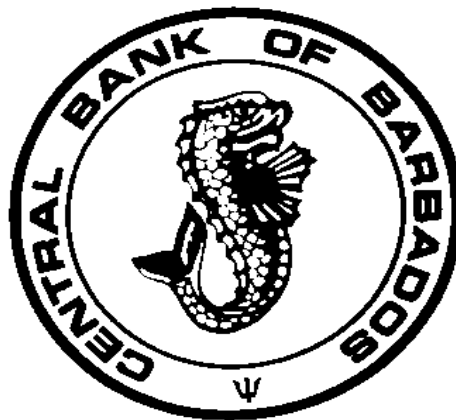


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**ESTIMATING QUARTERLY INDICATORS OF
ECONOMIC ACTIVITY FOR THE STATES OF THE
EASTERN CARIBBEAN CURRENCY UNION**

BY

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CENTRAL BANK OF BARBADOS

Estimating Quarterly Indicators of Economic Activity for the States of the Eastern Caribbean Currency Union

Shane Lowe¹ and Tiffany Grosvenor²

ABSTRACT

Indicators of economic activity provide key inputs into policymakers', business persons', investors' and consumers' decision making processes. However, the Eastern Caribbean Central Bank (ECCB) currently only publishes annual gross domestic product (GDP) series for each of the 8 member states on which it reports, with quarterly reports providing qualitative guidance as to the general direction of economic activity. This study applies the technique of Chow and Lin (1971) to related, high-frequency macroeconomic variables in an attempt to produce quarterly estimates of economic activity for each member of the Eastern Caribbean Currency Union (ECCU) over the period 1993 to 2014. The results indicated that changes in our quarterly GDP estimates generally track the ECCB's approximations regarding the direction of economic activity for most economies and at least match estimates from a univariate model for seven of the eight countries.

KEYWORDS: Chow-Lin procedure, GDP disaggregation, ECCU

INTRODUCTION

Understanding the economy's most recent state in the business cycle provides important and timely information to inform policymakers' current and future stabilisation policies as well as aids businesses, investors and consumers in adjusting short-term investment and consumption decisions in light of the booming or busting economy.

Despite the importance of up-to-date indicators of economic activity, only annual GDP estimates are available for the members of the Eastern Caribbean Currency Union (ECCU). The ECCB produces quarterly reports which assess the magnitude and movement of key developments in several sectoral indicators that are key to the economies on which they report, but only provide qualitative guidance on the overall direction of economic activity in each of its member countries³. More specifically, no clearly defined published quarterly indicator exists to guide the size of quarterly economic expansion in each economy.

Techniques used in the literature for the temporal disaggregation of GDP estimates cover both univariate and multivariate interpolations. While univariate methods are relatively simple and

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³ These directional statements provided quarterly and year-to-date changes up until 2003 and only year-to-date changes thereafter.

easy to derive given the econometric software packages available, employing data on related macroeconomic variables is deemed to be more reliable as it captures movements in specific periods more realistically (Abeyasinghe and Lee, 1998). The Chow-Lin method (Chow and Lin, 1971) in particular has been widely used for estimating GDP of higher frequency (see Abeyasinghe and Lee (1998), Abeyasinghe and Rajaguru (2004), Hall and McDermott (2007) and Lahari et al. (2008)). The technique utilises GDP-related series that are available at higher frequencies to estimate GDP of that frequency based on the relationship between annual GDP and the annual related series. Abeyasinghe and Rajaguru (2004) for instance employed the Chow-Lin technique to estimate quarterly GDP for China and four other Asian territories and found that the disaggregated series were of good quality and suggested improved forecasting performance relative to standard time series models when compared to official GDP estimates.

This study aims to produce quarterly estimates of real GDP for each member of the ECCU over the period 1993 to 2014 by applying the Chow-Lin procedure to the annual real GDP series. The study contributes to the existing literature by providing quarterly real GDP figures which previously did not exist (Gonzalez-Garcia, et al., 2013 applied the Chow-Lin procedure to derive quarterly GDP in order to estimate fiscal multipliers in the ECCU, but did not report any output from this exercise). The results will likely provide decision makers in the public sector with more up-to-date measures of growth to evaluate the economic impact of policy decisions, and provide a framework for private sector players to evaluate the economy's most recent position in the business cycle using publicly available data. In addition, the results can be used for econometric modeling and objective forecasting which often require longer series of data that the annual dimension may not provide. Unlike Abeyasinghe and Rajaguru (2004), the study cannot compare the results to any subset of quarterly data since such is not available for the region, and could only use as a possible benchmark the qualitative guidance provided by the ECCB and crude estimates produced from univariate simulations.

The rest of the paper is structured as follows: section 2 presents the data and associated stylised facts, section 3 outlines the methodology, section 4 discusses the estimation procedure, section 5 discusses and analyses the results and section 6 summarises the findings and provides some limitations of the study.

DATA/STYLISTED FACTS

The study employs annual GDP data on the eight members of the ECCU (Anguilla, Antigua and Barbuda, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines) spanning the period 1993-2014 and obtained from the ECCB. Quarterly selected indicators over a similar period were also obtained for use in the estimation of quarterly GDP estimates also sourced from various databases and reports produced by the ECCB.

Table 1 below presents a compressed breakdown of the industries that comprise GDP for the region⁴ (2009-2014) and Figure 1 depicts the percentage contribution to value added of the five largest components (2014). The largest components are Real Estate, Renting and Business

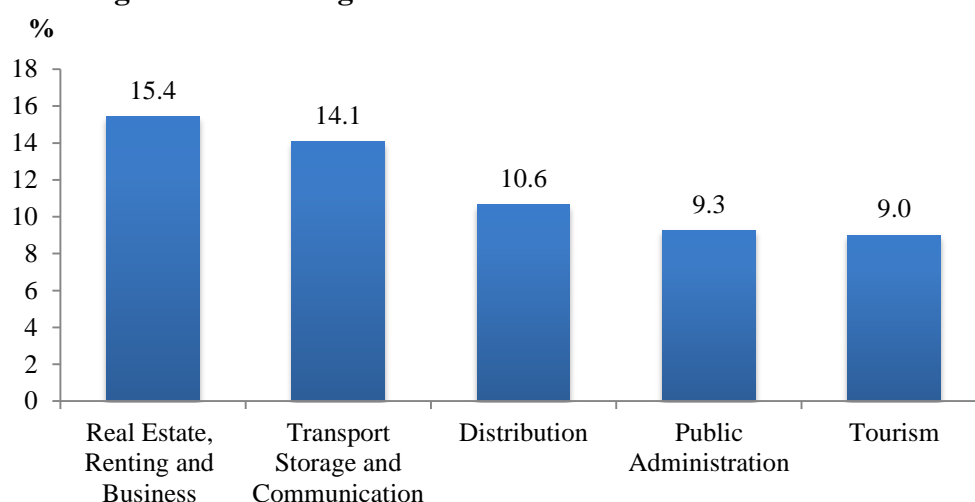
⁴ A detailed breakdown of value added by industry is presented in Appendix I.

Activities (RERB) (15 percent) and Transport Storage and Communication (TSC) (14.1 percent), while Education accounts for approximately half of the ‘Other’ category.)

