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ECONOMETRIC MODELLING AND FORECASTING IN THE CARIBBEAN: A CRITICAL APPRAISAL

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Economic modelling in the English speaking Caribbean has quite a long tradition, especially in the area of macroeconometric modelling. Such models began to appear in the early 70's, not too long after they had taken off in North America and Europe. Examples of early attempts are Harris (1970), Carter (1970) and Manhertz (1971) for Jamaica; and Persad (1975) and Gaffar (1977) for Trinidad & Tobago.

These early efforts at modelling were fairly well rooted in the tradition of the open Keynesian economy (Kennedy (1966)) or, perhaps, more accurately, they were examples of open Hicksian type IS-LM models (although some were more IS than LM). This, after all, was the tradition emanating from the metropolitan centres and, in all fairness to these pioneers, the very limited statistical data base that existed at that time clearly favoured the construction of such models. On the odd occasion, and in deference to the "Caribbean reality", one or two "supply side" equations, ostensibly to explain employment or production, are thrown in for good measure.

Whatever the philosophical content of these early models, it is perhaps more worrisome that, from the earliest forays of Caribbean scholars into this domain right up to the present time, models seemed to be constructed more for the intellectual thrill of the exercise than for any other end use to which the model could be put. A cursory glance at the works cited above would reveal that efforts were limited to the specification, estimation and validation of the models. This of course, is not a useless exercise, but modelling counterparts in the developed centres were going (at least) one step further: they were constructing models particularly for the end use of forecasting and, relatedly, policy evaluation. In fact, the market for econometric forecasts grew tremendously in the 70's with actors in both the public and private sector participating. See, for example, Klein and Young (1980) and U.S. Department of Commerce (1986).

To be fair, Caribbean modellers always recognised the potential usefulness for forecasting of the models they constructed and, indeed, there is some small attempt to do just that in Harris (1970). But these efforts have never been as sustained nor as systematic as those done by, say, the Wharton School, the Bureau of Economic Analysis, and the Reserve Bank of New Zealand (see Brooks and Gibbs (1991)).

There has been a resurgence of macroeconometric modelling in the English speaking Caribbean in recent years, and the efforts are much more sophisticated than those of the previous years. Moreover, these models were specifically developed for forecasting and include Belchere (1988) for the Bahamas, Hilaire *et al.* (1990), Clarke and Watson (1992) and St. Cyr and Charles (1992) for Trinidad & Tobago, UNDP (1991) for Jamaica, Ganga (1990) for Guyana and Leon and Samuel (1994) for the ECCB area. Prototype models geared for generating forecasts of Caribbean economies, such as ILPES (1986) and Worrell and Holder (1987), have also appeared. Still, however, useful output is not forthcoming and, apart from some attempts of the original model builders in one or two

the specification, estimation and validation of the models.

Some General Views on Forecasting with Macroeconometric Models in the Caribbean

The most general form of a simultaneous equation macroeconometric forecasting model may be represented as

$$F(y_t, y_{t-1}, \ldots y_{t-m}, x_t, x_{t-1}, \ldots x_{t-n}, \beta) = u_t \qquad (1)$$

where y_{t-i}, $i = 0, 1, \ldots, m$, are vectors of current and lagged values of endogenous variables and x_{t-j}, $j = 0, 1, \ldots, n$, are vectors of exogenous variables. β is a matrix of (generally unknown) coefficients and u_t a vector of random disturbances.

There are (at least) four distinct but related steps in arriving at a forecast through the use of such a model:

- Specification
- Estimation
- Validation
- Forecasting

Whereas it is the last mentioned which will be the principal preoccupation of this paper, the other three are no less important and, indeed, poor forecasts may result from inadequate concern for them. None of these stages is mechanical or straightforward and each has its own particular difficulties which can be overwhelming. Detailed elaboration of these stages may be found in Klein and Young (1980) or Kmenta and Ramsey (1981) and what follows addresses the principal concerns that will arise when modelling in a Caribbean environment.

