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SOCIO-ECONOMIC PLANNING IN AN ERA OF FALLING OIL REVENUES: THE CASE OF VENEZUELA

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Abstract—Falling oil revenues have forced the OPEC countries to adopt a variety of austerity measures. It is often said that socio-economic programs are the first to be cut under these circumstances. This paper examines likely budgetary tradeoffs to determine the validity of this thesis for Venezuela. In particular the paper examines whether the government will be able to sustain (and if so under what conditions) the socio-economic programs established during the period of expanded revenues.

The results of several simulations of the economy using an optimal control, econometric model indicate that without major changes in national priorities (in terms of security vs socio-economic programs) that there are several strategies open to the authorities allowing socio-economic progress to continue over the period to 1990.

INTRODUCTION

Throughout the post-war period until the end of the 1970s Venezuela experienced continuous high economic growth, only broken by a mild recession in the early 1960s. The pace of growth accelerated during the period of expanded government revenues following the first world oil price increases in 1973–1974. However, momentum began to be lost in 1978, and a long period of stagnation commenced the following year as the authorities sharply reduced expenditures as part of a major anti-inflationary program.

The economy continued to experience difficulties as oil revenues declined from their maximum level of $19.1 billion attained in 1981. The country's current economic crisis began in February 1983. At this time the bolivar was devalued through the introduction of a complicated multi-tiered exchange regime, and an elaborate control system was established to disburse preferential dollars for imports and foreign debt payments. At the same time, a moratorium was declared on the amortization of the overseas debt of the public sector, and negotiations were started for the restructuring of these obligations.

Although decision making became somewhat paralyzed due in part to the Presidential elections in December 1983, some progress was made that year in adjusting the economy to lower oil revenues. On the external front, there was a dramatic fall in imports from $13.6 billion to $6.4 billion partly made possible by a rundown of inventories. Largely as a result of this there was an impressive turnaround in the current account of the balance of payments with a surplus of $4.4 billion being attained compared with the previous year's deficit of $4.3 billion despite the further fall in oil exports from $15.7 billion to $13.7 billion. As regards internal balance, the public sector deficit was reduced from 12.3% to 2.2% of GDP due to the profits earned by the state from foreign exchange operations and a large cutback in investment expenditure. All this was however achieved at a substantial cost in terms of domestic output. Real GDP fell by 5% and this together with uncertainty concerning the course of future developments led to unacceptable loss in business confidence.

All indications are that the government will continue to face either falling or at best stagnant oil revenues for the foreseeable future. Clearly the country's period of high growth has been temporarily halted. The major problem now facing the government is how best to utilize its dwindling oil revenues to generate positive overall rates of economic growth while at the same time meeting to the fullest extent possible the basic needs of the majority of the population.

The main purpose of this paper is to examine the consequences of declining oil revenues on the Venezuelan economy over the remaining part of the 1980s. In particular the paper is interested in examining whether the government will be able to sustain (and if so under what conditions) the socio-economic programs established during the period of expanded revenues.

For this purpose a macroeconomic model of the economy is constructed and linkages between the overall rate of economic growth and public sector budgetary allocations are established. Finally the pattern of socio-economic allocations is forecast through several optimal control simulations. These allocations are checked in terms of their consistency with the country's likely overall level of debt and borrowing capacity, the government's concern with inflation and potential tradeoffs stemming from the government's concern with external security while at the same time providing the maximum levels of social expenditures consistent with the constraints noted above.

In this context, a secondary purpose of the analysis below is to examine the feasibility and budgetary ramifications of various stabilization programs on the Venezuelan economy over the period to 1990.

Table 1. Venezuela: major macroeconomic trends (1979–1983)

Macro variables in millions of 1980 bolivars	1979	1980	1981	1982	1983	Average Annual Growth 1979–1983	1980–1983	1982–1983
Gross domestic product	252418	254200	245871	228066	210835	−4.4	−6.0	−7.9
Government investment	19860	20675	36005	33025	25159	6.1	6.8	23.8
Government consumption	33730	35120	36758	33456	30465	−2.5	−4.6	−8.9
Private consumption	134058	135380	138388	143158	139364	1.0	1.0	−2.7
Private investment	59787	43465	24150	22088	14559	−29.8	−30.6	−34.1
Public expenditures	53590	55795	72763	66482	55625	0.9	−0.1	−16.3
Private expenditures	193846	178845	162538	165246	153924	−5.6	−4.9	−6.9
Government revenue	61832	66405	83993	65754	56809	−2.1	−5.1	−13.6
Government deficit	1037	−3617	−6677	−13213	−3093	−41.3	5.1	76.6
Government debt	40089	38829	42609	50089	55250	8.4	9.21	10.3
Balance of payments	−10482	14978	16952	−15078	−4523	18.9	−62.8	70.0
Imports	68138	64550	66840	76168	55307	−5.1	−5.0	−27.4
Exports	72678	85459	82069	68115	66476	−2.21	−8.03	−2.41
Private public expenditures	3.61	3.21	2.23	2.48	2.77	−6.4	−4.81	11.7
Government debt/GDP	0.159	0.153	0.173	0.219	0.262	13.3	12.7	19.6
Government deficit/GDP	0.004	−0.014	−0.0272	−0.0577	−0.0147	−67.2	0.0	74.5
Private consumption per capita	9916	9732	9671	9732	9217	−1.8	−1.8	−5.3
Consumer price index	0.823	1.000	1.160	1.273	1.353	13.23	10.6	6.3
Central Bank credit to government	3216	2082	3291	5386	4048	5.9	24.8	−24.8
Defense expenditures (constant price)	3636	3893	3922	3770	3739	0.7	−1.3	−0.8
Defense expenditures (current prices)	2933	3893	4550	4800	5060	14.6	9.13	5.4

Source: Macro variables derived from International Monetary Fund, *International Financial Statistics*, various issues. Military expenditures derived from Stockholm International Peace Research Institute, *World Armaments and Disarmament Yearbook* (1984).

ECONOMIC PRIORITIES AND CONSTRAINTS

The continued, gradual erosion of the international market for petroleum and its derivative, besides its adverse impact on the production and investment programs of the petroleum sector, the receipts of the Central Government, the Venezuelan Investment Fund and the foreign exchange budget have led the authorities in recent years to move with great caution in public expenditures and in the management of monetary policy. At the same time, economic policy constrained the pressures for general increases in wages to compensate for losses in their real value. This coupled with the high level of unemployment (12.5% in 1986) has resulted in sustained weakness in overall demand in the economy [1]. A cursory look at the recent trends in the major macroeconomic indicators (Table 1) confirms the severity of the country's current economic crisis [2]. Clearly the government will have to define its policies and actions to respond to an economic environment will remain characterized by:

1. the need to reschedule public and private debt in arrears and short-term maturities;
2. a low volume of exports and low international oil prices;
3. severe restraint on the amount of resources available to the public sector for executing programs and reviving the non-hydrocarbon economy;
4. a foreign exchange budget with little room for imports needed to restore domestic economic activity;
5. a growing number of price increase applications not resolved by the administered price system [3];
6. high unemployment and depressed real income of persons capable of exerting pressures on the government to act swiftly and take significant measures.