Table 1: Value Added by Industry for the ECCU (Percent)

	2009	2010	2011	2012	2013	2014
Agriculture, Livestock, Forestry, Fishing (Agriculture)	4.4	3.9	4.0	4.2	4.3	4.4
Construction	12.1	10.5	9.5	9.1	9.4	8.9
Manufacturing	4.4	4.2	4.2	4.1	4.0	3.9
Distribution	10.9	10.8	10.8	10.9	10.6	10.6
Tourism	8.0	8.4	8.6	8.7	8.8	9.0
Transport Storage and Communication (TSC)	14.4	14.8	14.7	14.2	13.9	14.1
Financial Intermediation (FI)	8.9	8.7	8.7	8.7	8.5	8.5
Real Estate, Renting and Business (RERB)	14.1	14.9	15.2	15.2	15.5	15.4
Public Administration (PA)	8.3	8.7	9.0	9.2	9.3	9.3
Other	14.6	15.1	15.4	15.6	15.8	15.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Figure 1: Five Largest Sectors of Value Added for the ECCU



Individual Member Countries

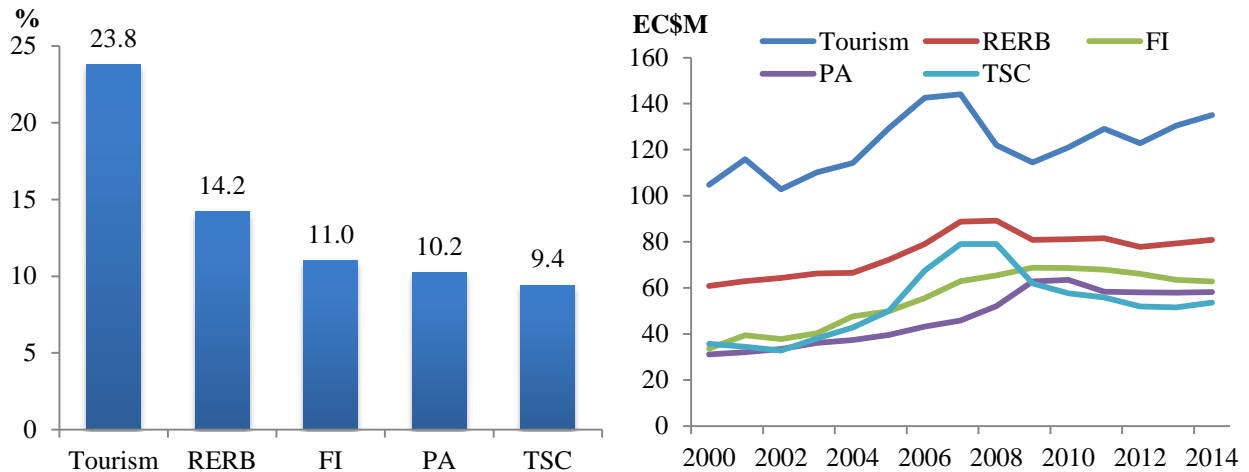
Anguilla

Anguilla, one of two remaining British Overseas Territories in the ECCU, has the second smallest economy in the Eastern Caribbean Currency Union, with nominal GDP in 2014 estimated at just EC\$827 million⁵. Of total output, hotels and restaurants directly contributed on average 23% between 2000 and 2014, representative of the highly open nature of this economy and its heavy dependence on the sector (5th most dependent globally as ranked by the World Travel and Tourism Council, 2015a). Although real estate, renting and business activities

⁵ US\$1 = EC\$2.70

accounted for 14% of output in 2014, real construction value added grew in importance up until 2008, reaching 22%, but declined drastically since the global financial crisis. Similarly, financial intermediation slowed after the global recession as domestic demand remained weak and loan growth declined on average 3% since 2008. However, growth in insurance services partially mitigated falling banking sector activity, resulting in an increasing share for the sector over the last 5 years.

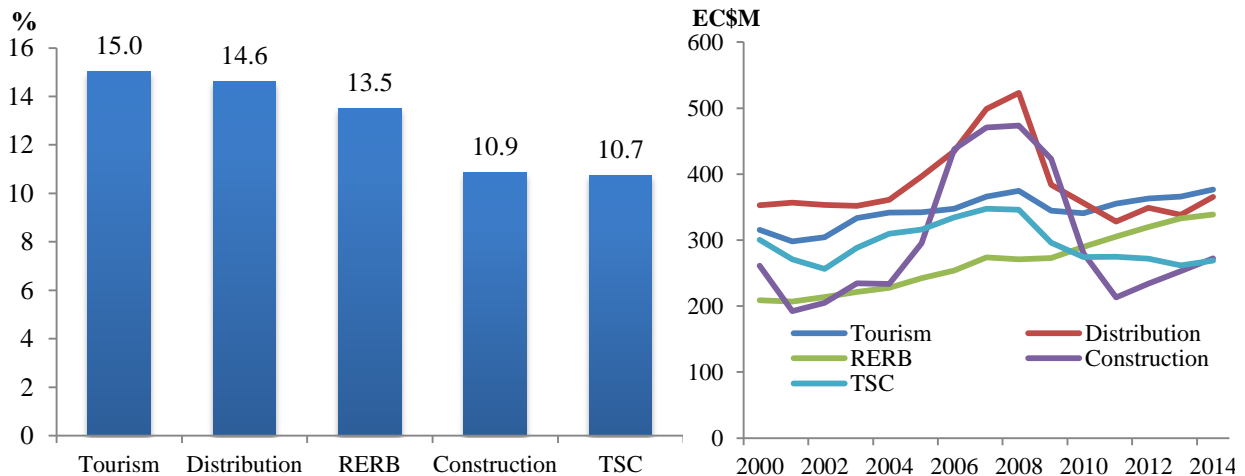
Figure 2: Anguilla GDP by Largest Sectors



Antigua and Barbuda

In Antigua and Barbuda, the 6th most tourism-dependent economy in the world (World Travel and Tourism Council, 2015b), hotels and restaurants directly account for 15% of real output, and contribute indirectly to activity in wholesale and retail trade, which accounts for 15% of GDP. Real Estate, Renting and Business Activities played a major role in the country’s growth developments, but construction activity, now accounting for 11% of real value added, declined six percentage points since 2007. The trend in Transport, Storage & Communications follows that of construction and hotels and restaurants.

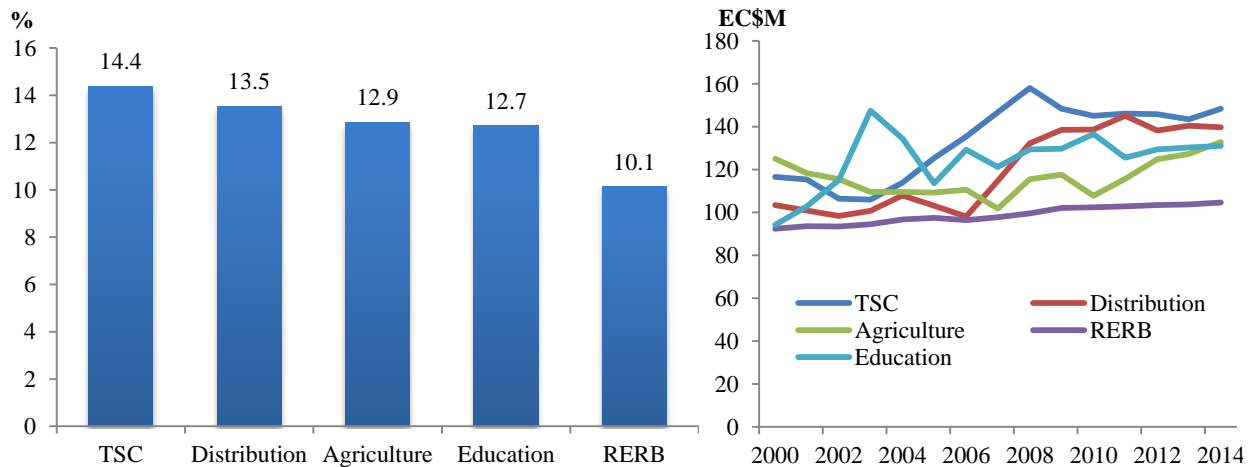
Figure 3: Antigua and Barbuda GDP by Largest Sectors



Dominica

The Dominican economy is unlike the other full members of the ECCU in that traditional tourism plays a relatively minor role in overall economic activity. In fact, it's the only member territory in which agriculture (including livestock, forestry and fishing) is included in the five largest contributors to value added, contributing 33 percent of the total agriculture production for the ECCU during 2014. However, while agriculture made the biggest direct contribution to GDP in the early 2000s, it slipped to third place by 2014, closely following transport storage and communication and distribution, which directly contribute 14.4 percent and 13.5 percent, respectively. The fall-off in banana production has affected this outturn, but there have been increased diversification efforts towards livestock and other non-banana crops to bolster agricultural activity within recent years. Further, education value added continues to benefit from the presence of the Ross University School of Medicine.

