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## Stormy Weather: Economic Forecasting at the Central Bank of Barbados

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*Roland C. Craigwell*

### Introduction

The Central Bank of Barbados has been involved in macroeconomic forecasting since 1980. During this time, policymakers have become more and more aware of its importance in the rational and systematic planning of economic, social and political life of the nation. So much so, that in 1994, a forecasting unit was set up in the Research Department of the Bank - the first of its kind in the English-speaking Caribbean region. Policymakers believe that failure to forecast strategic macroeconomic variables does not allow them to adequately assess the impact of current policy initiatives, and to alter these policies if need be. Thus, the unit is envisaged as crucial to policymaking, especially in helping to predict such phenomena as recessions and their deleterious consequences. However, the art of forecasting is intrinsically difficult because there are many variables impacting on the future which are either beyond the control of policymakers or are not adequately modeled. The challenge facing policymakers is to decide whether and how to use the projections supplied and, given the many available forecasts, which are the most likely to be accurate and useful. In doing this, they must be aware of the forecast limitations.

The purpose of this essay is to discuss the experience of macroeconomic forecasting at the Central Bank of Barbados. The paper begins with a brief review of the approach to forecasting undertaken at the Bank. Then, problems with forecasting are discussed, followed by an evaluation of the forecasting performance by the various models utilized by the Bank. Finally, conclusions are drawn.

## 1. A Review of the Forecasting Approach

The forecasting system at the Central Bank of Barbados started as a small system of interrelated equations. However, it was soon discovered that this small system was too aggregated, lacked detail, and gave poor results. Hence, it was deemed necessary to upgrade the system to a more dis-aggregated and larger one, that incorporated all the major accounts - real, monetary, fiscal and external.

Initially, the system used quantitative techniques like multiple regression methods to estimate models largely developed from outside of Barbados. For example, Worrell and Holder (1979) employed straightforwardly the simple monetary approach to the balance of payments model without testing the underlying assumptions of a stable demand for money function and a stable process through which the money supply is generated. Also Boamah (1981) set up an elaborate one sector model which emphasized the real sector but assumed, among other things, that tradeable and non-tradeable goods constitute one commodity. This assumption is contrary to what is known about the processes of small open economies like Barbados (see Holder and Worrell (1984)).

Given these shortcomings and a weak data base, it is not surprising to find that these early models did not track the performance of important endogenous variables like foreign assets and credit to government very well and were abandoned before they captured sufficient interest to suggest adoption by policymakers and/or their critics. As Worrell and Holder (1984,p3) note "in part, their fate reflects their pioneering status; they came at a time when economic policy making in Barbados was in its infancy and there were few technicians in Government to build on their efforts."

The next attempt to forecast at the Bank (Worrell and Holder (1984)) focused more heavily on policy issues of most vital interest to the decision makers like fiscal policies, interest rates, exchange controls and central bank reserve requirements. However, these researchers continued to use data-hungry regression methods on relatively weak data bases. As a result, the regression and simulation experiments, as before, generally gave poor results and led to the abandonment of this approach.

The next set of forecasters tried to construct models that required less data. This system, adopted from the International Monetary Fund (IMF), was built around a set of basic macroeconomic accounting identities to which behavioral equations were added. However, this system was estimated by qualitative forecasting methods, like intuitive thinking, judgment, accumulated knowledge and the expertise of specially trained people in the area of investigation. In essence these qualitative techniques were based on little more than an examination

of past trends and knowledge of recent movements in the economy. The results from this system often found criticism from international financial institutions as the system often produced outcomes that were different from those of the latter institutions. It was argued that this system lacked a formal econometric and statistical basis for forecasting and policy analysis. Of course, it had the disapproval of some local authorities because the system was fashioned after the IMF accounting framework, which had no explicit behavioural equations but the model estimates were based implicitly on parameter values from previously estimated single equation models. Augustine and Whitehall (1990) provide a useful discussion of this framework.

