

FINANCING RECOVERY: IMPLICATIONS OF NATURAL DISASTER EXPENDITURE ON THE FISCAL SUSTAINABILITY OF THE EASTERN CARIBBEAN CURRENCY UNIT (ECCU) STATES

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ABSTRACT

This paper addresses the issue of natural disaster expenditure and its impact on fiscal sustainability in the Eastern Caribbean Currency Unit (ECCU) countries. Most of these countries have financed recovery by acquiring loans and accessing emergency funds. When poor countries such as the ECCU States are faced with natural disasters, the cost of rebuilding becomes even more of an issue since they are already burdened with debt. This paper takes a two step approach to examine this issue. Firstly, it presents the results of surveys conducted on the effects of disaster expenditure on key players - budgetary, financing and disaster preparation and mitigation institutions. Secondly, it explores empirically the effect of natural disaster expenditure on fiscal policy cyclicity. Using panel data models for the ECCU States in the period 1990-2008 and utilizing a FE2SLS as the main technique of estimation, the empirical part uncovers three major results. First, fiscal policy is procyclical in the ECCU States in the period of interest. Second, the addition of a variable to account for environmental shocks (here natural disaster shocks) increases the size of procyclicality of fiscal policy. Third, environmental shocks are negatively linked to output. The study found evidence to suggest that natural disasters pressure governments to run procyclical fiscal policies.

Keywords: environmental vulnerability, natural disaster expenditure, fiscal sustainability, financing recovery, cyclicity.

1.0 Introduction

Fiscal sustainability of the Eastern Caribbean Currency Unit (ECCU) States¹ is inherently fraught with uncertainty. Indeed, in the first instance, the ECCU States policymaking decisions concerning fiscal policies have typically omitted the impact of environmental vulnerability and particularly natural disaster shocks² on their budgets and balance of payments. The implication of natural disaster shocks is critical in determining fiscal sustainability since natural disaster expenditure can cripple an entire economy, leading to rising fiscal deficit and increased debt levels. For recall, environmental shocks and in particular natural disasters such as earthquakes, floods, landslides, volcanic eruptions and hurricanes are unpredictable and vary in frequency and intensity. For instance, during the period 1980-2008 an estimated 185 natural hazards occurred through the entire Currency Union. On average, 11 events took place during 1980 in comparison to 25 recorded in 1996. In addition, the associated economic costs of disaster relief and reconstruction increased. For example, the estimated cost of damage resulting from Hurricane Georges (in St. Kitts and Nevis) in 1998 of EC\$1.3m is relatively low when compared to the cost incurred by Grenada of EC\$54.0m as a result of Hurricane Ivan in 2004. The various outcomes were accompanied by increases in public expenditure in conjunction with decreases in public sector revenue.

The broad objective of this study is to investigate whether or not natural disaster expenditure forces governments of the ECCU to adopt further pro-cyclical policies. For recall, the period of investigation goes

¹ The ECCU States comprise: Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines. However, Anguilla does not form part of this current study.

² The term "natural disaster/natural hazards" is used to refer to catastrophes that arise from acts of nature such as volcanic eruptions, floods, winds, droughts and earthquakes. These are dangerous events that cause environmental damages and/or other damages (physical, biological, social, and economic).

from 1990 to 2008. The existing literature suggests that fiscal policy in developing countries is procyclical. Samuel (2009), Iltzetki and Vegh (2008), Lane (2003), Kaminsky, Reinhart and Vegh (2004), Talvi and Vegh (2000) and Gavin and Perotti (1997) are representative works. It is, however, worth noting that the literature mainly focuses on the relationship between output growth and fiscal policy to analyze the cyclicity of fiscal policy. This study, by bringing in environmental considerations³, expands this literature⁴. Even though the theoretical literature generally considers government expenditure constraints as the basis for procyclical fiscal policy, this study argues that expenditure resulting from environmental shocks is one of the primary reasons for destabilizing fiscal policy.⁵

The contribution of this study is twofold: the collection of much needed primary data on natural disasters as well as the empirical analysis of the impact of natural disaster expenditures on the ECCU's fiscal sustainability in the context of fiscal cyclicity. Concerning the last item, the empirical estimation, which uses panel data framework coupled with a Fixed Effects Two-Stage Least Square (FE2SLS) as the main technique of estimation, leads to results according to which fiscal policy is procyclical in the ECCU States. The results also reveal that the addition of a variable to account for environmental shocks⁶ increases the impact of the procyclical variable. This implies that lower levels of environmental shocks will help governments of the ECCU to improve their fiscal stance/fiscal sustainability position. Indeed, indicators of fiscal sustainability analysis should therefore be extended to account for the environmental vulnerability of the ECCU States. Moreover, environmental shocks negatively affect output, at least in the short run.

The study is divided into six sections. Section 1 provides the introduction. Section 2 presents the arguments as to why natural disasters/natural hazards should be targeted. Section 3 deals with the

³ Natural /hazards /disasters are elements of environmental shocks.

⁴ See for example Gavin et al. (1996) and Fatas and Mihov, 2003.

⁵ This notion is supported by Samuel (2009).

⁶ In this study environmental shocks and environmental vulnerability are measured by costs incurred as a result of natural disasters/hazards.

research methodology to collect data. Section 4 contains the survey findings. Section 5 presents the empirical analysis of cyclical models and a case study. Section 6 contains policy recommendations. Section 7 presents the conclusions.

2.0 Why to Target Natural Disasters/Natural Hazards?

A country's vulnerability to natural disasters is associated with negative aspects of underdevelopment, economic growth and poverty. Problems resulting from environmental vulnerability and specifically natural disasters are more likely to be intense in ECCU States because of the weak capacity of the region to resist the negative impact of a natural disaster; weak capacity is explained by the low level of provision of environmental services as well as the lack of availability of adequate finance to rebuild the economy. A recent study by the United Nations has shown that at least 13 out of 25 countries are mostly prone to disasters – specifically, storm surges, landslides, droughts and floods. The Eastern Caribbean States are among the top thirteen. For these reasons it is important to consider natural disasters.

Moreover, consequences of the impact of natural hazards and natural disasters on ECCU States are of significant concern because the cost of hurricane reconstruction, added to already existing capital projects, may lead to an increase in the cost of future projects and affect governments' ability to deliver essential services. In addition to their geographic location and structure, poverty is a growing problem. Rapid population growth drives the need for more natural resources and strains the economies and standard of living. Population growth and poverty are likely to result in increased pollution. Another major reason to target natural disasters originates from the dependence of the ECCU economies on agriculture as a major source of foreign exchange or revenue. Bananas, sugar cane, nutmegs, fruits and other tree and root crops are prone to damage from natural disasters. Bananas, for example, cannot withstand winds over 45mph. Moreover, bananas are really giant members of the grass family that cannot survive in soggy conditions; hence, severe rains

and floods affect them. Chief examples of the vulnerability of ECCU's agriculture industry to natural disaster were demonstrated through the impact of hurricanes Luis and Marilyn (1995) which resulted in the total loss of Dominica's banana crop and tropical storm Debbie (1994) which causes Dominica's economy to record a 17.0 per cent contraction in the agricultural sector. Tropical storms Debbie (1994), Lenny (1999) and Lilly (2002) caused devastating damages to crops. Hurricanes Georges (1999) in St. Kitts and Nevis and Ivan (2004) in Grenada had similar effects and significantly damaged nutmeg trees. These events caused severe drops in the export market; drops exacerbated by the lengthy period of maturation of major agricultural products: nine to twelve months for bananas and three years for nutmegs. Remarkably, within the ECCU, crops are produced by small-scale farmers. These farmers are less able to bear heavy losses because of their lack of assets, access to credit and crop insurance. Nonetheless, banana farmers are the only producers who have risk insurance. They are provided with partial financial protection under the WINCROP banana crop insurance scheme and partial compensation by the E.U., through its STABEX funds.⁷

3.0 Field Research Methodology

To isolate the impact of natural hazards on public sector debt, the study collected a set of primary and secondary data on fiscal practices, budget practices, debt management systems, agricultural statistics, natural disaster management systems and natural disasters statistics. Questionnaires were designed and distributed. These questionnaires focus on the relationship between the key variables and natural disasters/hazards. The implied null hypothesis is that there is no direct link between natural disaster shocks and the relevant aspect of economic performance. A total of ten offices within the ECCU states - with the exception of Anguilla - were surveyed.

⁷ STABEX is the acronym for a European Commission compensatory finance scheme to stabilize export earnings of the ACP countries. It was introduced in the first Lomé Convention (1975) with the purpose of remedying the harmful effects of the instability of export revenue from agricultural products.