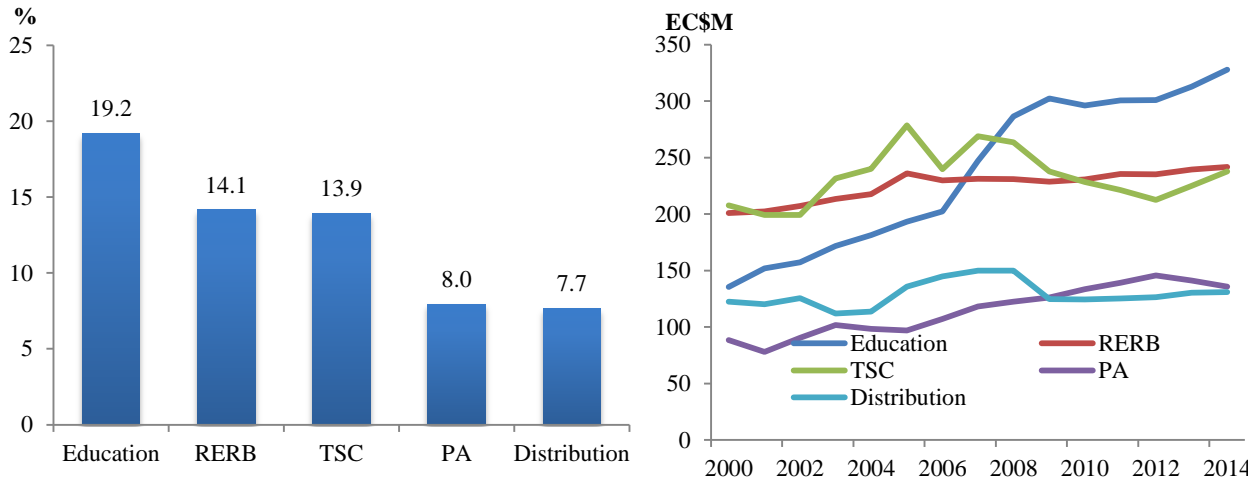
Figure 4: Dominica GDP by Largest Sectors



Grenada

Grenada also played a part in the decline of real construction value added for the ECCU growing to reach 20 percent in 2005 (the largest sector at the time), then falling to 8.5 percent in 2010 and 7 percent by 2014. Education however, has grown significantly over the last decade and a half in terms of its contribution to value added, almost doubling its performance from 10 percent in 2000 to 19 percent in 2014. This performance was driven particularly by private education, primarily St. George's University. The other main drivers of economic activity in Grenada are real estate renting and business activities and transport storage and communication which together directly contribute 28 percent of GDP.

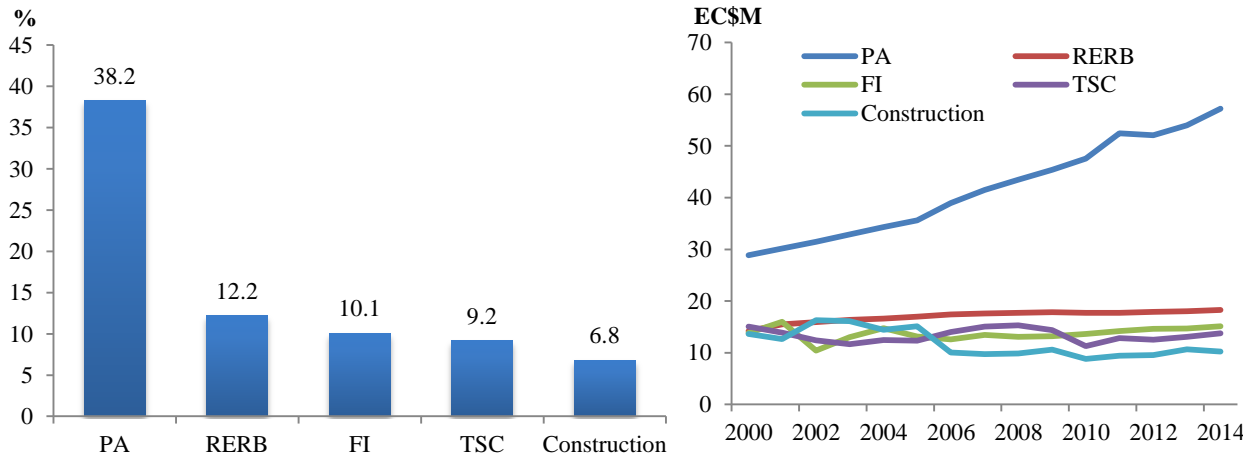
Figure 5: Grenada GDP by Largest Sectors



Montserrat

Montserrat, the other British Overseas Territory, is the smallest economy in the currency union with nominal GDP of EC\$170 million in 2014. Public Administration (PA) has historically been the largest sector and most significant driver of value added, accounting for 38 percent of economy activity in 2014. Severe volcanic activity since the mid-1990s has inhibited growth in key sectors, rendering the island highly dependent on the government for economic growth.

Figure 6: Montserrat GDP by Largest Sectors

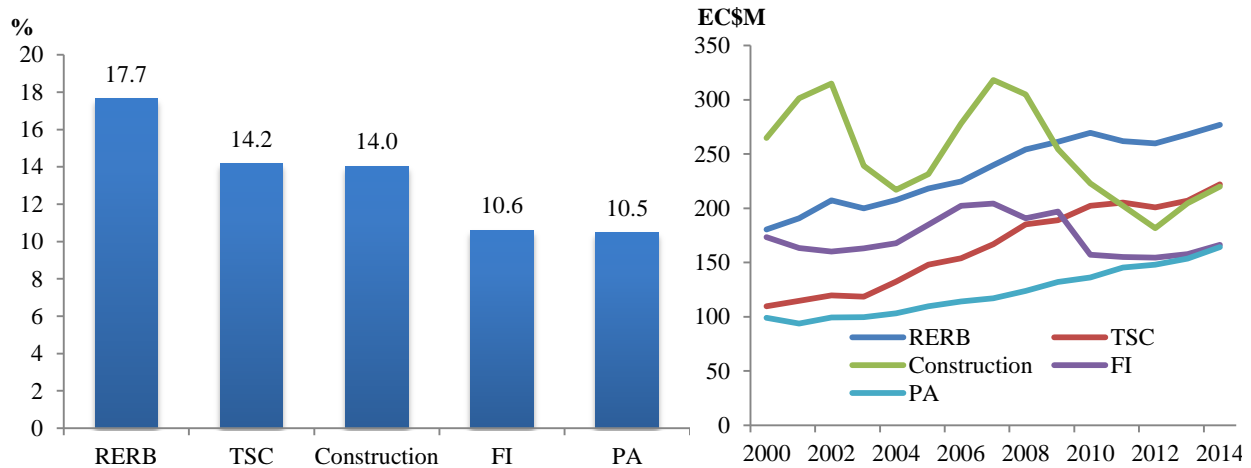


St. Kitts and Nevis

Similar to Grenada, real estate, renting and business activities and transport storage and communication account for the lion share of real gross value added. In the early 2000s, construction was the mainstay of the economy, representing 22 percent of value added. Yet, by 2012 it was relegated to 13% of output after several years of negative growth. Since 2013 however, significant foreign inflows associated with a booming Citizenship by Investment Programme boosted construction and supported real estate, renting and business activities,

transport, storage and communications and other ancillary sectors during 2013 and 2014. Further, even though hotels and restaurants currently only directly contribute 6 percent to economic activity, much of the growth in construction for 2014 was related to several tourism investment projects, suggesting an increase in value added is anticipated in the future.

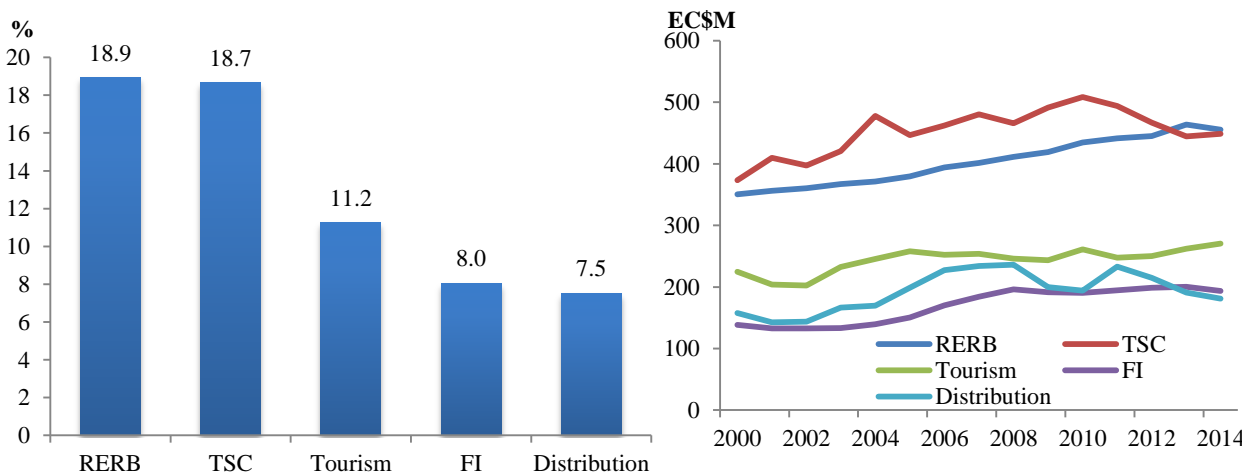
Figure 7: St. Kitts and Nevis GDP by Largest Sectors



St. Lucia

St. Lucia’s economic growth is high dependent on real estate, renting and business activities and transport, storage and communications, both of which can be linked to the tourism sector. Hotels and restaurants accounted for 11% of GDP in 2014 and have consistently directly contributed at least 10% to output over the last decade. The ongoing recovery in advanced economies continued to propel tourist arrivals higher in recent years, even amidst a contracting domestic economy. However, construction, previously a major contributor to economic activity (11% of real GDP in 2000), now only accounts for 7% of output as weak revenues and limited financing forced government to slash capital expenditure in 2014.