Specification This is arguably the most difficult part of the exercise. At this stage, the standard practice has been for the modeller to be guided by economic theory as well as his/her knowledge of economic structures and institutions in giving a specific structure to the general model defined by (1) above. It is at this stage that questions about the size of the model (or, equivalently, the level of disaggregation) and the dynamic structure of the equations should be answered. At the same time, the modeller cannot ignore the contents of the statistical data base at his/her disposal (which will be used at the estimation and validation stages) in answering such questions.

All this, of course, is easier said than done. First of all, it is not always certain what is meant by the term "theory". Is it what the standard textbooks teach us? Is it what the great economists coming out of the Caribbean tradition tell us? Or is it what our own training as economists lead us to understand about the structure and functioning of

consumption and investment analytically useful in a Caribbean context or should little or no concern be given to them? In the case where they are deemed to be useful, how else to model them than by, say, within the multiplier-accelerator framework or some other (metropolitan?) device? Finally, to what extent should our "theorising" be related to the end use to which the model is to be put and, in this case, should the approach to specification be not more "eclectic", using whatever might serve this purpose?

A study of the models cited above will reveal that all these approaches have been followed, sometimes all at the same time! There is even another alternative which, to the author's knowledge, has not yet been tried: Sims' (1980) "atheoretical" framework which uses Vector Autoregressive (VAR) models that require no greater knowledge or understanding of economics than "everything depends on everything else".

In the end, what has happened is the standard formulation of consumption functions using usually some variant of the well established theories like the Life Cycle hypothesis, the Permanent Income hypothesis etc.; investment functions incorporating the accelerator principle; import functions which relate import demand to income and relative prices ... and so on.

And what is wrong with that? It is difficult to accept the facile criticism that such functions may not reflect the Caribbean reality. What is required by those who make the comment is an alternative specification that is more acceptable on the grounds of economic theory (whatever that may mean) which can also perform better *statistically* than the standard formulations. Furthermore, it is also not certain that this Caribbean reality is not some sort of "black box" which is revealed in the coefficient values obtained from the estimation exercise.

Estimation The principal task estimation is to find good estimates of β. The appropriate technique for doing this has been the subject of considerable research and, indeed, was a major preoccupation of the Cowles Commission. To date, however, Ordinary Least Squares (OLS) has been the procedure of choice notwithstanding that it is consistent (some justification for this is given in Watson (1987)).

Modern developments, and in particular the literature associated with cointegration analysis, have given a major boost to the use of OLS as, within this framework, OLS is *super* consistent (Engle and Granger (1987)). Leon and Samuel (1994) apply this methodology to a model of St. Lucia but it is difficult to say with what success since this work is still at a preliminary stage. The only example of this approach known to this author lies outside of the Caribbean region: the model of the Reserve Bank of New Zealand (Brooks and Gibbs (1992)).

The use of the cointegration approach holds a lot of promise, perhaps more so because of the more recent contribution of Johansen (1988). In the first place, it imposes a

run" properties of the model. Secondly, the approach involves something of a built-in specification test because of the existence properties enunciated in the Granger Representation Theorem. However, there is a cost attached. In the first place, the determination of cointegrating variables can be a never ending process of determining the order of stationarity of all economic time series to be used in the model which may yield unsatisfactory results because of data series of inadequate length. Secondly, the length of the lag required to satisfy the choice of the VAR structure may either itself run into a data shortage problem or, even when it does not, yield coefficient values whose economic interpretation is not immediately obvious. See Charemza and Deadman (1992), p.201. Finally, there is the problem of the econometric software (and the corresponding hardware) requirements: to this author's knowledge, only MICROFIT ver. 3.0 (Pesaran and Pesaran (1991)) and EVIEWS (Lilien *et al.* (1994)) allow for estimation using the Johansen procedure.

