ESTIMATION OF SAVINGS FUNCTIONS

FOR THE

ORGANISATION OF EASTERN CARIBBEAN STATES

(AND THE DANGERS OF THE INAPPROPRIATE USE OF PANEL DATA METHODS)

by

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Summary

The principal concern of this paper is the econometric estimation of savings functions for the Organisation of Eastern Caribbean States (O.E.C.S.). A major concern is the examination of the validity of the McKinnon-Shaw hypothesis which predicts that savings responds positively to increased interest rates.

The econometric methods used are also of fundamental importance to this paper. Wheras it is tempting to use panel data methods as is so often done in similar studies, it is found that these methods are largely inappropriate in the current context and that straightforward estimation by Ordinary Least Squares gives much better and reliable results despite the short series used. This should serve as a warning to those who fashion economic policy in the O.E.C.S. and other countries to be very wary of uncritically formulating policies based on econometric models using panel data unless the necessary pre testing is done to confirm the validity of these methods.

1. Introduction

When it was first decided to undertake this study of savings functions in the Organisation of Eastern Caribbean States (O.E.C.S.), it appeared quite natural to consider the application of panel data econometric methods. On the surface, this grouping appears to be a natural setting for the application of such methods: it consists of seven (7) English speaking micro states of the Commonwealth Caribbean[1] - Antigua & Barbuda, Dominica, Grenada, Montserrat, St. Kitts & Nevis, St. Lucia and St. Vincent & the Grenadines. All countries use the same currency - the Eastern Caribbean (EC) dollar - and are all served by the same Monetary Authority - the Eastern Caribbean Central Bank (ECCB). Despite this, as will be illustrated in the body of this article, panel data methods for the estimation of savings functions proved to be very inadequate and indeed, if the results obtained are accepted without proper analysis and testing, would lead to completely erroneous policy prescriptions for the individual countries.

It has become quite fashionable indeed to use panel data (or the pooling of Cross Section and Time Series Data, or just pooled data) covering, in many cases, a wide cross section of countries whose principal (if not only) common feature is that they share some loosely defined characteristic such as being "developing" or "Asian". Furthermore, it is not unusual for these studies to be conducted in the absence of any rigorous testing procedures to establish whether or not assumptions underlying the application of the econometric methods associated with such data have been validated. Notwithstanding this, such studies are used to derive weighty policy prescriptions involving key variables like interest rates as for instance in Fry [7], [8] and Giovannini [11]. Finally, it is quite disturbing that many such studies appear to be undertaken by technocrats and researchers employed by multilateral organisations like the International Monetary Fund and, indeed, some of these studies are reported in quasi official documents of these organisations such as the *Staff Papers*, for instance Rossi [19], Blejer and Khan [2] and Greene and Villanueva [12]. There is good reason therefore to expect that such policies - based on econometric analysis which might be faulty - are being implemented.

Whatever the limitations, it is certainly not without interest to study the nature of savings functions in the O.E.C.S. There are some small-to-medium cities in larger metropolitan countries which are larger than all these countries put together, and it is therefore not difficult to appreciate that the resource base of all these countries is extremely narrow. Apart from the tourism sector, this consists largely of agricultural products like spices, sugar cane and bananas. Table 1 gives a brief profile of the individual countries making up the grouping:

[1] All former British colonies with the exception of Montserrat which is still a British colony.

Table 1

Profile of O.E.C.S. Countries 1991*

Country	Area (km^2)	Population	GDP (EC$ million) (1984 prices)	Population Density	Per Capita GDP
Antigua & Barbuda	440	82900	595.03	188.4	7177.7
Dominica	750	71199	273.20	94.9	3837.1
Grenada	340	90700	315.70	266.8	3480.7
Montserrat	100	10999	103.01	110.0	9364.4
St. Kitts & Nevis	270	43000	247.27	159.3	5750.4
St. Lucia	620	136000	748.02	219.4	5500.2
St. Vincent & the Grenadines	340	107600	361.26	316.5	3357.5
Total	2860	542400			

Source: Caribbean Development Bank (Social and Economic Indicators 1991)

* 1989 for Antigua & Barbuda

In 1991, the total population of all seven countries just exceeded half a million. The smallest - Montserrat - had a population of 11 000 living on a land area of 100 km^2 while the population of St. Lucia did not exceed 140 000 for a land area of 620 km^2.

Traditionally, domestic savings in these countries have not been a major preoccupation of policy makers and have tended to display a considerable amount of fluctuations, sometimes even becoming negative. Table 2 attests:

Table 2

Domestic Savings Ratios* in O.E.C.S. Countries 1980-1991 (%)

Year	Antigua & Barbuda	Dominica	Grenada	Montserrat	St. Kitts & Nevis	St. Lucia	St. Vincent & the Grenadines
1980	12.08	-19.70	-4.11	-27.15	7.87	16.48	-11.65
1981	16.49	-10.19	-2.95	-23.25	1.13	9.44	0.71
1982	26.71	2.57	-1.67	-21.56	3.27	6.59	-1.76
1983	25.54	8.67	4.27	-17.24	-7.33	16.03	0.47
1984	11.74	4.08	0.87	-10.50	-2.04	11.18	13.96
1985	10.28	5.07	0.96	-5.62	8.19	12.72	22.55
1986	11.39	17.05	2.31	-2.59	6.84	16.87	19.41
1987	12.92	13.76	8.32	5.83	12.34	12.27	14.80
1988	N.A.	15.06	10.23	13.54	20.41	20.11	23.21
1989	N.A.	8.00	12.90	7.52	26.92	13.47	5.97
1990	N.A.	15.57	14.53	18.62	16.82	16.21	5.94
1991	N.A.	8.63	11.95	5.44	N.A.	12.87	N.A.

Source: Caribbean Development Bank (Social and Economic Indicators 1991)

* Ratio of Domestic Savings to Gross Domestic Product (Market Prices)

Over the years, economic growth and development have been largely dependent on a steady inflow of foreign savings as well as foreign aid. Unfortunately, for a host of reasons, such flows are unlikely to continue in the future - see Aghevli *et al.* [1] and Bourne [3]. Like many other countries of the so-called third world, the O.E.C.S. countries will have to begin to make serious efforts to shore up the domestic savings effort.

It is principally for this reason that his study was undertaken. Some relatively straightforward functions are considered which, among other things, will be used to test the well known McKinnon-Shaw hypothesis on the responsiveness of savings to the (real) rate of interest. As will be seen, the indiscriminate use of panel data methods may lead to completely erroneous conclusions about this hypothesis for the individual countries and may even put in doubt the validity of the conclusions drawn in similar studies by Fry [7], [8] and Giovannini [11] and others where panel data were used.

In the following section (Section 2), there is a brief discussion about interest rates in the O.E.C.S.. This is included largely because of the focus in this paper on the impact of interest rates on savings behaviour. The model(s), the data and the econometric methodology are discussed in Section 3 while in Section 4, the results obtained are analysed in some detail. In Section 5 the paper is concluded.

2. Interest Rates in the O.E.C.S.

The potential of an active interest rate policy for the mobilisation of domestic savings is of central importance to the current study. However, the causal link between the two variables is not without controversy especially in the context of so-called developing economies like those comprising the O.E.C.S. Classical economists like Wicksell [23] firmly believed that the interest rate was the most important determinant of savings but Keynesian theory (Keynes [15]) which quickly established itself as the new orthodoxy, greatly de-emphasised its importance. For economies like those of the O.E.C.S., the Keynesian viewpoint is even more acceptable on *a priori* grounds because of the marked absence of organised financial markets which militate strongly against any possible potential of an active interest rate policy aimed at the mobilisation of savings.