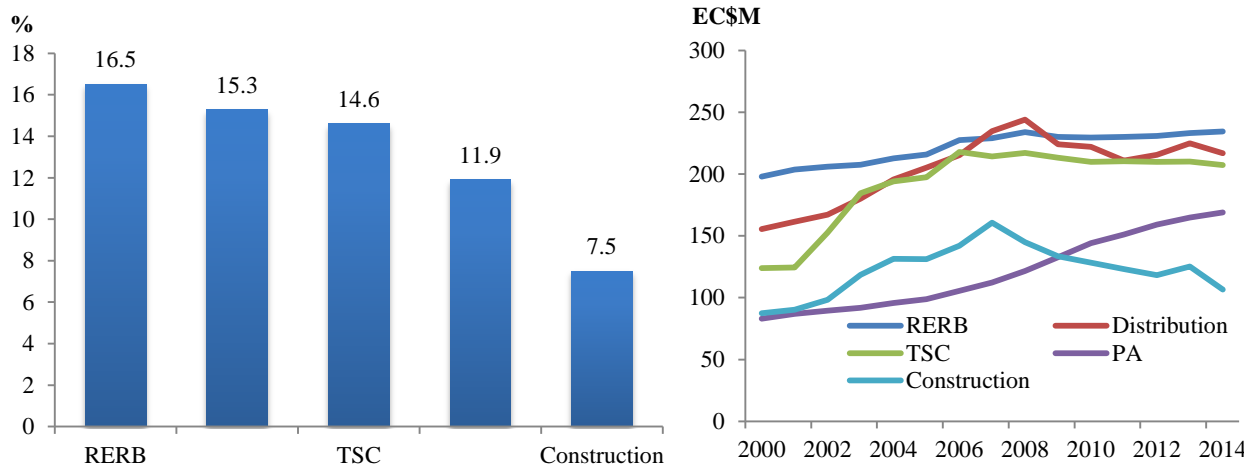
Figure 8: St. Lucia GDP by Largest Sectors



St. Vincent and the Grenadines

Real estate, renting and business activities, distribution and transport, storage and communications together account for almost half (46%) of real value added for St. Vincent and the Grenadines. Further, while public administration accounted for only 7% of GDP in 2000, government's spending on personal emoluments and transfers and subsidies surged between 2000 and 2014, pushing its contribution to 12%. On the other hand, the advent of the global financial crisis prompted cuts in public sector capital expenditure, dragging construction's contribution to output from its peak of 11% in 2007 to 8% by the end of 2014.

Figure 9: St. Vincent and the Grenadines GDP by Largest Sectors



METHODOLOGY

The methodology for the study is adapted from Abeyasinghe and Rajaguru (2004) who employed the Chow and Lin (1971) procedure since modified by Fernandez (1981) and Litterman (1983) to estimate quarterly real GDP estimates for China and four other Asian territories. The technique utilises GDP-related series that are available at higher frequencies to estimate GDP of that frequency based on the relationship between annual GDP and the annual related series. The main equation for disaggregating n annual GDP figures into $4n$ quarterly GDP figures is given as

$$\hat{y} = X\hat{\beta}_a + VC'(CVC')^{-1}\hat{u}_a$$

where \hat{y} represents a $(4n \times 1)$ vector of quarterly GDP figures, X represents a $(4n \times k)$ matrix of k related variables, $\hat{\beta}_a$ is a $(k \times 1)$ vector of GLS estimates of regression coefficients derived from the annual regression, C is an $(n \times 4n)$ aggregation matrix, V denotes a $(4n \times 4n)$ covariance matrix of quarterly error terms u_t and \hat{u}_a is an $(n \times 1)$ vector of residuals from the annual regression of GDP on the related variables⁶.

⁶ See Abeyasinghe and Rajaguru (2004) for further details on the methodology employed.

Abeyasinghe and Rajaguru (2004) note that the possibility of non-stationary residuals is a major difficulty that could arise with these regressions thus forming the basis for the adjustments of Fernandez (1981) and Litterman (1983). Abeyasinghe and Rajaguru (2004) suggest finding a cointegrating relationship among the variables prior to applying the Chow-Lin method or alternatively if a cointegrating regression is not available, first differencing the data series. However, the use of growth rates was considered less useful for this study as GDP figures still could not be derived. since no historical quarterly estimate exists. As such, the Chow-Lin technique was applied having tested for both cointegration between real GDP and the related variables and serial correlation in the models' residuals.

ESTIMATION & ANALYSIS OF RESULTS

A crucial aspect of the estimation of the quarterly GDP series for the ECCU is the selection of GDP-related variables for each member country given the requirement for cointegration (stationary residuals) amongst the annual series. The final GLS regression for each member country takes the following form:

$$GDP_t = \alpha + \beta_{1t}x_{1t} + \beta_{2t}x_{2t} + u_t$$

where x_{it} represents selected GDP-related variables unique to each individual case.

Several indicators or GDP-related variables were considered based on the major components of GDP for each country, including tourist arrivals and/or expenditure for tourism, the sum of wages and salaries and transfers and subsidies for public administration, imports and or/ loans to distributive trade for distribution, capital expenditure and/or loans to construction/mortgages for construction and loans for real estate for real estate, renting and business activities. Additionally, total deposits proxied monetary liabilities of the banking sector which should be positively related to output as suggested by the quantity theory of money. Further, total loans and advances was also included to represent those sectors where adequate proxies were unavailable such as Education in the case of Grenada.

Tourism in particular featured as a possible variable in many of the models, given its overall contribution to value added. According to the estimates of the World Travel and Tourism Council (WTTC), while many of these territories have a significant direct contribution of tourism to economic activity, the estimate is much larger when indirect effects are considered, for example through distribution, transportation and hotel-related construction or real estate activities. Table 2 presents the direct and indirect contribution of tourism for the ECCU member countries.

Table 2: Contribution of Tourism to Total Value Added

<i>Country</i>	<i>2014 Direct Contribution</i>	<i>2014 Indirect Contribution</i>	<i>2014 Total Contribution</i>
Anguilla	21.0	40.2	61.2
Antigua and Barbuda	15.5	42.8	58.3
Dominica	8.5	17.9	26.4
Grenada	7.0	17.2	24.2
Montserrat	n.a.	n.a.	n.a.
St Kitts and Nevis	6.7	18.8	25.5
St Lucia	13.8	25.7	39.5
St Vincent and the Grenadines	5.4	14.5	19.9

Source: World Travel and Tourism Council

Before conducting cointegration tests, each variable was tested for the presence of a unit root. Results suggest that all variables except Grenada's stay-over arrivals were integrated of order 1 and thus appropriate to test for cointegrating relationships. Table 3 presents the models and corresponding regressors that exhibit cointegrating relationships with annual real GDP. The eight regressors are stay-over tourist arrivals (STAY), total deposits (DEPO), total mortgage loans (MORT), total imports (IMPO), total loans to construction (CONS), total loans (LOAN), banana exports (BANA) and public administration (GOVT). All variables except stay-over tourist arrivals and banana exports were deflated to real series using the GDP deflator⁷; banana exports were deflated using the price for Central American bananas sourced from the International Monetary Fund's commodity price database. The results of the cointegration tests are detailed in Appendix II. The Chow-Lin procedure was then applied to each model to derive quarterly real GDP estimates between 1993 and 2014, except for the models for Montserrat including public administration (GOVT)⁸ which begin in 1996.

