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A comparative sensitivity analysis of the MODVEN VII macroeconomic model for Venezuela

Pedro A. Palma and Domingo Fontiveros

In the first section of the paper the authors present the structure and main features of the macroeconometric model for Venezuela, MODVEN VII, specifying the blocks of equations and their most relevant characteristics. The second part of the paper contains a sensitivity analysis of the model. That was done by analysing the results of eight alternative economic policy simulations, which were also compared with the results of similar exercises made with econometric models of seven other countries. These simulations served as the basis for analysis at the Conference on Performance of Econometric Models of NICs and Developing Countries, held in Taipei, Taiwan in May 1987. As a result of this comparison some conclusions are drawn about the model's sensitivity to different economic policy shocks. In this comparative analysis special emphasis is laid on the behaviour and performance of the Venezuelan model. Finally, changes in the specifications of some equations are introduced in the model in order to improve its response capacity. The eight simulations were rerun with the modified model and the results were compared with those of the original exercises. Some suggestions about future improvements of the model are presented in the conclusions of the paper. A detailed list of the equations of the model and the description of its variables are included in an appendix.

Keywords: Macroeconomic model; Venezuela; Sensitivity analysis

The MODVEN macroeconomic model for Venezuela has been under continuous development for a period of 15 years. Its first version was completed in 1976 (see Palma [6]), and since then it has been regularly applied to generate the mid-term projections for the Venezuelan economy produced by MetroEconómica, a consulting firm based in Caracas.

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This paper presents the seventh version of the model (Figure 1), and the results of a sensitivity analysis based on the simulation of eight economic policy scenarios for the 1985–91 period. The results of those simulations are compared with those generated in similar exercises using seven models for other newly industrialized or developing countries.

A number of improvements have been made in this version of the model. Its degree of disaggregation has been increased, making it much more complete and versatile than the previous versions. The external sector, prices, public finance, and the monetary and financial components, in particular, have been greatly disaggregated. MODVEN VII was estimated with annual data, using a sampling period of 36 years (1950–85). It is made up of 394 equations, 56 of which are behavioural; 7 additional ones, though basically definitions, can be taken as behavioural since they include changing coefficients established *a priori* and introduced into the model as exogenous variables.