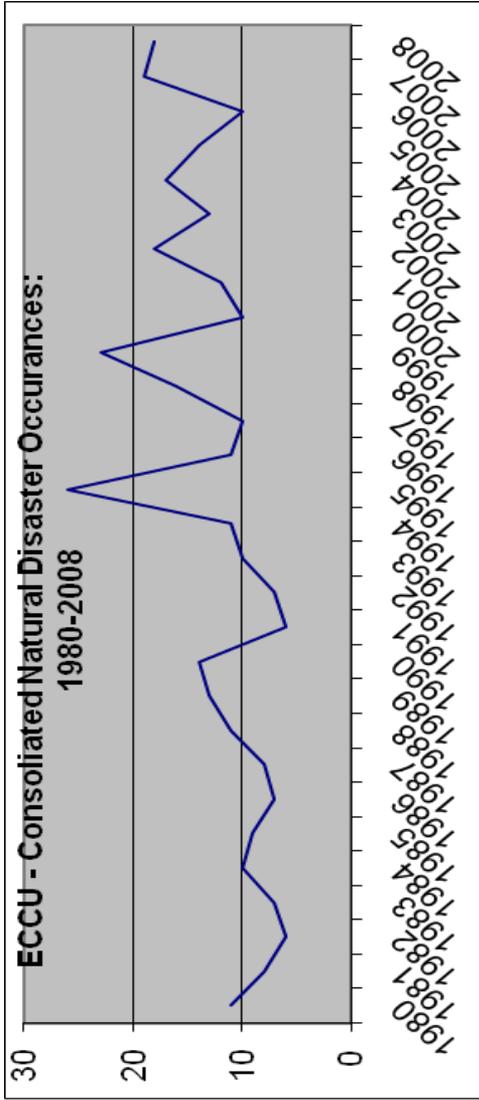
4.0 Field Research Findings

Unplanned human settlements and activities, alongside the continued population growth and the persistence of high poverty levels (particularly in rural areas), unsustainable resource use, urbanization, economic growth, intensification of agriculture, rising energy use and transportation, environmental degradation and pollution are factors that are reflected in an increase of the region's environmental vulnerability to natural disasters. The risk posed by changes to these variables drives up the full recovery cost which includes costs of prevention and emergency response. As a consequence, economic growth, fiscal balance and balance of payments are the key macroeconomic variables studied. That is, these variables are important ingredients for economic survival, prosperity and fiscal sustainability.

4.1 *Economic*

Throughout the entire Caribbean an estimated 355 significant natural disasters occurred during the period 1980-2008. These events include: hurricanes, volcanic eruptions, tropical storms, storm surges, landslides, droughts, earthquakes, floods and wildfires. During the first time period (1980–1992), the number of events ranged from five to 14 in the entire Eastern Caribbean within a single year. During the second time period (1993-2008), it went from ten to 25. Figure 1 illustrates the increase in frequency of violent events.

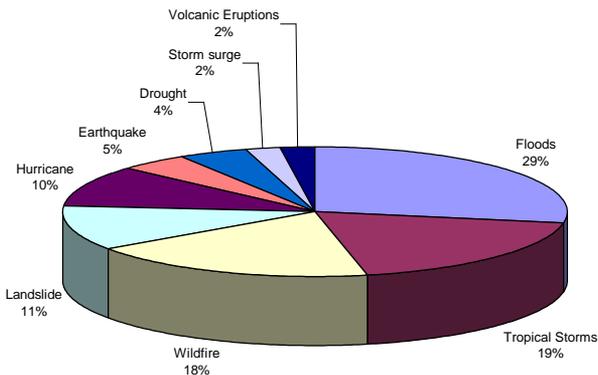
Figure 1



Source: Various National Disaster Agencies

Data collected from surveyed institutions within the ECCU revealed that the most frequent natural hazards over the period 1980-2008 were floods. Floods represent 29.0 per cent of all events. This is the highest number of events registered during the period under review. Storm surge and volcanic eruptions occurred the least, each accounting for 2.0 per cent of all occurrences (See Figure 2).

Figure 2: Occurrences by Event 1980-2008 (ECCU)



Source: Various National Disaster Agencies

When surveyed, participants were asked to indicate the most severe natural disaster that has affected their country. The results indicated that hurricanes had had the greatest negative impact. Specifically, participants indicated that hurricanes significantly affected government's financial resources. Changes in events have been witnessed through the unprecedented devastation of hurricanes – Emily (2005), Ivan in 2004 (the costliest hurricane in the Caribbean), José and Lenny (1999), Georges (1998), Marilyn (1995), Hugo (1989) and Allen (1980).

During the period 1980-2008, Grenada suffered six major tropical storms - Arthur (1990), Marilyn (1995), Lenny (1999), Lilli (2002), Earl (2004) and Felix (2007) and two major hurricanes – Ivan (2004) and Emily (2005). These caused considerable human and property losses and total

damages in excess of EC\$3.0 billion. With reference to Hurricane Ivan (2004), Grenada suffered the greatest impact. Indeed, in Grenada, Ivan (2004) left 60,000 persons homeless, 680 injured and 28 persons dead. Ivan (2004) was later followed by Emily (2005). .

Regarding Hurricane Georges (1998), Antigua and Barbuda and St. Kitts and Nevis were significantly affected. Hurricane Georges (1998) impacted St. Kitts and Nevis on the night of Sunday 20th September and the morning of Monday 21st September 1998. The hurricane was classified as a category three hurricane as the eye had winds of 115 mph. Hurricane Georges had the greatest negative impact on St. Kitts and Nevis during the period 1980-2008 causing damage of approximately EC\$1.0 billion. St. Kitts endured significant losses from eight hurricanes- Hugo (1998), Gustav (1990), Marilyn and Luis (1995), Georges (1998), José and Lenny (1999) and Omar (2008). In addition, the island endured five significant tropical storms, 1984, 1989, 1995, 1998 and 1999. Total damage resulting from these events exceeded EC\$2.0 billion.

Concerning hurricanes José (1999) and Lenny (1999), taken together these hurricanes were Antigua and Barbuda's costliest natural disasters. José ravaged the island in October 1999 while hurricane Lenny struck the islands in November 1999 with winds of up to 240 mph. After three days of heavy rain, huge tidal waves and strong winds, the hurricane left widespread destruction to housing, public buildings, water supplies, electricity lines, roads, piers and other infrastructure. It also affected crops and destroyed fishing equipment. There was one death and 13 persons injured. Over 3,500 homes were damaged or destroyed. Damages to homes, the environment, roads and bridges, health, utilities, agriculture and fisheries and businesses were an estimated at EC\$248.4m. In Barbuda, it is estimated that up to 65.0 per cent of the island was underwater (the island is quite flat) with sanitary facilities overflowing and water storage facilities contaminated. In addition to José (1999) and Lenny (1999), Antigua and Barbuda suffered extensively from damage inflicted by hurricanes Hugo (1989), Luis and Marilyn (1995) and Georges (1998).

Another significant hurricane is Hurricane Allen (1980). This hurricane affected St. Lucia in August 1980 with damage totalling

EC\$250.0m. In terms of economic loss, Hurricane Allen had the greatest negative impact on the Saint Lucian economy. Hurricane Allen was the strongest hurricane of the 1980 Atlantic hurricane season and one of the strongest hurricanes recorded in history. Over the period 1980-2008 St. Lucia was affected by four significant hurricanes, Allen (1980), Lenny (1999), Ivan (2004) and Dean (2007).

In addition to the above mentioned hurricanes – Hugo (1989) impacted significantly on the ECCU region during the period 1980-2008. In 1989 the centre of Hurricane Hugo passed directly over Montserrat. The damage from this hurricane was catastrophic, both to the island's infrastructure and the environment. Most of the island's infrastructure was damaged or destroyed.

Concerning tropical storms, the survey found that tropical storms represent 19.0 per cent of all events that took place between the period 1980 and 2008 (as seen in Figure 2). In particular, tropical storm Lilli (2002) was recognized as St. Vincent and the Grenadines most severe natural disaster occurring during the period 1980-2008. This tropical storm caused extensive damage to the environment, infrastructure, tourism facilities, housing, banana crops and caused loss of lives. Damage was estimated in excess of EC\$35.0m. St. Vincent and the Grenadines was also affected by ten severe tropical storms and four significant hurricanes including Lenny (1999), Lilli (2002), Ivan (2004) and Dean (2006).