⁷ The Quadratic Match Average procedure in EViews 7.2 was used to derive quarterly estimates of the GDP deflator.

⁸ Despite such a short time period, public administration was chosen as a potential regressor for Montserrat as it represents 38% of Real GDP; few other regressors proved to exhibit a cointegrating relationship with Real GDP

Table 3: Models Exhibiting Cointegration for Each Member Country

Model #	Anguilla	Antigua and Barbuda	Dominica	Grenada	Montserrat	St Kitts and Nevis	St Lucia	St Vincent and the Grenadines
1	STAY	STAY	BANA, LOAN	DEPO	GOVT	CONS	IMPO	DEPO
2	DEPO	DEPO		DEPO, MORT	STAY, GOVT	STAY, DEPO	STAY, IMPO	STAY, IMPO
3	MORT	MORT		DEPO, LOAN	DEPO, GOVT			DEPO, IMPO
4	STAY, DEPO	CONS			MORT, GOVT			
5	STAY, MORT	STAY, DEPO			CONS, GOVT			
6	DEPO, MORT	STAY, MORT						
7		STAY, CONS						
8		DEPO, MORT						
9		DEPO, CONS						
10		MORT, CONS						

Having estimated each model, the models’ directional accuracies were tested relative to the ECCB’s approximations based on real time data as sourced from their quarterly Economic and Financial Review, as well as crude estimates based on a simple, univariate, mechanical procedure⁹ which as noted by Abeysinghe and Rajaguru (2004), may impose pseudo-seasonal patterns in the data. Table 4 presents the percentage of occasions that each model predicts the directional change of year-to-date GDP in line with the ECCB’s preliminary estimates using data spanning 2000Q1 to 2014Q3, but excluding the fourth quarter of each year¹⁰.

The results suggest a mixed performance across countries relative to both the ECCB’s directional statements and the univariate models’ estimates. In Anguilla, Antigua and Barbuda and St. Kitts and Nevis, the best models track the ECCB’s approximations at least 84% of the time. However, in Dominica, Montserrat and St. Lucia, the best models are only able to match the ECCB’s approximations between half and three-fifths of the time. Grenada’s and St. Vincent and the Grenadines’ models provide moderate performance. Nonetheless, the best models are able to at least match the univariate models’ estimates, the lone exception being Dominica.

⁹ Quadratic Match Sum procedure available in EViews 7.2

¹⁰ We exclude the year-to-date change in GDP during the fourth quarter as the models’ predictions will also equal the percentage change in actual GDP during the full year.

Table 4: Percentage of Model Predictions in Line with ECCB Approximations

Model #	Anguilla	Antigua and Barbuda	Dominica	Grenada	Montserrat	St Kitts and Nevis	St Lucia	St Vincent and the Grenadines
1	82%	80%	49%	64%	56%	82%	60%*	78%*
2	87%	84%		64%	60%*	84%*	58%	73%
3	80%	87%*		67%*	54%			76%
4	89%*	84%			56%			
5	82%	82%			49%			
6	87%	84%						
7		80%						
8		87%*						
9		84%						
10		87%*						
Univariate model	82%	87%*	53%*	62%	51%	84%*	56%	76%
Sample size	45	45	45	45	45	45	45	45

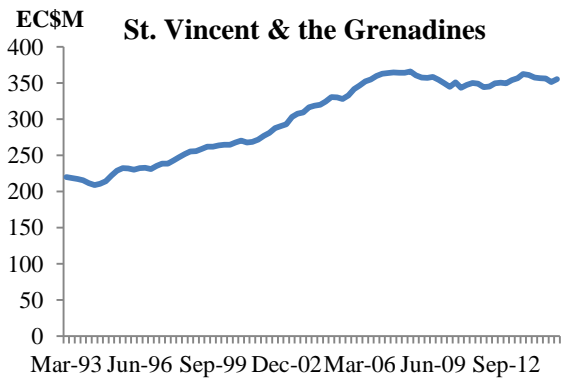
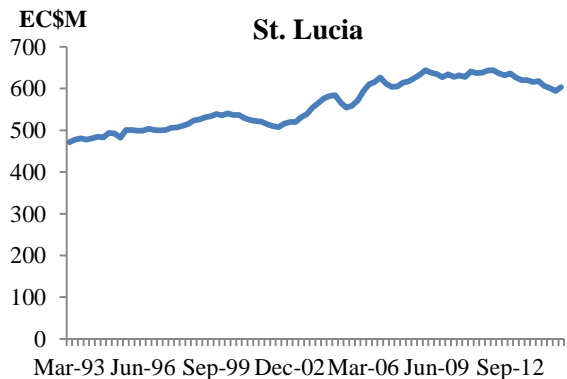
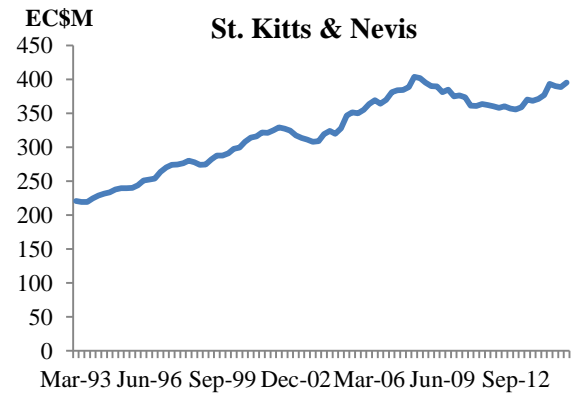
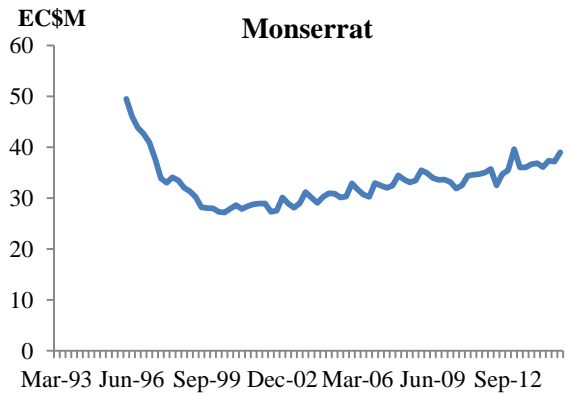
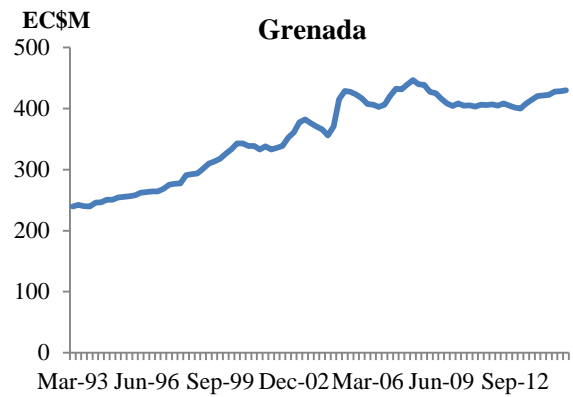
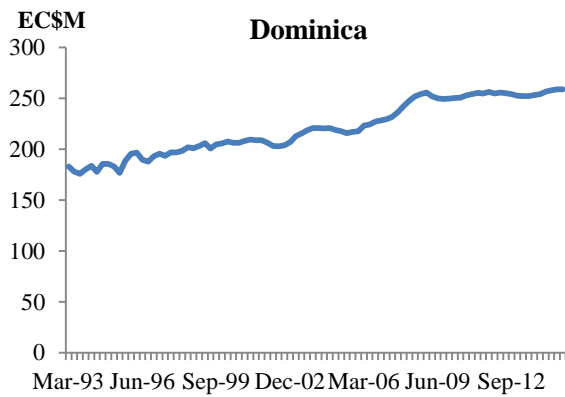
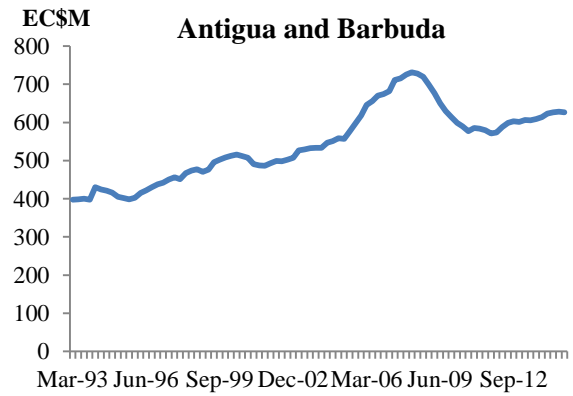
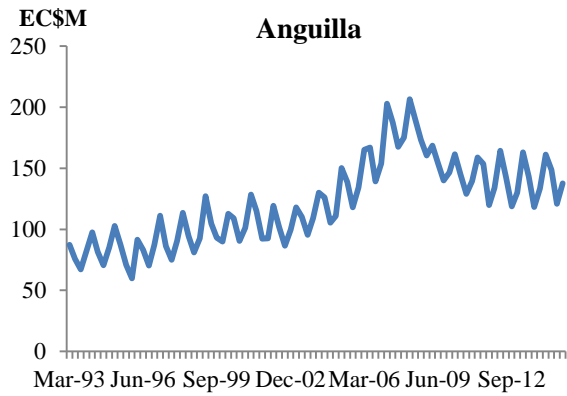
N.B. *denotes the model(s) with the highest percentage