Feldstein [6] was among the first to challenge the empirical validity of the econometric results tending to confirm the Keynesian hypothesis for both developed and developing economies. It was his contention that the use of nominal as opposed to real interest rates in these studies was tantamount to model misspecification and tended to bias results in favour of the Keynesian viewpoint. It was however the seminal works of McKinnon [17] and Shaw [20] which generated a flurry of theoretical and empirical studies with special emphasis on developing countries. One of the most important claims of these authors is that artificially low real interest rates discourage both saving *and* investment and even results in inefficient use of investible funds. The financial system should therefore be "liberalised" to allow for higher nominal and positive real rates of interest.

In Table 3, data on inflation rates (based on the Consumer Price Index) and a representative interest rate - the 12 month deposit rate of interest - are given for all O.E.C.S. countries. High inflation rates and relatively low to moderate nominal interest rates of the 70s (and corresponding negative real interest rates) carried over into the early years of the 80s. Due largely to slowdown in economic activity, inflation rates gradually subsided and, although there was virtually no movement in nominal interest rates (reflecting little if any active interest rate policy) real interest rates were more frequently positive in the later years of the 80s and the 90s (though this appears to be more by accident than design).

Table 3

Inflation and 12 Month Deposit Interest Rates in O.E.C.S. Countries 1980-1991 (%)

Antigua & Barbuda

	Inflation Rate	Interest Rate (Lower Bound)	Interest Rate (Upper Bound)
1980	19.16	4.50	7.50
1981	11.46	7.00	8.50
1982	4.17	6.00	8.50
1983	2.35	7.50	13.00
1984	3.80	7.00	13.00
1985	-2.00	4.75	8.50
1986	0.50	4.00	8.25
1987	3.60	4.00	7.50
1988	6.80	4.00	7.50
1989	3.70	4.00	10.00
1990	7.00	4.00	10.00
1991			

Dominica

	Inflation Rate	Interest Rate (Lower Bound)	Interest Rate (Upper Bound)
	32.70	4.00	5.00
	13.30	4.00	6.00
	4.40	6.00	6.00
	4.10	5.50	6.00
	2.20	5.50	6.00
	2.10	5.50	6.00
	3.04	4.00	6.00
	4.80	3.50	6.00
	2.20	3.50	6.00
	6.30	3.50	6.00
	2.50	3.50	7.00
	5.90	3.50	7.00

Grenada

	Inflation Rate	Interest Rate (Lower Bound)	Interest Rate (Upper Bound)
1980	21.10	3.00	5.50
1981	18.82	3.50	5.50
1982	6.60	3.00	5.00
1983	6.14	4.00	7.00
1984	5.60	4.00	8.00
1985	2.50	4.00	8.00
1986	0.60	4.00	7.50
1987	-0.90	4.00	6.50
1988	6.50	4.00	6.00
1989	5.60	4.00	7.00
1990	2.60	4.00	8.00
1991	2.60	4.00	7.00

Montserrat

	Inflation Rate	Interest Rate (Lower Bound)	Interest Rate (Upper Bound)
	2.98	3.50	3.50
	7.10	3.50	5.50
	9.80	3.50	5.50
	4.66	3.50	5.50
	5.50	3.50	5.50
	2.70	4.00	5.50
	3.10	4.00	5.50
	3.70	4.00	6.00
	4.10	4.00	6.00
	1.80	4.00	7.50
	6.80	4.00	7.00

St. Kitts & Nevis

	Inflation Rate	Interest Rate (Lower Bound)	Interest Rate (Upper Bound)
1980	17.83	4.50	7.00
1981	10.37	5.50	7.00
1982	5.94	5.50	7.00
1983	2.28	5.50	7.00
1984	2.70	5.50	7.00
1985	2.24	5.00	8.00
1986	0.40	4.00	7.00
1987	0.92	4.00	6.50
1988	0.23	4.00	8.00
1989	5.40	4.50	9.00
1990	4.20	4.50	9.00

St. Lucia

	Inflation Rate	Interest Rate (Lower Bound)	Interest Rate (Upper Bound)
	21.18	6.00	7.50
	9.40	8.00	9.00
	0.61	8.00	9.00
	1.31	7.50	10.00
	1.19	7.50	10.00
	0.00	3.30	10.00
	2.16	2.75	10.00
	7.01	4.00	6.00
	0.81	4.00	6.50
	4.36	4.00	6.50
	4.30	4 00	7.00
	6.00	4.00	7.00

St. Vincent

	Inflation Rate	Interest Rate (Lower Bound)	Interest Rate (Upper Bound)
1980	17.22	3.50	5.50
1981	12.69	3.50	6.00
1982	7.32	4.00	8.00
1983	5.42	4.50	7.50
1984	2.74	4.50	7.50
1985	1.30	4.00	6.50
1986	1.60	4.00	6.50
1987	3.40	4.00	5.50
1988	2.10	3.50	5.50
1989	3.50	3.50	5.50
1990	9.20	3.50	4.75
1991	2.30	3.50	5.50

Source: Caribbean Development Bank (Social and Economic Indicators 1991) and Eastern Caribbean Central Bank (Quarterly Commercial Banking Statistics)

The above data tend to indicate the presence of "financial repression" (in the McKinnon-Shaw terminology) which is typical of other Caribbean countries over the same period. One such case is that of Trinidad & Tobago where Watson [22] confirms the financial liberalisation hypothesis and also shows that artificially low rates may even result in lower rates of economic growth. Fry [7], [8] and [9] has also published a series of papers which tend to confirm this hypothesis for other countries. There is, however, no unanimity on the matter: Giovannini [11], for instance, is very critical of Fry's work and uses the same data to arrive at the opposite conclusion. It is interesting to note, *en passant*, that both Fry and Giovannini use panel data without rigorous justification for the use of such data.

3. The Models, Data and Econometric Methodology

The Models

Two (2) distinct models of the savings function will be presented here. The first, which will be referred to as **Model 1** is

$$S_d = \alpha_0 + \alpha_1 Y + \alpha_2 S_f + \alpha_3 i_r \qquad (1)$$

In this model, S_d is the level of domestic savings, Y is the level Gross Domestic Product (GDP), S_f the level of foreign savings and i_r a measure of the real rate of interest which, in this paper is calculated as

$$i_r = \frac{(1 + i_n)}{(1 + \pi)} - 1$$

where i_n is the nominal 12 month deposit rate of interest and π the rate of inflation based on the Consumer Price Index. S_d, Y and S_f are all measured at constant (1984) prices.

The second model, which will be referred to as **Model 2** is

$$s_d = \beta_0 + \beta_1 y + \alpha_2 s_f + \alpha_3 i_r \qquad (2)$$

In this model, s_d and s_f are, respectively, the ratio of domestic savings to GDP (the average propensity to save), and the ratio of foreign savings to GDP, and y is the natural logarithm of per capita GDP (at constant prices)

It should be abundantly clear from the outset that these two models are non nested (to use the Hendry type terminology associated with "General to Specific" modelling) and are not in any way intended to be specific instances of some more general savings function (whether or not such a general function exists). Despite their obvious resemblances, Model 1 can be regarded as an attempt to explain the level of savings while Model 2 looks more specifically at the Average Propensity to Save.

The inclusion on the right hand side of each model of the interest rate variable has already been justified in the previous section. The McKinnon-Shaw hypothesis will be verified if α_3 (in Model 1) and β_3 (in Model 2) are positive and significant.

The inclusion of income type variables hardly needs justification and, at least since the publication of Keynes' *General Theory* is generally taken in one form or another to be a major determinant of savings. In Model 1, α_1 can be interpreted as the marginal propensity to save and should be a positive fraction. In Model 2, $\frac{\beta_1}{100}$ measures the

response of the Average Propensity to Save to a 1% change in per capita income. β_1 should be positive since theory predicts that the Average Propensity to Consume declines when income rises.