Given this set of constraints, the outlook for economic and social progress in the near term is not very bright. The earnings in the oil sector will probably not experience any important gains. Crop and livestock production, even though the declared target of special policies to encourage sector development, will take some time to show a positive response. Manufacturing will probably continue to be buffeted, on the one hand by the stimulating effects of conditions favoring import substitution and on the other hand by the dampening effects of lower real private consumption spending and public and private investment. In view of weak domestic demand, significant responses from the construction, transportation, and commercial sectors are unlikely. Since the central government has little control over oil revenues and only a weakly developed domestic tax base to replace lost oil revenues, it will probably have to further reduce its investment expenditures and transfer payments to other public sector agencies.

In addition, domestic prices which have been frozen since late 1983 have been recently adjusted due to political pressures. The inevitable side effect of this adjustment has been renewed fears of inflation. Increased rates of inflation could heighten workers demands for wage increases to regain some of the real income they have lost in recent years. Any granting of wage increases, coupled with price controls, could discourage private production, despite the higher consumer spending this would produce. Significant wage increases in the public sector would substantially reduce the savings of the sector and thus compromise its ability to finance investment.

As the Inter-American Development Bank has warned [4]:

Because of the expected fall in exports, measures designed to correct the foreseeable imbalances in public finances, and the balance of payments would need to be adopted, even if more imported goods are shifted from the lowest exchange rates to higher rates. At the same time, the Government is endeavoring to lay the basis for a sustained increase in production and employment. These efforts will require compatible adjustments in exchange rate, foreign trade, and public revenue and expenditure policies—including those for the prices and rates of state enterprises—and also in domestic price and wage policies. The central objectives of this package of coordinated economic measures must be to minimize the negative impact of the new business cycle on inflation and international reserves.

The main thrust of the analysis below is to develop an optimal fiscal program designed to meet the needs and concerns outlined above. The analysis rests on the presumption that Venezuela can be characterized as a country with sufficient oil to create problems (the so called "Dutch Disease" characterized by an overvalued currency, under-development of alternative sources of revenue and so on) but with revenues inadequate to solve them. Since the 1973–1974 oil price increases, the central feature of the government's longer run development policy has been the need to utilize petroleum export revenues in a manner capable of placing the economy on a high growth trajectory consistent with the public sector's long-standing income distribution objectives [5].

This orientation assumes that the current financial crisis is not a temporary aberration, but rather the culmination of monetary and fiscal policies pursued by successive administrations since the oil price increases of 1973–1974. These past public policies will continue to dictate the options open to the Venezuelan government in the foreseeable future. The resolution of the financial crisis in the long-term will come not from modification of energy policies or recovery in world petroleum markets, but rather from monetary and fiscal policies designed to achieve stable growth in the Venezuelan economy.

The econometric, optimal control model of the economy developed in the next section represents an attempt to identify an optimal set of governmental fiscal policies to achieve both renewed growth and socio-economic improvement over the remainder of the 1980s.

DESCRIPTION OF THE MODEL

The model constructed below is an econometric time series model, which was designed to utilize as much as possible the available Venezuelan national accounts statistics and fiscal statistics [6]. It aims at explaining the structural changes in the Venezuelan economy, particularly those during the 1970s and 1980s, as well as projecting values for the key macroeconomic variables and their link with budgetary expenditures over the 1984–1990 period.

The model is of the classical Keynesian econometric type, variations of which have been developed for various countries [7].

Ordinary least squares regression was used in the exploratory stage of model building, when much experimentation with various possible explanatory variables was undertaken to decide on the choice of variables and the form of the structural equations included. However, two-stage least squares technique was later used for the final estimations of parameters of the model to correct for any simultaneous equation bias in the estimates [8]. The estimation procedure was carried out using the national account statistics for the years 1950–1983 and the budgetary figures for the years 1972–1983. The national account and budgetary figures were deflated using the IMF consumer price index (1980 = 1.0). The Central Government debt was deflated using the United States export unit price deflater (1980 = 1.00). Exports and imports were similarly deflated to obtain the constant price series used in the regressions.

The model (Table 2) contains 42 equations with 28 variables endogenous and 12 of the variables exogenous (or predetermined). Eight of the equations are definitions and identities, while 20 of the equations are structural consisting of an inflation block, two consumption functions, two investment functions, two government fiscal policy functions and six budget composition relationships. Four dummy variables representing oil price changes were included to account for external shocks associated with changing world oil markets. A final political dummy was included to account for shifts in government policy associated with changing changes in the governing political party (on the presumption that the priorities of the two parties—the Accion Democratica (AD) are somewhat more liberal than that of the Christian Democrat (COPEI) party.

Consumption and investment functions were divided into public and private sector functions, as preliminary regressions showed the public and private sector to respond to markedly different economic forces.

STRUCTURAL EQUATION ESTIMATES

Since the model was designed largely for the purpose of examining the impact of government fiscal activity under alternative stabilization programs (associated with an assumed set of developments in the hydrocarbon sector), a relatively large number of public policy variables appear in the final estimated equations. More specifically, the model formulation allows the problems of government deficits, debt accumulation and inflation to be examined within the context of a simultaneous set of macroeconomic equations. Central Bank credit to the government is assumed to be the main policy variable at the disposal of the authorities.

As noted, in estimating the parameters of the model time series observations covering the period 1950–1983 were utilized. The first part of this period can be characterized as an environment of steady if not spectacular growth and the second half by significant structural changes in the Government's revenue and expenditure patterns. As might be imagined this period is characterized by an environment of high but extremely erratic growth patterns. Consequently, uncorrected for structural change, the

Table 2. Venezuela: macroeconomic forecasting model

Two stage least square estimates

Equation

Macroeconomic Block

(1) Central Bank Reserve Money (Nominal)

CBRM = 5.51 CBCGL + 12464.2 DUMA
(13.37) (10.41)

$r^2 = 0.960$. $F = 363.48$ DW = 2.56

(2) Money Supply M1 (Nominal)

M1 = 2.10 CBRM + 0.287 GDEFL − 701.95
(40.25) (2.88) (−0.63)

$r^2 = 0.992$ $F = 1862.95$ DW = 2.56

(3) Consumer price index—CPI

CPI = 0.0000162 M1 + 0.00000 GDEFL
(15.93) (3.32)
+ 0.0000366 CBCGP − 0.156 DUMA + 0.297
(3.56) (−5.71) (30.69)

$r^2 = 0.988$ $F = 606$ DW = 2.06

(4) Exports—ENPL (Real)

ENP = 0.455 ENPL + 122.12 CPP + 315.0 WCP
(2.61) (3.39) (2.83)

$r^2 = 0.855$ $F = 57.23$ DW = 2.51

(5) Government Revenue—GRP (Real)

GRP = 0.352 ENP + 0.166 GDPNP
(3.03) (3.22)

$r^2 = 0.939$ $F = 249.51$ DW = 3.00

(6) Government Budgetary Expenditures GEP (Real)