Concerning earthquakes, the survey reveals that earthquakes represent 5.0 per cent of the environmental events which occurred during the period 1980-2008 (see Figure 2). Remarkably, over 7000 minor earthquakes (i.e. tremors) occurred each year. The survey further reveals that in 1999 Montserrat experienced 150 minor earthquakes; whereas Antigua felt 31 tremors within a 29 day period. Residents could not detect these earthquakes. The findings also show that the costliest earthquake was the one which struck Dominica on November 21, 2004, measuring 6.3 on the Richter scale. The earthquake caused damage estimated at EC\$90.0m and affected 19,527 persons. The impact was exacerbated by heavy rainfall from a tropical wave that resulted in land

slippage, further complicating the relief effort as several villages could only be reached by air transport for several days. The earthquakes in Dominica originated from tectonic earthquakes resulting from movements of the Atlantic Plate which pushes under the Caribbean Plate and seismic events relating to Dominica's origin as a volcanic island, a consequence of plate-tectonic forces (Rowley, 1992). On November 29, 2007 all countries within the ECCU were affected by an earthquake which measured 7.4 on the Richter scale. Although this was a strong earthquake, it did not cause any significant damage.

It must be noted that St. Vincent and the Grenadines and Dominica registered the highest number of environmental events over the entire period with 145 and 73 events, respectively. The key events that affected Dominica over this period have been Hurricane Allen in 1980, Hugo in 1989, the three tropical storms in 1995 and Hurricane Lenny in 1999.

Evidently, the frequency of strong tropical cyclones appears to have risen. This is supported in studies by Emanuel (2005) and Hoyos et al. (2006) who examined the intensity of global warming and the hypothesis of Atlantic hurricanes. Emanuel (2005) noted that Atlantic hurricanes have doubled in power (duration and strength combined) over the past 30 years. This is correlated with the warming of the ocean. Hoyos et al. (2006) showed that hurricane power dissipation is highly correlated with temperature reflecting global warming. The World Meteorological Organization (WMO) reported that the warmest years on record have been 1998-2007. NASA scientists noted that the year 2005 was the hottest year recorded since instrumental measurements began. The years 1998, 2002, 2003 and 2006 were among the top five years. Evidently the Earth has warmed significantly. Heat waves and droughts have increased. A notable example was the European heat wave of 2003, which killed around 50,000 people. Droughts can result in heavy crop and livestock losses while leaving infrastructure and productive capacity largely unaffected.

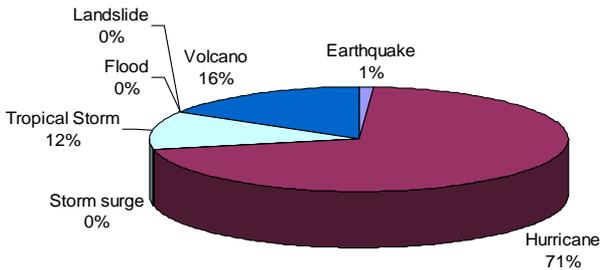
This research found that drought had the least impact on the ECCU countries. Nonetheless, the most severe drought of the region

took place in Antigua and Barbuda during the period 1983-1984. During this period, damage to crops and the death of livestock resulted in major income losses to farmers. The population was without pipe-borne water for months and the country had to resort to importing water from Dominica. As a result of this, water desalination plants were constructed and they now supply 62.0 per cent of Antigua's water requirements. In 2002, the island experienced severe drought-like conditions for five months. Between the period 1980 and 2008, Antigua and Barbuda suffered from six significant periods of drought (1983, 1984, 1993, 2002, 2003 and 2004). Dominica experienced drought in the first half of 2003 whereas drought occurred in St. Vincent and the Grenadines during 2002, 2003 and in the first quarter of 2005.

4.2 Fiscal Balance

The fiscal stress placed by natural disasters within the ECCU is echoed by the fiscal deterioration experienced by Grenada in the aftermath of Hurricane Ivan of 2004. In 2004 Grenada's fiscal deficit was estimated at EC\$28.4m. An accumulation of fiscal deficits in the Eastern Caribbean States represents a mortgaging of future tax revenues rather than a buildup of inflationary pressure (USAID, 2000,5). Thus, economic losses such as cost of hurricane reconstruction, add to existing capital projects. This may lead to an increase in the cost of future projects and affect governments' ability to deliver essential services. This study found that on average, the greatest economic loss across the region between 1980 and 2008 resulted from hurricanes (EC\$5.8 billion equivalent to 71.0 per cent of total losses), followed by volcanic eruptions (EC\$1.4 billion) then tropical storms (EC\$1.0 billion). Although hurricanes constitute the greatest financial loss, no hurricane has destroyed an entire economy as is the case of the volcanic eruption in Montserrat (See Figure 3).

Figure 3: Average Economic Loss (%) by Category: 1980-2008 (ECCU)



Source: Various National Disaster Agencies

The survey found that 99.0 per cent of the most significant events are hurricanes. Among these events the worst natural disasters by economic loss were: Hurricane Ivan 2004 (Grenada) - EC\$2,417.0m, Soufriere Hills volcanic eruption (Montserrat) - EC\$1,350.0m, Hurricane Allen 1980 (St. Lucia) - EC\$250.0m, Hurricanes José and Lenny 1999 (Antigua and Barbuda)- EC\$247.0m, earthquake 2004 (Dominica) - EC\$90.0m, Hurricane Lilli 2002 (St. Vincent and the Grenadines) - EC\$35.0m and Hurricane Georges 1998 (St. Kitts and Nevis) - EC\$1.3m (See Table 1).

Table 1: Major Natural Disasters

Event	Year	Country	Damage (EC\$M)
Hurricane Ivan	2004	Grenada	2,417.00
Soufriere Hills Volcanic eruption	1995, 1996 & 2006	Montserrat	1,350.00*
Hurricane Georges	1998	St. Kitts & Nevis	1,035.13
Hurricane Allen	1980	St. Lucia	250.00
Hurricane José & Lenny	1999	Antigua & Barbuda	247.00
Earthquake	2004	Dominica	90.00
Hurricane Lilli	2002	St. Vincent & the Grenadines	35.30

Source: Various National Disaster Agencies

Nine hurricanes affected Dominica and resulted in an estimated loss of EC\$338.9m, while Grenada suffered from six tropical storms and two major hurricanes. The total estimated cost of damages of the two hurricanes amounted to EC\$2,620m. Montserrat was affected by two severe hurricanes, one earthquake of significance and a series of volcanic eruptions. The estimated total loss resulting from these events was approximately EC\$2,047.1m. St. Kitts and Nevis was affected by eight major hurricanes. The total cost of these events was estimated in excess of EC\$1,942.0m. Two significant hurricanes occurred in St. Vincent and the Grenadines and the cost of these amounted to an estimated EC\$39.4m. The effects of five events in : one tropical wave, two tropical storms and two hurricanes, amounted to a total cost of EC\$39.6m. St. Lucia was affected by two tropical storms at an estimated cost of EC\$250.0m, three tropical waves with approximate expenditure of EC\$15.7m, four hurricanes amounting to EC\$294.7m in financial losses, and one earthquake (1990) resulting in the loss of EC\$579,996. The total estimated cost of these events amounted to EC\$561.3m.

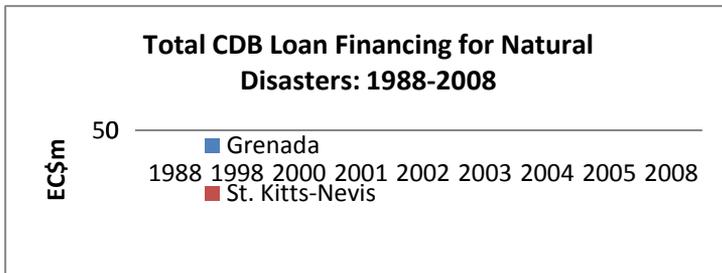
Nearly all past studies of the financial impact of natural events and disasters have tended to employ a single event study and estimate the impact by focusing on economic growth (GDP) and international trade. This study differs from others in that it examines natural disasters from a fiscal sustainability standpoint and considers natural disaster expenditure as a macro-economic adjustment variable.

4.3 Public Debt

Based on this researcher's findings, no ECCU State would be able to finance losses induced by a severe natural disaster without securing additional external help. The poorest of these seven counties in terms of GDP, Montserrat, would not have difficulty accessing financial aid mainly because it is a British colony, although its natural disaster risk and potential losses are quite large. On the other hand, the other islands – Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Vincent and the Grenadines and St. Lucia - would continue to experience financing difficulties because of their geographical location, economic

exposure and volatile revenue base. This study found that six of the eight Eastern Caribbean States contracted loans to offset disaster expenditure, namely Antigua, Dominica, Grenada, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines (See Figure 4).