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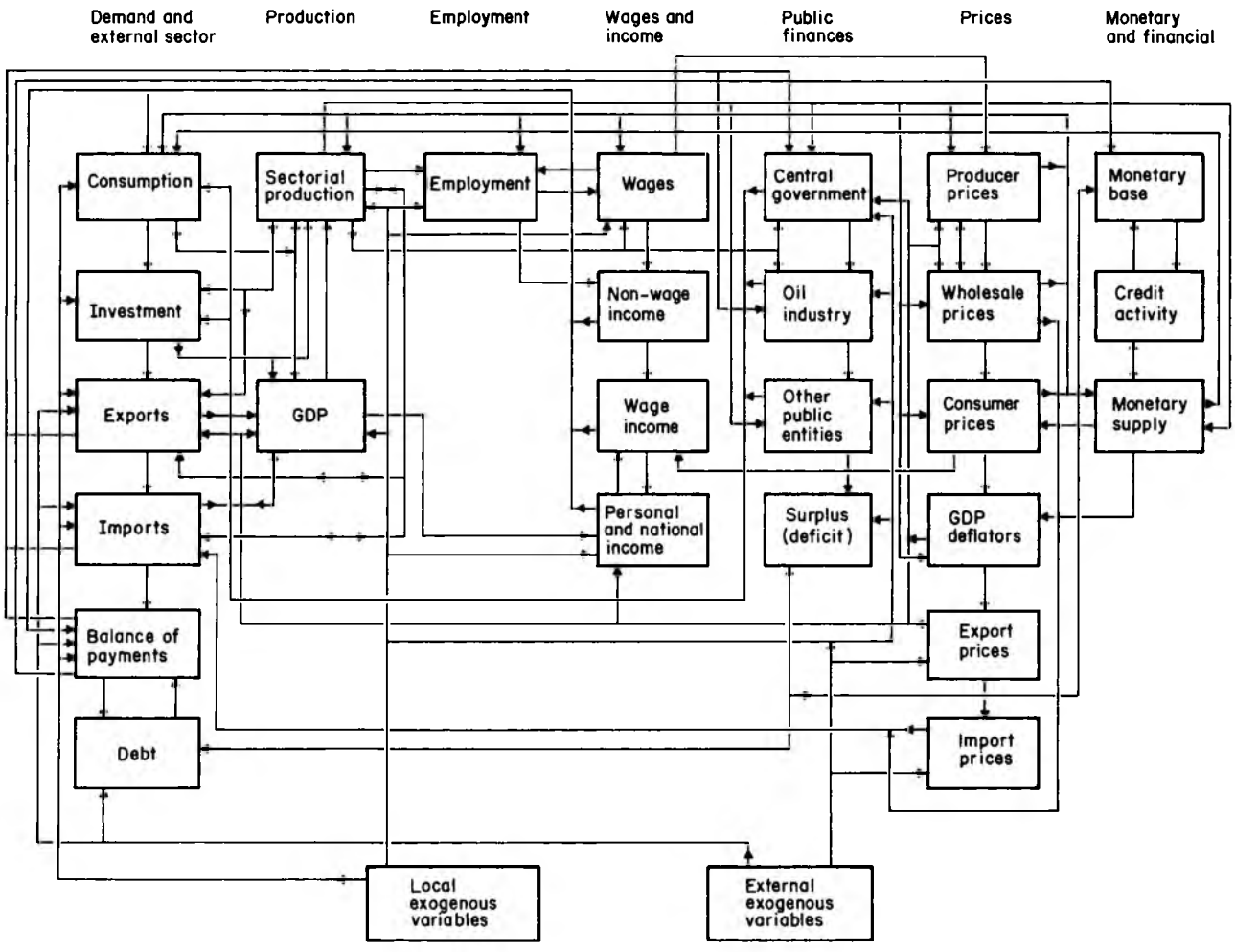

Figure 1. Modven VII Venezuelan econometric model flowchart.

Of the 394 equations, 124 constitute the pre-simultaneous or prerecursive block of the model, 101 the simultaneous block, and 169 the post-simultaneous or post-recursive block.[1]

The model has 162 exogenous variables, of which 15 are dummies, 29 are the changing coefficients of the *a priori* (or quasi-behavioural) equations which define exchange rates and the remaining 118 are regular exogenous variables.

MODVEN VII is a dynamic linear model; it contains several lagged variables, some of which are in the form of Almon's polynomial distributed lags. The maximum number of lags is three years.

The most relevant aspects of the model's structure are discussed in the first part of this paper, followed by the description of the equations' specifications and the results of the comparative sensitivity analysis. Finally, the model's equations and the definition of its variables are given in an appendix.

[1] For a definition of these blocks of equations see Johnson and Van Peeterssen [4].

Overall structure of the model

The model is composed of the following seven blocks:

(i) aggregate demand and external transactions;
(ii) production;
(iii) employment;
(iv) wages and income;
(v) public finance;
(vi) prices; and
(vii) monetary and financial aspects.

The aggregate demand and external sector block contains a set of equations which explain the behaviour of the main aggregate demand and external transactions variables. The equations that explain real private and public consumption and investment, stock variations and real exports and imports of goods and services form the aggregate demand component of this block.

The external transactions component includes the equations explaining the behaviour of the different elements of the balance of payments. The model

estimates merchandise exports and imports, the fob trade balance, services transactions (broken down into transportation and insurance, travellers' expenses and others), the different components of the investment income subaccount (for the public and private sectors), and unrequited transfers, in dollar terms. The combination of these estimates permits us to calculate the current account balance.

Thereafter the model shows the debits and credits of the disaggregated components of the capital account. The balances of the current and capital transactions, plus the net errors and omissions and the official creation of reserves, yields an estimate of the overall balance of payments and, consequently, the variations in the country's international reserves, which are broken down into those held by the Central Bank of Venezuela and those belonging to other financial institutions.