The final model selection was dependent on those which best predicted the changes in real GDP in line with the ECCB's directional statements. In cases where two or more models produced the same level of precision, the most parsimonious model was chosen. Table 5 presents the final models, while Figure 10 illustrates the corresponding quarterly real GDP estimates for each country. Appendix III provides the data series for each economy, and the ECCU as a whole.

Table 5: Final Models for Quarterly GDP Estimates

Country	Final Model
Anguilla	Model 4: $RGDP = 13.11849 + 0.00517 * STAY + 0.00004 * DEPO$
Antigua and Barbuda	Model 3: $RGDP = 296.80995 + 0.00053 * MORT$
Dominica	Model 1: $RGDP = 190.76565 + 0.00006 * BANA - 0.00079 * LOAN$
Grenada	Model 3: $RGDP = 170.18265 + 0.00017 * DEPO - 0.00007 * LOAN$
Montserrat	Model 2: $RGDP = 38.71860 + 0.00182 * STAY - 0.19073 * GOVT$
St Kitts and Nevis	Model 2: $RGDP = 220.38657 + 0.00060 * STAY + 0.00003 * DEPO$
St Lucia	Model 1: $RGDP = 499.62806 + 0.14913 * IMPO$
St Vincent and the Grenadines	Model 1: $RGDP = 175.36383 + 0.00011 * DEPO$

Figure 10: Quarterly Real GDP estimates (1993Q1 – 2014Q4)



Stay-over tourist arrivals and total real deposits play key roles in explaining quarterly GDP in Anguilla and St. Kitts and Nevis. Despite their high dependence on tourism, Antigua and Barbuda's and St Lucia's quarterly GDP estimates rely solely on changes in total real mortgages and total real imports respectively, but these models are only marginally superior to those including tourist arrivals. Unsurprisingly, real exports of bananas are important to quarterly fluctuations in GDP in Dominica, given that agriculture directly contributes 13% to total output, while changes in tourist arrivals and government spending on wages, salaries, transfers and subsidies explain fluctuations in output in Montserrat. Finally, changes in banking system balances explain growth in Grenada and St. Vincent and the Grenadines.

CONCLUSION

The purpose of this study was to provide quarterly estimates of real economic activity for the eight members of the ECCU by employing the Chow-Lin procedure. Quarterly real GDP was estimated based on the relationship between annual GDP and the annual GDP-related series selected based on major contributing factors to value-added for each territory. A cointegrating relationship was established for each country, permitting estimation of quarterly GDP series.

The results indicated that changes in our quarterly GDP estimates generally track the ECCB's approximations regarding the direction of economic activity for most economies, and at least match estimates from a univariate model for seven of the eight countries. However, it should be noted that the ECCB's approximations are based on real-time indicators subject to revisions and are not official estimates. This, coupled with the absence of any previously estimated quarterly series, precludes the authors' ability to adequately test the models' accuracies.

Nonetheless, the study's results may still provide more current measures of growth to aid in evaluating the most recent economic performance of each country. Further, researchers and econometricians alike now have access to higher frequency data for use in econometric and forecasting models which may have previously suffered from issues of short samples and temporal aggregation.

However, similar to Abeysinghe and Rajaguru (2004), the study's estimates may be further improved with greater data availability. Also, at the time of writing, adequate proxies for some key economic sectors were unavailable at the required frequencies and time spans. A longer data set with more appropriate proxies may reveal additional long-term relationships that may produce more robust estimates.

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Appendix I
Value Added by Industry

	Industry
1	Agriculture, Forestry and Fishing
2	Mining and Quarrying
3	Manufacturing
4	Electricity & Water
5	Construction
6	Wholesale & Retail Trade
7	Hotels and Restaurants
8	Transport, Storage & Communication
9	Financial Intermediation
10	Real Estate, Renting & Business Services
11	Public Administration, Defence & Compulsory Social Security
12	Education
13	Health and Social Work
14	Other Community, social and personal services
15	Private Households with Employed Persons

Source: National Accounts: Concepts Definitions & Methodology, ECCB

Appendix II
Engle Granger Cointegration Tests

Null hypothesis: series are not cointegrated

Economy: Anguilla

Dependent Variable: Real GDP

Independent Variables:

1. Stay-over tourist arrivals (STAY)
2. Real Deposits (DEPO)
3. Real Mortgages (MORT)

Regressor 1	Regressor 2	tau-statistic	tau-statistic p-value	Z-statistic	Z-statistic p-value	Number of observations
STAY	n.a.	-3.134	0.124	-26.894	0.000***	20
DEPO	n.a.	-3.432	0.075*	-25.116	0.001***	20
MORT	n.a.	-3.516	0.065*	-28.974	0.000***	20
STAY	DEPO	-3.719	0.109	-35.858	0.000***	20
STAY	MORT	-2.585	0.474	-16.659	0.096*	20
DEPO	MORT	-3.663	0.119	-29.561	0.000***	20

N.B. ***, **, * denote cointegration and significance at 1%, 5% and 10% levels of significance respectively

n.a. denotes not applicable

Economy: Antigua & Barbuda

Dependent Variable: Real GDP

Independent Variables:

1. Stay-over tourist arrivals (STAY)
2. Real Deposits (DEPO)
3. Real Mortgages (MORT)
4. Real Loans to Construction (CONS)

Regressor 1	Regressor 2	tau-statistic	tau-statistic p-value	Z-statistic	Z-statistic p-value	Number of observations
STAY	n.a.	-4.164	0.019**	-15.589	0.050*	20
DEPO	n.a.	-3.200	0.113	-58.464	0.000***	19
MORT	n.a.	-3.763	0.041**	-33.476	0.000***	20
CONS	n.a.	-3.993	0.027**	-37.459	0.000***	20
STAY	DEPO	-4.757	0.020**	107.384	1.000	19
STAY	MORT	-3.874	0.085*	-32.139	0.000***	20
STAY	CONS	-4.276	0.043**	-40.740	0.000***	20
DEPO	MORT	-3.935	0.079*	-248.576	0.000***	19
DEPO	CONS	-4.100	0.061*	-492.762	0.000***	19
MORT	CONS	-4.049	0.064*	-38.259	0.000***	20

N.B. ***, **, * denote cointegration and significance at 1%, 5% and 10% levels of significance respectively

n.a. denotes not applicable

Economy: Dominica

Dependent Variable: Real GDP

Independent Variables:

1. Stay-over tourist arrivals (STAY)
2. Real Deposits (DEPO)
3. Real Imports (IMPO)
4. Real Banana Exports (BANA)
5. Real Loans (LOAN)

Regressor 1	Regressor 2	tau-statistic	tau-statistic p-value	Z-statistic	Z-statistic p-value	Number of observations
STAY	n.a.	-2.663	0.250	-10.843	0.218	21
DEPO	n.a.	-2.910	0.174	-12.241	0.150	21
IMPO	n.a.	-1.495	0.766	-5.842	0.619	21
BANA	n.a.	-1.948	0.565	-6.666	0.539	21
LOAN	n.a.	-2.048	0.516	-6.992	0.509	21
STAY	DEPO	-2.894	0.338	-12.339	0.314	21
STAY	IMPO	-2.476	0.523	-10.652	0.438	21
STAY	BANA	-2.163	0.669	-7.127	0.731	21
STAY	LOAN	-2.840	0.360	-11.959	0.340	21
DEPO	IMPO	-2.655	0.441	-10.778	0.428	21
DEPO	BANA	-2.848	0.357	-12.121	0.329	21
DEPO	LOAN	-3.333	0.190	-14.735	0.178	21
IMPO	BANA	-1.864	0.792	-7.585	0.694	21
IMPO	LOAN	-2.361	0.577	-9.517	0.531	21
BANA	LOAN	-4.062	0.062*	-36.469	0.000***	20