The inclusion of the foreign savings variable is not unusual in the literature relating to developing economies and it is argued in Grinols and Bhagwati [13], for instance, that such foreign inflows tend to discourage the domestic savings effort, especially (as is very likely to be the case for the economies under consideration here) if they have a direct impact on the government budget surplus/deficit. In Model 1, α_2, which measures the responsiveness of domestic savings to a unit change in foreign inflows is therefore expected to be negative and likewise for β_2 in Model 2, where $\frac{\beta_2}{100}$ measures the response of the Average Propensity to Save to a 1% change in the foreign savings ratio.

Data

Data on the 12 month deposit rate of interest were obtained from various publications of the *Quarterly Commercial Banking Statistics* published by the Eastern Caribbean Central Bank. The other data were obtained directly or derived from the Caribbean Development Bank's *Social and Economic Indicators 1991*. In the absence of appropriate deflators, all data were deflated by the Consumer Price Index (rebased, where necessary, to 1984). The most coherent set of data was available for the period 1980 - 1990 for all countries except Antigua & Barbuda which only had data covering the period 1980 - 1987. It unfortunately turned out that, in addition to being the shortest series, the data from Antigua & Barbuda were quite unreliable. In the econometric analysis in the following section, this country was therefore excluded.

Econometric Methodology

To a large extent, the methodology employed in this section is an application of Hendry's General-to-Specific Modelling approach to (separately) models 1 and 2 (refer to Gilbert [10] or Charemza and Deadman [5], chs. 3-4, for a discussion of this methodology). What may appear as different estimation methods applied to the same model are nothing more than special estimation methods applied to specific cases of a more general model. These specific cases imply very definite restrictions on the general model and, in the interest of intellectual rigour, these restrictions must be properly tested.

The most general form of the model (either 1 or 2) is each of equations 1 or 2 taken separately for each country (there is no pooling of the data at all). The appropriate estimation method is then Ordinary Least Squares (OLS) applied to the data of each country. We shall refer to this approach as the OLS version of the model.

At a less general level, if we impose the restriction that the slope coefficients are identical for all countries but that the intercepts differ, we obtain the so-called "Within" or "LSDV"

version of the model if we also assume that the "individual" effects as measured by the different intercepts are fixed (hence the term "Fixed Effects" model which appears frequently in the literature). Once again, the appropriate estimation procedure is OLS, applied this time to the pooled data with due cognisance taken of the different intercepts. This is by far the most popular panel data model appearing in the literature and a particular concern of this paper will be the comparison of results obtained from it with the OLS version.

If the individual variation is random, then we obtain the so called Random Effects version of the model and the appropriate estimation procedure is a Generalised Least Squares (GLS) approach applied to the pooled data. It can be shown that, for very long time series or for very large individual variations, the random effects version approximates the fixed effects version of the model.

The most restricted form of the model is obtained if we assume that there is no individual (or temporal) effect whatsoever and that equations 1 or 2 are immediately applicable to each individual country with intercepts and slopes equal. OLS may be applied here too and, for want of a more appropriate term, we will refer to this version as the Pooled (OLS) version of the model. That this is a special case of the LSDV version is quite obvious and it can also be shown (it is also intuitively obvious) that it is the limiting case of the random effects version when the individual variation tends to zero.

If a particular set of restrictions is true, then there is potentially a great deal to be gained in terms of efficiency[2] by application of the Panel Data methods rather than the individual OLS exercises applied to each individual country. In the particular case under consideration, where there are only 11 data points for each country, there will be a marked improvement in the efficiency of the estimation procedure resulting from the any justification for pooling will be most welcome, but such justification must be rigorously obtained.

A battery of tests will be applied to establish

1. whether or not the data should be pooled
2. in the event that a decision is made to pool the data, which particular pooling procedure should be employed

A standard F statistic (identical to those used for testing linear restrictions in the General Linear Regression Model - see Kmenta [16], ch. 10) may be used to test the LSDV version against the OLS version (in what follows, we will refer to this statistic as F_A) Another (F_B) may be used to test the Pooled (OLS) against the OLS version and, yet another (F_C) may be used to test for the equality of the intercepts and to determine whether the LSDV model is (or is not) more appropriate than the Pooled (OLS) version. A Hausman [14] statistic can be used to discriminate between the Random Effects and the

[2]Degrees of Freedom will be increased manifold.

LSDV versions while a statistic devised by Breusch and Pagan [4] may be used to test the random effects against the Pooled (OLS) version. Both the Hausman and Breusch-Pagan statistics are χ^2 and their use in panel data models is discussed in Kmenta [16], ch.12.

It may be argued that the length of the time series for each individual country being used in this study may be too short to allow for uncritical application of the above tests, and there is merit in this argument. It is for this reason that, in addition, the more traditional test statistics ($\bar{R}^2$, F, T and Durbin-Watson statistics) will also be used to judge the quality of the results. For easy comparison with the OLS version of the model, these statistics will be simulated for the individual countries using the results obtained from the panel data methods. Furthermore, the following more "descriptive" statistics will be used to compare "predicted" values of Domestic Savings (obtained from solving the various versions of the model) with the actual values:

CC = Correlation Coefficient between Actual Values and Predicted
RC = Regression Coefficient of Actual Values on Predicted
U = Theil's Inequality Coefficient
U_1 = Fraction of Error due to Bias
U_2 = Fraction of Error due to difference of Regression Coefficient from unity
U_3 = Fraction of Error due to Residual Variance

Ideal values are CC =1, RC = 1 and U = 0. The statistics , U_1, U_2 and U_3 represent the decomposition of the Mean Square Error and are due to Theil [21]. For a "perfect" fit, U_1 =0, U_2 = 0 and = U_3 = 1. These statistics, together with supporting graphical plots of the actual and predicted values, may also be used to judge the potential of the various versions of the model as forecasting tools..

4. Results

Model 1

The results based on the estimation and solution of the various versions of Model 1 are presented in summary form in, respectively, Tables 4 and 5:

Table 4

Model 1: Summary Results of Estimation Exercise

$$S_d = \alpha_0 + \alpha_1 Y + \alpha_2 S_f + \alpha_3 i_r$$

		α_1	α_2	α_3	$\bar{R}^2$	D.W.	F
Pooled (OLS)		0.203	-0.208	119.4	0.801		88.5
		(14.4)	(2.86)	(2.58)			
LSDV		0.231	-0.127	106.9	0.814		36.5
		(10.4)	(1.61)	(2.32)			
Random Effects		0.207	-0.184	114.1	0.749		73.2
		(13.3)	(2.56)	(2.52)			
Dominica		0.349	-0.338	63.58			
	a.	(9.42)	(4.32)	(1.44)	0.956	2.23	73.3
	b.	(2.79)	(1.33)	(1.39)	0.831	1.07	17.4
	c.	(3.13)	(0.813)	(1.22)	0.823	1.37	16.8
Grenada		0.329	0.009	24.99			
	a.	(5.70)	(0.041)	(0.420)	0.858	1.17	21.2
	b.	(1.76)	(0.469)	(1.00)	0.434	0.362	3.55
	c.	(2.90)	(0.422)	(1.30)	0.736	0.687	10.3
Montserrat		0.929	-0.415	-5.07			
	a.	(18.3)	(5.93)	(0.129)	0.977	1.53	144.9
	b.	(0.638)	(0.466)	(0.485)	0.117	0.461	1.44
	c.	(0.800)	(0.318)	(0.478)	0.270	0.486	2.23
St. Kitts & Nevis		0.363	0.206	-156.5			
	a.	(4.03)	(0.787)	(1.79)	0.869	2.38	23.2
	b.	(0.890)	(0.308)	(0.528)	0.165	0.655	1.66
	c.	(1.26)	(0.237)	(0.585)	0.455	0.925	3.78
St. Lucia		0.166	-0.252	-123.0			
	a.	(5.26)	(1.61)	(1.07)	0.827	2.95	16.9
	b.	(4.60)	(0.937)	(0.748)	0.665	1.47	7.63
	c.	(5.01)	(0.556)	(0.640)	0.633	1.56	6.75
St. Vincent		0.408	-1.16	-303.0			
	a.	(10.2)	(9.42)	(3.28)	0.967	2.09	99.9
	b.	(1.41)	0.459)	(0.359)	0.578	1.44	5.67
	c.	(1.46)	(0.261)	(0.294)	0.495	1.43	4.27