GEP = 0.623 GRP − 0.729 GDEFPL + 2.88 CBCGP + 3121.17
(12.83) (−3.46) (2.38) (2.19)

$r^2 = 0.952$ $F = 195.46$ DW = 2.76

(7) Central Government Debt—GDP (real)

GDP = 0.867 GDPL − 0.806 GDEFP + 1.9 CBCGPL − 1416.85 DUMP + 734.27
(17.49) (−8.49) (2.54) (−2.83) 0.98

$r^2 = 0.984$ $F = 436.27$ DW = 2.64

(8) Central Government Consumption GCNP (real)

GCNP = 0.289 GRP − 0.233 GDEFP + 0.187 GDP + 4777.60
(11.59) (−2.12) (4.20) (7.35)

$r^2 = 0.960$ $F = 234.64$ DW = 2.27

(9) Central Government Investment—IGP (real)

IGP = 0.329 GRP − 0.516 GDEFPL + 61.58
(13.37) (−4.11) (0.06)

$r^2 = 0.902$ $F = 139.46$ DW = 1.51

(10) Financial Sector Credit to Private Sector-MSCPP (real)

MSCPP = 1.02 MSCPPL − 0.38 MSCGP + 1.82 CBCGP − 1067.91
(20.94) (−6.62) (2.30) (1.28)

$r^2 = 0.990$ $F = 981.29$ DW = 2.28

(11) Private Consumption—PCNP (real)

PCNP = 0.60 PCNPL + 0.152 GDNPPL + 0.23 MSCPP + 4168.55
(9.91) (3.71) (2.73) (3.06)

$r^2 = 0.996$ $F = 2926.84$ DW = 2.79

(12) Private Investment—IPP (real)

IPP = 0.85 IGPL + 1.16 IPPL − 0.16 KPL
(4.82) (14.17) (−5.89)

$r^2 = 0.934$ $F = 124.38$ DW = 2.54

(13) Imports—ZNP (real)

ZNP + 0.87 IGP + 0.47 IPP + 0.23 PCNP − 3406.03 EXAA + 12514.2
(5.10) (9.09) (4.85) (−2.94) (3.55)

$r^2 = 0.985$ $F = 473.57$ DW = 2.72

(14) Net Factor Payments—NFPNP (real)

NFPNP = 0.657 NFPNPL + 0.06 GDPNPL − 0.186 ENP
(5.89) (2.83) (−2.42)
− 0.229 GDP + 4340.2 DUMC − 2342.86
(−4.03) (2.45) (5.89)

$r^2 = 0.419$ $F = 3.25$ DW = 2.89

Budget Block

(15) Defense Expenditures—MESIP (real)

MESIP = 0.009 GDPNP + 0.409 MESIPL + 224.81
(2.28) (3.81) (2.32)

$r^2 = 0.952$ $F = 298.14$ DW = 2.71

(16) Social Security Welfare—GSSWE (Share of Government Expenditures)

GSSWE = 0.409 GSSWEL − 0.718 GDEE − 0.0000 GEPOP + 0.21
(−3.69) (−2.60) (−3.05)

$r^2 = 0.738$ $F = 7.51$ DW = 2.11

(17) Public Services GPSE (Share of Government Expenditures)

GPSE = −0.85 GDEE − 0.00049 GEY − 0.258
(−2.28) (−2.50) (3.70)

$r^2 = 0.419$ $F = 3.25$ DW = 2.89

Continued

Table 2. (*Continued*)

Two stage least square estimates		
(18)	Education—GEDE (Share of Government Expenditures)	
	GEDE = 1.17 GDEE −0.0000 GEPOP + 0.469 GPSE + 0.35	$r^2 = 0.827$ $F = 12.83$ DW = 2.41
	(−4.25 (−5.65) (2.91) (8.11)	
(19)	Health—GHE (Share of Government Expenditures)	
	GHE = 0.329 GHEL + 0.405 GDEE + 0.32 GEDE 0.0235	$r^2 = 0.600$ $F = 4.00$ DW = 2.81
	(2.81) (2.37) (2.98) (−0.68)	
(20)	Other Community Services—GOCE = (Share of Government Expeditures)	
	GOCB = −0.381 GDEE −0.00000795 GEPOP + 0.685	$r^2 = 0.427$ $F = 435$ DW = 2.61
	(−2.57) (−2.35) (3.02)	
	Identities	
(21)	Government Deficit GDEFP (real)	
	GDEEP = GRP − GEP − LMRP	
(22)	Government Expenditures—National Accounts—GENANP (real)	
	GENANP = GCNP + IGP	
(23)	Private Expenditures—National Accounts—PENANP (real)	
	PENANP = PCNP + IPP	
(24)	Total Investment—INP (real)	
	INP = IPP + IGP	
(25)	Capital Stock—KP (real)	
	KP = INPL + INPL2 + INPL3	
(26)	Gross Domestic Product—GDPNP (real)	
	GDPNP = PCNP + GCNP + ENP − ZNP + IPP + IGP + ICNP	
	Transformations	
(27)	Government Expenditures per GDP −GEY = Government Expenditures/GDP	
(28)	Government Expenditures per capita GEPOP = GEP/POP	
(29)	Population—POP	
(30)	POP = 2.8% increase per annum	
(31)	Real Exports ENP	
	ENP = −5.0, −2.5, 0, 2.5 increase per annum	
(32)	Government Credit From Financial System—MSCGP (real)	
	MSCGP = 5% increase per annum	
(33)	Change in Stocks ISNP (real)	
	ISNP = 0.0	
(34)	Exchange Rate – EXAA = 7.5B ($)	
(35)	Crude Petroleum Production – CPP = constant	
(36)	Wholesale Price Index Crude Petroleum – WCP = constant	
(37)	Government lending Minus Repayment – LMRP = 1.0% (real) increase	
	Dummy Variables	
(38)	DUMA – oil price effect 0, 1950–1973; 1, 1974–1983	
(39)	DUMB – oil price effect 0, 1950–1972; 1, 1973–1983	
(40)	DUMC – oil price effect 0, 1950–1973; 1, 1974–1978; 2, 1979–1983	
(41)	DUMD – oil price effect 0, 1950–1973; 1, 1974–1978; 2, 1979–1983	
(42)	DUMP – political administration effect Dictatorship = 0, 1950–1957	
	AD = 1, 1958–1968, 1974–1978	
	COPEI = 2, 1969–1973, 1979–1983	

Notes: Estimated over 1950–1983.
( ) = t-statistic; F = F-statistic; r^2 correlatoin coefficient.
DW = Durbin Watson statistic.

parameter estimates derived from regressions for the period as a whole would provide a description of what happened in the economy during this period only in an average sense. To correct for the structural shifts in the 1970s and 1980s, a number of dummy variables were introduced in each of the estimated equations [9]. As noted below a number of shift dummy variables were statistically significant in a number of the structural equations. Therefore, major structural shifts affecting Venezuela in the 1970s and 1980s have, to the extent possible been systematically accounted for with the estimated parameters providing a more reliable basis for forecasting to 1990.

