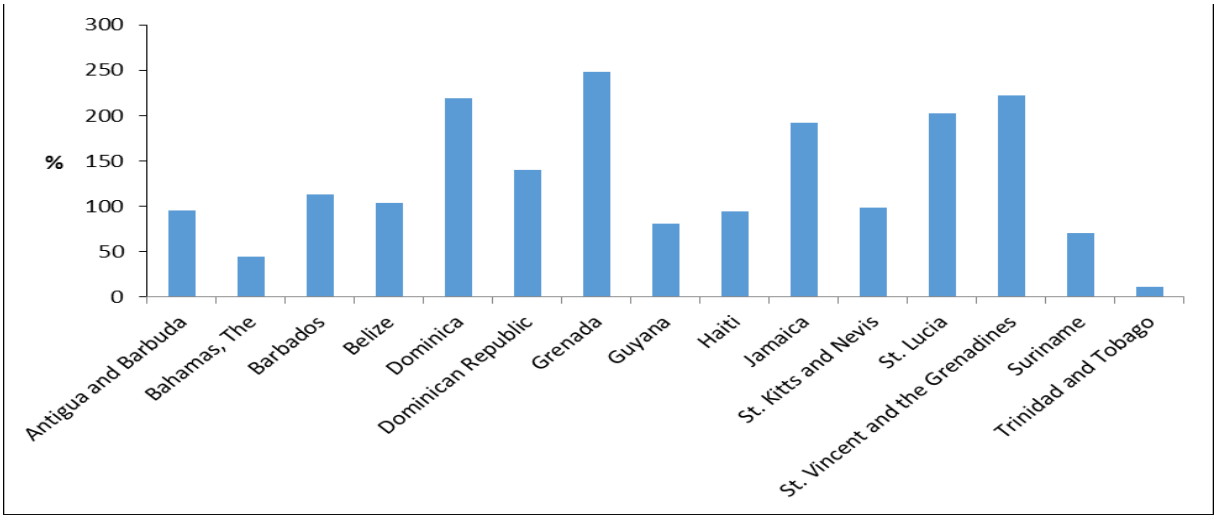
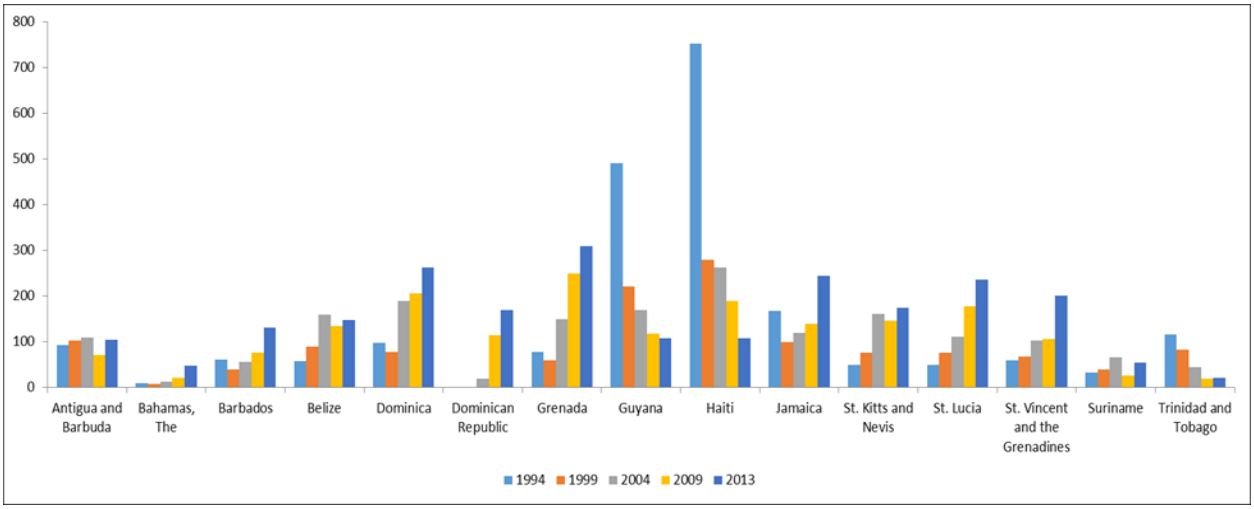


Figure 5.4: Evolution of External Debt to Export Ratio for Caribbean Countries 1990-2013



5.6.2 Theoretical Models of External Debt

This section presents a parsimonious theoretical framework to analyse the determinants of external debt and provide a starting point from which to select those variables that might lead to a change in the stock of external debt in the region. The theoretical framework used for analysing external indebtedness is based on the two-gap model of Mckinnon (1964), Avromovic (1964), Chenery and

Strout (1966) and Gerald M. Alter (1968). The two gap model identifies the savings-investment gap and the foreign exchange gap as constraints to a country's economic growth which ultimately results in foreign borrowing.

The "two-gap" model purports that a country's economic growth is restricted by either the level of domestic saving or the capacity to import capital goods. Thus, for a country to achieve a target rate of growth they will need to borrow externally to relieve the savings or foreign exchange constraint. Specifically, the model states that in a country when there is a gap between domestic savings and investment in order to achieve a target rate of growth, foreign borrowing is needed to compensate for the shortage of domestic savings to finance investment. In addition to filling the savings gap, foreign borrowing is also required to fill the gap between the required import expenditures on capital goods that are used in the production process and export earnings. Export earnings are usually insufficient to generate enough foreign exchange to finance imports, making overseas borrowing a crucial means of gaining access to the technology that is vital for the expansion of the export sector that ultimately leads to rapid economic growth. Thus, in the two-gap model the role of foreign borrowing in the development process is to relieve whichever is the dominant constraint.

Several studies of the two-gap model including Chenery et.al (1962) point to the foreign exchange as the dominant constraint in developing countries. As a result, the need to borrow externally is theorized to be determined by those factors that affect the foreign exchange gap. One such factor is the trade or current account deficit which determines the magnitude of the foreign exchange gap and therefore external borrowing.

Another determinant of the foreign exchange gap is the level of reserves held by a country. A country uses foreign reserves to maintain liquidity in case of economic exigencies and to provide confidence and assure foreign investors that the central bank is ready to take action to protect their investments, and prevent a sudden flight to safety and loss of capital for the country. Thus, a strong position in foreign currency reserves can prevent economic crises caused when an event triggers a

flight to safety. In addition, reserves are used to ensure that a country will meet its external obligations. These include international payment obligations, including sovereign and commercial debts, financing of imports, and to absorb any unexpected capital movements. Thus, international reserves is a substitute for external debt and therefore also a determinant of external borrowing.