Validation The validation of the model usually begins at the estimation stage where, because of the nature of the estimation methods used, it is necessarily done on an equation by equation basis. But it is the more informal evidence provided by statistics based on solution (simulation) of the model that is most widely used.

In the framework of equation (1) above, simulation involves the determination of the time path of the elements of the **y** vector given **x** and β. The rationale for the use of statistics based on simulation is that equation by equation evaluation does not capture the full richness of the simultaneous system and that, if the model is truly a representation of the reality, then it should produce output that closely resembles that reality (i.e. the observed values). Intuitively, too, it would seem very plausible that a model purporting to forecast future values should at least be able to satisfactorily explain the past. See Watson (1987).

But how satisfactory is the explanation of the past? The methods used to determine this, like visual inspection of plots of actual and fitted values, the Theil inequality coefficient, the Theil decomposition and so on are purely *descriptive* and it is therefore impossible to attach a precise measure of confidence to any rule that we may apply. Furthermore, the model is judged on its ability to predict this or that variable and no global measure of the model's explanatory power is used. The only such measure known to this author is one proposed by Smith (1977) which does not seem to have found widespread acceptance.

Perhaps more fundamental than this is the question as to whether the whole concept of validation of the past as the best justification for forecasting the future is acceptable in the context of the Caribbean of the 90's and beyond. Due to data availability (or rather the lack of it), Caribbean macroeconometric models have been based on annual (as opposed to, say, quarterly) data. For instance, the UNDP model of the Jamaican economy uses data from 1974 to 1989 while the Hilaire *et al.* model of the Trinidad & Tobago economy employs data from 1966 to 1986. And yet it is the intention of the modellers to use these models to forecast variables into the 90's and to base policy prescriptions on

these forecasts. But the structure of these economies have undergone such radical changes in the very recent past that the analytical usefulness of the equations comprising the models as well as the coefficient values obtained is no longer obvious.

Forecasting Forecasting in the framework of the general model defined by equation (1), is the estimation of the as yet unobserved y_{t+k}, k = 1,2, .. given y_{t-k}, k = 0,1,2, .. x and β. Ironically, it is probably the most misunderstood stage of the whole forecasting cycle and there is a widespread belief that this is a fairly mechanical exercise requiring not much more than interfacing with the computer.

Nothing could be further from the truth: there is a very rigid and disciplined routine to follow which requires, among other things, a lot of expert opinion and judgement about the future path to be taken by the exogenous variables in the model. This path may be known with some certainty in the case of certain variables, especially if the model is being used by some state agency like a Ministry of Planning, but it is likely to be very much unknown for variables which are of fundamental importance - like the price of oil in the case of Trinidad & Tobago. In the final analysis, the forecast will be as good as the assumptions made about the (usually numerous) exogenous variables in the model.

In fact, it is the use of inappropriate assumptions rather than, say, the validity of the underlying UNDP model of Jamaica which may be responsible for poor forecasting performance. It is for this reason that the exercise to determine these assumptions is one of the most important of the forecasting exercise and should not be taken lightly. It will require, among other things, the marshalling of the best resources available to the planning team which, obviously, may prove to be a very costly. Klein and Young (1980) give a fairly detailed treatment encountered at this stage of the forecasting cycle.

Material and Human Prerequisites to Good Econometric Forecasts

There are many (including the most highly trained) professional economists who believe that all that is required for a good model is a competent econometrician able to ply his trade of running regressions and interpreting t ratios and R^2's. Nothing can be further from the truth and, indeed, the discussion in the previous section would have already given a hint that the generation of an econometric forecast and, by extension, the maintenance of a macroeconometric model, may require human and material resources that go way beyond this. In fact, it may turn out to be quite an expensive business!

A probable reason for the marked absence of forecasts of the Caribbean economy despite the existence of a model of one form or the other may very well be the unwillingness or the inability to provide the resources required. This might have involved an implicit cost benefit analysis which would have ruled against the econometric forecasting exercise (and there is nothing fundamentally wrong with that). This section is about the items that need to go into the costing side of such a calculation for an average Caribbean country.