Inflation (CPI)

In terms of the individual equations (Table 2), the first three sets of relationships (1–3) attempt to capture the inflationary impact stemming from:

1. Central Bank lending to the Government (CBCG); and
2. the government budgetary deficits (GDEF);

have on the money supply (and in turn, eventually on the overall increase in the consumer price index).

A strong link was found to exist (eqn 1, Table 2) between Central Bank lending to the government and

reserve money of the Central Bank (CBRM). Reserve money and lagged government deficits (GGDEF) were found to be largely responsible for the movements in the nominal stock of transaction balances held by the public (M1) (eqn 2, Table 2). The consumer price index itself is in turn determined by the stock of transaction balances (M1), the government deficit lagged one year (GDEFL), and the real volume of Central Bank credit to the government (CBCGP). It should be noted that one conspicuous absence from these equations is the exchange rate. In recent years (and in contrast to most other Latin American countries) Venezuela has managed to undertake major devaluations without sparking off an inflationary spiral. A number of factors explain this important achievement [10]:

1. despite all its faults, the multi-tiered exchange rate regime (introduced in 1983) has allowed the impact of devaluation on prices to be spread out over a period of time, instead of being absorbed as a once and for all shock;
2. economic recession in recent years has kept inflationary pressures in check;
3. there has also been a reduction in sales margins at both producer and distributor levels; and
4. most important of all the "social pact" between government, labor and business promoted by the current Lusinchi administration has led to trade union restraint on wages and responsible pricing behavior by business under official guidelines and controls.

Hence, there is some justification for not formally introducing the exchange rate into the inflation equations.

Exports (ENP)

As might be imagined, exports in an oil-dominated economy such as Venezuela's are largely affected by exogenous events in the world petroleum markets. Developments in the world oil markets are assumed to act on overall real exports with a slight lag due to the fact that changes in these variables do not necessarily coincide with the annual value of real exports—i.e. the oil price increases in 1973–1974 did not impact much on real exports in 1973. Real exports are estimated by a Koyck distributed lag formulation [11]. Although Venezuela's OPEC quota was cut by 120,000 barrels per day (b/d) in October 1984 export volume has advanced slightly from 1,500,000 to 1,517,000 by the end of 1985. Being one of the founders of OPEC, the country has stuck quite closely to its allocation under the organization's production sharing arrangements. No major deviation from this policy is foreseen. On the other hand export revenues fell by approximately $2 billion in 1985 due to both reduced volume and lower prices. Given what has been perceived as inability to alleviate the worsening oil picture, some influential critics and commentators in Caracas have suggested that the nation should take a more independent position in OPEC, and even consider withdrawal from the organization. However the government appears firmly committed to OPEC policy and no major changes in this position are foreseen over the forecast period.

On the brighter side, Venezuela's wide variety of types of crude (heavy, light etc.) and its ability to export refined products give the country a high degree of flexibility in marketing its hydrocarbons. Proven and probable reserves of 55 million barrels and a production capacity of about 2.5 million b/d give the country a number of options to counter adverse world market trends. In addition the country has huge natural gas reserves and untapped heavy oil deposits in the Orinoco Heavy Oil Belt.

As a result of the above factors, the country has been able to stabilize its earnings from oil to a certain extent. Forecasting the differential impact of world prices and production levels on the country's export earnings is possible with the estimated equation (eqn 4, Table 2), but the uncertainties surrounding each development (production level and price) make it more realistic to project an overall aggregate movement in export earnings. For purposes of the simulation exercises below, four forecasts of export earnings were made:

1. optimistic—export earnings increase at an average annual rate of 2.5 percent over the 1986 to 1990 period;
2. moderately optimistic—real export earnings remain stable at their 1983 levels over the 1986–1990 period;
3. moderately pessimistic—real export earnings decline at an average annual rate of 2.5% over the 1986–1990 period; and
4. pessimistic—real export earnings decline by an annual average rate of 5% over the 1986–1990 period.

The simulations described below are intended to map out a general matrix of environments in which government fiscal policy can be conducted.

Government revenue (GRP)

In an oil-based economy, the government is normally reliant almost exclusively on export revenues (ENP). In fact, the continuing dependence on petrodollar financing and the increasing role of the state have been the two most prominent features of the Venezuelan development model promoted by successful Venezuelan governments since the early 1970s. Annual revenues from oil exports averaged around 95% of total export earnings. While the contribution of petroleum revenues to the gross national product fell from nearly 40% in 1974 to 21.5% in 1978, and while the percentage of total government income derived from petroleum sales dropped from 17.6% in 1976 to 49.6% in 1978, oil income continued to sustain the major role of the state in the country's economy. The declining proportion of government income derived from petroleum revenues does however, suggest some progress has been made in the country's tax reform efforts. This is evidenced by the fact that when gross domestic product (GDPNP) was regressed on real government revenue (GRP), it was found to be statistically significant in addition to real exports (Eqn 5, Table 2).

Real government budgetary expenditures (GEP)

Overall government expenditures (GEP [12]) were found (eqn 6, Table 2) to be largely determined by the level of real government revenues (GRP), real gov-

ernment deficit lagged one year (GDEFPL), and the Central Bank's real volume of credit to the government (CBCGP). As noted above (Table 1) the government's level of real deficits increased rapidly over the 1979–1983 period, averaging slightly over a 40% percent annum increase throughout this period.

Recently, however, the government has gained more control over the budgetary process and in 1984 actually achieved a significant budgetary surplus. The government therefore, does have considerable discretion over its expenditure policies and is able to finance them from an increasingly differing sources of funds.

A medium-term investment program has been proposed for the 1986–1989 period under which Bs15,000 million per annum is to be spent over and above regular budget allocations. Including these expenditures, the fiscal surplus is forecast to fall to 2% in 1985, with the budget surplus-deficit close to zero in 1986. Because of the July 1985 reductions in oil prices, however, the final budgetary position was a moderate deficit in 1986. In any case it is likely that the government will continue to attempt to expand the economy at a moderate rate in light of its current depressed condition.

Real government debt (GPD)

The real level of government debt (GPD) is assumed to adjust marginally over time in a distributed lag fashion to changes in the public sector deficits (GDEFP) and Central Bank lending to the government (CBCGPL). A political variable (DUMP) was also found to be statistically significant (eqn 7, Table 2) with a negative sign—indicating less of an inclination on the part of COPEI administrations to increase the overall level of debt [13]. Given the country's current external debt problems, the government will undoubtedly be much more constrained than in the past in financing its expenditures through increased indebtedness. Over the 1980–1983 period, the level of real government debt increased at an average annual rate of 9.2%.

After repeated deferals of principal payments on the external debt of the public sector a rescheduling program was agreed in September 1985 between the Government and the international bank advisory committee. By removing the burden on the balance of payments of the previous short-term nature of much of the public debt, and avoiding the bunching of future obligations, the multi-year rescheduling arrangement represents an importation to the restoration of business confidence. Of the aggregate debt of $26.4 billion outstanding at the end of 1984, $21.2 billion or 80% of the total is to be rescheduled.