Notes

F_A (15, 42) = 7.63
F_B (20, 42) = 6.97
F_C (5, 57) = 1.82
Breusch-Pagan Statistic = 0.017
Hausman Statistic = 5.72

a = Statistics associated with OLS
b = Simulated statistics based on Pooled (OLS)
c = Simulated statistics based on LSDV
T statistics are in parentheses

Table 5

Model 1: Summary Results of Model Solution

	CC	RC	U	U_1	U_2	U_3
Dominica:						
Pooled (OLS)	0.972	1.33	0.270	0.012	0.505	0.483
LSDV	0.973	1.35	0.273	0.006	0.543	0.451
Random Effects	0.974	1.36	0.271	0.002	0.566	0.431
OLS	0.983	1.01	0.145	0.000	0.003	0.997
Grenada:						
Pooled (OLS)	0.896	1.23	0.457	0.288	0.091	0.622
LSDV	0.925	1.23	0.339	0.002	0.170	0.828
Random Effects	0.905	1.25	0.424	0.219	0.117	0.664
OLS	0.962	1.02	0.222	0.001	0.005	0.994
Montserrat						
Pooled (OLS)	0.667	2.41	0.882	0.096	0.194	0.710
LSDV	0.865	2.87	0.756	0.013	0.551	0.436
Random Effects	0.716	2.68	0.878	0.113	0.259	0.628
OLS	0.992	1.01	0.125	0.000	0.003	0.998
St. Kitts & Nevis:						
Pooled (OLS)	0.807	1.80	0.578	0.137	0.233	0.631
LSDV	0.860	1.53	0.459	0.000	0.252	0.748
Random Effects	0.824	1.76	0.548	0.100	0.254	0.646
OLS	0.954	0.986	0.232	0.000	0.002	0.998
St. Lucia:						
Pooled (OLS)	0.933	0.862	0.196	0.002	0.146	0.852
LSDV	0.936	0.807	0.209	0.003	0.288	0.709
Random Effects	0.934	0.856	0.196	0.011	0.161	0.828
OLS	0.950	1.01	0.156	0.000	0.001	0.999
St. Vincent:						
Pooled (OLS)	0.882	1.46	0.398	0.000	0.261	0.739
LSDV	0.820	1.32	0.440	0.000	0.107	0.893
Random Effects	0.869	1.45	0.409	0.000	0.230	0.770
OLS	0.988	1.00	0.110	0.000	0.107	0.893

The F_A and F_B statistics convincingly reject the restrictions implied by the LSDV and Pooled (OLS) versions of the model in favour of the unrestricted OLS version. Since the Breusch-Pagan statistic is indicating no significant difference between the random effects and the Pooled (OLS) model, this too is rejected in favour of the OLS version. The overwhelming superiority of the OLS version is further emphasised, firstly, by comparison of the standard statistics ($\overline{R}^2$, F, T and Durbin-Watson statistics) generated by this version with those simulated from the versions based on panel data methods and, secondly, by the results presented in Table 5 which attest more particularly to the potential of the various versions of the model as forecasting tools. Graphs of the actual and predicted values based on the solution of the various versions of model 1 are presented in Appendix A for each country as Figures A1 to A6. Visual inspection of these graphs tend only to reconfirm the fundamental result that the OLS version systematically outpoints all the others especially as a forecasting tool.

What are the consequences for economic policy in the individual countries of ignoring this conclusion? Even a cursory glance at the results in Table 4 is enough to indicate that these consequences might be quite serious. Firstly, the estimated coefficients for the individual countries are markedly different from each other and from the those obtained from the panel data methods. Secondly, and perhaps most significantly, the panel data methods would lead to non rejection of the McKinnon-Shaw hypothesis: α_3 is positive and significant in all 3 cases considered. But based on the OLS result, this hypothesis is rejected in all cases: α_3 is significant only in the case of St. Vincent & the Grenadines where it is also negative and, in three other cases (Montserrat, St. Kitts & Nevis and St. Lucia), it is negative in addition to being insignificant. Thirdly, the marginal propensity to save out of income would be roughly 20% in each country if the panel data results are uncritically accepted while, based on OLS estimation of individual country cases, this coefficient varies dramatically from one case to the next. Finally, the influence of foreign savings clearly differs depending on the case in question: whereas it carries the predicted negative sign for the panel data methods and is significant in two of the three cases considered, when the OLS results for the individual cases are considered, it is positive and insignificant in two cases (Grenada and St. Kitts & Nevis) and is not significant in the case of St. Lucia. For Montserrat and St. Vincent & the Grenadines, however, they are very significant and, in the latter case, domestic savings decrease by $1.16 for every $1.00 of foreign inflows.

Apart from being preferred to the panel data methods in the current exercise, the OLS results are quite good in their own right: the D.W. statistic indicates the absence of serial correlation while the $\overline{R}^2$ and F statistics indicate reasonably high quality goodness of fit. The values of the marginal propensity to save, though, may cause us some misgivings, especially in the case of Montserrat where it climbs to as high as 93%. It must be remembered, however, that over the period of the study (and before that), a vast amount of the spending power of these countries flowed in from outside in the form of gifts, aid and other "unrequited" transfers which do not enter into the measure of Gross Domestic Product used here. Indeed, accompanying these high coefficients are the correspondingly high <u>negative</u> values for the coefficient of foreign inflows.

The most important policy lesson is that the domestic savings effort of the individual countries comprising the O.E.C.S. would not, in the current circumstances, benefit from an active interest rate policy (the opposite conclusion would follow if the panel data methods were uncritically accepted). In the case of St. Vincent & the Grenadines, it would actually result in a weakening of this effort since the (negative) income effect of an interest rate change seems to be stronger than the (positive) substitution effect.

Model 2

The results based on the estimation and solution of the various versions of Model 2 are presented in summary form in, respectively, Tables 6 and 7. Graphs depicting the evolution of domestic savings for the different countries based on the solution of the various versions of the model are displayed in Appendix B as Figures B1 to B6.