Debt servicing is also an important determinant of the foreign exchange gap, as foreign exchange is used towards debt servicing obligations. Debt servicing obligations includes amortization and interest payments which are the compulsory components of debt servicing on past debt.

Based on the above discussion and previous studies on external debt such as Varghese and Varghese (1988), Malati Anagol (1991), Nirupam Bajpai (1994) and Sunanda Sen (1994), the current account balance, reserves, and debt servicing commitments are the main determinants of external borrowing.

5.6.3 Econometric Model of External Debt

The econometric model that will be used in the analysis of the determinants of external debt, and the effect of export earnings instability on external debt, is based on the theoretical literature discussed in the previous section and on the findings from previous empirical studies.

The level of debt is viewed primarily as a function of the balance of payments:

$$CA = X - M - rD_{t-1} \quad (5.17)$$

$$KA = (D_t - D_{t-1}) + R_t \quad (5.18)$$

where CA is the current account balance and KA is the capital account balance, X is exports, M is imports, r is interest rate, D_t and $D_{t-1}$are current and past debt, respectively and R_t is the level of reserves. rD_{t-1} represents interest payment on past debt. Thus, according to this theory the current level of external debt is as follows:

$$D_t = M_t - X_t + (1 + r)D_{t-1} - R_t \quad (5.19)$$

Equation (5.19) is derived from adding equations (5.17) and (5.18), setting it equal to zero and solving for D_t . In equation (5.19), external debt is an increasing function of imports of goods *and* services and interest payments and a decreasing function of exports of goods *and* services and international reserves. $(\mathrm{X} - \mathrm{M})$ is the current account balance which should have an overall negative relationship with external debt.

Based on the model described above and the theoretical discussion in section 5.6.1, external debt is modelled as:

$$ExtDebt_{it} = \alpha + CA_{it} + export\ growth_{it} + DSD_{it} + R_{it} + I_{it} \quad (5.20)$$

where $extdebt$ is the external debt to export ratio; CA is the current account balance as a share of exports; DSD is the debt service to export ratio (interest and principal payments); R is international reserves as a share of exports and I is export earnings instability. Export growth is added as a control variable since the debt to export ratio could vary with changes in the value of exports (the denominator of the equation). Similar to what is done in the balance of payments equation; a slope dummy will be included in the external debt equation to account for negative deviations of export earnings from its trend value.

With regards to the relationship between export earnings instability and external debt, there could be either a positive or negative relationship between these two variables. If export earnings fluctuations are dominated by negative deviations, it means that when export earnings fall relative to trend it becomes difficult for countries that are dependent on exports to maintain the level of their imports of essential goods. Thus, countries will borrow to finance foreign currency transactions resulting in an increase in external debt levels. On the other hand, when export earnings are dominated by positive deviations, when export earnings increase they may be spent rather than be used for the repayment of debt. It is an interesting question, therefore, whether export earnings instability is associated with a build-up of debt over time.

There are two studies in the literature that establishes a relationship between export earnings instability and external debt; these include Eaton, et al. (1981) and Eichengreen and Portes (1986). Eaton, et al. (1981) uses ordinary least square estimation to investigate the determinants of external central government debt in a group of developing countries from 1930 to 1938. The variables included in the estimated equation are GDP, population, openness, export variability (to proxy income variability) and the rate of growth of GDP. The study found that external debt is positive but not statistically signicantly related to the population and the degree of openness and insignificantly negatively related to real GDP growth in these groups of countries. GDP exhibits a positive and significant relationship with external debt. The results for export variability (measured by the standard deviation of exports[44]) indicate a positive relationship; however, the relationship is not statistically significant.

Eichengreen and Portes (1986) use the same set of variables as used by Eaton, et al. (1981) to examine the determinants of external debt for 16 to 23 developed and developing countries, but not including the Caribbean from 1930 – 1938. To examine the determinants of external debt, the study uses annual cross-section and panel data. The study shows that when cross-section analysis is used GDP is the only variable that is found to have a positive and statistically significant relationship with external debt. Panel data analysis reveals that external debt is positive and significantly related to GDP, population and the degree of openness; and significantly negatively related to real GDP growth. Export instability has a positive and significant relationship with external debt, implying that as income variability increases external borrowing increases.

Before presenting the results for the panel data estimation, Table 5.11 shows the change in external debt and export earnings instability. The table presents the values for the change in external debt and the level of export earnings instability for each of the four five year periods from 1995 to 2013. These five year periods chosen are similar to the five year periods that will be used in the panel data estimation. The table shows that in Barbados, Dominica, Guyana, St Lucia and Suriname

[44] In this study exports was not de-trended before the standard deviation was calculated.

there appears to be an overall negative relationship between export earnings instability and external debt. For the other countries in the region the relationship is less clear.

Table 5.11: Change in External Debt and Export Earnings Instability in the Caribbean

	Δ(External Debt/Export)	Export Instability	Δ(External Debt/Export)	Export Instability	Δ(External Debt/Export)	Export Instability	Δ(External Debt/Export)	Export Instability
	(1995-1999)		(2000-2004)		(2005-2009)		(2010-2013)	
Antigua and Barbuda	0.11	0.19	0.07	0.05	-0.38	0.07	0.14	-0.33
Bahamas, The	-0.03	-0.40	0.06	-0.14	0.09	0.17	0.18	0.38
Barbados	-0.22	0.04	0.16	-0.07	0.21	0.20	0.30	-0.10
Belize	0.30	0.00	0.71	-0.09	-0.26	0.09	-0.23	-0.02
Dominica	-0.20	0.37	1.12	0.00	0.16	-0.15	0.03	-0.15
Dominican Republic	0.05	0.33	-0.09	0.02	0.19	0.03	0.20	-0.18
Grenada	-0.19	0.22	0.90	0.24	0.99	-0.16	-0.02	-0.17
Guyana	-2.70	0.02	-0.52	-0.12	-0.52	-0.04	-0.34	0.14
Haiti	-0.79	-0.15	-0.17	0.00	-0.72	0.23	-1.12	0.46
Jamaica	-0.68	0.16	0.20	0.00	0.20	0.10	0.60	-0.16
St. Kitts and Nevis	0.26	0.12	0.85	-0.03	-0.16	0.02	-0.19	-0.16
St. Lucia	0.26	0.25	0.35	-0.04	0.65	-0.04	0.12	-0.18
St. Vincent and the Grenadines	0.08	0.29	0.34	0.15	0.03	0.01	0.68	-0.29
Suriname	0.07	-0.31	0.27	-0.35	-0.40	0.20	0.23	0.75
Trinidad and Tobago	-0.33	-0.34	-0.38	-0.12	-0.26	0.59	-0.04	0.22