Given these developments, it is assumed in the simulations that follow that the Central Government's level of real outstanding debt will increase (at the maximum) in the range of between 5.0 and 7.5% per annum.

Central government consumption (GCNP)

Real government consumption (GCNP) has decreased fairly rapidly, falling by 2.5% per annum between 1979 and 1983 and 4.6% per annum between 1980 and 1983 (Table 1). During 1983, however, real consumption expenditures decreased by 8.9%, indicating considerable scope for austerity measures still remains. Statistically, the government consumption in Venezuela is highly influenced (eqn 8, Table 2) by the level of real government revenue (GRP), the lagged real government deficit (GDEFPL), and the overall level of government real debt (GDP). In the simulations that follow government consumption is shown to be fairly sensitive to the tolerable levels of public sector deficits and the overall feasible expansion of the stock of real government debt.

Central government investment

As might be expected, the pattern of government capital formation has behaved much more erratically over time than government consumption. The government's capital expenditures have increased particularly rapidly following increases in oil revenues, only to be cut back rather severely during periods of declining revenues.

In a recent study, Looney [14] found that:

> The apparent bias toward maintaining expenditures in the social services and defense may reflect the government's preference for present consumption over investment and future consumption, since social sectors and defense typically have a heavy bias toward recurrent expenditures and within these there is a sizeable employment component. Politicians in Venezuela, particularly in election years, may find it more acceptable to reduce investment, growth and future consumption, especially if these reductions are uncertain and far off, than to make politically difficult cost cuts in present consumption.

This pattern is evidenced by the fact that overall, real government investment increased by 6.1% during the post-1979 oil boom years (1979–1983), but was cut back by 23.0% in 1983, a year of austerity.

Statistically the public sector investment was found (eqn 9, Table 2) to be highly influenced by the level of real government revenue (GRP) and the lagged real deficit (GDEFPL). These two variables accounted for over 90% of the fluctuations in government real capital formation.

Private consumption

For purposes of analysis, private sector expenditures were broken down into private consumption and investment. Preliminary analysis indicated that real private consumption was strongly influenced by the amount of credit made available to the sector by the financial system (MSCPP) [15]. Real credit to the private sector (MSCPP) was in turn found to be determined (eqn 10, Table 2) by another distributed lag relationship—real private sector credit adjusting to increases in the financial sector's credit from the government (MSGP [16]) and the Central Bank's real credit to the government (BCGP) [17].

Historically, the government has been a net lender to the financial system as a whole (thus resulting in MSGCP having a negative value). Based on past trends, it was assumed that the government's net credit to the financial system would increase at 5% in real terms.

Private consumption (PCNP) was hypothesized to be a function of personal disposable income (as proxied by real gross domestic product—GDPNP). Again, a distributed lag function was found to give the best statistical relationship (eqn 11, Table 2) with private consumption lagged being highly significant. This formulation implies that past consumption as well as present disposable income affects present consumption. This formulation of the consumption function implies that individuals in Venezuela adjust their consumption patterns over time to year-to-year increases in income, a pattern anticipated in Friedman's "permanent income hypothesis" [18].

Private investment (IPP)

Private sector investment in Venezuela has been particularly depressed in recent years, declining at an average annual rate of nearly 30% between 1979 and 1983 (Table 1). In 1983 private investment declined by 34.1%. Clearly any explanation of the determinants of private capital formation will have to explicitly take this decline into account, and also be capable of indicating the point at which capital formation by this sector will bottom out and again resume its upward trend (real private sector investment increased at an average annual rate of 17.4% per annum between 1970 and 1978).

Several recent institutional changes should create a more favorable climate for investment and this help revive private sector capital formation. In June 1985 a liberal foreign investment code (Decree 656) was adopted. The reforms in this code bring Venezuela closer into line with the more relaxed stance adopted toward private foreign investment by the other members of the Andean Pact (Colombia, Peru, Ecuador, and Bolivia).

Another major change in the government's policy toward foreign investment is that investments in agriculture, agro-industry, tourism, and certain construction activities may be exempted from many of the regulations, including those concerning remittances, international transfer and changes of ownership to national investors.

The equation for private investment used in the model assumes that private investors undertake investment to bring the actual capital stock in line with their perception of an optimal stock of capital. The optimal capital stock is, in turn, a function of the profitability of investment. Since no consistent historical series exists for the rate of return on investment in Venezuela, we have used the capital stock (KP) as a proxy for profitability, i.e. the larger the existing stock of capital at the beginning of the year, *ceteribus paribus*, the less profitable investment will be. No series of the capital stock exists for Venezuela, but following Chenery and Eckstein [19], the capital stock was approximated as the sum of total investment over the three previous years. The optimal capital stock is also assumed to be determined by profitable investment opportunities opened up by the government's investment in infrastructure and the like. The speed of adjustment of the private sector's actual to optimal capital stock takes place in a distributed lag fashion as evidenced by the high statistical significance of the lagged private sector investment term (eqn 12, Table 2).

Imports (ZNP)

The major achievement of the country's adjustment efforts in the last several years has been the marked turnaround in the balance of payments. The substantial current account deficit in 1982 was converted into equally large surpluses in the following years (as a consequence of a significant decrease in imports and sharply reduced outgoings for tourists and other services). The result is that the country's imports are now largely confined to capital goods. This is reflected in the fact that both private investement (IPP), and government investment (IGP) were highly significant when regressed on imports. Private consumption was also highly significant and, thus included in the regression equation. The extent to which the government continues to restrict luxury consumption imports may, however, result in a slight overestimation of future imports.

Budgetary items

The major budgetary categories were linked with the macro-economic variables listed above through a series of trade-off equations. In particular one of the major dilemmas the country must face is the degree to which defense expenditures which appear to be relatively non-compressible, given the priorities of succesive Venezuelan administrations, reduce the allocations for other social programs [20]. The striking pattern of Venezuelan defense expenditures is that they have remained a relatively fixed proportion to gross domestic product over the post World War II period [21]. The adjustment of real military expenditures over time to changes in the level of real gross domestic product was also estimated by a Koyck distributed lag function (eqn 15, Table 2). This formulation allows military expenditures to expand over time to changes in, for example, government revenues as they impact on gross domestic product (GDPNP) or contract as a result of declining export earnings, reduced levels of government expenditures, and thus real gross domestic product. It should be noted that this formulation produced a very good fit of estimated vs actual values of real military expenditures over the 1950–1983 period. The regression equation accounted for over 95% of the fluctuations in real military expenditures.

The estimated equation for defense expenditures is consistent with much of the recent literature [22] which has it a "rational" or "neo-classical" model of defense allocations. According to this line of argument, social welfare is a function of civilian output and an unobserved variable, security; security depends among other things on military expenditure. The role of the state is then to balance the welfare benefits of extra security derived from military expenditures with its opportunity cost in foregone civilian output and/or welfare.