Table 6

Model 2: Summary Results of Estimation Exercise

$$s_d = \beta_0 + \beta_1 y + \alpha_2 s_f + \alpha_3 i_r$$

		β_1	β_2	β_3	$\bar{R}^2$	D.W.	F
Pooled		0.041	-0.581	0.055	0.576		30.5
(OLS)		(1.75)	(7.81)	(0.257)			
LSDV		0.173	-0.330	0.146	0.653		16.3
		(4.22)	(3.57)	(0.732)			
Random		0.078	-0.504	0.067	0.485		25.1
Effects		(2.73)	(6.63)	(0.339)			
Dominica		0.168	-0.367	0.283			
	a.	(4.91)	(4.63)	(1.52)	0.961	2.30	83.3
	b.	(0.632)	(3.85)	(0.157)	0.859	0.919	21.4
	c.	(3.89)	(3.20)	(0.604)	0.936	1.64	48.5
Grenada		0.249	-0.081	0.214			
	a.	(2.95)	(0.390)	(0.990)	0.673	1.20	7.86
	b.	(0.326)	(1.87)	(0.171)	0.267	0.859	2.21
	c.	(1.85)	(1.44)	(0.610)	0.600	1.03	6.00
Montserrat		0.733	-0.471	0.218	0.968	1.39	102.4
	a.	(13.3)	(6.08)	(0.500)	0.134	0.230	1.51
	b.	(0.138)	(1.44)	(0.024)	0.378	0.208	3.02
	c.	(0.686)	(0.962)	(0.076)			
St. Kitts &		0.294	-0.062	-0.680			
Nevis	**a.**	(5.91)	(0.276)	(1.95)	0.784	2.31	13.1
	b.	(0.366)	(1.14)	(0.070)	-0.107	0.718	0.679
	c.	(2.35)	(0.987)	(0.283)	5.271	1.40	4.72
St. Lucia		-0.043	-0.267	-0.407			
	a.	(0.731)	(1.98)	(1.94)	0.348	3.01	2.78
	b.	(0.201)	(1.22)	(0.075)	-7.10	0.284	-1.92
	c.	(0.831)	(0.682)	(0.194)	-7.35	0.314	-1.93
St. Vincent		0.071	-1.15	-1.16			
	a.	(1.40)	(6.64)	(2.52)	0.948	1.71	61.6
	b.	(0.447)	(1.85)	(0.066)	0.830	1.15	17.1
	c.	(1.41)	(0.785)	(0.131)	0.695	1.31	8.59

Notes

F_A (15, 42) = 14.0
F_B (20, 42) = 14.7
F_C (5, 57) = 3.74
Breusch-Pagan Statistic = 0.062
Hausman Statistic = 11.7

a = Statistics associated with OLS
b = Simulated statistics based on Pooled (OLS)
c = Simulated statistics based on LSDV
T statistics are in parentheses

Table 7

Model 1: Summary Results of Model Solution

	CC	RC	U	U_1	U_2	U_3
Dominica:						
Pooled (OLS)	0.928	0.997	0.296	0.003	0.000	0.997
LSDV	0.984	1.10	0.157	0.014	0.191	0.795
Random Effects	0.953	1.08	0.250	0.029	0.054	0.918
OLS	0.986	1.02	0.131	0.000	0.008	0.991
Grenada:						
Pooled (OLS)	0.869	1.38	0.467	0.087	0.175	0.738
LSDV	0.935	1.17	0.310	0.013	0.130	0.857
Random Effects	0.898	1.38	0.430	0.095	0.217	0.688
OLS	0.942	1.11	0.285	0.008	0.076	0.916
Montserrat						
Pooled (OLS)	0.431	1.01	0.901	0.003	0.000	0.997
LSDV	0.794	3.03	0.829	0.057	0.408	0.535
Random Effects	0.568	1.50	0.845	0.007	0.050	0.943
OLS	0.990	0.994	0.143	0.000	0.002	0.998
St. Kitts & Nevis:						
Pooled (OLS)	0.688	1.71	0.651	0.133	0.116	0.751
LSDV	0.898	1.19	0.362	0.011	0.097	0.892
Random Effects	0.808	1.61	0.536	0.073	0.197	0.730
OLS	0.939	0.940	0.272	0.000	0.029	0.971
St. Lucia:						
Pooled (OLS)	0.938	0.601	0.357	0.009	0.757	0.234
LSDV	0.952	0.521	0.501	0.143	0.764	0.093
Random Effects	0.945	0.588	0.376	0.035	0.777	0.188
OLS	0.933	1.03	0.180	0.000	0.005	0.994
St. Vincent:						
Pooled (OLS)	0.967	1.31	0.252	0.026	0.431	0.543
LSDV	0.880	1.17	0.357	0.000	0.070	0.930
Random Effects	0.958	1.38	0.304	0.139	0.397	0.465
OLS	0.987	1.03	0.118	0.000	0.032	0.967

In comparing the various versions of this model, conclusions similar in spirit to those drawn in the case of model 1 about the superiority of the OLS version may also be drawn here. Once again, too, the coefficient values obtained by applying OLS to the individual cases are sufficiently distinct from each other and from those obtained by the panel data methods as to make policy prescriptions based on one rather than the other a fairly risky affair.. This time, however, there is greater unanimity in the rejection of the McKinnon-Shaw hypothesis: where the coefficient of the interest rate variable is significant at least at the 10% level (St. Kitts & Nevis, St. Lucia and St. Vincent & the Grenadines) it is also negative. In all other cases, it is not significant.

There is no evidence of serial correlation resulting from OLS estimation in any of the cases and, in most cases, goodness of fit as measured by, $\overline{R}^2$, the F statistics is reasonably good. Even when it is not, as in the case of St. Lucia (where the value of the F statistic is highly unsatisfactory), the statistics based on the solution of the model show that there is still some reasonable predictive power. For instance, Theil's U statistic shows an 18% error and the U_3 statistic is very close to unity (its ideal value). But the St. Lucian case clearly sticks out like a sore thumb for other reasons, in particular that the coefficient of the income variable is both negative and insignificant and great care should be taken in using this result.

Apart from the St. Lucia case, the average propensity to save responds, as predicted by theory, positively to changes in per capita income although it is not significant in the case of St. Vincent & the Grenadines. The most rapid rate of increase in this propensity is in the case of Montserrat where, for a 1% increase in real per capita income, it increases in value by 0.0073 (a relatively high income sensitivity was also reported in the case of Model 1). For the remaining countries, however, the response is more moderate, ranging from 0.0017 for Grenada to 0.0029 for St. Kitts & Nevis.

The effect of foreign savings once again differs across the cases: although this time the corresponding coefficient always carries the correct sign, it is not significant in the case of Grenada and St. Kitts & Nevis. The response is greatest in the case of St. Vincent & he Grenadines where a 1% rise in foreign savings leads to an absolute fall in the value of the average propensity to save of 0.015.

5. Conclusion

There seems, first of all, to be no evidence for the McKinnon-Shaw hypothesis in any of the countries although the uncritical use of the panel data methods would have led to the opposite conclusion in the case of Model 1. Clearly, the policy makers of the O.E.C.S. have to find other policy instruments to assist in the mobilisation of domestic savings, and this may well include the introduction and/or amelioration of the existing financial institutions and instruments. This may well be a useful direction in future research.

There is also the very clear lesson, especially to those of the multilateral lending agencies whose role in policy making is increasing in the Caribbean region, that panel data methods improperly applied may lead to erroneous policy formulation. It is indeed very tempting to use such measures when time series data appear to be lacking (as in he case of the present study) on the very reasonable ground that savings in degrees of freedom will automatically lead to improved efficiency in estimation. Our study has shown that this is clearly not so and that it is dangerous to assume that the homogeneity necessary for the application of such methods can be justified on *a priori* grounds. When such homogeneity is not verified by proper procedures, far from obtaining improved coefficient estimates, we are likely to end up instead with completely misleading results with potentially disastrous implications for policy formulation.