The discussion which follows assumes a model of the size and complexity of the ILPES (1986) model (two of the models cited above, the St. Cyr-Charles (1992) model and the UNDP (1991) model of Jamaica, take their inspiration from this prototype). This is somewhat larger than the other known Caribbean prototype, the Worrell-Holder (1987) model, largely because it is more disaggregated and it takes specific account of the demand side of the economy. Notwithstanding this, it is fairly modest in size (less than 100 equations) and is relatively highly aggregated so much so that it is not difficult to imagine that the ILPES model is close to some minimum requirement of a Caribbean type model. It is very likely, therefore, that any useful model may require even more data.

Statistician The modelling and forecasting exercise, of course, must depend on third parties like a Central Statistical Office and the Central Bank to generate most of the data to be used. These include national income data, Balance of payments data, Monetary data, data on government's fiscal operations and so on. It is impossible in a paper like this one to fully deal with all the difficulties in this area and the discussion will be limited to the more obvious ones. The problem of the inadequacy of the statistical data base in relation to econometric modelling in Trinidad & Tobago was addressed more than a decade ago by Watson (1984) and the issues raised then were valid for all English speaking Caribbean countries. Today, the "inadequacy gap" has widened.

In the Caribbean, the practice of generating these data is a fairly well established one although things are far from perfect. Some immediate shortcomings, valid for most (and perhaps all) countries are the following:

- data in most categories are available at best on an annual basis which limits the exercise to annual models. Adjustments that take place from quarter to quarter, for instance, cannot be anticipated to allow for corrective measures
- inter sector demand (Input/Output) data are totally absent
- there is little or no useful disaggregation in certain key areas like the components of aggregate demand
- the availability of constant price information, and corresponding price deflators, is limited for components like import demand, exports of tradeables and so on

To make matters worse, most of the data are published with an appreciable lag so that, for instance, in 1992, the modelling team may be working with data for which a complete set is available only up to 1989. But in 1992, policy makers are interested in forecasts for 1993 and beyond, and not for 1990 to 1992, which is clumsy given the state of the data. Furthermore, for completeness, data emanating from different sources are frequently related to each other by obvious identities but, more often that not, such coherence is absent from the published data either because of different practices of the various

agencies preparing the data or because of the timing of the publications are for some other reason.

It might be asking too much to have all these various agencies, and sometimes even the sub units within an agency, to so radically alter their practices to suit the modelling unit, even though the latter may be part of the state sector to which the data collecting agencies belong. For all these (and other) reasons, it is imperative for the modelling unit to have the services of at least one competent and trained statistician whose principal task would be to acquire an almost perfect knowledge of data collection and compilation practices and data sources in the country or countries concerned. To him/her will fall the (full-time) task of liasing with the various data collection agencies, of filling the inevitable gaps in the data so as to bring the data base up to date and of marshalling the existing data into a coherent whole (so that, for example, identities required by economic theory are respected). The ideal person would be computer competent (and not simply literate) and should be able to make recommendations about data capture, retrieval etc. in a computer environment.

The statistician should also be a pioneer and be able to use his/her privileged relationship with the data collection agencies to obtain data to satisfy the demands of an ever increasingly sophisticated model. One immediate area in which this is possible is in the construction of an Input/Output table and, eventually, a Social Accounting Matrix (SAM). A major concern of Caribbean economists is the "demand management" emphasis of macroeconometric models and the consequent inability of these models to forecast supply bottlenecks (Boamah (1981)). With the increasing emphasis on "structural adjustment" and "economic independence" in Caribbean countries, inter industry linkages are going to become more and more important and so too therefore must input-output models. These can be used in conjunction with standard econometric models as was outlined by Klein (1980).