An examination of official Venezuelan documents does not shed much light on the manner in which the government authorities or populace at large value the country's allocations to defense. The distributed lag formulation of defense expenditures does, however, show that, in general the country feels it necessary to maintain a fairly stable pattern between overall economic production and allocations for security. Pre-

sumably, the relationship between military expenditures and gross national product breaks down when military expenditures expand too much at the expense of other budgetary items and are restored when socio-economic expenditures have expanded relatively rapidly. In general the Venezuelan government has not allowed defense expenditures to expand significantly at the expense of historical shares of social expenditures in the public sector budget.

On the other hand preliminary analysis found a negative tradeoff to exist between military expenditures and a number of other major social expenditures. Apparently, given the high priority for social expenditures in Venezuela, and the distributed lag nature of defense expenditures, allocations to socio-economic activities expand relative to defense allocations during periods of budgetary ease. During periods of budgetary austerity, however, these allocations are reduced proportionately in terms of allocations to defense expenditures [23]. Following this interpretation of the country's budgetary priorities, both a general expansion and a contraction of government socio-economic expenditures would produce a negative sign for military expenditures when regressed on the share of military expenditures in the over-all public sector budget. A control variable must be included in the regressions along with the share of military expenditures in the budget to obtain less biased estimates of the budgetary tradeoffs [24]. Existing evidence in the area of public finance indicates the importance of such factors as increased government expenditures per capita or public expenditures as a share of gross domestic product as important in the rise of public spending in general, and as a significant factor in budgetary priorities. Moreover, real increases in either public expenditures per capita or public expenditures as a percent of GDP are measures of the level of economic development and the growth in resources available to the public sector.

The final estimated budgetary equations show:

1. A negative relationship between military expenditures as a share of the government budget and social security and welfare expenditures as a share of the budget. Social security and welfare expenditures also contract as a share of the budget as the overall level of government expenditures per capita (GEPOP) increase (eqn 17, Table 2). Public services share in the government's budget is also a negative function of the share of military expenditures in the budget (GDEE). Public services as a share of the budget also declines with increases in government expenditures as a percentage of gross domestic product (GEY)—eqn 17, Table 2.

2. Education also shows a negative relationship to increase in the share of military expenditures in the government's budget and government expenditures per capita. The share of education allocations in the overall government budget does, however increase with the share of funds allocated to public services (GPSE)—eqn 18, Table 2.

3. In contrast to the other budgetary items, health expenditures share in the budget increase with both increases in military (GDEE) and education (GEDE) shares in the budget—a positive tradeoff indicating a complementary relationship between military allocations and the government's health programs (eqn 19, Table 2).

4. Other community services show a negative pattern, with their share in the public sector budget declining with an increase of military expenditures and government expenditures per capita (eqn 20, Table 2).

Identities

The first 20 equations described above produce the endogenous block of the macroeconomical model. Given various assumed values for real export growth (ENP)—an exogenous variable and the growth of Central Bank credit to the government (CBCGP)—a policy variable, values for these variables are determined through the estimated relationships. The model also contains a number of identities:

1. The public sector deficit (GDEFP) is simply the difference between government real revenue (GRP) and real government expenditures (as defined above) and lending minus repayments (LMRP) [25]. Lending minus repayments has not followed any particular historical pattern. For model purposes the variable is set to increase at one percent over the 1986–1990 period.

2. Total private (PENANP) and government (GENANP) expenditures are simply the sums of their respective consumption and investment components (eqn 24, Table 2).

3. Total investment is the sum of private and governmental capital formation (eqn 24, Table 2).

4. The capital stock in any time period is for reasons noted above approximated by the sum of past investment. Due to the high depreciation of capital in Venezuela, the sum of investment over the prior three years was used as a proxy for the nation's stock of capital assets (eqn 25, Table 2).

The model is a national income accounting model; therefore the sum of various accounts must add to gross domestic product. Gross domestic product, is, therefore determined by the sum of the components of aggregate demand, and is generated as the outcome of decisions to consume and invest (PCNP, GCNP, IPP, IGP), together with changes in stocks (ICNP), and the trade account (ENP-ZNP)—eqn 26, Table 2.

THE MODEL'S USE IN FORECASTING

As noted, the model is driven by the values assigned to variables assumed to be exogenous to the Venezuelan economy and a policy variable Central Bank credit to the public sector. In terms of exogenous variables:

1. population growth (POP) is assumed to follow its historical growth of 2.8% per annum;

2. real exports (ENP) are simulated from values ranging from an annual decline of 5% per annum to an expansion of 2.5% per annum;

3. government credit to the financial system is assumed to expand at 5% per annum in real terms; and

4. the change rate is set at 7.5Bs per dollar.

A fixed exchange rate is assumed since Venezuela cannot gain much short run stimulus from any exchange depreciation—the price of oil is set in US dollars, and luxury consumer goods are already controlled by import restrictions.

In order to stabilize the exchange rate at the current 7.5 figure, the simulations below assume that there is some inflation barrier such that, if the country is able to keep inflation under this amount, the authorities will be able to maintain the par value of their currency with the dollar [26]. The maximum rate of domestic inflation consistent with the maintenance of a stable exchange rate was set at 20% per annum. Admittedly, rates of inflation in the 20% range will most likely result in the eventual overvaluation of the Bolivar. However, inflation averaged 12.32% annually over the 1976–1982 period. The current administration has also indicated officially that it intends to pursue whatever measures it requires to contain inflation under 20% per annum.

PRELIMINARY OPTIMAL CONTROL SIMULATIONS

A series of preliminary optimal control [27] simulations of the economy were performed in an effort to determine the sensitivity of the forecasts to alternative government policies and stabilization programs. In all the simulations, the model was set to optimize the level of real gross domestic product in 1990. The loss function was inflation, i.e. the optimal control model steered the economy on a path over time that resulted in a minimal rate of inflation consistent with the values of the government's policy variables. As noted above, the chief policy variable (the design variable in optimal control terminology) assigned to the Venezuelan authorities was the increase in real Central Bank credit to the government.

The main findings of the exploratory analysis indicated that:

1. in general, inflation reaches 20% at real rates of increase in Central Bank credit to the government at increases of over 15% per annum;
2. there is less inflationary pressure at each rate of increase in real Central Bank credit to the government as the rate of real export growth declines;
3. as the government is forced to pursue increasingly harsh austerity measures, given government budgetary priorities, the share of defense expenditures in the overall government budget increase at each rate of change in exports i.e. at a rate of credit expansion of 7.3%, the share of defense in the budget is 6.67% (given zero growth in exports) while at a 12.35% of credit expansion to the government, the share of defense in the budget falls to 5.64 (again with a zero expansion in exports to 1990).

The most significant finding of this exploratory analysis is that as the government's fiscal policy, given a debt constraint, becomes more expansive, a high proportion of incremental allocations would go to economic services and not to defense. This finding is consistent with the greatly stepped-up government investment program immediately following the oil price increases of 1973–1974 and 1978–1979, a period in which defense expenditures actually declined as a proportion of GDP.

Clearly, if social programs are to be expanded (accepting the government's priorities) the greatest pay-off in terms of policy would be anti-inflationary programs.