The models of Worrell and Galawish (1988) and Craigwell et al (1994) form the basis for the current 'New Forecasting System' which operates in an environment where qualitative techniques are combined with quantitative techniques to produce economic forecasts. This combination has allowed this system to go a step further than previous systems in that, for the first time in the history of Barbados forecasting and indeed the history of the English-speaking Caribbean, policymakers are using results based on econometric models to provide quantitative answers to major policy questions pertaining to key macroeconomic variables like real output, the fiscal deficit and the level of international reserves. The Appendix provides a brief review of this current system taken from Craigwell (1996b). What differentiates this system from previous ones is the combined use of econometrics and judgement in the development of several of the forecasts (see tourism, for example).

## **2. Problems with Forecasting**

The task of forecasting at the Central Bank of Barbados has not been easy. At one point or another, development was hampered by (i) the non-existence of a formal model; (ii) insufficient data and (iii) inadequate expertise and facilities.

### **2.1 *Model Development***

The need for a formal model is beyond doubt, since it is required to provide the basis for rational and systematic decision-making. This has proven to be particularly relevant in times of structural adjustment when international lending institutions make reference to a model which they think captures the distinctive features of the home country. In many cases their generic models do not match up to reality and "home-grown" models have proven to be very useful in ensuring that appropriate policies are implemented.

Model building has been particularly difficult from inception as no clear-cut theory was available for Caribbean economies like Barbados. Indeed, the early models were basically of the neo-Keynesian genre, with their emphasis on the demand side of the economy, and little or no discussion of the supply side of the macroeconomic structure, the latter deemed important because of the pervasiveness of bottlenecks in production due to limited quantities of certain factors, such as human capital and physical capital, and relatively inefficient production techniques. This problem, however, is not as great as in the 1970s and early 1980s as later models have not totally accepted the applicability of the Keynesian theoretical framework. This shift is as a result of a general consciousness that economies like Barbados are *sui generis* and therefore models emanating from the metropolitan centers should be treated with some scepticism when applied to small open economies. Moreover, statistical data bases have improved, favoring the construction of different types of models.

Another problem with model development at the Central Bank of Barbados stemmed from the fact that forecasts were done for the major sectors - national accounts, fiscal, monetary and external - independently. This led to inconsistencies in the forecasts and invited scepticism. However, as time went on the forecasting process became iterative so that the forecasts became consistent even if inaccurate.

## 2.2 *Data*

The lack of economic data in Barbados and the Caribbean as a whole is a well known problem and there is no need to dwell on it here. It suffices only to say that Forde (1996) outlines six major areas of weaknesses in Caribbean economic statistics. They are (1) timeliness of current output; (2) the lack of new data series; (3) inadequate periodicity; (4) not enough transformations; (5) short data sets and (6) absence of forward-looking indicators. The Bank in its forecasting efforts has experienced all of these types of problems at some stage or another. For example, Craigwell (1996a) notes that in preparing the Economic Outlook document, "there was not enough data at the start of the Outlook. This is common in the real sector, BOP and fiscal sectors. Delays could be as long as two to three weeks". Unavailability of timely data increases the probability that the behavioral relationships of the model may be mis-specified or judgmentally incorrect.

The Central Bank has done its part in enhancing the economic data base by the compilation and publication of the balance of payments, financial, fiscal and real sector statistics. The Central Bank by undertaking a survey each year acts

as the initial source for the Balance of Payments statistics. What is needed now is a series of special surveys for the financial and real sectors to improve the information content in these sectors. This will be costly but in the end benefits should outweigh costs.

### 2.3 Resources

Forecasting at the Central Bank was often subject to human and physical resource constraints. In the initial stages there was a lack of computer facilities and only with the advent of the personal computer and specialized econometric software has empirical modeling expanded. In addition, research was also hampered by the scarcity of literature, especially on Caribbean economic problems. In recent times, a new crop of economists skilled in econometrics has emerged. Not only has the Bank engaged in in-house training but it has facilitated the training of several economists in forecasting and model building overseas. At present, the Forecasting Unit of the Bank consists of well-trained economists with knowledge of several computer applications. The Central Bank's Library facilities have also increased and now information can be obtained from any place in the world in a very short space of time.