N.B. ***, **, * denote cointegration and significance at 1%, 5% and 10% levels of significance respectively

n.a. denotes not applicable

Economy: Grenada

Dependent Variable: Real GDP

Independent Variables:

1. Real Deposits (DEPO)
2. Real Mortgages (MORT)
3. Real Loans (LOAN)

Regressor 1	Regressor 2	tau-statistic	tau-statistic p-value	Z-statistic	Z-statistic p-value	Number of observations
DEPO	n.a.	-4.147	0.024**	13.704	1.000	17
MORT	n.a.	-2.193	0.447	-9.173	0.325	21
LOAN	n.a.	-1.874	0.600	-7.089	0.500	21
DEPO	MORT	-4.427	0.037**	22.494	1.000	18
DEPO	LOAN	-4.811	0.019**	23.353	1.000	18
MORT	LOAN	-3.409	0.171	-16.275	0.116	21

N.B. ***, **, * denote cointegration and significance at 1%, 5% and 10% levels of significance respectively

n.a. denotes not applicable

Economy: Montserrat

Dependent Variable: Real GDP

Independent Variables:

1. Stay-over tourist arrivals (STAY)
2. Real Deposits (DEPO)
3. Real Mortgages (MORT)
4. Real Loans to Construction (CONS)
5. Real Public Administration Costs (GOVT)

Regressor 1	Regressor 2	tau-statistic	tau-statistic p-value	Z-statistic	Z-statistic p-value	Number of observations
STAY	n.a.	-2.179	0.454	-10.359	0.241	20
DEPO	n.a.	-2.678	0.251	-9.053	0.318	18
MORT	n.a.	-1.893	0.592	-6.736	0.525	19
CONS	n.a.	-2.516	0.305	-11.040	0.207	21
GOVT	n.a.	-5.403	0.002***	-9.533	0.283	18
STAY	DEPO	-2.294	0.610	-11.625	0.355	20
STAY	MORT	-1.452	0.908	-5.428	0.854	21
STAY	CONS	-3.212	0.237	14.265	1.000	17
STAY	GOVT	-6.594	0.001***	-14.215	0.175	18
DEPO	MORT	-3.454	0.160	-15.672	0.138	21
DEPO	CONS	-3.528	0.143	-16.066	0.123	21
DEPO	GOVT	-5.807	0.003***	-10.284	0.443	18
MORT	CONS	-3.057	0.277	-13.410	0.247	21
MORT	GOVT	-4.528	0.031**	-14.277	0.172	18
CONS	GOVT	-4.687	0.024**	-16.835	0.076*	18

N.B. ***, **, * denote cointegration and significance at 1%, 5% and 10% levels of significance respectively

n.a. denotes not applicable

Economy: St Kitts and Nevis

Dependent Variable: Real GDP

Independent Variables:

1. Stay-over tourist arrivals (STAY)
2. Real Deposits (DEPO)
3. Real Mortgages (MORT)
4. Real Loans to Construction (CONS)

Regressor 1	Regressor 2	tau-statistic	tau-statistic p-value	Z-statistic	Z-statistic p-value	Number of observations
STAY	n.a.	-2.296	0.400	-9.255	0.314	20
DEPO	n.a.	-1.962	0.558	-9.097	0.326	20
MORT	n.a.	-2.174	0.455	-7.763	0.439	21
CONS	n.a.	-2.873	0.184	-14.537	0.075*	21
STAY	DEPO	-2.969	0.311	-19.007	0.043**	20
STAY	MORT	-2.378	0.569	-8.639	0.605	21
STAY	CONS	-2.916	0.330	-14.171	0.205	21
DEPO	MORT	-2.128	0.685	-7.264	0.720	21
DEPO	CONS	-2.431	0.544	-9.095	0.566	21
MORT	CONS	-2.075	0.708	-6.974	0.743	21

N.B. ***, **, * denote cointegration and significance at 1%, 5% and 10% levels of significance respectively

n.a. denotes not applicable

Economy: St Lucia

Dependent Variable: Real GDP

Independent Variables:

1. Stay-over tourist arrivals (STAY)
2. Real Deposits (DEPO)
3. Real Mortgages (MORT)
4. Real Imports (IMPO)

Regressor 1	Regressor 2	tau-statistic	tau-statistic p-value	Z-statistic	Z-statistic p-value	Number of observations
STAY	n.a.	-1.953	0.562	-7.559	0.457	21
DEPO	n.a.	-2.366	0.368	-9.405	0.308	21
MORT	n.a.	-1.125	0.877	-3.769	0.814	21
IMPO	n.a.	-3.267	0.098*	-13.105	0.117	21
STAY	DEPO	-2.419	0.550	-9.648	0.520	21
STAY	MORT	-3.079	0.277	15.362	1.000	18
STAY	IMPO	-3.853	0.085*	-17.953	0.069*	21
DEPO	MORT	-2.370	0.574	-9.868	0.502	21
DEPO	IMPO	-2.863	0.351	-12.029	0.335	21
MORT	IMPO	-3.558	0.137	-14.759	0.177	21

N.B. ***, **, * denote cointegration and significance at 1%, 5% and 10% levels of significance respectively

n.a. denotes not applicable

Economy: St Vincent and the Grenadines

Dependent Variable: Real GDP

Independent Variables:

1. Stay-over tourist arrivals (STAY)
2. Real Deposits (DEPO)
3. Real Mortgages (MORT)
4. Real Loans to Construction (CONS)
5. Real Imports (IMPO)

Regressor 1	Regressor 2	tau-statistic	tau-statistic p-value	Z-statistic	Z-statistic p-value	Number of observations
STAY	n.a.	-0.231	0.981	-0.478	0.982	21
DEPO	n.a.	-2.654	0.257	-47.223	0.000***	19
MORT	n.a.	-1.880	0.598	-6.177	0.586	21
CONS	n.a.	-1.307	0.830	-2.506	0.906	20
IMPO	n.a.	-3.201	0.109	-12.915	0.124	21
STAY	DEPO	-1.425	0.913	-3.611	0.944	21
STAY	MORT	-1.891	0.782	-6.165	0.804	21
STAY	CONS	-0.446	0.991	-0.977	0.993	21
STAY	IMPO	-3.720	0.106	-17.289	0.085*	21
DEPO	MORT	-3.108	0.267	38.319	1.000	18
DEPO	CONS	-1.789	0.818	-5.534	0.847	21
DEPO	IMPO	-2.326	0.595	-21.871	0.011**	19
MORT	CONS	-2.591	0.470	-9.820	0.506	21
MORT	IMPO	-3.347	0.187	-16.074	0.123	21
CONS	IMPO	-3.167	0.240	-12.738	0.288	21

N.B. ***, **, * denote cointegration and significance at 1%, 5% and 10% levels of significance respectively

n.a. denotes not applicable

Appendix III
Quarterly Estimates for Real GDP for the ECCU (EC\$M)