Figure 4



Source: Caribbean Development Bank

In 2004, Grenada's natural disaster rehabilitation and reconstruction activities amounted to EC\$12.7m. To cover this expenditure, a loan amounting to EC\$5.4m was acquired and the Government of Trinidad and Tobago issued a bond of US\$16.5m to the Government of Grenada. This represents 54.0 per cent of total disaster expenditure during the period under review. An emergency response loan totalling EC\$2.2m was approved immediately following hurricane Ivan. In 2004 the Caribbean Development Bank (CDB) assisted Grenada with a Hurricane Reconstruction Support Loan of \$8.1m. Grenada borrowed a total of EC\$23.2m to cover the cost of rehabilitation after hurricane Ivan. In 2005, an additional EC\$22.7m was borrowed from the CDB for natural disaster purposes thereby covering the cost of both Ivan and Emily. Grenada acquired loans for natural disaster purposes in at least three years. These loans amounted to EC\$12.9m and represented 56 per cent of total disaster expenditure. After the passage of Hurricane Ivan, Grenada was unable to pay interest on its two largest bond issues. The Government then sought the cooperation of its creditors to restructure its commercial debt. As a result in November 2005, EC\$708.0m of

Grenada's commercial debts, or approximately 42.7 per cent of total public debt, was restructured. In addition, in 2006 the Paris Club agreed to reschedule EC\$43.2m of Grenada's debt thereby reducing by over 90.0 per cent, the debt service to the Paris Club Creditors.

The research findings indicate that during the period 1980–2006, Antigua and Barbuda's annual average natural disaster rehabilitation and reconstruction activities amounted to EC\$5.1m (estimated total of EC\$81.17m). To cover this expenditure, loans amounting to EC\$62.7m were acquired over a ten-year period. These loans represent 77.0 per cent of total disaster expenditure during the period under review. The results also indicate that Dominica's natural disaster rehabilitation and reconstruction expenditure for the period 1980-2008 amounted to EC\$66.9m (yearly average of EC\$2.5m). Loans contracted by Dominica for natural disaster purposes amounted to EC\$34.7m and represented 52.0 per cent of total disaster expenditure. Natural disaster expenditure for Lilli and Ivan amounted to EC\$10.0m. Funding to offset these expenditures was acquired through local revenue, loans from the CDB and the World Bank in addition to grants in the amount of EC\$825,000.

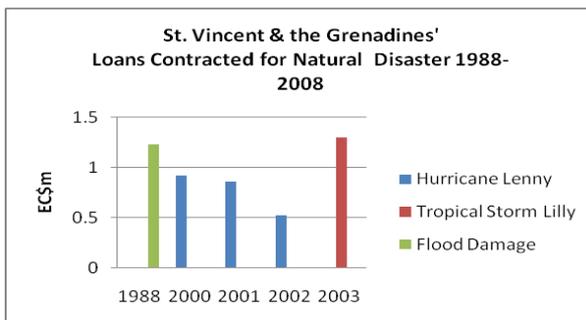
This research also found that in Montserrat, 90.0 per cent of the budget relates to disaster rehabilitation and reconstruction. The largest disaster related capital expenditure recorded is an estimated EC\$68.0m in 2004 to cover cost of constructing buildings in the wake of the volcanic eruptions. In the aftermath of the devastation, domestic customers withdrew savings from Montserrat's commercial banks, and creditors were not repaying loans. These led to a financial crisis. Pensioners were mostly affected since they could not receive monies/payments. The Eastern Caribbean Central Bank (ECCB) served as a buffer and helped the Bank of Montserrat to restructure. The CDB restructured US\$4.6m of Montserrat's debt to concessionary terms, a loan which Montserrat contracted to build its Port Authority.

Concerning St. Lucia, the survey indicated that during a four year period, St. Lucia's natural disaster rehabilitation and reconstruction activities amounted to EC\$25.6m. The Government of St. Lucia borrowed from the CDB under its Special Development Fund (SDF)

programme to cover the cost of landslides and floods during the years 2001 (EC\$6.9m), 2002 (EC\$1.35m) and 2004 (EC\$0.637m). The largest amount, EC\$6.9 m, was contracted in 2001 to cover the cost of a severe landslide. In comparison, St. Kitts and Nevis' natural disaster rehabilitation and reconstruction spending for the period 1988-2004 amounted to EC\$23.2m (yearly average of EC\$2.1m). St. Kitts Nevis borrowed EC\$8.7m in 1998 to cover the cost of Hurricane George. During 2004, CDB approved two loans for capital projects, including the Natural Disaster Management Rehabilitation - Hurricane Lenny Project (Additional Loan) \$3.7 mn – OCR, to provide additional funding required by St. Kitts to undertake the restoration of economic infrastructure damaged by the passage of Hurricane Lenny. Loans were acquired in at least three years, amounting to EC\$12.9m and represent 56.0 per cent of total disaster expenditure.

The St. Vincent and the Grenadines data on natural disaster expenditure indicated that the latter amounted to EC\$7.6m over a five year period. St. Vincent and the Grenadines contracted three loans from the CDB for natural disaster rehabilitation. An estimated EC\$1,228,803 was acquired in 1988 to cover the cost of flood damage. The impact of Hurricane Lenny led to a loan of EC\$1,010,700 in 2000. This loan was disbursed over a three year period. The third loan, EC\$1,296,026, was contracted in 2003 to cover the cost of tropical storm Lilly (See Figure 5).

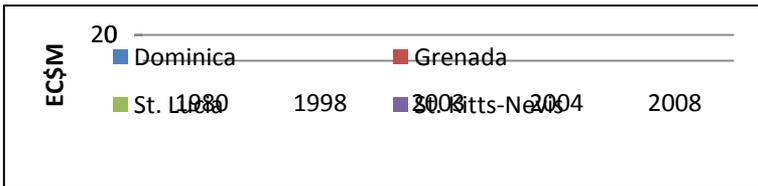
Figure 5



Source: Ministry of Finance and Economic Planning, St. Vincent & the Grenadines

In 1980 the World Bank (WB) provided finance in the amount of EC\$4.86m and EC\$1.08m to St. Lucia and St. Vincent and the Grenadines, respectively. Among the recipients within the ECCU, Grenada is the largest borrower of WB’s Natural Disaster Emergency loans and with an amount of EC\$1.1m St. Vincent and the Grenadines is the smallest borrower (See Figure 6).

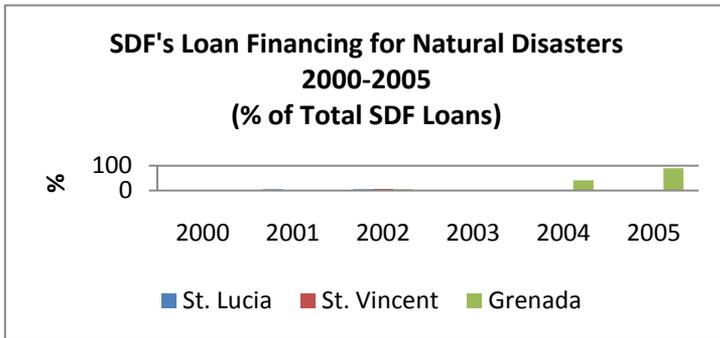
Figure 6: World Bank’s Natural Disaster Emergency Loans 1980-2008



Source: IMF and World Bank Emergency Response

In 1974, CDB disbursed its first disaster loan for the rehabilitation of houses damaged by an earthquake in Antigua and Barbuda. By 1997, the bank financed 14 loans for disaster rehabilitation, amounting to some US\$50.0m, to eight of its borrowing member countries (CDB, 1998). Figure 7 shows that natural disaster loans disbursed by the CDB represented 40 per cent and 90 per cent of total SDF loans in 2004 and 2005, respectively. In 2004 Grenada’s Government borrowed US\$8.1m from the CDB to support post-hurricane reconstruction. During that same year, St. Lucia borrowed US\$5.5m to undertake the disaster risk-reduction project, flood mitigation for Castries and Anse La Raye. In 2005 Grenada was one of CDB’s largest borrowers with a loan totalling EC\$25.0m or 17 per cent of total debt. In 2005 St. Lucia’s loans from CDB amounted to US\$22.6m or 15 per cent of total loans.

