



UNITED NATIONS



Economic Commission for Latin America and the Caribbean
Subregional Headquarters for the Caribbean

Expert Group Meeting on Macroeconometric
Modelling in the Caribbean: New challenges and
new direction, Port of Spain, Trinidad and Tobago
22 November 2009

Distr. LIMITED
LC/CAR/L.241
18 December 2009
ORIGINAL: ENGLISH

**REPORT ON EXPERT GROUP WORKSHOP ON
MACROECONOMETRIC MODELLING IN THE CARIBBEAN:
NEW CHALLENGES AND NEW DIRECTIONS**

This report has been reproduced without formal editing.

Table of contents

I. Background and justification	1
A. Opening remarks.....	2
II. Critical issues in macroeconomic modelling in the Caribbean.....	3
A. Stylized facts and modelling issues in the Caribbean	3
B. The challenge to modelling issues in the Caribbean	4
III. Critical issues in macroeconomic modelling in the Caribbean	5
A. The algebra of modelling and new ways of thinking about Caribbean economics	5
B. Modelling and forecasting in the Caribbean – the Barbados experience	6
C. T21 Model: the Jamaican experience.....	6
IV. Economic modelling to determine the impacts of climate change in the Caribbean.....	7
A. Evaluating models for climate change and other environmental issues in the Caribbean	7
B. The impact of climate change on the tourism sector in selected Caribbean countries	8
C. The impact of climate change on the agricultural sector in the Caribbean.....	8
V. Wrap up	10
Annex I: Programme.....	11
Annex II: List of participants	13

REPORT ON EXPERT GROUP WORKSHOP ON, MACROECONOMETRIC MODELLING IN THE CARIBBEAN: NEW CHALLENGES AND NEW DIRECTIONS

The Economic Commission for Latin America and the Caribbean (ECLAC), Subregional Headquarters for the Caribbean, convened an expert group meeting on Macroeconometric Modelling in the Caribbean: New Challenges and New Directions, on 22 November 2009, in Port of Spain, Trinidad and Tobago

The meeting was attended by experts from national, regional and international private sector organizations. The list of participants appears as an annex to this report.

I. BACKGROUND AND JUSTIFICATION

The purpose of the expert group meeting was to bring together modelling practitioners to share experiences and to reflect on how to overcome new and old challenges to model building in the Caribbean. As part of the rationale for such a meeting, it was argued that since a major objective of policymaking in the Caribbean was to create the conditions for growth with equity while reducing vulnerability to economic and environmental shocks, model builders must develop strategies to properly address those questions in a unified way. It was further suggested that those goals, though straightforward, required a concentrated technical effort to clarify and update understanding of the workings of Caribbean economies. The emphasis on addressing issues of growth, equity and vulnerability was urgent because Caribbean economies were at a crossroads, with major challenges to the foundations and premises on which the economies had been built.

A. OVERALL OBJECTIVE OF THE SEMINAR

Through the expert group meeting, the ECLAC Subregional Headquarters for the Caribbean hoped to ignite interest in ways to incorporate new issues and strategies in Caribbean model-building. The objective was to find areas of collaboration with individuals and institutions interested in addressing the issues set out above.

The specific objectives of the meeting were:

- (a) To bring together leading macroeconomic and environmental modelling strategists from various institutions in the subregion and to explore avenues for greater collaboration
- (b) To critically examine the premises and objectives of traditional modelling strategies in the Caribbean
- (c) To begin to develop a relationship with individuals and institutions in (a) so that a programme of model building and forecasting could be pursued by ECLAC over the next two years
- (d) To lay the foundations for a workshop which would examine a possible methodology developed by, or in collaboration with, ECLAC to address the problems of growth with equity and reduced vulnerability

B. EXPECTED OUTCOMES

Among the expected outcomes were the following:

- (a) To help to clarify for ECLAC the kinds of issues to be confronted in developing its own modelling strategy to meet some of the economic challenges facing the Caribbean
- (b) To establish links with institutions and individual partners to determine the level of collaboration that was possible between those partners and ECLAC, in the short and medium term
- (c) Increase awareness of the nexus between economic and climatic modelling and to determine what was being done, with respect to both, in the Caribbean

C. OPENING REMARKS

The Director of the ECLAC Subregional Headquarters, Mr. Neil Pierre, said that the Caribbean confronted several challenges (debt, limited fiscal space, lower foreign exchange inflows) and in light of the economic crisis, new approaches must be found, guided by careful analysis, to chart an alternative and more sustained development path.