5.6.4 Results for External Debt

To estimate the relationship between external debt and export earnings instability, random effects and pooled OLS estimations are used. Although GMM would have been preferred to account for the possibility of endogeneity, the limited data that are available does not permit the use of GMM. The results for external debt are presented in Table 5.12 and 5.13. The Hausman test[45] chose the random effects model which jointly captures cross-country and within country determinants of external debt. Pooled OLS was also used to take advantage of the time series properties of the data and use the full-time period of the data available rather than using 5 year averages. Using the pooled OLS estimation also facilitates robustness checks. Two sets of regression results are presented below; the first set of results estimates the determinants of external debt and the effect

[45] The results for the Hausman test are as follows: for the estimations using the absolute deviation measure of export earnings instability the

of export earnings instability without the slope dummy while the second set of equations includes the slope dummy.

Table 5.12: Panel Regression Results for External Debt

	Absolute Deviation		Standard Deviation	
	Random Effects	Pooled OLS	Random Effects	Pooled OLS
VARIABLES	External Debt/Export	External Debt/Export	External Debt/Export	External Debt/Export
Curent Account/Export	-0.722***	-0.284***	-0.714***	-0.237***
	(0.158)	(0.0861)	(0.164)	(0.0869)
Export Growth	-0.813**	-0.243*	-0.808***	-0.272**
	(0.319)	(0.134)	(0.309)	(0.122)
Debt Service/Export	2.404***	0.315***	2.422***	0.252***
	(0.788)	(0.105)	(0.832)	(0.0973)
Reserves/Export	-0.145**	-0.00607	-0.133**	-0.00498
	(0.0605)	(0.0366)	(0.0572)	(0.0333)
Export Earnings Instability	-0.500	-0.151	-0.533	-0.672**
	(0.544)	(0.123)	(1.018)	(0.318)
Constant	0.859***	1.050***	0.869**	1.189***
	(0.252)	(0.0728)	(0.345)	(0.109)
Observations	75	337	75	337
R-squared		0.174		0.182
Number of id	15	15	15	15

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; * significant at the 5% level, and * significant at the 10% level. The data set for the random effects estimation is 75 and the pooled OLS is 337 because of the data for external debt begins in 1990.

The regression results presented in (Table 5.12) indicate that the current account balance has a highly significant negative relationship with external debt in both the random effects and pooled OLS equations for both the absolute and standard deviation measure of export earnings instability. This implies that as the current account balance improves, governments in the Caribbean reduce their borrowing on the external market. The coefficient on the current account to export ratio indicate that a one percentage point improvement in the current account to export ratio causes an average reduction of 0.49 percentage point in the external debt to export ratio. Export growth has a negative and highly significant relationship with external debt. However, export growth in the external debt equation is a control variable which controls for the variation of the external debt to export ratio.

The results also indicate that an increase in the debt service ratio increases external borrowing by an average of 1.36 percentage points for the estimated equations done with the absolute deviation measure of export earnings instability and 1.33 percentage points for the estimations using the standard deviation as a measure of instability. The implication of this result is that as Caribbean countries ability to service their debt declines/deteriorate they tend to borrow on the external market, thus external debt increases.

Reserves measured as the reserves to export ratio has a negative and significant relationship with external debt in the random effects equations for both the absolute deviation and standard deviation measure of export earnings instability. However, the results for reserves in the pooled OLS equations are not significant.

Export earnings instability exhibits a negative relationship with external debt. However, the relationship is not statistically significant in either the random effects or the pooled OLS equation using the absolute deviation measure of export earnings. For the standard deviation measure of export earnings, there is a negative and insignificant relationship in the random effects estimation and a statistically significant negative effect in the pooled OLS estimation. This result is contrary to those obtained in the studies of Eichengreen and Portes (1986) and Eaton et. al. (1981) and implies that any negative deviation in export earnings is nullified by positive deviations.

Table 5.13: Panel Regression Results for External Debt with Slope Dummy

	Absolute Deviation		Standard Deviation	
	Random Effects	Pooled OLS	Random Effects	Pooled OLS
VARIABLES	External Debt/Export	External Debt/Export	External Debt/Export	External Debt/Export
Curent Account/Export	-0.703***	-0.262***	-0.699***	-0.221**
	(0.145)	(0.0890)	(0.148)	(0.0887)
Export Growth	-0.761*	-0.170	-0.766*	-0.223*
	(0.397)	(0.136)	(0.391)	(0.122)
Debt Service/Export	2.328***	0.295***	2.369***	0.235**
	(0.867)	(0.102)	(0.883)	(0.0965)
Reserves/Export	-0.141**	-0.00480	-0.130**	-0.00372
	(0.0642)	(0.0371)	(0.0626)	(0.0336)
Export Earnings Instability	-0.545	-0.342**	-0.555	-0.827***
	(0.488)	(0.137)	(0.954)	(0.320)
Slope Dummy	0.314	0.868***	0.243	0.747***
	(0.776)	(0.289)	(0.732)	(0.244)
Constant	0.853***	1.031***	0.861**	1.172***
	(0.258)	(0.0698)	(0.360)	(0.105)
Observations	75	337	75	337
R-squared		0.192		0.200
Number of id	15	15	15	15

Notes: Robust standard errors in parentheses *** indicates that a coefficient is significant at the 1% level; * significant at the 5% level, and * significant at the 10% level. The data set for the random effects estimation is 75 and the pooled OLS is 337 because of the data for external debt begins in 1990.

Including the slope dummy in the external debt equations shows similar results to the equations that exclude the slope dummy (see table 5.13). Specifically, the results indicate that the current account to export ratio has a negative and significant relationship with external debt; the debt service to export ratio has a positive and statistically significant effect and the reserves to export ratio is negative but insignificant. As it relates to export earnings instability, the results are negative and insignificant in the random effects estimation for both measures of instability and negative and significant in the pooled OLS estimation for both measures of instability. With regards to the slope dummy, the results indicate that the slope dummy is positive and insignificant in the random effects estimations and positive and significant in the pooled OLS estimations. Since the findings for the slope dummy is not robust, we cannot conclude that it positively affects external debt.