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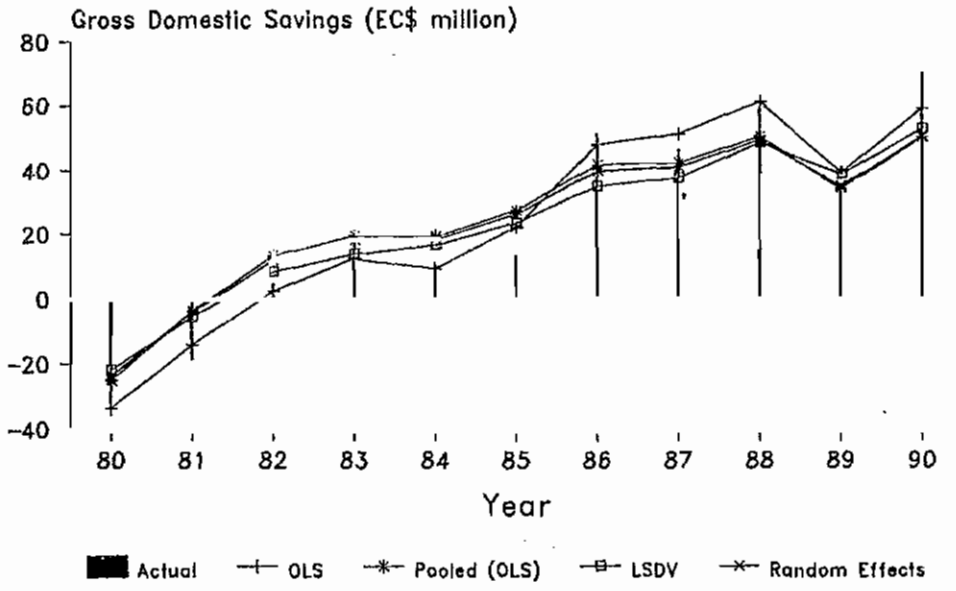
APPENDIX A