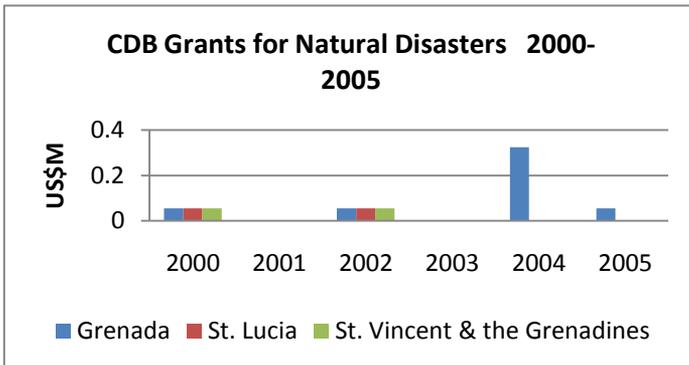
Figure 7



Source: Caribbean Development Bank

In 2004, SDF grant financing by the CDB for Grenada represented 30.0 per cent of total SDF grant (See Figure 8). In addition, a total of US\$12.7m was committed to Jamaica and Grenada to assist those governments in meeting their fiscal obligations, in order to sustain an economic recovery programme, subsequent to the damage and destruction wrought by Hurricane Ivan.

Figure 8



Source: Caribbean Development Bank

Emergency response loans and grants approved by the CDB during 2005 for the purpose of natural disasters totalled US\$0.8m. The mitigation loan approved during that year for St. Lucia totalled US\$0.24m. Over the period 2002-2006 the SDF committed 51.1 per cent of resources or US\$79.7 m to the reduction of vulnerability of deprived groups, natural disasters and other risks that impact on income and well-being. The main areas of focus included immediate response and disaster management.

In the entire ECCU region, Grenada is the CDB's largest borrower for financing natural disaster rehabilitation, with the largest loans secured in 2004 and 2005. This and other indebtedness is more than just the problem of losing much needed resources to debt payments. The payment of huge amounts of debt service amplifies the effects of the environmental climate crises and hampers the ability of countries and peoples to deal with these crises. The ECCU's governments' revenue bases are extremely volatile. Natural disaster expenditure feeds directly into this already volatile revenue base.

Studies of the impact of natural disasters on countries' debt were conducted by Benson and Clay (2004). With the use of a growth model of Kenzy and identifying negative shocks in the form of lessening public and private capitals and augmenting government expenditure for emergency, Benson and Clay (2004) found that natural disasters can reduce the confidence level of a country, enlarge the debt rate or foreign loans and increase the debt stock with declining investment and long-term growth. A UN report indicated that the cost of rebuilding devastated Central American countries after Hurricane Mitch of 1998 has highlighted the economic and financial impact of natural disasters. A number of studies have addressed a variety of dimensions regarding the economic and financial impact of natural disasters including those done by Zeckhauser (1996), Skidmore and Toya (2002), Horwich (2000), Albala-Bertrand (2000) and Skidmore (2001). Skidmore and Toya's (2002) study examined the effect on a few Caribbean economies. They showed that, after conditioning on other determinants, the frequency of climatic disasters was positively correlated with human capital accumulation, total factor productivity growth and GDP per capita growth.

5.0 Empirical Analysis: Model Specification, Empirical Procedure, Data, and Results

The purpose of this section is to use cyclical models to investigate the role of environmental shocks in explaining fiscal sustainability in the ECCU States. If fiscal policy is found to be procyclical and the addition of a variable to account for environmental shocks increases the impact value of the procyclical variable, then we can conclude that environmental shocks are important in determining fiscal sustainability. Moreover, if the environmental shock coefficient is positive we can further conclude that lower levels of environmental shocks will help governments of the ECCU to improve their fiscal stance/fiscal sustainability position.⁸ A look at the literature reveals that only a handful of studies to date have analyzed factors other than macroeconomic outcome that might be associated with changes in the fiscal policy cyclicity and fiscal sustainability. This study contributes to the literature by identifying natural disasters as an important underlying factor for changes in cyclicity and fiscal sustainability.

Model Specification

The first step for empirically assessing the cyclicity of fiscal policy is to estimate the change in the output. The starting point of the model specification is Keynes' (1936) model. To recall, an assumption of the Keynesian model is that government expenditure is a function of output, that is,

$$GOVEXP_t = A GDP_t^\beta \quad (1)$$

where t represents time index, $GOVEXP_t$ denotes real government expenditure, GDP_t stands for real output, A is a constant and β is the long-run elasticity of spending with respect to output. When written in linear form equation (1) reads as follows:

⁸ A number of works have examined cyclicity of fiscal policy by regressing some measure of fiscal policy on output while controlling for other factors (Lane 2003, Gali and Perotti, 2003 and Strawczynski and Zeira, 2007)

$$\log GOVEXP_t = \alpha + \beta \log GDP_t \quad (2)$$

where \log stands for logarithm and α is the logarithm of A . If the conversion of $\log GOVEXP_t$ to its steady-state ($\log GOVEXP_t^*$) is slow, then the level of spending will respond to temporary changes in output ($\log GDP_t$) and $\log GOVEXP_t$ will move gradually towards its equilibrium point. A general autoregressive distributed lag specification for spending can be used to capture this movement. Hence equation (2) leads to the following partial adjustment model

$$\log GOVEXP_t = \alpha + \theta \log GOVEXP_{t-1} + \beta_0 \log GDP_t + \beta_1 \log GDP_{t-1} + \varepsilon_t \quad (3)$$

Note that an error term, ε_t , which represents a shock to real government expenditure, has been added to the model. To reflect steady-state, equation (3) can be rearranged to give rise to the standard cyclical model (see, for example, Talvi and Végh, 2005; Lane, 2003; Fatas and Mihov, 2003; Catão and Sutton, 2002; and, Gavin and Perotti, 1997):

$$\Delta \log GOVEXP_t = \alpha + \beta \Delta \log GDP_t + \varepsilon_t \quad (4)$$

where Δ is the first difference operator and the parameter β measures the degree of cyclical policy. The latter cyclical policy is determined by the sign and size of the coefficient β . Indeed, the sign informs about the type of cyclical policy; thus, if $\beta < 0$, then fiscal policy is countercyclical; if $\beta = 0$, then it is acyclical; and if $\beta > 0$, then fiscal policy is procyclical. The size of β is indicative of the strength (or lack of) of the cyclical policy.

For recall, in equation (4) the focus is on the growth of real government spending, a proxy for fiscal policy, and the growth of real GDP. An alternative approach would be to measure GDP and government spending as deviations from their long-run trends by using the Hodrik-Prescott filter to detrend the original series. Since de-trending is highly problematic in developing countries (see Aguiar and Gopinath, 2004), we use a less parametric approach. We follow Iltzetzki and Vegh

(2008) in not attempting to differentiate between discretionary and automatic government spending because we wish to capture the overall cyclical behaviour of fiscal policy.

A certain number of issues can be raised concerning equation (4). Among others, there is the possibility of omitted variable bias. Indeed, in the context of the ECCU, the growth in government spending can also be determined by changes in natural disaster consumption expenditure (a proxy for environmental shocks). Hence, a more interesting relationship could read as follows:

$$\Delta \log GOVEXP_t = \alpha + \beta \Delta \log GDP_t + \gamma \Delta \log NDCE_t + \varepsilon_t \quad (5)$$

where $\log NDCE$ represents the log of natural disaster consumption expenditure. As for β , the sign of γ can be anything.

If equation (5) represents the true model, then the estimator of β in equation (4) is most likely biased. The potential bias is given by $\gamma \delta$ where γ is the coefficient of the omitted variable and δ is the regression coefficient in a regression of the excluded variable on the included variable. The direction of the bias depends on the signs of these two coefficients. Thus, if $\gamma \delta > 0$, there is an upward bias and if negative, a downward bias.

Another issue is whether it is useful to use a panel data framework to deal with the cyclicity of the ECCU. Since this study is interested foremost in making a general statement about the overall behaviour of the countries of interest, it seems appropriate to use a panel data framework. In addition, to boost the data size with all the benefits entailed (i.e., increased efficiency), it is also advisable to resort to a panel data framework. Thus, equation (5) now reads as follows:

$$\Delta \log GOVEXP_{it} = \alpha_i + \beta \Delta \log GDP_{it} + \gamma \Delta \log NDCE_{it} + \varepsilon_{it} \quad (6)$$

where i represents country index, t stands for time index, α_i denotes country-specific effect assumed to be fixed and ε_{it} is the error term.