5.7 Conclusion

This chapter examined the relationship between export earnings instability, the current account balance, the trade balance and external debt for 15 Caribbean countries. Short panel analysis which includes the difference and system GMM and fixed and random effects were adopted to estimate the effect of export earnings instability on the trade balance and current account balance. The results from the random effect, fixed effects and GMM estimations show that export earnings instability does not have a statistically significant relationship with the trade balance or the current account balance.

In addition, the pooled mean group estimator finds that in the short-run, export earnings instability have a positive and significant effect on the current account in Belize, St. Vincent and the Grenadines and Trinidad and Tobago and negative and significant relationships in Antigua and Barbuda, Barbados and Haiti. For the trade balance, there are positive and significant results in the Dominican Republic, Haiti and Trinidad and Tobago and negative and significant results in the Bahamas and Jamaica. In the long-run, export earnings instability has a positive and statistically significant effect on the current account balance of the Caribbean. The long-run estimate for the trade balance shows that export earnings instability has a positive but statistically insignificant relationship with the trade balance.

The estimations for the balance of payments also reveal that domestic income growth has a negative effect on the current and trade balance, and the current account and the trade balance are increasing functions of world income growth. The estimates for world income growth show that exports from the Caribbean are highly income elastic. In fact, a one percentage point increase in world income growth results in an increase of approximately 2.11 percentage points in the current account to GDP ratio and 2.92 percentage points in the trade balance to GDP ratio. A change in the real exchange rate improves the current account balance but has no statistically significant relationship with the current account. At the country level the determinants of the current and trade balance varies.

Regarding the relationship between export earnings instability and external debt, both the random effects and pooled OLS estimation techniques show that there is no statistically significant effect of export earnings instability on external debt. But the analysis shows that the current account to export ratio has a significant negative relationship with external debt. The debt service to export ratio has a positive and significant relationship with external debt.

The results from this chapter have a few policy implications; one such implication is that efforts should be made to improve the performance of the export sector. In addition, higher exports will earn additional foreign exchange which in turn will reduce the need to borrow to fill the foreign exchange gap. Also, alternative ways of obtaining foreign financing, such as encouraging foreign direct investment, must also be examined.

APPENDIX 5

Table A5.1: Summary Statistics of the Balance of Payments and its Determinants

Country		BOPGDP	TBGDP	ΔLRGDP	World Growth	ΔLRER	iexpgsab	iexpgscv
Antigua and Barbuda	Mean	-0.129411	-0.407208	0.033275	0.008026	0.022325	0.217049	0.217922
	Std. Dev.	0.099968	0.075272	0.050743	0.015585	0.023667	0.153890	0.109879
	Min	-0.407262	-0.608372	-0.128243	-0.051830	-0.016877	0.003940	0.067785
	Max	0.028132	-0.290147	0.125542	0.042796	0.098175	0.451342	0.402917
Bahamas	Mean	-0.073162	-0.241103	0.019512	0.017827	-0.000664	0.239653	0.240237
	Std. Dev.	0.059165	0.029892	0.041273	0.016457	0.013648	0.163620	0.100847
	Min	-0.182744	-0.298567	-0.096802	-0.016658	-0.034496	0.007808	0.071736
	Max	0.013464	-0.190710	0.132528	0.064489	0.017681	0.701818	0.414543
Barbados	Mean	-0.032426	-0.217011	0.009132	0.016834	-0.010218	0.087368	0.101677
	Std. Dev.	0.051804	0.044416	0.030886	0.011555	0.023743	0.076759	0.055111
	Min	-0.119524	-0.309173	-0.072570	-0.016995	-0.059055	0.001896	0.037837
	Max	0.080030	-0.143334	0.055434	0.043694	0.028174	0.312528	0.226703
Belize	Mean	-0.061223	-0.156982	0.044020	0.018692	0.004755	0.129866	0.141670
	Std. Dev.	0.067674	0.046138	0.036149	0.013511	0.020033	0.107843	0.059983
	Min	-0.218343	-0.239694	-0.021763	-0.021076	-0.038001	0.009170	0.053291
	Max	0.052435	-0.068890	0.122389	0.037410	0.068244	0.420231	0.307369
Dominica	Mean	-0.141672	-0.232656	0.028814	0.014459	0.003671	0.231659	0.239169
	Std. Dev.	0.061655	0.094270	0.032205	0.014358	0.014211	0.128152	0.085818
	Min	-0.276907	-0.541091	-0.020585	-0.033684	-0.026400	0.001797	0.102414
	Max	-0.018479	-0.034168	0.114086	0.044018	0.025589	0.570446	0.380412
		BOPGDP	**TBGDP**	**ΔLRGDP**	**World Growth**	**ΔLRER**	**iexpgsab**	**iexpgscv**
Dominican Republic	Mean	-0.031792	-0.116753	0.042509	0.020842	0.012708	0.164533	0.190591
	Std. Dev.	0.030285	0.040000	0.035686	0.015747	0.202131	0.130882	0.101858
	Min	-0.095100	-0.204517	-0.051340	-0.018593	-0.519822	0.005639	0.032795
	Max	0.048460	-0.029421	0.101394	0.057901	0.796700	0.608936	0.388701
Grenada	Mean	-0.180778	-0.340694	0.033033	0.019208	-0.000922	0.199067	0.213941
	Std. Dev.	0.086006	0.041704	0.043404	0.013188	0.020526	0.116472	0.082523
	Min	-0.321639	-0.410548	-0.068869	-0.019020	-0.073991	0.051752	0.114922
	Max	0.031485	-0.255983	0.124607	0.047014	0.045488	0.652802	0.392563
Guyana	Mean	-0.132852	-0.051645	0.034963	0.014621	0.134491	0.069575	0.072565
	Std. Dev.	0.066773	0.094467	0.120087	0.010942	0.297910	0.064188	0.050967
	Min	-0.254789	-0.248950	-0.411695	-0.018027	-0.075554	0.002228	0.014695
	Max	-0.015852	0.099464	0.221436	0.032015	1.073818	0.261082	0.170908
Haiti	Mean	-0.027055	-0.169220	0.002580	0.021421	-0.024041	0.385252	0.386319
	Std. Dev.	0.020232	0.097866	0.040384	0.015877	0.142725	0.268225	0.195547
	Min	-0.079227	-0.369553	-0.127194	-0.023696	-0.311234	0.005789	0.068330
	Max	0.007641	-0.048998	0.094325	0.054795	0.420298	0.929514	0.698362
Jamaica	Mean	-0.068404	-0.167069	0.013800	0.016157	0.005094	0.116653	0.126904
	Std. Dev.	0.049287	0.077093	0.029229	0.012991	0.120066	0.065914	0.039761
	Min	-0.204000	-0.350382	-0.047542	-0.021029	-0.151223	0.008523	0.044985
	Max	0.015100	-0.024791	0.098314	0.046934	0.510516	0.246481	0.178260