Graphical Plots of Actual and Predicted Values Based on Solution of Model 1

Figure A1

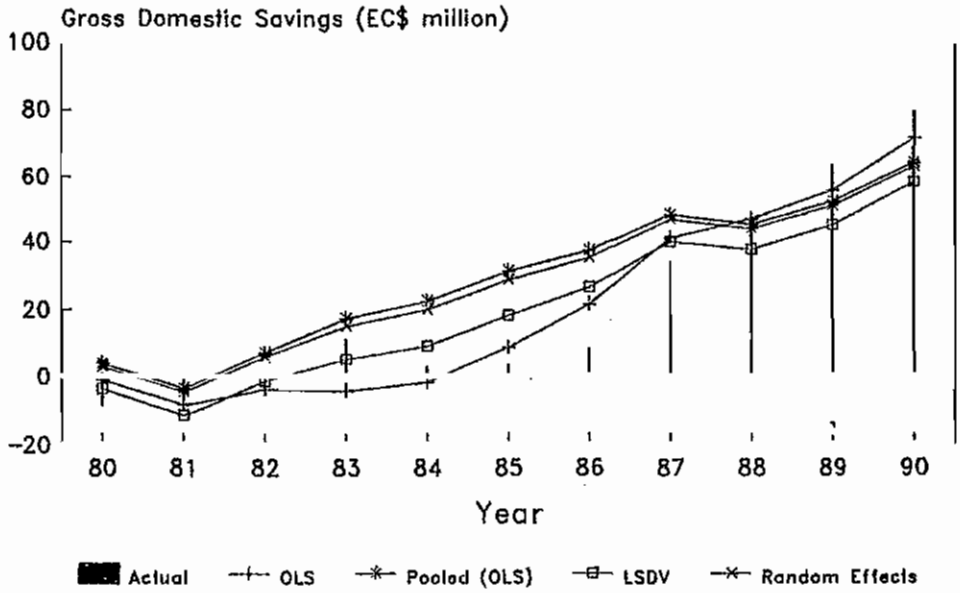
Model 1: Dominica



Comparison of Actual and Predicted

Figure A2

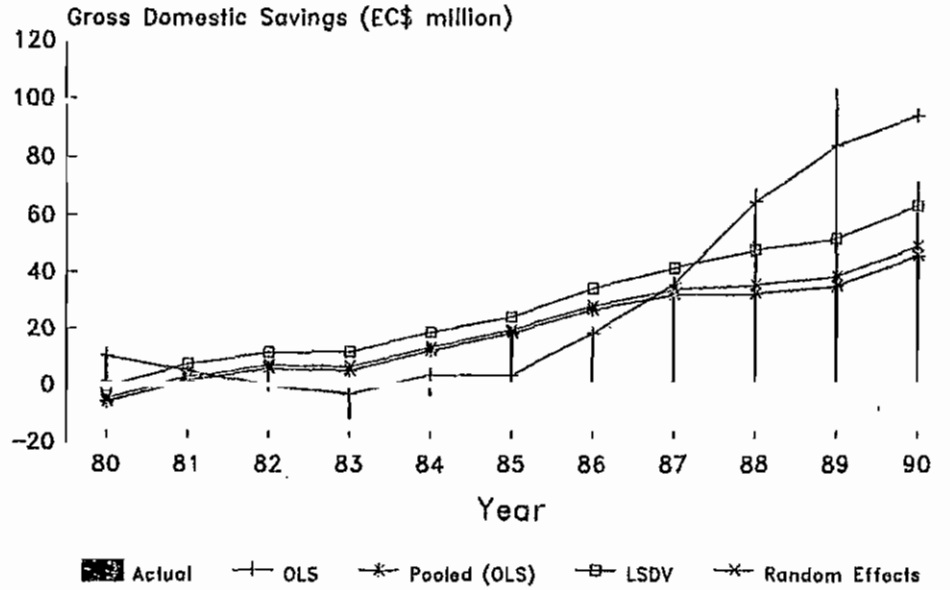
Model 1: Grenada



Comparison of Actual and Predicted

Figure A3

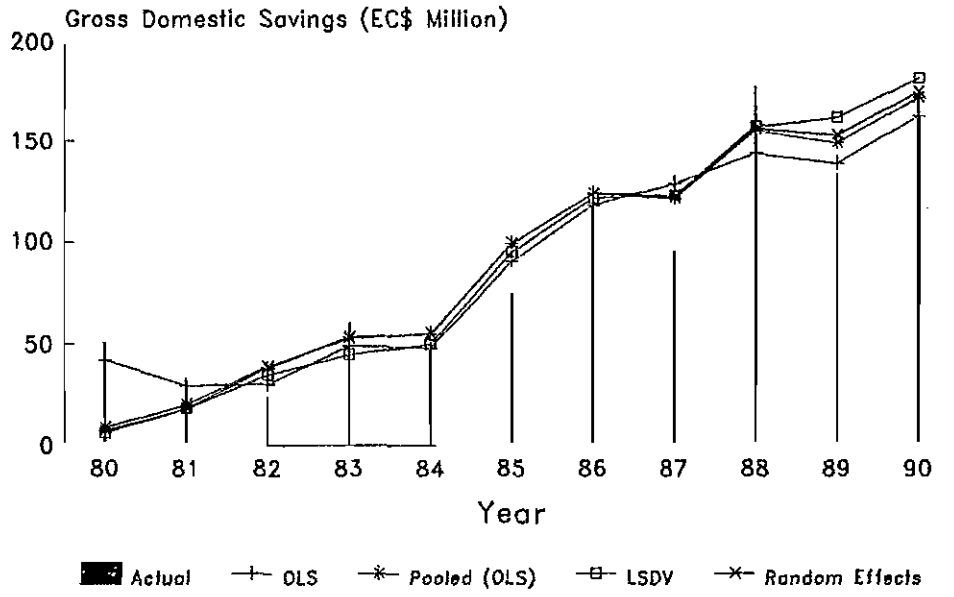
Model 1: St. Kitts & Nevis



Comparison of Actual and Predicted

Figure A4

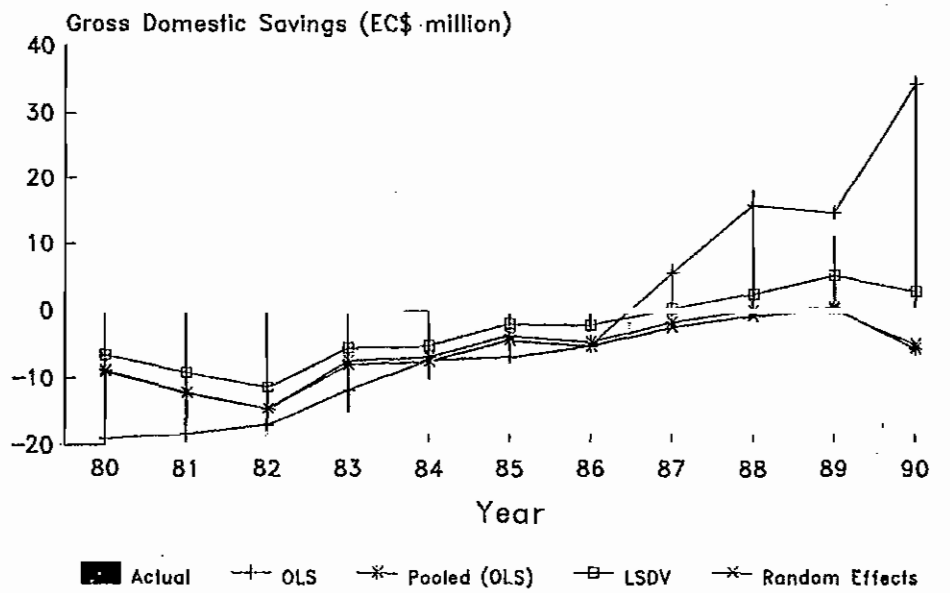
Model 1: St. Lucia



Comparison of Actual and Predicted

Figure A5

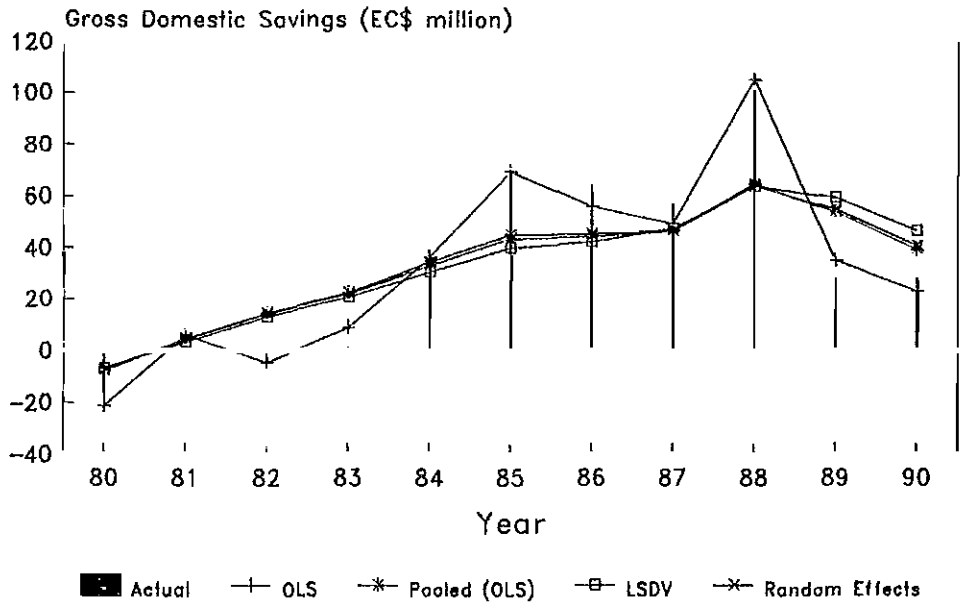
Model 1: Montserrat



Comparison of Actual and Predicted

Figure A6

Model 1: St. Vincent & the Grenadines



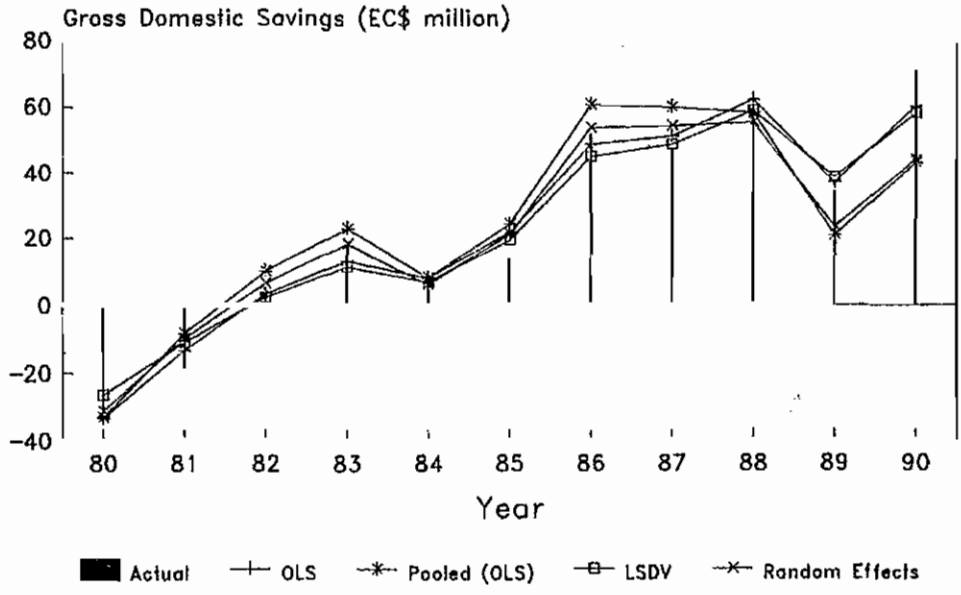