He argued that the problems were complicated by environmental threats and damage and losses due to extreme events, and that the emerging difficulties would impact negatively on poverty, inequality, employment and other areas of social development. Gender equality and social cohesion were all at increased risk from the prevailing situation.

He pointed out that policy and decision-making were, by definition, premised on uncertainty but careful analysis with appropriate models would help to minimize such uncertainty. By implication, the development and use of modelling frameworks were integral to the development of the modern Caribbean.

He said that the meeting had assembled some of the foremost modelling experts in the subregion whose work could help to strengthen policymaking, especially in the present difficult period, and that the meeting brought together traditional modelling practitioners and other scholars grappling with the impact of the new challenges in climate change and other extreme events.

He said that he was eager to hear how scholars had confronted the challenges of forecasting, scenario building and related issues in the Caribbean and he urged participants to have a frank and open discussion of the challenges and opportunities which their craft offered to policymaking and policymakers.

Dr. Shelton Nicholls, Deputy Director, Central Bank of Trinidad and Tobago, in a historical introspection, noted that the genesis of macroeconomic modelling in the Caribbean could be traced back from the pre-1980s to the Cowles Commission and was, therefore, largely influenced by Keynesian ideas. However, that form of modelling began to lose popularity owing to several shortcomings, including the fact that the models did not appeal to policymakers since they found that the models were too large and complex, too abstract, inflexible and expensive to maintain. By the 1990s, the neoclassical paradigm began to become more influential with respect to its emphasis on markets.

In more recent times, at the beginning of the first decade of the century, he pointed out that Trinidad and Tobago attempted to build a macroeconomic model to enable forecasting for its vision 2020

plan. However, the model did not overcome the constraints noted with respect to the earlier generation of models. He noted that a challenge still remained with respect to how to build a model which would reflect the Caribbean experiences as opposed to market-based orthodox models written in textbooks. Markets were not well developed to lead to steady State equilibrium that would allow for the construction of theoretical and empirical models based on the economic orthodoxy. Moreover, graphical representation of models were deficient, thus limiting the ability of modellers to communicate with policymakers. As such, Dr. Nicholls contended that models must be based on market imperfections, and forecasting and policy analysis must be based on the economics of disequilibrium.

He recommended that modellers should try to obtain a deeper insight into the linkages between sectors and institutions by paying attention to balance sheets, impact of output tables, and flow of funds matrices. He also recommended the development of a regional economic model that would capture the transmission of shocks among territories. Noting that the subregion did not perform well in the devising of model-building Caribbean paradigms, he pointed out that disequilibrium was perhaps a more realistic end game for Caribbean economies. He suggested that there should be an expert group constituted by ECLAC with a work programme that could further the development of model-building in the subregion.

II. CRITICAL ISSUES IN MACROECONOMETRIC MODELLING IN THE CARIBBEAN

A. STYLIZED FACTS AND MODELLING ISSUES IN THE CARIBBEAN

Mr. Dillon Alleyne, Economic Affairs, ECLAC Subregional Headquarters for the Caribbean, set the context for macro econometric modelling in the Caribbean by suggesting that for macroeconomic models to be of practical use, they should be relevant to the critical needs of the subregion. He pointed out that, ideally, models should be geared towards the many evolving facets of long-term growth of the subregion while striking a balance with equity and environmental protection. He identified some of those contemporary issues as the deficits on the fiscal and external current accounts which led to increasing dependence on debt financing, the lack of technological sophistication as evidenced by the fact that high technology manufactures accounted for only 1% to 6% of exports.

In the pursuit of macroeconomic model-building, he suggested that a variety of frameworks should be used to take cognisance of the severe resource constraints confronting the subregion. In addition, he suggested that innovative frameworks that take into account nonlinearities, threshold effects, parameter instability and the tendencies towards disequilibrium due to supply and demand shocks should be encapsulated in devising Caribbean models. In addition, models must grapple with how to incorporate environmental issues in traditional economic analysis, and how best to address twin deficits and debt problems, among others.

He noted that the evolution of models in the pre-1980s in the Caribbean largely began in the university as they were done by academic experts. However, by the 1980s, the fabric of models were dominated by International Financial Institutions (IFIs) and largely built through the efforts of central banks. From the 1990s onwards, the models mushroomed into a variety of approaches beyond the traditional structural models. These included Computable General Equilibrium (CGE) models, the T21 methodology as implemented in Jamaica, and new time series methods. In many cases, these models had been built with the assistance of overseas experts.