Table A5.1 Cont'd

		BOPGDP	TBGDP	ΔLRGDP	World Growth	ΔLRER	iexpgsab	iexpgscv
St. Kitts and Nevis	Mean	-0.148649	-0.270337	0.036823	0.019872	-0.000619	0.153671	0.168080
	Std. Dev.	0.065474	0.042255	0.038535	0.015159	0.019629	0.091775	0.058064
	Min	-0.276769	-0.375490	-0.057612	-0.016987	-0.062200	0.006857	0.068537
	Max	-0.039326	-0.202104	0.100601	0.047571	0.036986	0.335927	0.272282
St. Lucia	Mean	-0.130586	-0.296440	0.032794	0.017667	-0.000457	0.208518	0.218247
	Std. Dev.	0.072894	0.063788	0.043189	0.015240	0.019500	0.121639	0.096488
	Min	-0.301417	-0.439602	-0.037723	-0.009261	-0.042672	0.007933	0.104490
	Max	-0.022124	-0.171572	0.155338	0.051257	0.031048	0.429030	0.381336
St. Vincent and the Grenadines	Mean	-0.157159	-0.257795	0.033256	0.015001	-0.000211	0.183073	0.182201
	Std. Dev.	0.096209	0.097486	0.033996	0.012581	0.019322	0.098151	0.071408
	Min	-0.331219	-0.440347	-0.034230	-0.014639	-0.058240	0.033873	0.069324
	Max	0.027742	-0.060594	0.131679	0.037837	0.037038	0.349687	0.295672
Suriname	Mean	0.003032	0.077681	0.046968	0.017535	0.004236	0.356343	0.320463
	Std. Dev.	0.111581	0.104916	0.172941	0.010072	0.192405	0.312173	0.172254
	Min	-0.233183	-0.051378	-0.744031	-0.010783	-0.391107	0.004799	0.087677
	Max	0.388319	0.517376	0.271188	0.035938	0.732621	1.255409	0.787165
Trinidad and Tobago	Mean	0.051854	0.118929	0.023320	0.015746	-0.012702	0.418301	0.420654
	Std. Dev.	0.116153	0.108259	0.054506	0.012475	0.078319	0.413690	0.224104
	Min	-0.121923	-0.122582	-0.108820	-0.014287	-0.109663	0.002280	0.160305
	Max	0.387870	0.412372	0.134890	0.047216	0.329142	1.893710	1.195900