Comparison of Actual and Predicted

APPENDIX B

Graphical Plots of Actual and Predicted Values Based on Solution of Model 2

Figure B1

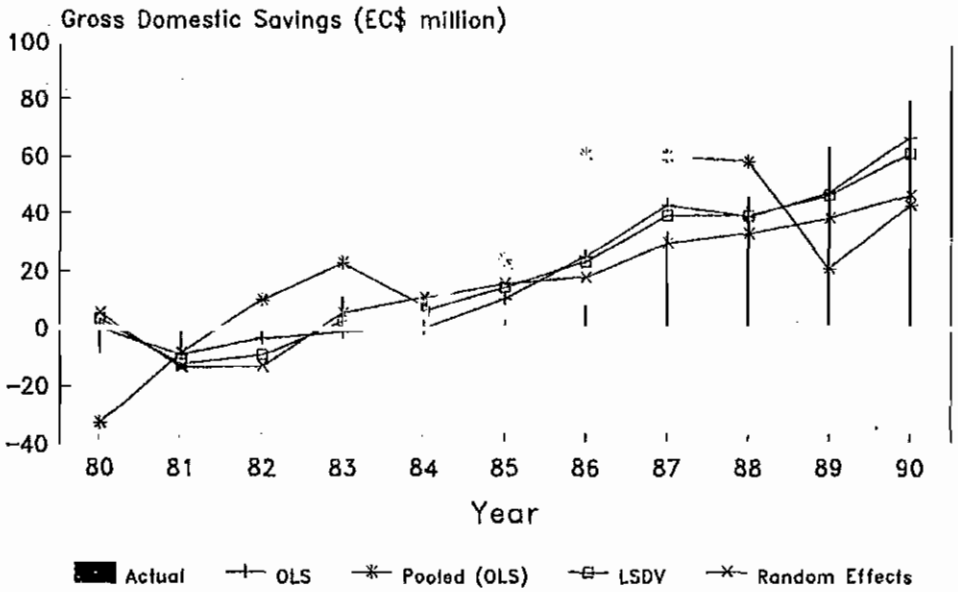
Model 2: Dominica



Comparison of Actual and Predicted

Figure B2

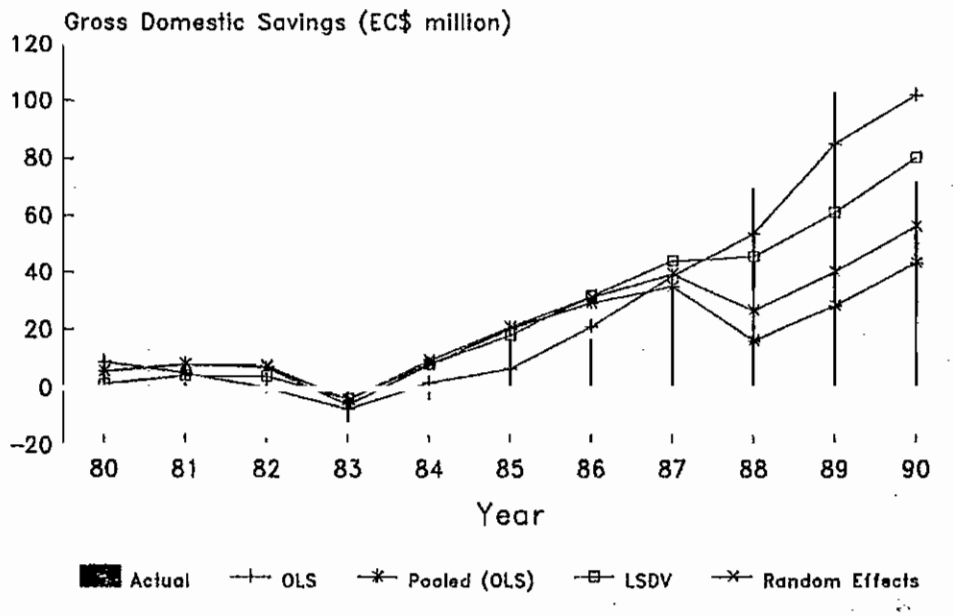
Model 2: Grenada



Comparison of Actual and Predicted

Figure B3

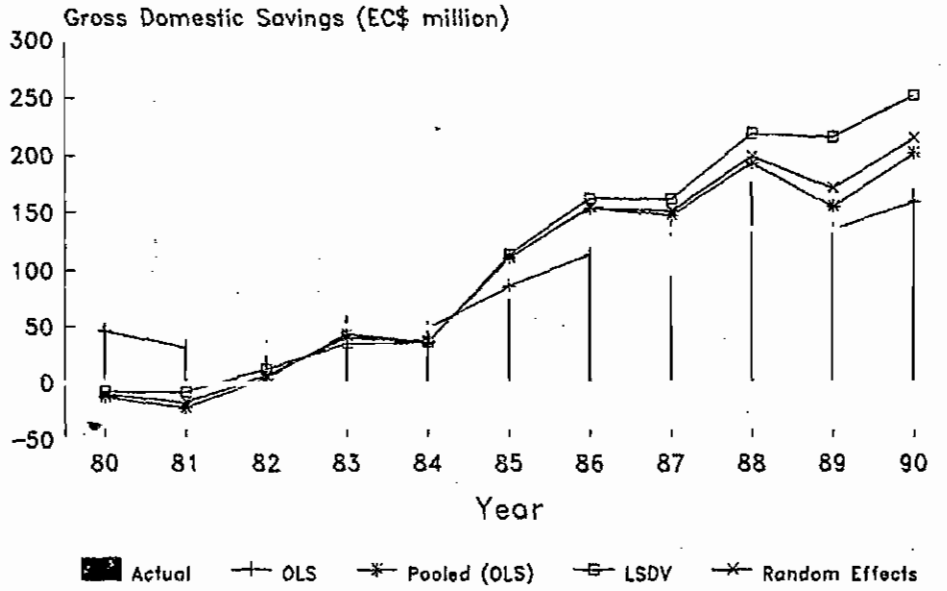
Model 2: St. Kitts & Nevis



Comparison of Actual and Predicted

Figure B4

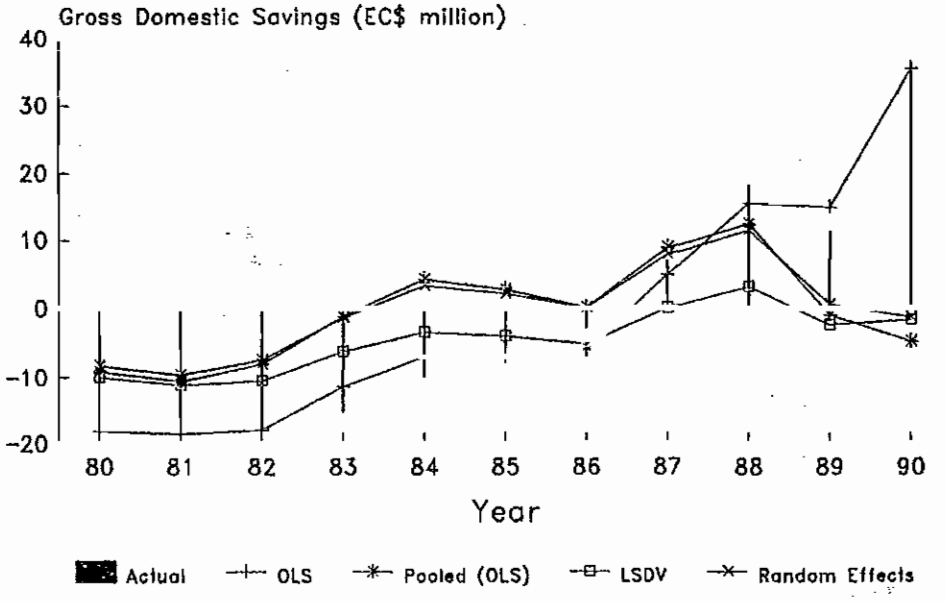
Model 2: St. Lucia



Comparison of Actual and Predicted

Figure B5

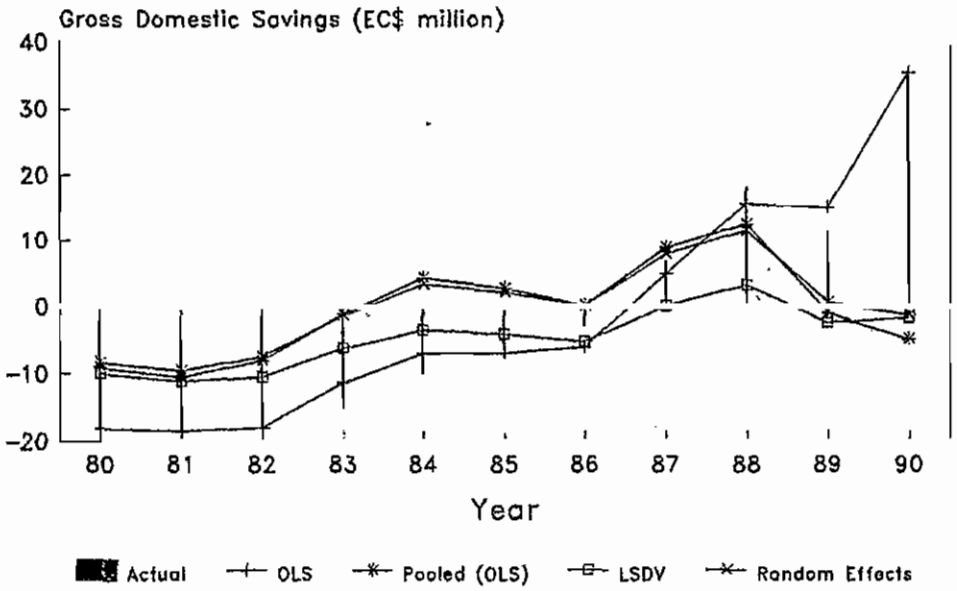
Model 2: Montserrat



Comparison of Actual and Predicted

Figure B5

Model 2: Montserrat



Comparison of Actual and Predicted