## 3. Forecasting Performance

The Central Bank's *'Economic Outlook'* document based on the models discussed above contains annual and quarterly projections which are made at the end of each quarter. To assess its accuracy a comparison is made between what was forecasted for the year at two different points (the end of March and the end of September) with the actual out-turn in that respective year. This is done only for the change in real GDP, private sector credit and liabilities, the fiscal deficit and international reserves for the years 1980 to 1995; this allows for an assessment of the forecasting accuracy in the four major sectors over time. It should be noted that it is somewhat difficult to develop criteria by which accuracy of projections in all sectors may be judged but a 'fixed error margin' of 10% is adopted for all areas implicitly assuming that the size of an error carries the same significance in different areas. Note also that since these sectors are interrelated the error in one sector may compound the error in another. Further note that the absolute size of a variable influences the percentage changes for the errors, for example, the fiscal deficit in 1994 and 1995 show very large errors when the fiscal deficit is relatively low. Unfortunately there is no easy way to normalize these changes.

Figure 10.1a  
**Real GDP Growth  
 Percentage Error**

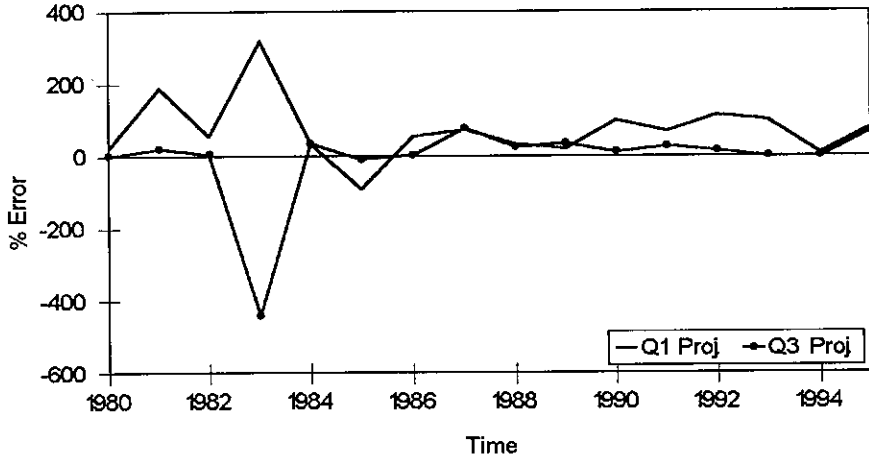


Figure 10.1b  
**Fiscal Balance  
 Percentage Error**

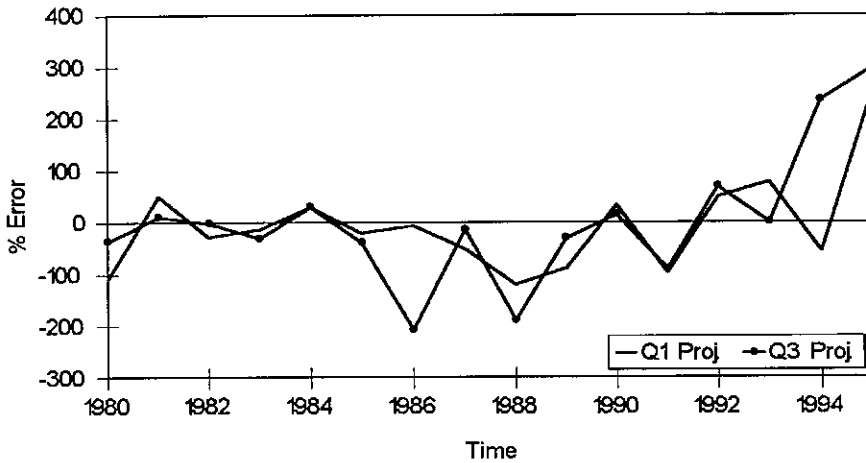


Figure 10.1c

### Reserves Percentage Error

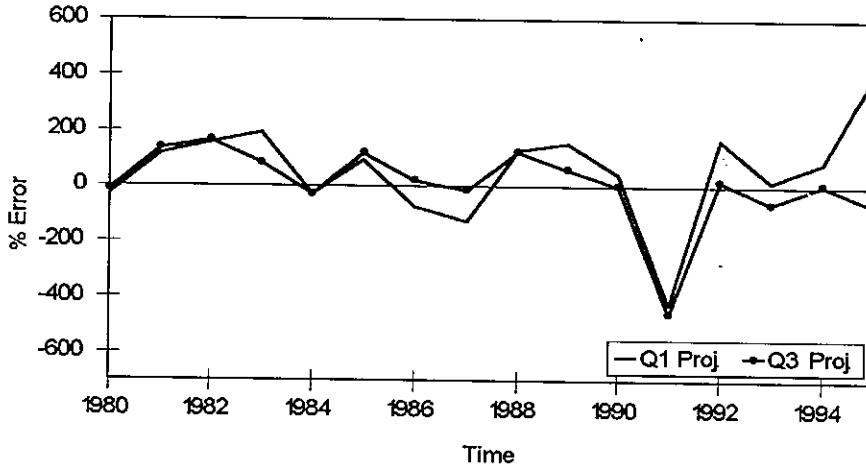


Figure 10.1d

### Credit to Private Sector Percentage Error

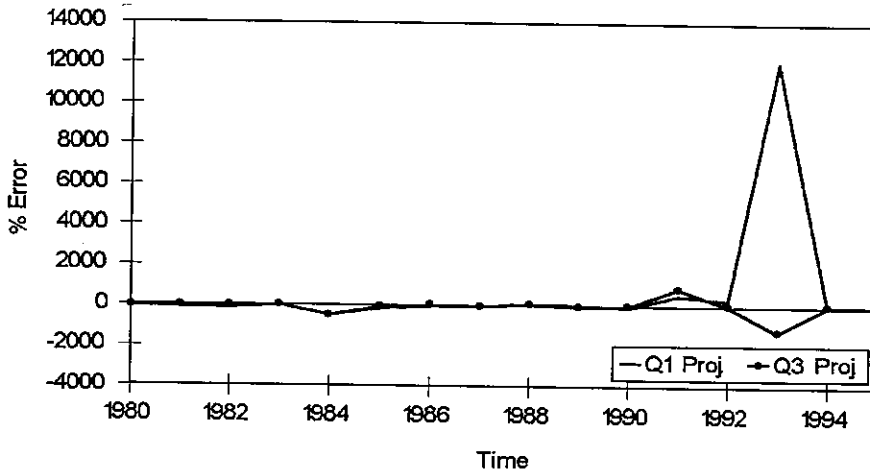
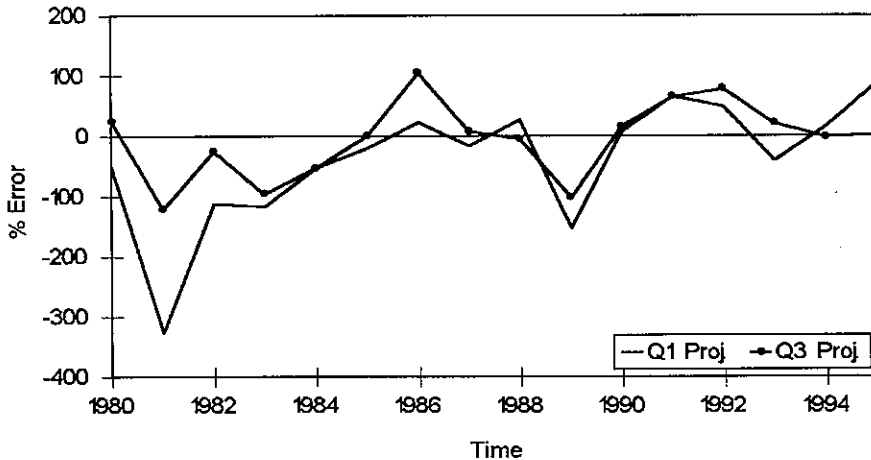


Figure 10.1e Liabilities to Private Sector Percentage Error



It is clear from Figures 1a - 1e that the projections have deviated somewhat from the actual outcome for all variables except private sector credit. The forecast error for the change in private sector credit, except for 1993, ranged between zero and two per cent. Nineteen ninety-three was an exceptional year for credit flows as adjustments were made for a finance company conversion into a full-scale commercial bank and the liquidation by Government of debt issued under letters of comfort.