Figure A5.1: Current Account to GDP for the Caribbean

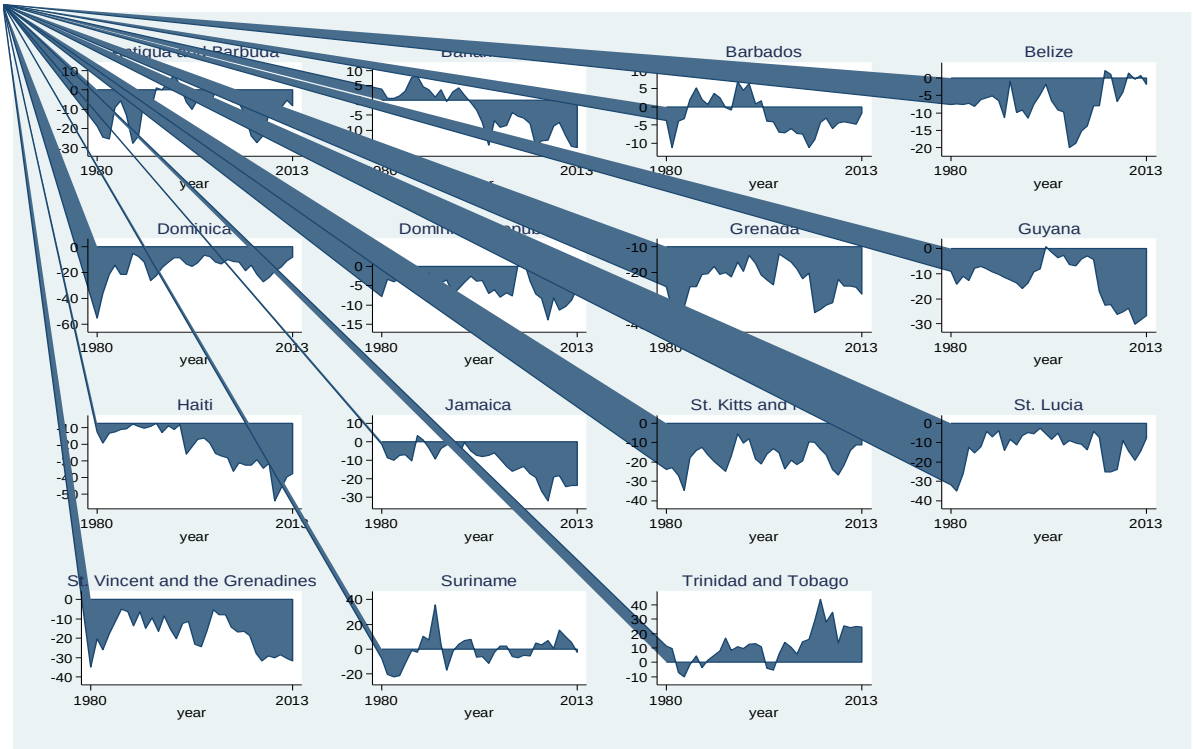


Figure A5.2: Trade Balance to GDP for the Caribbean

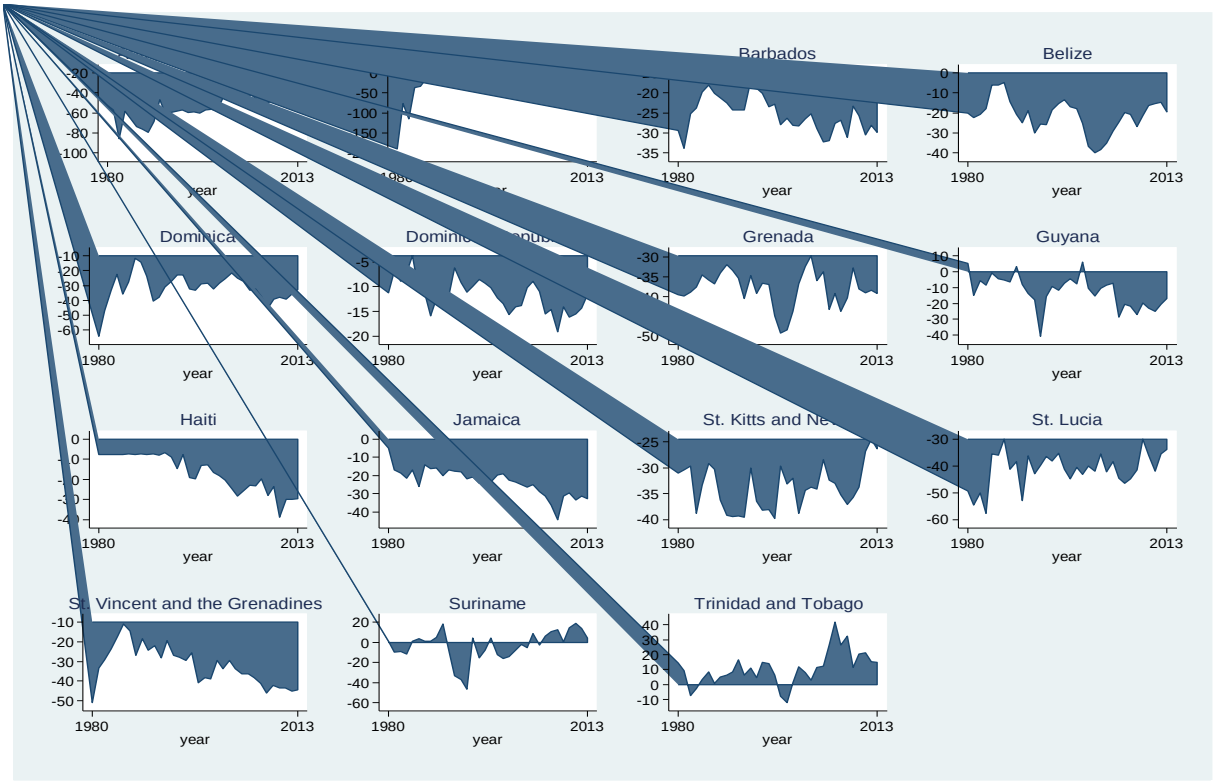


Table A5.2: Current Account Panel Results with Slope Dummy

	Absolute Deviation				Standard Deviation			
	DIFF-GMM	SYS-GMM	Fixed Effects	Random Effects	DIFF-GMM	SYS-GMM	Fixed Effects	Random Effects
VARIABLES	CAGDP	CAGDP	CAGDP	CAGDP	CAGDP	CAGDP	CAGDP	CAGDP
$CAGDP_{t-1}$	0.327*	0.715***	0.498**	0.830***	0.393*	0.721***	0.444**	0.828***
	(0.185)	(0.115)	(0.183)	(0.106)	(0.217)	(0.125)	(0.161)	(0.119)
RGDP Growth	-0.0413*	-0.0536***	-0.0380*	-0.0525***	-0.0451*	-0.0519***	-0.0328*	-0.0491***
	(0.0246)	(0.0134)	(0.0192)	(0.0115)	(0.0235)	(0.0147)	(0.0185)	(0.0138)
World Growth	2.787**	1.899**	2.632**	1.959**	3.116**	2.176*	2.057*	2.138**
	(1.155)	(0.966)	(1.031)	(0.993)	(1.437)	(1.125)	(1.075)	(0.946)
ΔLRER	0.162*	0.172*	0.135*	0.185**	0.146**	0.167**	0.155*	0.155**
	(0.0967)	(0.0967)	(0.0718)	(0.0926)	(0.0734)	(0.0846)	(0.0869)	(0.0720)
Export Earnings Instability	0.113*	0.117	0.135	0.105	0.196***	0.167	0.206**	0.150
	(0.0655)	(0.0787)	(0.0771)	(0.0893)	(0.0734)	(0.111)	(0.0802)	(0.109)
Slope Dummy	-0.143	-0.0817*	-0.134	-0.103**	-0.113	-0.0729*	-0.113	-0.0805*
	(0.105)	(0.0430)	(0.0929)	(0.0449)	(0.0965)	(0.0419)	(0.0953)	(0.0451)
Constant		-0.0783***	-0.106***	-0.0672***		-0.0883***	-0.121***	-0.0725**
		(0.0245)	(0.0151)	(0.0253)		(0.0285)	(0.0201)	(0.0294)
Arellano-Bond AR(1)	-1.81	-2.17			-1.75	-2.22		
	(0.071)	(0.030)			(0.081)	(0.026)		
Arellano-Bond AR2)	0.54	0.40			-0.30	-0.04		
	(0.589)	(0.687)			(0.768)	(0.966)		
Sargan Test	12.89	13.45			11.35	10.92		
	(0.377)	(0.996)			(0.414)	(0.999)		
Observations	75	90	90	90	75	90	90	90
Number of id	15	15	15	15	15	15	15	15
			0.316				0.331	