FINAL OPTIMAL CONTROL FORECASTS

Given the findings listed above the final optimal control forecasts were structured to allocate the maximum amount of funds for socio-economic programs (consistent with maximizing the overall rate of GDP in 1990). Accordingly, the simulations were calibrated to come as close as possible to the 7.5% average annual increase in external public sector external debt barrier. Real Central Bank credit to the government was set at 12.5% average annual increase, beginning with a low of 7.5% in 1986, expanding to 15.0% in 1990. Real exports were assumed to decline slightly—an annual decline of one percent per annum, reflecting the government's flexibility in adapting to likely changes in world oil market conditions, and its resolve to stabilize the overall level of crude oil production within the context of OPEC.

Given these assumptions, the final optimal control forecasts indicate (Table 3) that the optimal path of the economy to the year 1990 occurs with a 7.3% average increase in public sector external debt, a rate of inflation of 18.9% and an overall expansion of real gross domestic product of 4.1% per annum.

This growth path does not create any particularly severe budgetary tradeoffs, and in fact produces a favorable expansion (particularly by recent standards) in socio-economic allocations (Table 4). By 1990 defense expenditures will have contracted to 5.57% of the government budget (from 6.78 in 1983). As noted above, if the government is particularly concerned with the social and economic welfare of the population, it has a great incentive to control inflation, allowing an expansive fiscal policy. For example, at a Central Bank credit to the government averaging 14.77%, real government expenditures increase from 5.3 to 7.0%. On the margin, this fiscal policy (implying an increase in public external debt of 12.4% per annum), results in an expansion of:

1. public services—2.6%;
2. education—0.7%; health—0.3%;
3. social Security–Welfare—0.4%; and
4. economic services—3.8%;

i.e. these increased allocations can occur if the government is able to increase its external indebtedness from 7.5% per annum to 12.4% per annum.

The forecasts therefore demonstrate the high returns in terms of expanded socio-economic programs produced if the government is able to restore its external credit worthiness.

CONCLUSIONS

The main thrust of the analysis above has been to determine if the Venezuelan government, during an era of falling oil revenue, will be able to maintain and even expand the socio-economic programs initiated during the oil boom years. In general, the results

Table 3. Venezuela: final macroeconomic—defense expenditure forecast (1990)

Millions of 1980 bolivars	1983 Value	1980 Values average rate of growth of central bank credit to the government 1984–1990				Average annual rate of growth 1984–1990 central bank credit to the government (average annual growth 1984–1990)			
		7.3	10.0	12.4	14.7	2.3	3.7	12.4	14.7
Gross domestic product	210840	257460	271810	278960	291210	2.9	3.7	4.1	4.7
Government investment	25160	22111	25800	28192	31823	−1.8	0.4	1.6	3.4
Government consumption	30466	34948	41169	45203	51151	2.0	4.4	5.8	7.7
Private consumption	139360	172490	178750	181740	186210	3.1	3.6	3.8	4.2
Private investment	14560	22333	27657	29320	33112	6.3	9.6	10.5	12.5
Government revenue	56809	64549	66931	68117	70151	1.8	2.4	2.6	3.1
Government deficit	−3093	−3564	−10351	−16353	−23801	−2.0	−18.8	−26.9	−33.8
Government debt	55251	57140	78274	90535	109910	0.5	5.1	7.3	10.3
Balance of payments	−4523	2051	−11793	−18285	−29945	+5.5	−14.6	−22.1	−31.0
Imports	55308	56374	63527	66964	73047	0.3	2.0	2.8	4.1
Private public expenditures	2.77	3.41	3.08	2.87	2.64	3.0	1.5	0.5	−0.7
Government debt/GDP	0.262	0.222	0.288	0.324	0.377	−2.3	1.4	3.1	5.3
Government deficit/GDP	−0.015	0.014	−0038	−0.58	−0.082	+9.9	−14.2	−21.3	−27.5
Private expenditures per capita	9215	9403	9744	9879	10151	0.3	0.8	1.00	1.4
Consumer price index	1.353	3.846	4.378	4.539	5.038	16.1	18.3	18.9	20.7
Central bank credit to government	4048	6644	7888	9146	10546	7.3	10.0	12.4	14.7
Defense expenditure (real)	4126	4185	4366	4446	4594	1.6	2.2	2.5	3.9
Defense expenditure (nominal)	5060	16098	19117	20179	23145	18.0	20.9	21.9	24.3

Note: all simulations assume an average annual decline of one percent per annum in real exports over the 1984–1990 period.

Table 4. Venezuela: final forecast of major budgetary items (1990)

Millions of 1980 bolivars	1983 Value	1990 Values: Average annual rate of growth in central bank real credit to the government 1984–1990				Average annual rate of growth 1984–1990—average annual growth in central bank credit to the government 1984–1990			
		7.5%	10.0%	12.4%	14.7%	7.3%	10.0%	12.4%	14.7%
Share in budget									
Defense	6.78	6.59	6.01	5.57	5.14	−0.4	−1.7	−2.8	−3.9
Public services	6.53	5.90	6.39	6.77	7.13	−1.4	−0.3	0.5	1.3
Education	19.40	18.21	17.37	16.69	15.54	−0.9	−1.6	−2.1	−3.1
Health	8.12	9.23	8.56	8.06	7.36	1.8	0.8	−0.1	−1.4
Social services–welfare	7.27	7.39	6.99	6.64	6.13	0.2	−0.6	−1.3	−2.4
Economic services	21.10	21.50	24.22	26.42	29.97	0.3	2.0	3.3	5.1
Other community services	1.98	1.59	1.41	1.26	1.02	−3.1	−4.7	−6.3	−9.0
Other expenditures	28.82	29.61	28.96	28.59	27.71	0.4	0.1	−0.1	−0.6
Value									
Defense	3740	4185	4366	4446	4594	1.6	2.2	2.5	3.0
Public services	3634	3748	4649	5408	6373	0.4	3.6	5.8	8.4
Education	10811	11568	12629	13334	13896	1.0	2.3	3.0	3.7
Health	4519	5869	6222	6442	6577	3.8	4.7	5.2	5.5
Social services–welfare	4043	4694	5080	5310	5477	2.2	3.3	4.0	4.4
Economic services	11740	13661	17608	21102	26778	2.2	6.0	8.7	12.5
Other community services	1098	1008	1026	1013	910	−1.2	−1.0	−1.1	−2.7
Other government expenditures	16040	18794	21115	22828	24761				
Total government expenditures	55625	63527	72695	79883	89366	1.9	3.9	5.3	7.0

Note all simulations assume an average decline of one percent per annum in real exports over the 1984–1990 period.

indicated that without major changes in national priorities (in terms of security vs socio-economic programs) there are several strategies open to the authorities allowing socio-economic progress to continue over the period to 1990. Given the fact that the inflationary impacts of increasing governmental debt from 5.1% per annum to 10.3% per annum is only 2.4% per annum (20.7–18.3, Table 3), and given the fact that social and economic programs could increase relative to defense expenditures as the budget is expanded over this range (defense falling from 6.01% of budget allocation with debt increasing at 5.1% per annum to 5.14% with debt increasing at 10.3% per annum—Table 4), it would seem that the government should be inclined to push for as large an increase in debt as international capital markets would allow. In lieu of the fact that real government debt increased at an average annual rate of 9.21% between 1980 and 1983 (and 10.3% in 1983), the 10.3% high forecast must be considered the absolute maximum that an expansive fiscal policy could achieve.