For the variables with 'incorrect' projections, these are likely to have been affected by one time shocks similar to that that made the 1993 credit out-turn difficult to predict. For example, back-pay of wages could influence the fiscal sector in an unexpected way. More important to note, however, is that forecasts of the deficit tended not to make assumptions about future wage increases in the same way that forecasts about the level of international reserves ignored the impact of future foreign borrowing. Since these variables are interrelated, deviation in one variable may influence another variable. For example, the 1990 fiscal deficit may have been worse than expected because of a weaker than anticipated revenue performance.

Generally, the forecast errors have diminished over time suggesting that there has been a continuous improvement in the forecasting accuracy at the Bank. Somewhat surprising however, is that for GDP and the fiscal balance, the forecasts made at March seem to be better than the forecasts made in September. This



implies that the more information available the worse the forecast and may suggest that Government is constantly updating and changing their economic expectations.

#### 4. Conclusion

Macroeconomic forecasting is an important cornerstone of government planning in Barbados. This study has shown that forecasting at the Central Bank of Barbados underwent three phases. Phase one focused on the use of quantitative methods to estimate relatively simple theoretical models that were developed in the metropolitan countries. In phase two, qualitative techniques were applied to models that had some resemblance to the generic features of the Barbados economy. Finally, in phase three, qualitative and quantitative methods were combined to produce results from a model largely descriptive of the Barbados economy.

In addition, this study revealed that forecasting at the Bank was never an easy task as it was hindered from time to time with problems of model development, data and human and physical resources. However, despite these troublesome issues, forecasting at the Bank has progressed to a fairly advanced stage with the current system - the New Forecasting System - being used by decision makers to answer several policy questions pertaining to key macroeconomic variables like the fiscal deficit and real output.

This study also made some attempt to evaluate the experience of the forecasting system at the Bank. It is shown that the accuracy of the forecasts improved over time. However, some forecasts deviated substantially from actual outcomes, implying that there is still room for further development of the system to make better forecasts. This can be done by the further training of economists, familiarizing them with the intricacies of the system. Finally, more research dealing with the working of the model should be encouraged. Research using alternative forecasting methods would be helpful in this regard as well as developing programmes for scenario analysis that considers 'what if' propositions.

### Appendix

#### The New Forecasting System

The model developed here stresses the crucial role played by the demand for money and monetary disequilibrium in the behavior of such macroeconomic variables as prices, output and the balance of payments. It recognizes that the

money supply is not entirely under the close control of the authorities and suggests that the domestic component of the money supply should be the focus of the authorities. And because in small economies with thin capital markets the growth of domestic credit is closely linked to the Government's borrowing constraints, there is a role for fiscal policy in this model as well.

The model presented here consists of the four major accounts - real, balance of payments, fiscal and monetary and has several behavioral equations and identities.

### *Real Sector*

Output is divided into tradeable and non-tradeable. With respect to tradeable, separate forecasts are developed for tourism, manufacturing, sugar and non-sugar agriculture and fishing, incorporating both price and non-price factors. The forecast of tourism uses a two-step procedure. First, the demand for the Barbados tourism is estimated and projected. The determinant is real output in the visitors' home countries. Secondly, supply effects, non-price strategies and market specifics are introduced to modify the projection which is derived from step one. Specific account is taken of expansion in hotel capacity in Barbados, and the upgrade of hotels and facilities, increases or decreases in airline seat capacity, intensification of marketing expenditures, changes in productivity and improved service quality.

The projections for manufacturing are also based on a two-step procedure. The forecast begins with a projection based on recent trends. This baseline projection is modified to take account of trade and tariff reform, the latter being largely judgment determined.