Estimation Procedure

In equation (6) the environmental shock variable can be considered exogenous as well as correlated with country-specific effects. This is so since that variable is in general beyond the control of a given country and also affects countries differently. Since fiscal policy also affects GDP or GDP growth through aggregate demand, the latter variable is considered endogenous (that is, correlated with the error term) in addition to being correlated with the country-specific effects. The existence of correlation between the explanatory variables, the presence of the country-specific effects as well as the fact that the inference concerns only the ECCU countries, largely justify the use of a fixed effects model. The presence of an endogenous variable on the right hand side of the equation means that instrumental variable method estimation should be of interest. We use a fixed effects two stage least squares method (FE2SLS). (See Baltagi, 2005, 113-134 for details). In this context, natural disaster consumption expenditure (*NDCE*), change in the number of natural disasters, change in the degree of openness of the country, change in $\frac{M}{GDP}$ as a ratio of $\frac{M}{GDP}$, change in the per capita income, change in the Terms of Trade as a ratio to GDP, lagged change in GDP and the lags of variables alluded to above, are all potential instrumental variable candidates.

Data

The dataset covers annual data for the period 1990 to 2008 for a panel of seven ECCU countries: Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines. The data on real GDP, imports and exports were extracted from various statistical offices and the Eastern Caribbean Central Bank (ECCB). Fiscal balance, central government revenue (which includes current revenue, capital revenue and capital grants) and real central government expenditure were collected from the ministries of finance.

It is worth noting that in the literature on the cyclicity of fiscal policy, several measures have been used to measure government expenditure. These include: government consumption from the national

accounts (Ilzetzki and Végh, 2008) and government spending from the fiscal accounts (Talvi and Vegh (2005)). The use of government consumption is not very convenient from a comprehensive perspective, because it does not take into consideration government investment (capital expenditures) - a key determinant in establishing the impact of natural disasters. To emphasize capital expenditure aspects, this study follows closely the approach taken by Talvi and Vegh (2005). To recall, Talvi and Vegh found evidence of procyclical behaviour in developing countries. They attributed their finding to international credit constraints and political distortions but did not point out the direct impact of external shocks on fiscal positions.

The key variable which measures the impact of natural disasters is natural disaster consumption expenditure (). captures all categories of spending on natural disasters – both capital expenditure and recurrent expenditure. Data on were collected through field research and includes sources such as budget estimates and country reports on natural disasters. It is recognized that is not a perfect proxy for environmental shocks but it is the best proxy available for this study. The rationale for this choice is presented below.

First, to recall, environmental shocks refer to risk of damage to natural ecosystems and the recurring phenomena of hurricanes, volcanic eruptions, earthquakes and other natural disasters. This implies that the environmental shock indicator should include ecological and environmental elements (Veeman 1989). However, unlike ecological variables (e.g. cost of ozone damage) that are complex and relatively difficult to compile, the indicator is more cost-effective - yielding useful data that provide appropriate information on environmental endeavours. In fact, the most visible environmental shocks are natural disasters. Second, the most common, most probable and historically used measure of environmental shocks is natural disasters (see Crowards, 2000 and Sahay, 2004) since it adequately represents the situation of ECCU States; in fact, the often overwhelming proportional impact of disasters in these countries justifies special treatment (UNCTAD, 1983). Additionally, the international community has been focusing on natural

disasters to proxy environmental shocks mainly because countries' experiences and the devastation caused by natural disasters (IMF Country Report, 2003). Not surprisingly, a number of national and regional entities have been established to manage natural disasters. These include the Caribbean Disaster Emergency Response Agency (CDERA), the UNDP-financed Disaster Emergency Response and Management Systems Project (DERMS).

Results

Since our panel data has a time series dimension of a certain length, it is useful to examine the unit root properties of the variables of interest. In this connection, two types of panel unit root tests are used: Levin, Lin, and Chu (2002) (LLC) and Breitung (2000) (see Baltagi, 2005, 237-250 for details). These tests are conducted on the variables in first differences since these variables are the ones of interest. The results are presented in Table 2. They indicate that the null hypothesis of a unit root can be rejected. That is, variables in first differences are stationary.

Table 2: Panel Unit Root Test in 1st Difference

Variables	Levin, Lin & Chu	Breitung
GDP	-10.95*	-3.54*
GOVEXP	-12.68*	-3.35*
NDCE	-15.91*	-6.71*
TOT/GDP	-11.98*	-6.38*

*Note: All tests are conducted with a trend included in the specification. The critical values are -1.20, -1.68, and -2.92 at the 10% (***), 5% (**), and 1% (*), respectively. An asterisk denotes rejection of the null hypothesis of non stationarity.*

The results above clearly indicate that co-integration is not an issue since all the variables of interest are stationary. Thus, we can proceed by estimating equation (4) in panel data form and equation (6).

Table 3: Cyclical Stance of fiscal policy in ECCU: 1990-2008
Estimation Method: Fixed Effect Two-Stage Least Square (FE2SLS)

Explanatory Variable	Coefficient	Standard error	t-value
(cyclicality)	1.36	0.51	2.67**
No. Countries	7		
No. Observations	133		
R-Squared	0.29		
P-value	0.03		
Durbin-Watson	2.23		

*Note: The dependent variable is β is estimated using Equation.4 in panel data form. White's heteroskedasticity and autocorrelation consistent standard errors are reported. The instruments include lagged GDP growth and lagged change in per capita income. ** denotes statistical significance at the 5 per cent level.*

Table 3 which contains the fixed effects 2SLS results of equation (4) indicates that in the period 1990-2008 fiscal policy is procyclical in the seven countries of ECCU as the indicator β is positive and significant. Specifically, $\beta = 1.36$, therefore a one per cent increase in real output leads to a 1.36 per cent increase in government expenditure.

Table 4 displays the estimation results of equation (6); that is, the impacts of the cyclical variable β and the proxy variable for environmental shocks (β on fiscal policy (β). The results indicate that the impact of β variable is significant at the five per cent level with a coefficient $\beta = 1.36$. This implies that an increase in environmental shocks leads to an increase in government expenditure. Indeed, one expects that to alleviate the environmental shocks the government will increase expenditure.

**Table 4: Cyclical Stance of fiscal policy in ECCU: 1990-2008
(Estimation Method: Fixed Effects Two-State Least Square)**

Explanatory Variables	Coefficient	Standard error	t-value
	1.67	0.72	2.31**
	0.22	0.04	6.72***
No. Countries	7		
No. Observations	133		
R-Squared	0.48		
P-value	0.00		
Durbin-Watson	2.78		

*Note: The dependent variable is β is estimated using Equation 6. White's heteroskedasticity and autocorrelation consistent standard errors are reported. The instruments include lagged GDP growth, lagged change in per capita income and NDCE. ** and *** denotes statistical significance at the 5 and 1 per cent level, respectively.*

The results also show that procyclicality increases when β is added to the model. Indeed, $\beta = 1.67$; that is, now a one per cent increase in real output leads to a 1.67 percentage point increase in government expenditure. In any case, since the addition of a variable to account for environmental shocks increases the impact value of the procyclical variable, we can conclude that environmental shocks are important in determining fiscal sustainability.

To repeat, the comparison of the sizes of cyclicity in the two scenarios (Table 3 and Table 4) reveals that the omission of an important variable leads to the underestimation of the size of procyclicality. This underestimation of the size essentially means there is a negative or downward bias in the cyclicity if NDCE variable is omitted in the estimated model. As signalled above, the bias value is β with β being the regression coefficient in a regression of the excluded variable on the included variable. The results of such a regression using a FE2SLS model are presented in Table 5.

Table 5: Evaluation of
Estimation Method: Fixed Effects Two-Stage Least Square (FE2SLS) δ

Explanatory Variable	Coefficient	Standard error	t-value
$\Delta \log GDP_{it}$	-1.65	0.60	-2.73
No. Countries	7		
No. Observations	133		
R-Squared	0.14		
P-value	0.00		
Durbin-Watson	2.65		

*Note: The dependent variable is estimated using Equation 6. White's heteroskedasticity and autocorrelation consistent standard errors are reported. The instrumental variables are logged GDP and lagged change in per capita income. **and*** denotes statistical significance at the 5 and 1 per cent level, respectively.*

It can be noticed that the product $\gamma \delta$ $\gamma \delta$ (0.22 x -1.65=-0.363) is negative, confirming the negative bias. A reciprocal relationship to the one used in Table 5 allows us to make a further statement on the relationship between GDP growth and NDCE growth (see Table 6). That is, we are interested in the fixed effects model with output growth explained by NDCE growth. There is no issue of endogeneity of NDCE growth. Similarly to Table 5, Table 6 reports a negative and significant coefficient; this implies that changes in real output growth GDP are negatively affected by changes in environmental shocks, at least in the short-run. Precisely, an increase in changes of environmental shocks leads to decrease in real output growth. In the case of ECCU States this is logical since environmental shocks impact on the two productive sectors: agriculture and tourism. Notably, environmental shocks have a negative effect on real economic growth. Indeed, natural disasters destroy crops, lower supplies of agriculture products, damage ports of entry and in general hamper the productive capacity of both industries. This negative effect compounds unsustainable fiscal policy decisions.