Team of Highly Trained Economists A successful modelling and forecasting effort requires the (almost) full time attention of a team of very skilled economists headed by a Chief Economist whose forte should be Economic Theory, more specifically Caribbean Economic Theory. The ideal person should have a thorough understanding of the Caribbean reality (including institutions and structures) and should be fully steeped in the knowledge of recent Caribbean economic history. Knowledge of modern and traditional econometric practice would help but it should be more optional than absolutely necessary.

The Chief Economist would lead a team of sector specialists who should be required to have a thorough knowledge of areas like monetary economics and so on. It is absolutely necessary for such economists to be thoroughly familiar with published economic statistics, especially as it pertains to the data directly related to their specialisation. Once again, a sound knowledge of econometric practice would be a useful asset.

One of the chief responsibilities of the sector specialist would be the specification (and estimation) of equations purporting to explain the workings of the sector under his/her purview as well as the identification and the modelling of the linkages with other sectors. The Chief Economist would be responsible for co-ordinating the overall modelling effort and for ensuring that the linkages between the various sectors are theoretically and technically sound. It is this team, together with the statistician, who would be responsible for formulating the assumptions about the future path of the exogenous variables in the model and to analyse the main consequences of the forecasted scenarios.

Econometrician The modelling effort, of course, requires the services of an econometrician whose principal intervention would be at the stages of estimation and validation of the model. At the same time, he/she must work closely with the team of economists in the specification exercise and must be in close contact with the statistician in working out the data requirements of the model. The econometrician would also be required to keep *au courant* with the current practices and a specifically important duty would be to train (and retrain, if necessary) the economists on the team in the relevant econometric and mathematical methods necessary for the modelling exercise. Whereas he/she must be more concerned with the mathematical properties of the model (such as its stability), there must also be concern about the economic meaning of the coefficients obtained from the estimation exercise, especially if it involves complicated lag structures like those associated with VAR-Error Correction models. Here, too, he will rely heavily on the inputs from the team of economists.

It goes without saying, then, that the econometrician must have a relatively sound knowledge of the underlying economics of the model. But he/she must necessarily be very familiar with state-of-the-art software packages used for estimation and model solution and, ideally, should be able to programme in packages like EVIEWS, AREMOS and GAUSS.

Computer Specialist The person sought here is a relatively rare breed in the Caribbean today: he/she will be an economist who is at the same time an expert programmer/analyst (perhaps someone with a good first degree in economics with a post graduate training in computer science). In addition to ensuring the required level of computer competence of the other members of the team, this person would be principally responsible for all major programming exercises, including a user friendly interface for use by the economists whose task it will be to generate the forecasts. He/she must also have or be able to acquire specialist knowledge in hardware and software (including standard software like Lotus 1-2-3, Microsoft Excel, DBASE, Foxpro etc.) and be particularly adept in modern methods of data communication using local and wide area networks.

Junior Economists The technical competence of the team would be incomplete without the services of two or three junior economists who, in addition to serving as apprentices, would be required to function as research assistants to the senior technical personnel. They must of course have a sound training in economics and in quantitative methods

including economic statistics and econometrics) in addition to which they must be computer literate.

The first task of the team would be the construction of a new prototype model (which will clearly be influenced by the existing ones) which can be easily adapted for specific use by individual countries. The construction of an adequate data base can proceed side by side with this which will eventually feed into the estimation, validation and forecasting stages for the various countries.

The sustained generation of good forecasts, then, requires the ongoing commitment of a critical minimum level of resources. It is more than likely that, despite the presence of so many econometric models in the Caribbean, it is the absence of this commitment of resources that has resulted in the non production of forecasts. The author's own experience as a modelling consultant with Public Sector agencies has shown that the personnel attached to the exercise as "counterparts" are generally not properly qualified for the task and, worse than that, they are invariably attached to some other aspect of the organisation where the model is but a small and insignificant part. The end result is that the designated users of the model - those who must generate the forecasts - would have played almost no part in its construction. Yet it is absolutely imperative for users to have internalised the structure of the model and there is no better way to do this than getting involved in the construction.