He also noted that the smaller models increased in popularity compared to large models, since the latter suffered from severe weaknesses, which included the Lucas Critique and deficiencies in describing

the Caribbean reality. In addition to data deficiencies, they were also costly to maintain, and policymakers were not very enthusiastic to embrace them. He noted that only Barbados maintained a modelling framework.

He further suggested that the subregion would need to develop a network of model builders to share experiences and to consolidate and extend theoretical advances with respect to the subregion. Moreover, he suggested that the subregion needed to integrate model building with policymaking and environmental and equity considerations.

B. The challenge to modelling issues in the Caribbean

In an examination of macroeconometric models in the Caribbean, Professor Temisan Agbeyegbe, Hunter College, New York, noted that they did not take into account issues of climate change. This partially occurred as a result of the lack of certain modelling infrastructure such as household survey, social accounting matrices and forecast of climate change.

He pointed to the United Nations Environment Programme (UNEP) geo4 report which identified various elements in the region that were susceptible to climate change. These elements included tropical rain forests in Meso America and the Amazon basin mangroves and coral reefs in the Caribbean, among others. Specific environmental effects included surface temperatures, rainfall and extreme events. The presenter questioned the ability of the subregion's infrastructure to deal with climate change particularly because of limited information, poor monitoring systems, and limited capacity-building initiatives.

He cited a study which showed that inaction by the Caribbean could cost the subregion as much as 21.7% of current GDP by 2100. However, the range of quantitative modelling experiences in the region focused on time series, CGE and related models, but failed to take the environment and social sectors into account.

In contrast, the T21 integrated development model might be the most promising with respect to the development of a holistic model. The model took into account the linkages among economic, social and environment spheres. In identifying key elements of the model, he pointed out that the social sphere contained detailed population dynamics along with interactions with other parts of the system, such as health and education, which in turn determined population growth. While employment and labour productivity impacted production, the model also allowed for factors that impacted negatively on the population such as HIV/AIDS, infections and food insufficiency, which could impair growth of the labour force.

Moreover, he highlighted that the environment sphere tracked pollution created in the production processes along with its impact on health. It also estimated the consumption of natural resources and its impact of the depletion of those resources on production and other factors. It also examined the effect of soil erosion and other forms of environmental degradation and their impact on other sectors, such as agricultural productivity and nutrition. Additional issues addressed were fossil fuel use, forest depletion, land and water degradation, air and water pollution, and greenhouse gas emission.

Professor Agbeyegbe then elaborated on how those sectors could be linked through a social accounting matrix, household survey and forecasts of climate change. As such, he suggested that more research should be undertaken with respect to forging linkages among sectors through those types of models.

1. Discussions

A participant noted that while macro econometric models were continuously undergoing change in theory and estimation techniques, data collection that fuelled those models tended to be static. As such, there was the need for new areas of data to allow for the implementation and development of those models. At the same time, it was noted that while theory was extremely important for econometric model-building in the Caribbean, not many persons in the subregion had worked on the development of formalized theory.

It was pointed out that the integration of model-building with policymaking was more integrated in Barbados and that model builders, there, were proactive in selling their models to policymakers. Indeed, it was noted that the policymakers were not interested in any particular type of model but were interested in strategies to deal with current problems. As such, the Central Bank in Barbados invited the ministries to meetings because they were the ones that provided the Bank with data. In exchange, the Bank produced models based on what the ministries wished to be addressed. There were also monthly meetings chaired by the Prime Minister where the Central Bank presented the country's monetary position and economic forecasts.

One participant noted that the management incapacity and absorptive capacity was the reason for high foreign direct investment but low growth in the subregion. A particular problem that confronted modellers grappling with that issue was the form and type of models that should be used, whether it should be cross country or time series analysis and whether the forecast should be forecast driven.

It was also noted that the model builder was often confronted with insufficient data. In addition, there were only a few model builders working on individual, specific areas without the benefit of a large body of literature developed in the subregion.

II. CRITICAL ISSUES IN MACROECONOMETRIC MODELLING IN THE CARIBBEAN

A. THE ALGEBRA OF MODELLING AND NEW WAYS OF THINKING ABOUT CARIBBEAN ECONOMICS

Professor Van James, in his presentation, pointed out that advances in algebra provided expanded options beyond the use of production functions to allow for more dynamical systems. Thus, questions arising from traditional Caribbean models could now be probed more rigorously. In addition, theoretical simulations were a valid and more flexible option available to model builders in the subregion. Moreover, these models were not data dependent, but rather they were dependent on logical thought processes. As such, those new advances could provide greater insights into classical regional models, such those of Lewis (1954), Best (1968).