Table A5.3: Trade Balance Panel Results with Slope Dummy

	Absolute Deviation				Standard Deviation			
	DIFF-GMM	SYS-GMM	Fixed Effects	Random Effects	DIFF-GMM	SYS-GMM	Fixed Effects	Random Effects
VARIABLES	TBGDP	TBGDP	TBGDP	TBGDP	TBGDP	TBGDP	TBGDP	TBGDP
$TBGDP_{t-1}$	0.0455	0.529***	0.138	0.714***	0.0754	0.521***	0.148	0.698***
	(0.184)	(0.160)	(0.143)	(0.151)	(0.166)	(0.160)	(0.140)	(0.146)
RGDP Growth	-0.0617*	-0.0938***	-0.0488*	-0.0825***	-0.0584**	-0.0907***	-0.0510*	-0.0826***
	(0.0318)	(0.0351)	(0.0270)	(0.0309)	(0.0265)	(0.0334)	(0.0269)	(0.0318)
World Growth	3.381**	3.458**	1.949**	2.498	3.098**	3.018*	2.368**	2.857
	(1.441)	(1.638)	(0.869)	(1.707)	(1.293)	(1.776)	(0.969)	(1.937)
ΔLRER	0.0256	0.115	0.0447	0.0470	0.0200	0.161	0.0113	0.0548
	(0.105)	(0.124)	(0.0928)	(0.101)	(0.108)	(0.125)	(0.120)	(0.105)
Export Earnings Instability	0.116	0.133	0.0709	0.0816	0.128	0.206	0.129	0.159
	(0.0942)	(0.111)	(0.0960)	(0.0910)	(0.131)	(0.163)	(0.137)	(0.124)
Slope Dummy	-0.116	-0.0129	-0.122	-0.0268	-0.0976	-0.00518	-0.101	-0.0244
	(0.105)	(0.0419)	(0.123)	(0.0495)	(0.0964)	(0.0431)	(0.104)	(0.0444)
Constant		-0.187***	-0.245***	-0.122**		-0.200***	-0.257***	-0.141**
		(0.0597)	(0.0368)	(0.0562)		(0.0627)	(0.0470)	(0.0630)
Arellano-Bond AR(1)	-1.49	-1.89			-1.62	-1.84		
	(0.136)	(0.059)			(0.105)	(0.066)		
Arellano-Bond AR2)	0.45	-0.09			0.32	-0.14		
	(0.656)	(0.929)			(0.751)	(0.885)		
Sargan Test	9.45	13.46			9.73	13.14		
	(0.581)	(0.994)			(0.555)	(0.995)		
Observations	75	90	90	90	75	90	90	90
Number of id	15	15	15	15	15	15	15	15
R-squared			0.131				0.180	

Table A5.4: Panel Unit Root Test

Variables	Im, Pesaran and Shin (IPS)		Breitung	
	Test-Statistic	P-Value	Test-Statistic	P-Value
Current Account/GDP	-4.87	0.000	-2.75	0.003
Trade Balance/GDP	-3.27	0.001	-3.25	0.001
Real GDP Growth	-9.00	0.000	-4.96	0.000
World Growth	-8.13	0.000	-3.06	0.001
Δ LRER	-12.2	0.000	-6.09	0.000
Instability (Absolute Deviation)	-6.14	0.000	-4.40	0.000
Instability (Standard Deviation)	-3.51	0.000	-3.34	0.000

CHAPTER 6: CONCLUSION

This thesis has provided a critical analysis of the causes and macroeconomic effects of export earnings instability in the Caribbean. From a methodological point of view, the study applies modern empirical analysis to explore various issues about export earnings instability. To my knowledge this is the first study to explore this topic for the Caribbean. The analysis done in this study provides convincing results about the factors that are driving the level of export earnings instability in the region and the effects that this has on economic growth, investment, the balance of payments and external debt in the Caribbean. In addition, the thesis also provides empirical evidence regarding the determinants of each of these macroeconomic variables.

The first essay which examines empirically the components of exports that contribute most to export earnings instability and the causes of export earnings instability in the Caribbean finds convincing results about the causes of export earnings instability. Specifically, through a portfolio variance decomposition analysis the essay finds that merchandise exports are more unstable than services exports and that merchandise exports are the component of exports of goods *and* services that contribute most to export earnings instability in the region. In addition, the results indicate that in most of the Caribbean countries, the level of instability in merchandise exports is due mainly to instability in raw material and manufacture exports. The portfolio variance analysis also shows that the instability in merchandise exports is due to instability in the price of merchandise exports from the region, rather than instability in the quantity of merchandise exports from the region. The results from the panel data analysis provide strong support for the findings of other studies on the causes of export earnings instability in developing countries. Panel data analysis shows that the main causes of export earnings instability in the region are commodity concentration and the share of raw material exports in total exports of goods *and* services. All the findings obtained in this essay indicate that instability in export earnings in the Caribbean is driven by fluctuations in the demand for exports and is in line with the results of the broader literature on the causes of export earnings instability.

The second essay addresses the effect of export earnings instability on economic growth and establishes the factors that drive economic growth in the region. To demonstrate the effect of export earning instability on economic growth, an econometric growth model that includes the determinants of economic growth identified in the theoretical and empirical literature is developed and estimated. The model is tested at the regional level using panel data techniques and at the country level using the autoregressive distributed lag methodology (ARDL) of Pesaran et.al (2001). Economic growth equations are often plagued by endogeneity, due to the correlation between economic growth and its determinants. For example, there could be correlation between the investment to GDP ratio and real GDP growth. To control for this possibility in our analysis, we use the GMM estimation technique in our panel data analysis. In the ARDL analysis the structure of the equation which includes lags of the dependent and independent variables controls for endogeneity. The results of both the panel data estimation and the times series estimation show that economic growth in the Caribbean is driven by the investment to GDP ratio and export growth. Both investment and export growth are found to be positive and significant in all 15 countries in our sample. This result is in line with theoretical predictions and is consistent with the structure of Caribbean economies.

With regards to the effect of export earnings instability on economic growth, the estimates from the panel data analysis show that export earnings instability is harmful for economic growth and the ARDL estimation show that export earnings instability has a significant negative effect on economic growth in the Bahamas, the Dominican Republic, Grenada, Jamaica and St. Kitts and Nevis. Of the five countries where a significant negative relationship is observed, four of these countries namely the Bahamas, the Dominican Republic, Jamaica and St Kitts and Nevis have significant shares of their export in manufacture and raw materials (refined petroleum, manufactures, bauxite and light manufacture, respectively), while Grenada has a narrow export basket. This indicates that in these countries where export earnings instability is found to be harmful, their exports are characterized by the factors identified in chapter 2 as the main drivers/causes of export earnings instability (that is the share of raw material exports in total exports of goods *and* services and commodity concentration).