Critique of Two Caribbean Macroeconometric Models

The absence of resources is one thing, but there may be some intrinsic shortcomings in the models which have been constructed that would militate against their use for forecasting. It is to this question that this section will be devoted, with particular reference to two of the more recent (and more substantial) models: the Hilaire *et al.* (1990) model of Trinidad & Tobago and the UNDP (1991) model of Jamaica. These two are chosen largely because they both have a forecasting record (albeit quite a limited one!).

The following table provides a summary of the principal characteristics of each model:

Principal Features of Two Caribbean Macroeconometric Models

Model	Country	Data Coverage	Total No. of Equations	No. of Identities	No. of Exogenous Variables	Principal Estimation Method	Forecast Period
Hilaire *et al.*	Trinidad & Tobago	1966-86	34	17	19	2SLS	1990-95
UNDP	Jamaica	1974-89	113	104	36	OLS	1987-88

Some further details of each model now follow.

The Hilaire *et al.* Model of The Trinidad & Tobago Economy

This model has six blocs: Government, Monetary, Price, Balance of Payments, Consumption, Labour Market and Wages, and Gross Domestic Product. The software used for both estimation of the behavioural equations and simulation of the model is PC TSP (this was ascertained during discussions with one of the authors). There are some serious shortcomings in the specification, estimation and validation of this model of which only a few will be discussed here.

The model suffers, first of all, from the use of current (as opposed to constant) priced values in every case. Consumption, income, imports etc. are all modelled and corresponding equations are fitted using current prices notwithstanding the fact that the period covers years of moderate to almost no inflation (the 60's) to years where inflation went to as high as 22% (the 70's).

The model also suffers from a relative preponderance of econometrically fitted (so-called behavioural) equations many of which can be modelled as identities. In fact, many of them *are* identities. Consider, for instance, equation (11), p.111:

$$NDAT = f(BUD, NDAT(-1))$$

where NDAT = Net Domestic Assets of the Central Bank and BUD = Government's Budget Surplus[1]. This equation is fitted as a behavioural equation when, clearly, it is true (or very approximately true) that:

$$NDAT - NDAT(-1) = - BUD$$

or

$$NDAT = NDAT(-1) - BUD$$

The estimated coefficients verify this (p.111):

$$NDAT = -115.91 - 1.006\ BUD + 1.108\ NDAT(-1)$$

The constant term (which should not have been used at all) is not significant while the coefficients of BUD and NDAT(-1) are not significantly different from -1 and 1 respectively, which are their correct values. The same is true for equation (12) which should be modelled as:

$$NFA = CAB + NFA(-1)$$

instead of being "estimated" as

[1] In the paper, this is defined as the Budget Balance but it is really the Central Government's Borrowing requirement (with the sign reversed). But this is a less important point.

$$NFA = 169.2 - 1.095\ CAB + 1.058\ NFA(-1)$$

where, once again, the constant term is not significant and the two coefficient values are not significantly different from unity (their true value).

There are some other examples of this kind of "*behaviouralising*" of obvious identities in the paper, but there are some others where a choice could have been made and, in each case, Hilaire *et al.* went for the behavioural equation rather than the identity. This is particularly true for the modelling of the various tax revenue functions which invariably took the form similar in spirit to:

$$\text{Tax Revenue} = a + b^* \text{ Tax Base}$$

where a and b would be obtained by least squares fit. This author would have preferred an identity like:

$$\text{Tax Revenue} = \text{Average Tax Rate} * \text{Tax Base}$$

where the average tax rate could be deduced from the data.

Two justifications can be advanced for this preference. In the first place, if this model is to be used for policy making purposes, then use of the second specification provides a very powerful policy instrument: the average tax rate. A fixed value for b clearly does not provide for this possibility (in fact, it is not clear what the coefficient b measures, especially if the data span a very long period as it does in this model). The second justification is really more general and is a case for preferring identities to estimated equations wherever the former are possible (as in the tax revenue example but clearly more so in the NFA and NDA examples above). After all, an estimated equation, *by definition*, contains errors whereas the identities always hold exactly. The estimated equation will therefore never perform better on forecasting than an identity. Why then should it be preferred by the modeller?