In addition, he suggested that dynamic systems could be applied to those traditional models, which allowed comparison of productions systems with domestic (endogenous) and external (exogenous) resources.

He suggested that the classical model had validity in the exploration of theoretical and empirical issues confronting the Caribbean. For example, he emphasized that the ability of the country to create capital was vital to long-term growth. In his framework, domestic capital must grow faster than imported capital. Thus, dynamic systems could capture the long-run growth through the Lewis model. As a result, dynamic systems could answer questions that might have been raised but not answered through

econometric models. He argued for the use higher order derivatives, in order to assess non-linear and non competitive relationships in the Caribbean.

B. MODELLING AND FORECASTING IN THE CARIBBEAN – THE BARBADOS EXPERIENCE

Professor Roland Craigwell, University of the West Indies (UWI), presented an overview of the macroeconomic modelling approach of the Barbados Central Bank. He intimated that the approach had sprung out of the threat of devaluation in 1991/1992 resulting from the extreme foreign exchange crises which had left the country at one point with only seven days of import cover. The government was pressured by the International Monetary Fund (IMF) to devalue the currency, as a condition for funding. The government resisted and soon realized that, in negotiating with the IFIs, if the country did not have a model the IFIs would impose one. By 1994, the Bank went about establishing its own formal forecasting model geared primarily to the real and monetary sectors. In addition, that model also had the capability of conducting scenario analysis, financial programming and financial stability assessment combined with a banking module, including capital adequacy and liquidity ratios.

As Barbados sought to develop its own model, the system evolved to a disaggregated model to include the fiscal and external sectors. The Bank conducted annual quarterly projections which were made at the end of each quarter, consisting of short-term forecasts up to six quarters and medium-term forecasts up to five years. Professor Craigwell found that the forecasts were fairly accurate, falling within an error margin of 10%.

He noted a few drawbacks, however, which included the need for regular updates and adequate skilled resources. On the latter point, all new economists to the Bank must work with the model before going on to another portfolio. This allowed those economists to get a feel of how the economy operates.

C. T21 MODEL: THE JAMAICAN EXPERIENCE

Mr. Hugh Morris, Planning Institute of Jamaica (PIOJ) argued that a criticism of macroeconomic models was that they aimed primarily at economic development, and often ignored the social and environmental matters. Jamaica, for example, had been pursuing a series of 5-10 year plans but had found certain shortcomings. These included a lack of strategic focus for long-term development, weak synergies between targets and indicators, limited involvement and buy in and ownership by the society, lack of effective implementation and monitoring framework and lack of timely and adequate resources to support implementation. As a result, the government embarked on a new approach to planning. This was a planning model which took the structure of the economy into account, and a move towards long-term a National Development Plan through a more structured approach to collaboration.

He spoke of the implementation of T21 in Jamaica, which was built by the Millennium Institute in collaboration with PIOJ. The model was implemented as a simulation tool geared towards the achievement of holistic and sustainable development and, as such, lent itself to dynamic simulation of economic, social and environmental factors. The government pursued such a technology given its plans of moving towards developed country status by 2030. Therefore, technicians from PIOJ received training from the University of Bergen, Norway, in 2007 in order to implement and develop the model for Jamaica.

The model was used to construct a draft National Plan that was prepared between January 2007-March 2008. The draft plan was tabled in the House of Representatives in April 2008 and the final plan was completed, after island-wide consultations on the draft.

On the economic side, the model combined production, investment, technology, rest of the world, households and government. On the environmental side, the model quantified matters related to land, water, emissions, sustainability, minerals and energy. Those areas were linked together by the society which constituted matters related to the population, labour, health, infrastructure, poverty and education.

He showed that the model allowed for transparency in the sense that the modelling process could be traced and important variables could be identified. In addition, the model allowed for collaboration by stakeholders, moreover, it was forward looking as it allowed for projections from social and environmental indicators identifying opportunities and threats. He showed how the model was customized for Jamaica, therefore playing a fundamental role in simulating scenarios, integrating sector plans, evaluating poverty reduction strategies and monitoring progress towards national goals.

1. Discussions

There were concerns expressed as to whether the T21 model was specific to Jamaica or whether it could be applied to other countries as well. Mr Morris responded by stating that the framework could be used for other countries. He also stated that the PIOJ and the Bank of Jamaica frequently collaborated concerning modelling.

He argued that the T21 approach was pursued, as the model made a deliberate attempt to capture constraints and divergences. As a result, the model was not based on equilibrium economics, which tended to block thinking through divergent processes.