Barbados exports sugar under quota to the European Community; a restructuring program is currently underway to increase the supply so as to fulfil the quota and the domestic market. The projections are based on data supplied by the sugar management company. For non-sugar agriculture and fishing, the forecasts are based on recent trends, adjusted by forecasts made by the officials of the various industries.

The forecast for non-tradeables is derived from the forecast of tradeables and targets for fiscal and monetary policy set with the balance of payments out-turn in mind. The specific equation is

$$Q_N = Q_N(Q_T, Q_N(-1), P_T, MB, r_F)$$

where  $Q_N$  is non-traded output,  $Q_T$  is tradeable output,  $P_T$  is the price of tradeable, MB is the monetary base,  $r_f$  is the foreign interest rate and  $Q_N(-1)$  is non-traded output lagged one period. It is expected that  $Q_T$ ,  $Q_N(-1)$  and MB are positively related to  $Q_N$  while  $r_f$  is negatively correlated.  $P_T$  is assumed to be ambiguous.

To get nominal GDP a forecast of the GDP deflator is required. We estimate the deflator using the national accounts identify  $C + I + G + X - M = \text{GDP}$ . Now  $\text{GDP} = \text{deflator (P)} \times \text{real output (Q)}$ . We use the retail price index (RPI) as a proxy for the price of consumer goods and P as the price for investment goods. RPI is also used as the price of the main exports, that is, sugar, manufacturing and tourism. The import price index is the price for imports and w the cost of Government. With a little algebra, the deflator forecast can be shown to depend on a weighted average of the change in the retail price index, wages, import costs, sugar and manufactured exports and tourism. The forecast of retail prices is based on projections of import cost (measured by  $P_T$ ), credit to government and wages according to:

$$RPI = RPI(CRG, W, P_T)$$

where CRG is credit to government. We expect a positive relationship for all three variables. Wages, W, are derived from the price of tradeable, and productivity (Q/N).

$$W = W(P_T, Q/N)$$

We assume *a priori* that the two variables are positively related to W. Estimates for import costs, sugar and export manufacturing and tourism are taken from the World Economic Outlook document of the International Monetary Fund.

### Balance of Payments

From the output projections we may derive projections for the balance of payments. Export growth reflects recent trends. Imports are generated from the forecast of nominal GDP and adjustments for elasticity changes. Travel credits are derived from the previous year's estimate times the percentage change in tourism value added and inflation, while travel debits are on a historical ratio to domestic exports and travel credits. Investment income, transfers and transportation are based on trend as well as debt projections. All other services are projected using historical relationship based on freight and insurance. The capital

account is generated from numbers taken from the Ministry of Finance and reserves change is calculated as the difference between the current account and the capital account.

### *Fiscal Sector*

This system envisions three sources of funding for Government expenditure: Central Bank lending not exceeding the amount derived from in the financial sector, foreign borrowing identified by Government (net of amortization) and tax revenues. Government revenues are projected according to total and sectoral GDP components and inflation, adjusted for the impact of tax reform and divestment. Current expenditures are projected according to the rate of inflation and the wage rate. Capital expenditure is a residual forecasted in line with a targeted fiscal deficit.

### *Monetary Sector*

This sector indicates how much finance may be available for Government to fund its deficit. Commercial banks accumulate deposits and other monetary liabilities. The equation for monetary liabilities to the private sector is as follows:

$$LPS = LPS (RPI, RPI(-1), LPS(-1), RQ (-1))$$

where RPI is assumed to be negatively related to LPS and LPS(-1) and RQ(-1) carry a positive sign. Most of these funds will be needed for loans to the private sector. Forecasts for credit to the private sector follows from

$$CRP = CRP (CRP (-1) r(-1), RQ (-1))$$

where  $r$  is the domestic interest rate. CRP(-1) and RQ(-1) are assumed to be positively related while  $r(-1)$  carry a negative sign. We assume that the finance which remains to the bank after satisfying the loan demand is deposited with the Central Bank. These 'net claims' plus net international reserves are elements of the Bank's 'monetary base'. Thus, these forecasts enable us to deduce the liquidity changes in the banking system, from which we can infer the availability of non-inflationary financing for government.

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