Some of the other shortcomings[2], in brief, are:

- the authors distinguish between money supply and money demand and claim that "there is no assumption of money market equilibrium". Yet it is a fact that the data available do not make the distinction between demand and supply of money and it is certain that the same data were used for both functions

- there is clearly some link between RESCHG (eq. 27) and NFA but this link is not at all evident in the model

[2]The list is not exhaustive

) out of the 17 behavioural equations had to be corrected for serial correlation. Are the authors dodging the rigours of proper specification of the equations under the pretext of the presence of serial correlation?

the authors never discuss their data sources and, indeed, how they managed to reconcile data from different sources. For instance, a series for private investment is used which is not available in the published accounts. One wonders if the authors did not deduct government capital expenditure from Gross Fixed Capital Formation to arrive at this figure, in which case it must be stated

The authors claim that the simulation results were acceptable. Yet when the model was simulated to determine the effects of a fall in oil prices, the model predicted that domestic prices will rise. The corollary to this, of course, is that a rise in oil prices would result in a slow down of domestic inflation, a result which, in addition to being counter intuitive, is contrary to all the existing evidence. This result alone should have been sufficient to lead to a re specification of the model.

Finally, the forecast. The model was used to generate forecasts for 1987 and 1988 and, eventually, the forecasts were compared to the figures actually published. The actual percentage errors are quite large, especially for the second year of the forecast (1988). The Table below illustrates (see p. 143-4, Hilaire *et al.* (1990)):

% Forecast Errors 1987 and 1988:
Selected Variables (Hilaire *et al.* Model)

	BUD	MS	WAGRET	GDP
1987	-24.15%	18.76%	10.58%	4.82%
1988	-14.85%	47.3%	26.44%	10.03%

BUD = Budget Balance
MS = Money Supply
WAGRET = Wage Rate
GDP = Gross Domestic Product

Some of the reported results are even worse than those given above. It appears even worse if, as shown in the table below, the actual growth rates of the variables are compared to the forecasted rates:

Comparison of Forecast and Actual Growth Rates 1988:
Selected Variables (Hilaire *et al.* Model)

	BUD	MS	WAGRET	GDP
Actual	16.6%	7.9%	-3.64%	-2.94%
Forecast	6.4%	33.9%	10.8%	1.8%

The differences are staggering: an actual growth rate in the money supply of 7.9% is forecasted as 33.9% while a contraction of 2.94% in Domestic Production is forecast as a 1.8% growth. This does not at all mesh with the authors' claim that "forecasts were generally good".

The UNDP Model of The Jamaican Economy

The model has six blocs: a Global Balances bloc, an External bloc, a Government bloc, a Prices bloc, a Wages and Employment bloc, and a Savings and Investment bloc. It is essentially a Keynesian inspired demand driven model with no attempt to model the monetary sector or external debt (a serious shortcoming in the case of Jamaica). The software used for estimation of the behavioural equations is Micro TSP and for simulation of the model Lotus 1-2-3 is used.

The main shortcoming of this model is the absence of a monetary bloc and the inability, therefore, to use monetary instruments or attain monetary and other targets. Furthermore, despite the fact that it is considerably larger than the previous model, it still remains highly aggregated in areas that matter, for instance in the external sector. Imports are modelled as "Fuel" and "Non Fuel" whereas there can be a more meaningful breakdown of non fuel imports, for example imports of consumer goods, capital goods and so on. Exports, on the other hand, are not disaggregated at all and treated as exogenous. In particular, no attempt is made to model the export of manufactured goods which will clearly be endogenous in such a model, particularly under conditions of "restructuring" where emphasis is being placed precisely on areas like this one.