III: ECONOMIC MODELLING TO DETERMINE THE IMPACTS OF CLIMATE CHANGE IN THE CARIBBEAN

A. EVALUATING MODELS FOR CLIMATE CHANGE AND OTHER ENVIRONMENTAL ISSUES IN THE CARIBBEAN

Dr. Juan Llanes, University of Havana, Cuba, observed that integrated assessment models were complex due to the attempt to link and integrate climate models to future events, derived from unknown increases in temperature to assess impacts into chaotic societal systems. One part of this involved a framework related to ignorance, precaution, uncertainty and risk. However, the outcomes emanating from climate change models were poorly defined and the basis for probabilities was shaky.

He noted that the existing climate change models, such as PAGE or FUND, would require considerable adjusting if they were to fully represent the Caribbean situation since there was no global model that contained enough specific Caribbean details. Even where data were available, the challenge would have been to have that data digitized for entry into model/formulae.

An investigation of policy options hinged on what the country was willing to commit to and to realistically accomplish. Further, construction of a model should start from specific scenarios for several climate parameters, for example, sea level rise, storm surges, precipitation and other relevant information as inputs into a mathematical model that would produce an assessment of the impacts of various scenarios such as a worst case scenario (“Paradise lost”) vs. a best case scenario (“island on the sun”). As such, sectoral and country-specific information was critical to risk and uncertainty within a precautionary framework.

The presenter recommended that the mathematical models not be used in an optimizing mode, as the emphasis should not be on determining optimum policy. Instead, he recommended that it was more important to understand what the special risks were for the Caribbean so as to undertake detailed risk assessments. As such, he suggested that regional model builders should examine specific categories of risk in different geographical spreads and in specific vulnerable sectors, such as coastal destruction for low lying areas. He, therefore, concluded that there should be a range of studies to ensure that a range of possible climate change outcomes with respect to worst case scenarios were adequately captured.

B. THE IMPACT OF CLIMATE CHANGE ON THE TOURISM SECTOR IN SELECTED CARIBBEAN COUNTRIES

Dr. Sandra Sookram, Sir Arthur Lewis Institute of Social and Economic Studies (SALISES) presented a model on the impact and cost of climate change on the tourism sector up to the turn of the century with respect to nine Caribbean countries – Aruba, Barbados, Dominican Republic, Guyana, Jamaica, Montserrat, Netherlands Antilles, Saint Lucia and Trinidad and Tobago. She used three weather scenarios, -- “A2” which assumed that the population was continuously increasing, and economic growth occurred at regional scales; “B2” which assumed that local solutions were conducted towards sustainability and population increases but lower than “A2”; and Business as Usual which assumed continuing current trends in population, economy, technology and human behaviour.

She took an econometric approach through the use of panel estimation. In particular, a random effects model of tourism demand was employed as the technique of investigation. The variables used in the model were taken from forecasts by the Instituto de Meteorología (INSMET), Cuba. The annual cost of changes in temperature and precipitation were estimated in United States dollars using 2007 as the comparator base year.

Extreme events were captured by making various assumptions with respect to the variables incorporated into the forecasts. The model was applied to forecasting extreme events, such as losses due to increases in the frequency and intensity of hurricanes and accompanying windstorms, floods and landslides. Hurricanes were assumed to increase by 27% on an annual basis and were accompanied by a decrease in tourism expenditure by 21.6%. She justified the decrease in tourism by stating that rising sea levels and ecosystem destruction would cause tourists to reduce expenditure on sea-related activities.

Using scenario analysis on year-by-year costs, she said that collectively it would be more costly for countries to operate under the business as usual model, followed by A2 and then by B2 scenario. However, within each scenario, there were important differences in the incidence of costs between countries. In particular, the distribution of cost was most severe in scenario “A2” with respect to Dominican Republic, Guyana and Saint Lucia, while under scenario “B2” it was found that the incidence was most severe for Barbados and Netherlands Antilles. On the other hand, the Business as usual model was most costly for the remaining countries, Jamaica, Montserrat and Trinidad and Tobago.

C. THE IMPACT OF CLIMATE CHANGE ON THE AGRICULTURAL SECTOR IN THE CARIBBEAN

Dr. Roger de Vega, INSMET, Cuba, spoke of the problem of modelling global warming and its implications for agriculture and food. He remarked that the urgency of climate change and its implications brought it to the forefront of economic modelling. As a result, efforts had been expended on developing a scientific methodology to analyze climate change through the development of Integrated Assessment Models (IAM). A version of that model that was applied was the Dynamic Integrated Model of Climate and the Economy (DICE). Agricultural impacts were parameterized through one parameter,

usually temperature. Thus, in that model, global warming was assumed to be the major stimulus and, therefore, it conditioned behaviour.