**Table 6: Impact of Environmental Shocks on Output
(Fixed Effects Model)**

Explanatory Variable	Coefficient	Standard Error	t-value
$\Delta \log NDCE_{it}$	-0.60	0.22	-2.73**
No. Countries	7		
No. Observations	133		
R-Squared	0.37		
P-value	0.00		
Durbin-Watson	2.54		

*Note: The dependent variable is $\Delta \log GDP_{it}$. White's heteroskedasticity and autocorrelation consistent standard errors are reported. *** denotes statistical significance at the 10 per cent level.*

The finding of this study is similar to Araujo's (2009). For recall, Araujo (2009) investigated whether the ECCU's fiscal policy changed systematically along with business cycles, natural disaster cycles and political cycles. He found that fiscal policy in Caribbean economies has the tendency to be procyclical. Specifically, he found that Antigua and Barbuda, Dominica, and St. Lucia exhibit a procyclical total expenditure policy. For these countries most subaccounts are also procyclical. Particularly, the capital expenditure account stands out as being strongly procyclical. The difference between this study and that of Araujo (2009) is that Araujo (2009) did not consider environmental shocks.

Summing up, two problems in the existing literature have been addressed so far in this study. First, most literature on fiscal procyclicality focuses mainly on the relationship between output growth and fiscal policy. The second issue concerns the main cause of fiscal procyclicality. This study addresses the main gap in the literature by contending that fiscal procyclicality is also attributable to expenditure resulting from environmental shocks. This argument is examined empirically using a panel data model and fixed effects two stage least squares (FE2SLS) as the main estimation technique. The study finds that: (a) the ECCU governments adopted procyclical spending policies during the period 1980-2008; (b) the addition of a variable to account for environmental shocks increases the impact of the procyclical variable; in other words, the

presence of environmental shocks reinforces the procyclicality of fiscal policy of the ECCU States; (c) there is a negative impact of ECCU countries' environmental shocks on their output (that is, the greater the shock the lower the output).

5.1 Case Study: The Economic Impact of Natural Disasters on Crop Farmers within the ECCU 1980-2008

The purpose of this section is to present data on farmers collated through the survey and to establish the impact of natural disasters on agricultural production from the producers' (farmers) point of view.

(i) Case Study Methodology

For the case study on the economic impact of natural disasters on crop farmers, the study reviewed various national accounts statistics, agricultural census documents and literature. The author also made field visits and interviewed representatives of the Ministry of Agriculture, personnel in the various statistical offices as well as farmers within seven ECCU States – Antigua, Grenada, Dominica, Montserrat, St. Kitts and Nevis and St. Lucia and St. Vincent and the Grenadines. A total of 31 farmers were surveyed in the seven countries. The survey results have been incorporated throughout the case study.

(ii) Case Study Findings

From the sample, 20 farmers reported that hurricanes had the greatest negative impact on their production, during the period 1980-2008 (See Figure 9).

Farmers in Antigua reported that Omar of 2008 affected them most and data collected reflected their experience with Omar. Those of Grenada reported on Emily and Ivan and in St. Kitts respondents disclosed information on hurricanes José and Lenny and those in Dominica on Hurricane Dean. Farmers in St. Vincent had mixed views about the effect; four farmers reported that drought (hot weather condition) mostly affected their production. When asked about the impact of the most significant natural hazard on production, 47.0 per cent of the

respondents (equivalent 15 farmers) reported that the impact was extremely significant. Three farmers or 9.0 per cent of respondents reported that it was not at all significant. Ninety-nine per cent of the farmers whose production was not significantly affected were from the island of St. Vincent (See Figure 10).

Figure 9

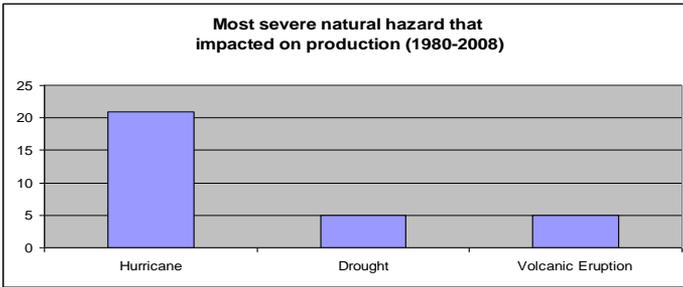
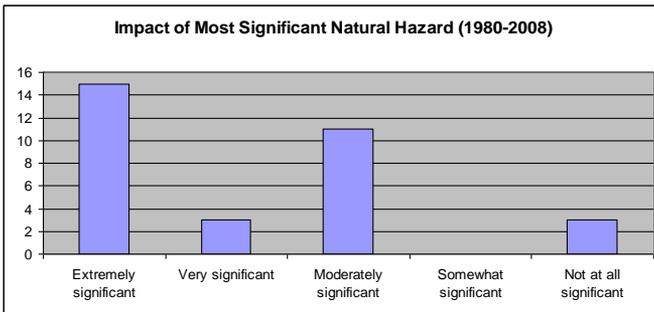


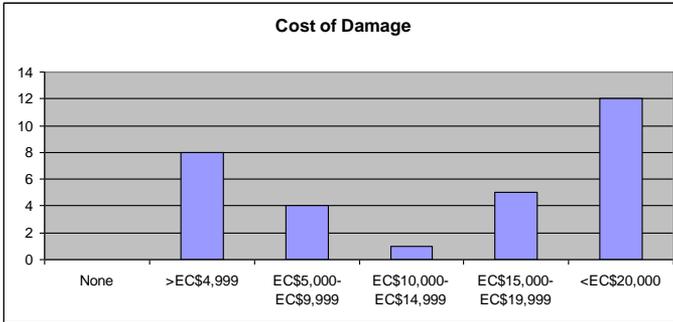
Figure 10



Forty per cent of the farmers interviewed indicated that the cost of damage which resulted from the most severe natural hazard exceeded EC\$20,000. (See Figure 11). All farmers interviewed in Grenada along with one farmer of Antigua reported losses in excess of EC\$100,000. Some farmers changed the types of crops farmed after a disaster. In Grenada, farmers moved from nutmeg farming to ground provision.

Nutmeg was one of the main crops of Grenada, but most of these trees were destroyed during Ivan. It took nutmeg farmer three years to revive farming activities. In Montserrat, farmers are now producing soil crops, that is, crops that grow almost completely under the earth.

Figure 11



Insurance can act as a financial buffer to help offset cost of disaster expenditure. It can help protect farmers against the initial economic losses and allows them to continue farming after the disaster. Unfortunately, banana growers are the only farmers who are covered by insurance, through WINCROP - the Windward Islands Crop Insurance (1988) Ltd. WINCROP provides insurance for banana export growers against damage by ‘windblows’ and tropical storms. The scheme, launched in Dominica in 1987 was extended to cover the entire export crop in Dominica, Grenada, St Lucia and St Vincent and the Grenadines. The benefits are only 20% of potential losses. WINCROP does not cover damage such as landslide or flood, unless wind related, because of difficulties in quantifying risks and losses and a lack of interest by re-insurers. In many instances, government had to bear the majority of the rehabilitation costs, since most persons affected did not have insurance coverage or adequate financial means to undertake restoration works and recovery of livelihoods.

The post-hurricane recovery of Grenada’s agricultural sector was fuelled by approximately EC\$3.0m in ‘soft loans’ under the Government’s

Agricultural Enterprise Development Programme (AEDP) and production support to revitalize banana, plantain, cocoa and nutmeg production under the post-Ivan Agricultural Recovery Programme (ARP). Additionally, Government, through the Agricultural Emergency Rehabilitation Project, provided assistance to farmers through payment for work done on the farms and to the Commodities Boards, by paying the wages and salaries of those workers who would have otherwise been laid off because of the heavy losses realized by these boards due to the passage of hurricane Ivan.

Forty-five per cent of farmers interviewed indicated that they received a supply of seeds and basic inputs. These were provided by government and other agencies such as CARDI and FAO. Eighteen per cent of farmers received cash. In other instances, farmers received soft loans and other financial support. In Grenada the government acts as surety for soft loans to farmers for up to EC\$40,000. Figure 12 shows that among the 18 per cent of farmers who received financial assistance, 84 per cent received less than EC\$5,000. Thirty-two per cent claimed that the assistance received was very helpful, whereas 21.0 per cent reported that it was not helpful since the cost of damage was significantly higher (See Figure 13).