There are a few qualities of the UNDP model which are worthy of note. Generally, the glaring inconsistencies present in the Hilaire *et al.* model are avoided here. This model, for instance, counts 104 identities among the 113 equations it contains, which is a far different cry from the Hilaire *et al.* model. The specification of the 9 behavioural equations shows a more imaginative application of (traditional) theory than he previous one: the private consumption function, for instance, is dependent on both wage income an profits, the price equation specifically models the rate of inflation and not the level of the consumer price index and so on.

Yet the model remains inadequate as the following illustration of its forecasting performance emphasises forcefully. The table below compares the forecasts of the

growth rates of constant price GDP for the years 1990 to 1993 for Jamaica obtained from the UNDP model with the actual values as determined by the Statistical Institute of Jamaica (STATIN):

Comparison of Forecast and Actual Values of Growth Rate of Constant Price GDP 1990 - 1993: UNDP Model of Jamaica

	1990	1991	1992	1993
UNDP	2.5%	2.6%	1.1%	1.6%
STATIN	5.4%	0.5%	1.3%	1.2%

The forecasts for 1990 and 1991 are cause for the greatest concern not only because of the huge size of the errors but because these two years are closest to the experience of the historical data used to fit the model. Clearly, there may be many other reasons for the disparity between the actual values and forecasts, but the incontrovertible fact is that this model appeared to fit the data well on the basis of the standard criteria.

What kind of Model for Forecasting in the English Speaking Caribbean?

Assuming that it is cost effective to have reliable macroeconometric forecasts on which both the public and private sector organisations in the English speaking Caribbean can base policy decisions, there still remains the problem of the best (most cost effective) manner in which this can be achieved. The following alternative possibilities will have to be evaluated:

Alternative A a prototype model taking into account the general features of Caribbean type economies but flexible enough, say, to account for varying oil prices in Trinidad & Tobago and varying banana prices in the Windward Islands. The model, once adapted to the circumstances of a particular country, will become a model of that country alone. This is similar in spirit to the model of Worrell and Holder (1987) but may not at all resemble that particular prototype.

Alternative B a single model of the region which will take into account individual differences along the lines of "Pooling Data" methods similar to the IMF type models of Haque *et al.* (1990) and Leon and Samuel (1994).

Alternative C individual models tailor-made for each individual territories with at best a model of the type described under Alternative B for well defined sub groupings

The author's subjective ranking of these three alternatives is A followed by B followed by C. Alternative A takes into account the similarities as well as the very real differences that exist between the various countries making up the English speaking Caribbean.

Alternative B assumes that the similarities are much more noteworthy than the differences, an assumption that was roundly rejected by Watson (1993) in a study involving the OECS countries which, on *a priori* grounds, would be the most homogenous grouping in the region. Alternative C, finally, attaches too great an importance to the differences and the modelling effort following this alternative will very likely involve a monumental waste of resources due to duplication of effort.

It was shown above that the limited forecasting experience of both these models leave a lot to be desired. This raises the whole question of the practical validity of macroeconometric models in the Caribbean context and, of whether or not other kinds of models are not more appropriate. One possible alternative is the "accounting" type models such as the one proposed by Bruce (1987) for the more data deficient countries of the Caribbean and which bears a striking resemblance, at least in spirit, to the Revised Minimum Standard Model of the World Bank (Tims and Waelbroeck (1982), ch. 2). Another alternative is to look in the direction of the more elaborate Computable General Equilibrium (C.G.E.) models which, although not requiring a lengthy time series, presupposes the existence of a recent Social Accounting Matrix which, at the moment, exists in no English speaking Caribbean country. It would be necessary to evaluate these alternatives against the macroeconometric model.

Conclusion

To a large extent, macroeconometric forecasting in the English speaking Caribbean is still in its embryonic stages. The many models that have been constructed have either not been used consistently and, when they have been used, it has not been with any great amount of success. It is quite likely that this is fundamentally the result of a miscalculation of the resources required to produce good forecasts on an ongoing basis: this would explain both the inadequacy of the models themselves as well the lack of use to which they are put.

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