He then drew attention to three methods that had evolved to measure the sensitivity of temperature: cross sectional (Ricardian) models, agronomic-economic models based on biophysical crop models that could include adaptation and agro-ecological zone (AEZM). However, he intimated that those models tended to be optimistic, in general, because they attributed all temperature rises to be the result of CO₂ fertilization effect as a result of increases in temperature.

The presenter pointed out that precipitation was more relevant to the Caribbean, given the constancy and temperature levels of about 25° C. Suitably, a Net Primary Productivity (NPP) could be defined to include rainfall to enable simulation. As a result, an econometric model could be used to include the impact of precipitation on agriculture production. Consequently, the impact of the reduction of rainfall on potential crop yields was examined and it was noted that it depended on crop genetic potential, solar radiation and temperatures. Moreover, he estimated that potential yields of many staple crops would be negatively affected by regional warming during the century.

He noted that increases in production in developing countries were hardly likely to come from expansion in arable land, but was more likely to stem from increases in yields. However, yields were declining, so a major challenge was to reverse that trend through technology. He asserted that to increase the yield of actual crops, technological efficiency would have to rise. That could be circumvented, though, by introducing new varieties with higher potential yields, thus staving off the need to raise technological efficiency.

1. Discussions

Concern was expressed about the differences between regional territories and how they were accounted for in the Model by Dr. Sookram. It was recognized, however, that the limitations in the country data set did not allow the study to be sufficiently country specific. Rather, the study employed costing information from other generalized studies. It was also conceded that forecasts of hurricanes were not totally reliable for the prediction of extreme events. For example, while 15 hurricanes were forecasted for 2009, no hurricane actually hit the subregion for 2009.

The question was raised concerning the implications of Dr. Sookram's model for poverty, to which she replied that a CGE model could have been helpful in making such predictions. However, there was disagreement in this respect, since the CGE model depended on equilibrium dynamics which were difficult to sustain in a region where economic series were often divergent.

Other issues were also raised. This included the examination of a 1% rise in temperature as opposed to the use of actual temperature, for example, it was argued that a 1% rise with a temperature of 25° C was far different when the temperature was 40° C. There was also the question of the development of insurance mechanism against hurricanes, since this was an important issue to look at because of the loss of competitiveness when crops were damaged. As such, the resulting damage from a single aspect of climate change could be much wider than anticipated since it would involve severe damage to agriculture and, therefore, spiral costs.

IV. WRAP UP

A representative of ECLAC Subregional for the Caribbean, in reviewing the main issues covered in the meeting, pointed to several conclusions. Among these was the inability of modelers, by and large, to make their models accessible to policymakers. In addition, the continuing problems of data quality, limited data frequency and accessibility limited the efficacy of the modelling efforts in the subregion. He argued that given the limited range of skills that were available in any one country, a regional approach to modelling and model building should be pursued.

He pointed out that ECLAC would be prepared to lead such a process in a collaborative venture with other interested stakeholders. In light of the mandate of ECLAC to become more of a “think thank”, he pointed out that the workshop was conceived as one in a series of efforts designed to build the capacity of and that of its partners in developing a modelling strategy for the region.

The vote of thanks was given by a representative of the ECLAC Subregional Headquarters for the Caribbean on behalf of the Director.

Annex I**PROGRAMME**

8:30 am **Registration**

9:00 am **Opening remarks**

*Mr. Neil Pierre, Director, ECLAC Subregional Headquarters for the Caribbean
Dr. Shelton Nicholls, Deputy Governor, Central Bank of Trinidad and Tobago*

SESSION IA: CRITICAL ISSUES IN MACROECONOMETRIC MODELLING IN THE CARIBBEAN

Chair: Mr. Roberto Machado, ECLAC Subregional Headquarters for the Caribbean

9:15 am **Stylized facts and modelling issues in the Caribbean**

Mr. Dillon Alleyne, ECLAC Subregional Headquarters for the Caribbean

9:35 am **The challenge to modelling with environmental considerations in developing countries**

Professor Temisan Agbeyebe, Hunter College, CUNY

9:55 am **Discussion**

10:30 am *Coffee break*

Session IB: CRITICAL ISSUES IN MACROECONOMETRIC MODELLING IN THE CARIBBEAN

*Chair: Mr. Anthony Birchwood, Caribbean Centre for Money and Finance,
Trinidad and Tobago*