Figure 12: Value of Assistance Received

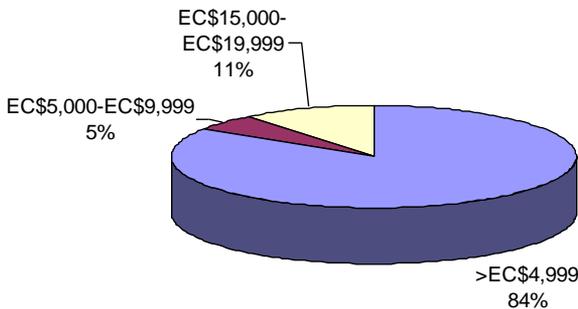
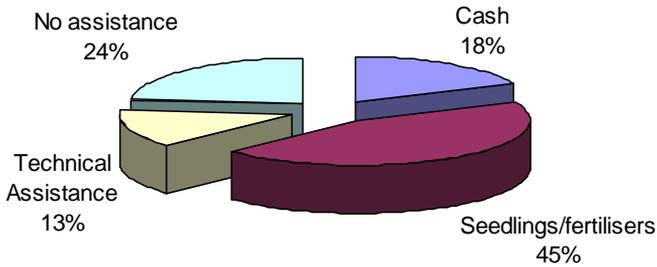
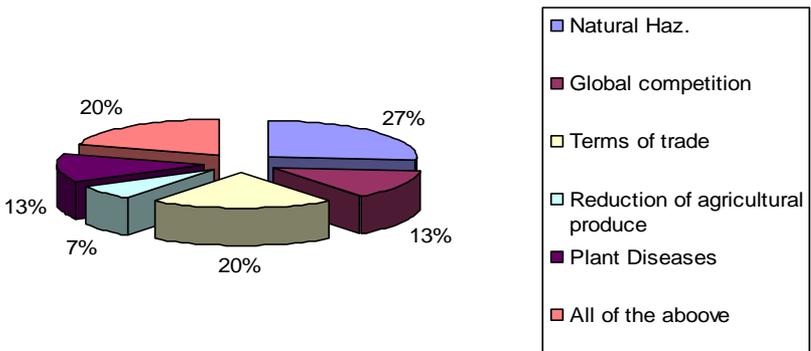


Figure 13: Type of Assistance Received



An examination of the national accounts indicates that agriculture’s value added declined significantly over the study period. Agriculture’s contribution to GDP has declined in every country within the sample. Data on ECCU countries as one unit indicate that agriculture’s contribution to GDP declined to 5.2 per cent in 2008 from 15.0 per cent in 1980. The case study reveals that 27.0 per cent of the respondents indicate that natural hazards are mostly responsible for the decline in output. These responses were gathered from the statistical office of each country (with the exception of Anguilla). (See Figure 14).

Figure 14: Factors Responsible for the Decline in Agricultural Output



Agriculture is one of the most important sectors for each of these economies (Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines). During the natural disasters reviewed, the agricultural sector sustained significant damage from the winds that uprooted trees and plants and destroyed infrastructure, and the rains that caused the rivers to overflow and flooded fields and destroyed cultivated land. The disruption to the agricultural sector translates into a decline in exports. The decline in exports and the increase in imports lead to a deterioration of net exports – which usually translate into a deterioration of the balance of payments. A study by Rasmussen (2004) supports this conclusion. The study concluded that natural disasters could decrease long-run growth by irrevocably destroying agriculture, fishing or other natural resources. However, the long-run impact of natural hazards is not exclusively negative. Floods provide sediments that increase future production (Abbott, 2004). Volcanic eruptions deposit ash which enriches the soil (Abbott, 2004). This is evident in St. Vincent and the Grenadines where the soil closest to the volcano is very fertile and produces good quality crops.

6.0 Policy Recommendations

Rebuilding can take many years. In the ECCU States the budgetary impact of extreme weather events (natural disasters and hazards) seems to have had a limited magnitude in terms of GDP but the impact on the sustainability of public finances in the long term is relatively significant. This implies that these events have negative implications for governments' budgetary expenditure. Given that these countries have to cope, governments need to recognize and prepare for these random shocks. The following measures can be very useful.

Firstly, early warning systems can be used to effectively reduce the impact on fiscal policy. Secondly, financial and insurance markets are underdeveloped and limited in these states, governments could enhance the emergence of these by providing necessary infrastructure and enforcing the building of institutional standards.

Thirdly, governments faced with considerable operational or financial constraints could opt for private sector participation. Fostering cooperation between the public and private sector can essentially ease financial constraints faced by governments. Prevention measures also include keeping debt levels down. It is therefore crucial that governments plan ahead, as debt and debt service payments may have significant long-term impacts upon the economy.

Fourthly, countries need to analyze systematically the scale of shocks which would make debt “unsustainable” and build contingency measures into programmes. Therefore, institutions should integrate analysis of shocks fully into the proposed long-term debt sustainability framework, tailoring the grant allocation and using formulas to absorb borrowing, to its vulnerability to shocks. Countries can also establish fiscal contingency reserves that are more useful than accumulating foreign exchange reserves, because they would make prevention plans based on the fiscal impact of shocks.

Fifthly, policies intended to reduce disaster impacts among countries must take into account what countries can themselves do to reduce their vulnerability and those broader actions that are required by the external institutions (multilateral and bilateral). Moreover, multilateral and bilateral banks can help ECCU States to manage their Volatility by enhancing these States’ access to international insurance and hedging instruments, both existing and new, increasing access to finances, reducing the level of conditionality imposed on borrowings, revisiting structural adjustment programmes and considering debt sustainability analysis (DSA’s). Lastly, DSA’s must be tailored to consider the impact of natural hazards and disasters on the fiscal stance of ECCU States. The abovementioned measures can mitigate the effects of natural disasters and hazard shocks as long as they contribute to reducing the procyclicality of fiscal policy.

7.0 Conclusion

As demonstrated in this study, the risk of natural disasters in the ECCU poses a sizable threat to GDP growth, balance of trade, the public deficit and indebtedness. Consequently, a number of ECCU States will reach the limit of their ability to finance such unexpected shocks due to low domestic savings, low donor support, small tax base and limited ability to borrow at favourable conditions. In the absence of risk financing options, governments will have to access external capital to fund post-disaster obligations that include providing relief to the poor and those in need, rebuilding infrastructure and rehabilitating the economy. These policy decisions have caused natural disasters expenditure to induce systematic bias in determining fiscal sustainability in ECCU States. It was the ultimate aim of this study to highlight this issue by examining environmental vulnerability and specifically the impact of natural disaster shocks of fiscal sustainability.

Using panel data models for the ECCU States for the period 1990-2008 and utilizing a FE2SLS as the main technique of estimation, the empirical part uncovers three major results. First, fiscal policy is procyclical in the ECCU States during the period of interest. Second, the addition of a variable to account for environmental shocks (here natural disaster shocks) increases the size of procyclical of fiscal policy. Third, environmental shocks are negatively linked to output.

In addition to the above findings from the study, the data collected from the field research are another contribution of the paper. Indeed, the data gathered through the field research suggest that when a government is challenged by a sudden need to finance unexpected events, it automatically increases public expenditure, leading to larger fiscal deficits.

In conclusion, it is essential to adopt strategies for addressing the potential impact of environmental shocks on governments' fiscal policies. Freeman et al. (2003) consider ways to create the necessary fiscal strategies to deal with catastrophic risk. Among various alternatives, Freeman advocates treating natural disasters as a contingent liability for the national government and suggests that the government make annual budgetary

allocations to provide for natural disasters expenditure when needed. A second suggestion is for the government to take catastrophe insurance. The disaster insurance available for ECCU States is provided by the Caribbean Catastrophe Risk Insurance Facility (CCRIF), under the leadership of the World Bank (see World Bank, 2006). This facility acts as a financial intermediary between the participating countries and the international reinsurance market. It allows participating governments in the Caribbean region to purchase insurance that would provide them with immediate assistance after the occurrence of an earthquake or the passing of a hurricane. Payments from this scheme are based on the occurrence or intensity of certain natural phenomena, as determined by a specialized agency such as the U.S. National Hurricane Center or the U.S. National Earthquake Information Center and not on the estimated cost of the damage suffered. These strategies can assist countries in reducing their environmental vulnerability and improve their fiscal stance given that environmental shocks are considered an important ingredient for analyzing fiscal sustainability.

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