	Anguilla	Antigua and Barbuda	Dominica	Grenada	Montserrat	St. Kitts and Nevis	St. Lucia	St. Vincent and the Grenadines	ECCU
1993 Q1	87.3	397.9	183.2	239.8		220.7	471.2	219.8	
1993 Q2	75.9	398.4	178.0	242.0		219.5	478.0	218.6	
1993 Q3	67.1	400.1	175.8	240.1		219.4	480.8	217.2	
1993 Q4	82.4	397.4	180.2	239.7		224.4	477.6	215.4	
1994 Q1	97.6	430.1	183.8	246.0		228.9	480.9	211.8	
1994 Q2	81.6	424.8	177.8	246.4		231.6	484.6	209.0	
1994 Q3	70.5	421.4	185.5	250.5		233.6	483.2	210.7	
1994 Q4	85.2	415.9	185.6	250.6		237.7	493.7	214.3	
1995 Q1	102.7	405.1	183.0	254.5		239.9	492.1	222.3	
1995 Q2	87.7	402.1	176.8	255.4		239.9	481.8	228.9	
1995 Q3	70.9	398.7	188.9	256.2		240.3	500.8	232.5	
1995 Q4	59.8	402.4	195.7	258.1		243.9	500.5	232.0	
1996 Q1	91.6	415.0	196.7	261.9	49.5	250.9	499.1	230.4	1,995.1
1996 Q2	83.1	422.3	189.7	263.3	46.0	252.6	499.1	232.5	1,988.8
1996 Q3	70.2	430.4	187.7	264.0	43.8	253.7	503.3	232.7	1,985.9
1996 Q4	87.3	438.2	193.2	264.2	42.7	263.7	500.8	230.9	2,021.0
1997 Q1	111.2	442.5	195.5	268.5	41.0	270.2	500.0	235.6	2,064.4
1997 Q2	86.3	450.6	193.3	275.1	37.8	274.2	500.4	238.5	2,056.3
1997 Q3	75.0	456.4	196.9	276.7	33.9	274.8	506.3	238.5	2,058.5
1997 Q4	90.3	451.3	196.8	277.6	33.0	276.5	506.9	242.8	2,075.3
1998 Q1	113.6	467.6	198.3	290.8	34.1	280.3	510.9	247.5	2,143.0
1998 Q2	94.5	474.0	201.8	292.3	33.5	277.7	514.9	251.8	2,140.4
1998 Q3	80.9	477.4	201.0	293.7	32.0	274.1	523.5	255.3	2,138.1
1998 Q4	92.6	470.7	203.1	301.4	31.3	274.8	526.2	255.7	2,155.8
1999 Q1	127.2	476.2	206.0	310.1	30.2	282.1	531.0	258.9	2,221.7
1999 Q2	104.5	495.6	200.7	313.6	28.2	287.7	533.9	262.1	2,226.4
1999 Q3	93.0	502.7	204.9	317.5	28.1	287.6	539.0	262.0	2,234.8
1999 Q4	89.9	508.2	205.7	325.8	28.0	291.0	536.0	263.7	2,248.2
2000 Q1	112.8	512.5	207.5	333.6	27.3	297.6	540.8	264.9	2,296.9
2000 Q2	109.0	515.4	206.4	342.6	27.2	299.6	537.0	264.7	2,302.0
2000 Q3	90.4	511.9	206.5	342.9	28.0	308.2	536.6	267.9	2,292.4
2000 Q4	101.1	507.7	208.2	338.6	28.6	314.1	528.9	270.2	2,297.5
2001 Q1	128.3	490.6	209.4	338.5	27.9	316.0	524.7	268.0	2,303.3
2001 Q2	115.2	487.7	208.9	333.1	28.4	321.9	522.1	268.7	2,286.0
2001 Q3	92.3	486.2	208.8	338.2	28.8	321.1	520.6	271.9	2,267.9
2001 Q4	92.6	492.9	206.4	333.0	28.9	325.0	514.5	277.0	2,270.2
2002 Q1	119.3	498.9	203.1	335.4	29.0	329.3	509.9	281.0	2,305.9
2002 Q2	101.8	498.1	203.0	338.6	27.3	327.6	507.6	287.8	2,291.8
2002 Q3	86.4	502.8	204.0	352.2	27.5	324.6	515.8	290.1	2,303.5
2002 Q4	99.5	507.2	206.8	361.2	30.2	317.4	519.8	293.2	2,335.3
2003 Q1	117.9	526.5	212.9	377.6	28.9	314.0	519.8	303.1	2,400.7
2003 Q2	110.1	528.9	215.6	382.2	28.1	311.2	530.9	307.7	2,414.6
2003 Q3	95.4	532.6	218.5	375.8	29.0	308.0	538.6	309.3	2,407.3
2003 Q4	109.2	533.6	220.7	370.4	31.2	308.8	554.4	316.5	2,444.7
2004 Q1	130.2	533.1	220.7	366.0	30.1	319.2	564.9	318.6	2,482.8
2004 Q2	126.0	547.3	220.4	356.0	29.1	324.0	576.8	319.9	2,499.6
2004 Q3	105.3	550.8	220.7	370.5	30.2	319.9	581.5	324.6	2,503.6

2004 Q4	110.9	558.9	219.0	415.2	31.0	327.7	584.4	330.6	2,577.7
2005 Q1	150.2	556.8	217.5	428.9	30.9	346.8	565.6	330.3	2,627.0
2005 Q2	138.7	576.0	215.7	427.4	30.2	351.4	554.2	327.9	2,621.4
2005 Q3	117.9	597.4	216.9	423.3	30.3	350.0	558.6	332.9	2,627.2
2005 Q4	134.3	617.9	217.8	416.5	32.9	355.3	572.2	341.8	2,688.6
2006 Q1	165.1	646.0	223.3	407.2	31.7	363.8	593.2	346.3	2,776.8
2006 Q2	166.9	656.2	224.4	406.0	30.7	369.4	610.5	352.1	2,816.3
2006 Q3	139.2	670.3	227.1	402.5	30.3	364.3	615.3	354.7	2,803.6
2006 Q4	153.8	674.3	228.5	406.0	33.0	370.0	626.2	359.7	2,851.4
2007 Q1	202.9	681.6	229.6	420.8	32.5	381.0	612.2	362.8	2,923.3
2007 Q2	187.5	711.2	231.9	432.5	32.0	384.0	603.9	363.7	2,946.7
2007 Q3	167.5	715.7	236.4	431.2	32.5	384.7	605.1	364.8	2,937.9
2007 Q4	175.0	725.3	242.6	439.1	34.5	388.5	614.1	364.3	2,983.4
2008 Q1	206.5	731.2	247.8	446.7	33.6	403.6	617.4	364.3	3,051.1
2008 Q2	190.3	727.7	251.9	439.8	33.1	401.7	624.6	365.8	3,034.9
2008 Q3	173.4	719.3	254.1	438.9	33.4	395.5	633.1	360.8	3,008.6
2008 Q4	160.4	699.4	255.8	427.3	35.5	389.9	643.9	357.6	2,969.8
2009 Q1	168.7	676.9	251.8	424.9	34.9	389.5	638.3	357.0	2,942.0
2009 Q2	154.5	649.9	250.0	416.3	34.0	381.1	634.8	358.6	2,879.2
2009 Q3	140.1	630.0	249.5	408.5	33.6	385.2	627.5	354.4	2,828.9
2009 Q4	146.6	613.9	249.6	404.2	33.6	374.9	634.1	349.5	2,806.5
2010 Q1	161.6	598.6	250.2	408.5	33.1	376.5	628.2	344.8	2,801.4
2010 Q2	144.6	590.0	250.7	404.6	31.9	373.5	631.7	350.9	2,777.9
2010 Q3	129.0	577.4	252.7	404.9	32.5	361.5	627.9	343.5	2,729.5
2010 Q4	139.4	585.4	254.2	403.1	34.4	360.7	641.3	347.2	2,765.8
2011 Q1	158.9	583.7	255.3	406.0	34.6	363.7	637.0	350.2	2,789.5
2011 Q2	153.6	579.5	254.7	405.8	34.7	362.2	638.1	349.2	2,777.8
2011 Q3	119.7	570.8	256.4	406.9	35.0	360.6	643.4	344.4	2,737.2
2011 Q4	133.9	573.5	254.9	404.7	35.7	358.0	644.3	345.2	2,750.2
2012 Q1	164.2	587.8	255.6	408.1	32.5	360.3	636.2	349.7	2,794.4
2012 Q2	142.6	598.5	254.9	404.7	34.7	357.2	632.1	350.7	2,775.3
2012 Q3	118.7	602.8	254.2	401.3	35.5	355.5	636.1	349.5	2,753.7
2012 Q4	130.0	601.7	252.7	400.0	39.6	359.1	626.1	354.2	2,763.5
2013 Q1	163.0	606.1	252.3	408.4	36.0	370.2	620.1	356.7	2,812.8
2013 Q2	143.2	605.3	252.2	414.5	36.0	368.4	619.9	362.3	2,801.8
2013 Q3	118.1	608.5	253.2	420.3	36.7	371.1	615.7	361.3	2,784.9
2013 Q4	133.4	614.3	254.1	421.6	36.9	376.9	617.6	357.4	2,812.4
2014 Q1	161.2	622.9	256.7	422.7	36.1	393.4	606.5	356.7	2,856.3
2014 Q2	148.6	626.4	257.9	427.6	37.4	390.0	601.4	356.1	2,845.5
2014 Q3	121.0	628.0	259.0	428.1	37.2	388.9	594.5	351.4	2,807.9
2014 Q4	137.7	626.6	258.8	429.6	39.0	395.2	603.1	355.4	2,845.5