10:45 am **The algebra of modelling and new ways of thinking about Caribbean economies**

Professor Vanus James, Trinidad and Tobago

11:05 am **Modelling and forecasting in the Caribbean - the Barbados experience**

Professor Roland Craigwell, UWI, Barbados

11:25 pm **T21 Model: The Jamaican experience**

Mr. Hugh Morris, Planning Institute of Jamaica

11:45 pm **Discussion**

12:30 pm *Lunch*

SESSION II: ECONOMIC MODELLING TO DETERMINE THE IMPACTS OF CLIMATE CHANGE IN THE CARIBBEAN

Chair: Ms Charmaine Gomes, ECLAC Subregional Headquarters for the Caribbean

- 2:00 pm** **Evaluating models for climate change and other environmental issues in the Caribbean**
Dr. Juan Llanes, University of Havana, Cuba
- 2:20 pm** **The impact of climate change on the tourism sector in selected Caribbean countries**
Dr. Sandra Sookram, SALISES, Trinidad and Tobago
- 2:40 pm** **The impact of climate change on the agricultural sector in the Caribbean**
Mr. Roger Rivero de Vega, INSMET, Cuba **Discussion**
- 3:00 pm** *Coffee break*
- 3:15 pm** **Discussion**
- 3:15 pm** **Wrap – up, the way forward**
Mr. Dillon Alleyne, ECLAC Subregional Headquarters for the Caribbean
- 4:30 pm** **Closure**
Mr. Neil Pierre, ECLAC Subregional Headquarters for the Caribbean

Annex II

List of Participants

Terence D. Agbeyegbe, Professor of Economics, Department of Economics, Hunter College and the Graduate Center, City University of New York, 695 Park Avenue, New York, NY 10021, United States. Tel: 212-772-5405; Fax: 212-772-5398; E-mail: tagbeyeg@hunter.cuny.edu

Dillon Alleyne, Economic Affairs Officer, ECLAC Subregional Headquarters for the Caribbean, 1 Chancery Lane, Port of Spain, Trinidad and Tobago. Tel: 868-623-5595; Fax: 868-623-8485; E-mail: Dillon.alleyne@eclac.org

Garfield Barnwell, Director, Sustainable Development, CARICOM Secretariat, Turkeyen, P.O. Box 10827, Greater Georgetown, Guyana. Tel: 592-222-0001-75 Ext: 2668; Fax: 592-222-0167; E-mail: gbarnwell@caricom.org

Anthony Birchwood, Research Fellow, Caribbean Centre for Money and Finance, The University of the West Indies, St Augustine Campus, St Augustine, Trinidad and Tobago. Tel: 868-645-1174/645-1610; Fax: 868-645-6017; E-mail: Anthony.Birchwood@sta.uwi.edu

Sharon Gillian Branch, Economist, The Central Bank of the Bahamas, P.O. Box N-4868, Nassau, The Bahamas. Tel: 242-302-9861; Fax: 242-356-4324; E-mail: SGBranch@centralbankbahamas.com

Mark Bynoe, Environmental/Resource Economist, Caribbean Community Climate Change Centre, 2nd Floor, Lawrence Nicholas Building, Bliss Parade, Belmopan, Belize. Tel: 501-822-1094; E-mail: m_bynoe@yahoo.co.uk

Roland C. Craigwell, Professor of Economics, Department of Economics, Faculty of Social Sciences, The University of the West Indies, Cave Hill Campus, Barbados BB11000. Tel: 246- 417-4474; Fax: 246-438-9104; Email: roland.craigwell@cavehill.uwi.edu

Gobind Ganga, Deputy Governor, Bank of Guyana, 1 Avenue of the Republic, Georgetown, Guyana. Tel: 592-227-5201; Fax: 592-227-2965; E-mail: gganga@bankofguyana.org.gy

Edward Ghartey, Senior Lecturer, Department of Economics, University of the West Indies, Mona, Kingston, Jamaica, Email: edward.ghartey@uwimona.edu.jm

Martin Goddard, Caribbean Catastrophe Risk Insurance Facility, The Towers, 6th floor, 25 Dominica Drive, Kingston 5, Jamaica. Tel: Fax: 876-920-5252; E-mail:

Charmaine Gomes, Sustainable Affairs Officer, ECLAC Subregional Headquarters for the Caribbean, 1 Chancery Lane, Port of Spain, Trinidad and Tobago. Tel: 868-623-5595; Fax: 868-623-8485; E-mail: charmaine.gomes@eclac.org