REFERENCES

1. Inter American Development Bank, Economic and Social Progress in Latin America: 1986 Report, p. 379. Washington: Inter-American Development Bank (1986).
2. A complete documentation is given in *Ibid* pp. 179–182.
3. For a documentation of recent stabilization policies and government programs to deal with the current crisis cf. the sections on Venezuela in *Latin America and Caribbean Contemporary Record*, Volumes III and IV, (Edited by J. W. Hopkins). Holmes & Meier, New York (1985, 1986).
4. Ibid., pp. 380–81.
5. Loring Allen. *Venezuelan Economic Development: A Politico-Economic Analysis*, Chap. VII. JAI Press, Greenwich, Connecticut.
6. Data were taken from: International Monetary Fund, *International Financial Statistics Yearbook*, various issues; and the International Monetary Fund, *Government Statistics Yearbook*, various issues.
7. A description of the validity of this type of model together with several examples for Latin America is given in Jere Behrman and James Hanson, eds., *Short Term Macroeconomic Policy in Latin America*. Ballinger, Cambridge, Mass. (1979). See in particular Roque B. Fernandez. *The Short-Run Output–Inflation Tradeoff in Argentina and Brazil*, in this volume. A similar model with the Mexican economic crisis is developed in Robert E. Looney. *Economic Policy Making in Mexico: Factors Underlying the 1982 Crisis*. Duke University Press, Durham, N.C. (1985).
8. cf. Ray C. Fair. *Specification, Estimation and Analysis of Macroeconomic Models*, Harvard University Press, Cambridge (1984), chapter 2 for a rationale for this approach. Estimations were made using the TSP program developed at Stanford University. See B. Hall and R. Hall. *Time Series Processor, Version 3.5 User's Manual* B. Hall and R. Hall, Stanford, California (1890) for a description of the estimation procedure.
9. The dummy variables were introduced to determine the nature of the structural change i.e. did oil revenues increases in the 1970s result in shifts in the intercept of the regression and/or changes in the slope of the regression equation. The shifts associated with increased oil revenues represent quantum changes in expenditures, while changes in the slope of the regression equation are indicative of the country's absorptive capacity for increased oil revenues. See Ragaei El Mallakh and Mihssen Kadhim. Absorptive capacity, surplus funds, and regional capital mobility in the Middle East, *Rivista Internazionale di Science Economiche e. Commerciali* pp. 308–327, (April 1977), for a description of this methodology. See also Robert E. Looney. Absorptive capacity of the prerevolutionary Iranian economy. *J. Energy Dev.* pp. 319–340 (Spring 1983), and Robert E. Looney. The impact of petroleum exports on the Saudi Arabian economy. (Edited by R. V. Stockley) Hoover Institution Press, Stanford, California (1984), pp. 37–64 for applications of this methodology.
10. Peter West. Venezuela. In *Latin America and Caribbean Review, 1986* (Edited by R. Green), p. 131. World of Information, Saffron Walden, England (1986).
11. cf. L. M. Koyc. *Distributed Lags and Investment Analysis* North Holland, Amsterdam (1954). For a detailed explanation of the theory of distributed lags, together with an outline of operational estimating procedures see Ziv Griliches. Distributed lags: a survey. *Econometrica* 15–49 (January 1967), and P. Rao and Rodger Miller. *Applied Econometrics*, Chap. 7. Wadsworth Publishing Company, Belmont, California (1971) Chapter 7.
12. Line 82 of the International Monetary Fund, *International Financial Statistics*.
13. DUMP has values of 0 for the AD party and 1 for COPEI.
14. Robert E. Looney. Austerity and military expenditures in developing countries: the case of Venezuela. *Socio-Econ. Plann. Sci.* 161–164 (1986).
15. Line 32 in the International Monetary Fund, *International Financial Statistics*.
16. Line 32 in the International Monetary Fund, *International Financial Statistics*.
17. Line 12a in the International Monetary Fund, *International Financial Statistics*.
18. For a description of the permanent income type consumption function, together with alternative specifications of the private sector's consumption pattern cf. Michael K. Evans. *Macroeconomic Activity: Theory, Forecasting and Control* Chaps 2 and 3. Harper and Row, New York (1969).
19. H. Chenery and P. Eckstein. Development alternatives for Latin America. Economic Development Report No. 29 (Harvard: Project for Quantitative Research in Economic Development).
20. See for example Robert E. Looney. Austerity and military expenditures in developing countries: the case of Venezuela, *op. cit.* and Robert E. Looney. Factors underlying Venezuelan defense expenditures, 1950–1983: *Arms Control* 74–101 (May 1986), and Robert E. Looney. Military expenditures in Latin America. *J. Econ. Dev.* 69–104. (July 1986).
21. cf. The references cited above.
22. cf. R. P. Smith. The demand for military expenditure. *Econ. J.* 811–20 (December 1980), Robert E. Looney and P. C. Frederiksen. The future demand for military expenditure in Argentina. *Arms Control* 197–204 (September 1986), and Robert Looney and P. C. Frederiksen. Consequences of military and civilian rule in Argentina: an analysis of central government budgetary tradeoffs. *Comp. Political Stud.* (Forthcoming, 1987).
23. cf. Robert Looney. Austerity and military expenditures in developing countries: the case of Venezuela," *op. cit.* and Robert E. Looney. Venezuela's economic crisis: origins and successes in stabilization. *J. Social, Political Econ. Stud.* 327–338 (Fall 1986).
24. cf. Joel Vener. Budgetary tradeoffs between education and defense in Latin America: a research note. *J. Dev. Areas* 77–92 (October 1983) for the rationale of this approach.
25. Line 82, International Monetary Fund *International Financial Statistics*.

26. cf. John Bilson. Leading Indicators of Currency Devaluation, *Columbia J. Wld Business* 62–76 (Winter 1979) for the rationale underlying this assumption.
27. The program utilized for the optimal control exercises is a modified version of that developed by G. Vanderplaats at the Naval Postgraduate School, Monterey, California. Documentation is given in G. Vanderplaats, COPES—A Fortran Control Program for Engineering Synthesis Paper presented at the ASME Winter Annual Meeting, New York (1976). The economic theory of optimal control is developed in G. Chow. *Analysis and Control of Dynamic Economic Systems* Wiley, New York (1975); and R. Pindyck. *Optimal Planning for Economic Stabilization: The Application of Control Theory to Stabilization Policy* North Holland, Amsterdam (1973); an application in the context of Latin American stabilization efforts is given in Robert E. Looney and P. C. Frederiksen. The feasibility of alternative IMF-Type stabilization programs in Mexico, 1983–1987. *J. Policy Modeling* 461–1970 (November 1983).