The third essay explores the determinants of private investment in the region and ascertains whether export earnings instability hinders the performance of private investment. Similar to the second essay, the third essay uses panel data analysis (including GMM estimation) and autoregressive distributed lag (ARDL) time series analysis to achieve both objectives. Also, as with the growth equation, GMM and ARDL controls for the possibility of endogeneity in the investment equation. Results from the panel data analysis show that private investment in the Caribbean is driven by real GDP growth and the availability of credit measured as credit to the private sector as a share of GDP. The real interest rate is statistically insignificant in the panel data analysis. This result is consistent with the broader literature such as Caballero (1999) which has struggled to establish a strong empirical relationship between investment and the cost of capital. The results from the time series analysis are varied and as such did not provide a general consensus as to the drivers of private investment in the 15 countries in the sample. For example, real GDP growth has a positive influence on private investment in the short-run in the Bahamas, Dominica, Grenada, Haiti, St. Lucia, St. Vincent and the Grenadines Suriname and Trinidad and Tobago. In the long-run, real GDP growth contributes positively to the level of private investment in the Bahamas, Dominica, St. Lucia, St. Vincent and the Grenadines, Suriname and Trinidad and Tobago. Credit to the private sector has a positive effect on private investment in the short-run in all six ECCU[46] countries, Barbados, Belize Dominican Republic, Guyana, Suriname and Trinidad and Tobago. In the long-run, there is a positive and significant relationship with private investment for Antigua and Barbuda, Barbados, Belize, Dominica, Guyana, Haiti, St. Kitts and Nevis, St. Vincent and Grenadines, Suriname and Trinidad and Tobago.

For export earnings instability, panel data analysis indicates that there is no statistically significant effect of export earnings instability on private investment in the region. This finding suggest that the negative effect of export earnings instability on economic growth which is observed in the second essay is not due to the effect on investment but rather on the productivity/efficiency of investment. The results for the effect of export earnings instability on private investment in the

[46] Antigua and Barbuda, Dominica, Grenada, St. Lucia, St. Kitts and Nevis and St. Vincent and the Grenadines

various countries in our sample are diverse. The estimates from the time series analysis show that in the short-run, export earnings instability has a negative and significant effect on private investment in Antigua and Barbuda and Belize. In the long-run, export earnings instability exhibits a significant negative effect on private investment in Barbados and Haiti and a significant positive long-run effect in Suriname.

The final essay estimates the determinants of the current account balance, the trade balance and external debt and examines the effect of export earnings instability on these variables in the region. To estimate the current account and trade balance equations, we use panel data analysis and times series analysis. The time series method used is the pooled mean group estimation technique. The main finding of the panel data analysis is that the current account and the trade balance are negatively affected by real domestic GDP growth and positively influenced by world income growth as predicted by the theoretical literature. In addition, the estimation finds that the real exchange rate exhibits a positive and significant influence on the current account but not on the trade balance. The results of the time series analysis done for each country did not reveal any unanimous determinants of the current account or trade balance; the findings vary for each country.

With regards to export earnings instability, panel data analysis did not find any significant effect of export earnings instability on the current account or trade balance. These results suggest that export earnings instability must be largely symmetrical around the trend. The estimates from the time series estimation show that in the short-run, export earnings instability has a positive and significant effect on the current account balance in Belize, St. Vincent and the Grenadines and Trinidad and Tobago and negative and significant relationships in Antigua and Barbuda, Barbados and Haiti. For the trade balance, export earnings instability has positive and significant effects in the case of Dominican Republic, Haiti and Trinidad and Tobago and negative and significant results for the Bahamas and Jamaica.

For external debt the determinants and the effect of export earnings instability are examined using an econometric model that includes variables that are theorized to affect the level of external debt of a country/region. This model is estimated using only panel data analysis. The analysis could not

be done at the country level due to lack of data availability. The estimation results show that the level of external debt in the region is positively related to the debt service to export ratio and negatively related to the current account balance. Export earnings instability does not seem to influence the level of external debt in the region.

The results of the empirical finding presented in this thesis give ground for a debate about appropriate policies to address export earnings instability in the Caribbean. One main implication brought out in this thesis is that in order to reduce export earnings instability Caribbean countries need to diversify their exports. While this is not the panacea to stabilizing export earnings it will help them to reduce the level of instability in export earnings and as a result reduce the effect on economic growth. Export diversification can lower instability in export earnings, expand export revenues, upgrade value added, and enhance growth. In addition, countries in the region should consider diversifying their export markets to reduce dependence on a few sources of demand. These countries can expand to markets outside of the region as well as boost intra-regional trade by improving transport links and simplifying customs and inspection procedures. Milner et.al (2008) provide a detailed study about the measures that developing countries can take to improve trade facilitation. In this study they highlight improving customs clearance procedures; introducing automation and use of information technology; and reducing excessive documentation requirements as some measures that developing countries can implement to improve trade. In addition, intra-regional trade presents countries with an opportunity for realizing trade gains and strengthening regional resilience. Gutierrez de Pineres and Ferrantino (2000) note that "When exports are more diversified, knowledge spillovers in the form of productivity improvements, efficient management and increased technical, technological and market knowledge tend to be enhanced."

While stability is essential for economic development in the Caribbean, stability by itself, does not ensure improvement in economic performance. Therefore, in addition to designing policies to address instability in export earnings, governments in the Caribbean will also need to design and implement policies that improve the macroeconomic framework of the countries in the region. One of the key areas for improvement is the rate of economic growth. Given the findings that export

growth is an essential driver/determinant of economic growth in the region there are several policy implications that can be drawn from this result. First, to expand export growth, and therefore economic growth, governments in the Caribbean should address constraints to export growth. For example, they would need to: address border constraints such as tariff and non-tariff barriers as well as customs facilitation; address supply constraints and address beyond the border constraints such as market access barriers. When addressing each of these constraints the governments will also need to ensure that the macroeconomic framework is appropriate to foster each policy. Second, governments in the Caribbean need to strengthen resilience to economic shocks caused by export earnings instability and buffer the economy in times of economic downturn. For example, the governments in the Caribbean could create a stabilization fund so that in time of economic downturn they will be able to use it to sustain their economies.

In addition, the findings from the thesis indicate that investment is a key determinant of economic growth in the region and that credit to the private sector is a key driver of private investment. Consequently, designing policies that improve the private sector's access to credit facilities may lead to an improvement in the performance of private investment and increase real GDP growth. Deepa (2002) in a study done for the World Bank highlights some policies that can be used to address access to credit in developing countries, that may also be applied to Caribbean economies; this includes improving borrower information and relaxing barriers to access to credit markets. Also, policies promoting better financial-sector credit allocation mechanisms based on project profitability and borrower information could improve access to credit.

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