Kevin Greenidge, Director (Ag), Research Department, Central Bank of Barbados, Tom Adams Financial Centre, Spry Street, Bridgetown, Barbados BB11126. Tel: 246-436-6870; Fax: 246-436-0606; E-mail: kcgreenidge@centralbank.org.bb

Ekhosuehi Iyahun, Caribbean Catastrophe Risk Insurance Facility, Suite #6 Barbados Hardware Complex, Haggat Hall, St Michael, BB11059, Barbados. Tel: 246-426-1525; Fax: 246-426-1704; E-mail: eyahun@ccrif.org

Vanus James, Adjunct Distinguished Professor, University of Technology, Faculty of The Built Environment, 237 Old Hope Road, Kingston 6, Jamaica. E-mail: Vanus.james@gmail.com

Juan Llanes, Director, Centre for Environmental Studies, University of Havana, San Lazano y L Street, Vedado, Havana, Cuba. Tel: 537-879-6054; E-mail: jllanes@rect.uh.cu

Roberto Machado, Economic Affairs Officer, ECLAC Subregional Headquarters for the Caribbean, 1 Chancery Lane, Port of Spain, Trinidad and Tobago. Tel: 868-623-5595; Fax: 868-623-8485; E-mail: Roberto.machado@eclac.org

Nadine Mc Cloud, Lecturer in Econometrics, Department of Economics, University of the West Indies, Mona, Kingston 7, Jamaica. Tel: 876-977-1188/876-512-3559; Fax: 876-977-1483; Email: Nadine.mccloud02@uwimona.edu.jm

Hugh T. Morris, Economist, Planning Institute of Jamaica, PIOJ Building, 16 Oxford Road, P.O. Box 634, Kingston 5, Jamaica. Tel: 876-935-5141; Fax: 876-960-5058; E-mail: hmorris@pioj.gov.jm

Shelton Nicholls, Deputy Director, Central Bank of Trinidad and Tobago, Level 20, Eric Williams Financial Tower, Independence Square, Port of Spain, Trinidad and Tobago. Tel: 868-625-4835 ext. 5076; Fax: 868-623-9585; E-mail: snicholls@central-bank.org.tt/sperryman@central-bank.org.tt

Willard Phillips, Economic Affairs Officer, ECLAC Subregional Headquarters for the Caribbean, 1 Chancery Lane, Port of Spain, Trinidad and Tobago. Tel: 868-623-5595; Fax: 868-623-8485; E-mail: Willard.phillips@eclac.org

Neil Pierre, Director, ECLAC Subregional Headquarters for the Caribbean, 1 Chancery Lane, Port of Spain, Trinidad and Tobago. Tel: 868-623-5595; Fax: 868-623-8485; E-mail: neil.pierre@eclac.org

Ronald Ramkissoon, Senior Economist, Republic Bank Limited, No. 9-17, Park Street, Port of Spain, Trinidad and Tobago. Tel: 868-625-4411 ext. 3107; Fax: 868-625-3617 ext.3353; Email: ramkissoon@republictt.com

Amar Ramlogan, Economic Analyst, Republic Bank Limited, No. 9-17, Park Street, Port of Spain, Trinidad and Tobago. Tel: 868-625-4411 ext. 3107; Fax: 868-625-3617 ext. 3353; Email: aramlogan@republictt.com

Mr. Roger Eduardo Rivero Vega, Senior Researcher, Camagüey Meteorological Center, Institute of Meteorology, Ministry of Science, Technology and Environment, Carretera de Nuevitas, Kilómetro 7 1/2, Camagüey, Cuba. Tel: 533-228-1979; E-mail: roger@cmw.insmet.cu and roger.rivero@insmet.cu

Garfield Riley, Economist II, Eastern Caribbean Central Bank, P.O. Box 89, Basseterre, Saint Kitts and Nevis. Tel: 869-465-2537; Fax: 869-465-5615; E-mail: Garfield.Riley@eccb-centralbank.org

Dave Seerattan, Research Fellow/Officer-in-Charge, Caribbean Centre for Money and Finance, The University of the West Indies, St Augustine Campus, St Augustine, Trinidad and Tobago. Tel: 868-645-1174/645-1610; Fax: 868-645-6017; E-mail: Dave.Seerattan@sta.uwi.edu or ccmf@sta.uwi.edu

Sandra Sookram, Sir Arthur Lewis Institute of Social and Economic Studies (SALISES), St Augustine, Trinidad and Tobago. Tel: 868-662-2002; Fax: 868-645-6329; E-mail: Sandra.Sookram@sta.uwi.edu