The foreign debt submodel is a very important component of this group of external sector equations. A large number of variables of the public, private and total foreign debt are estimated, including new indebtedness, existing debt balances, interest and principal payments, and others.

The production block contains equations explaining the behaviour of production in the different sectors of the economy, using the sectoral real value-added as the dependent variables. The total real gross domestic product is estimated on the basis of demand ($C + I + G + X - M$). To prevent statistical discrepancies between the calculations of GDP on the basis of demand and of sectoral production, the production of the tertiary sector (services), which represents more than 50% of the total GDP, is determined by subtracting the sum of the different extractive and industrial sectors' value-added from the total GDP.

As in the production block, that of employment contains equations explaining the demand for labour in the different sectors of the economy.

The wages and income equations explain the behaviour of such variables as national income and its components (wage and non-wage income), and personal disposable income, in both current and real terms. Some other variables such as sectoral wage revenues and ratios of different personal remunerations as income distribution proxies are also introduced.

The public finance section includes the most important variables of public sector finances, broken down into the different categories of revenues and expenditures of the central government, the independent public agencies and enterprises, in oil and non-oil activities, and the Venezuelan Investment Fund. The conjunction of the balances of these four groups yields the public sector surplus or deficit. With the addition of principal payments on internal and external public debts, we can obtain the annual financial requirements of the public sector (surplus or deficit).

The prices block, which has been substantially expanded in the current version of the model, contains equations explaining the different producer, wholesale, and retail price variables, as well as deflators for total GDP and its oil and non-oil components. Different export and import prices of goods and services are also estimated.

Finally, the equations of the monetary and financial section explain the behaviour of such variables as the monetary base, the monetary multipliers, the money supply (M1 and M2), the economy's liquidity needs based on price levels and real production, and credit activity.

Specifications for the equations of the model

The most important characteristics of the structure of the different equations of the model are discussed in this section.

Aggregate demand

As indicated above, this section contains the equations which explain the main variables of the aggregate demand.

Private consumption. The model contains behavioural equations explaining three of the four main components of real private consumption: food, beverages, and tobacco (*CPABTR*), household or durable goods expenses (*CPGHOGR*), and services and other goods (*CPSYOBR*). These categories of consumption are explained by their own values lagged one period, real personal disposable income (*YPDR*), real monetary liquidity (*LIQR*), the inflation rate, the ratio of the explained consumption price deflator to the overall cost of living index, and an income distribution variable (*RP/RT*) composed of the ratio of non-wage or property derived personal income (*RPROP*) to wage income (*RETC*).

Total real private consumption (*CPTR*) is defined as the sum of its different components – the three already mentioned, plus clothing and footwear (*CPVCR*) and the net real consumption of non-residents (*CNETONRR*). Current private consumption (*CPTC*) is derived by multiplying total real private consumption by its deflator, which is estimated in the price equations.

Private investment. The model does not contain a large number of estimates of gross fixed private investment; there is only one behavioural equation which explains real gross fixed private investment in the manufacturing sector (*IBFPMR*) as a function of that variable lagged

one period, the preceding year's real capital stock ($KPM@1$), and the real value of manufacturing production in the current period (PMR) and the previous three years, with the latter variables being introduced in the form of Almon's polynomial distributed lags. The structure of that equation can be described as a variant of the flexible accelerator, according to which the investment flows for the period t depend on the level of production for that period and that of the capital stock for the period $t-1$ (see Evans [3]).

One of the reasons why a larger number of private investment equations is not included in the model is their poor fit: they normally have an R^2 much lower than 0.9 and a very high mean absolute percentage error (MAPE), in some cases exceeding 10%. Since MODVEN VII is an applied model, normally used to derive realistic projections for the Venezuelan economy, the introduction of equations with low R^2 and a weak predictive capacity would seriously distort the projections and require the exogenization of the variables explained by those equations.

Consequently, most of the private sectoral investments are exogenous in the model. The estimate of total real private gross fixed investment ($IBFPR$) is obtained by adding the sectoral investment figures.

Public sector demand. Public consumption (CGR) and investment ($IBFGR$) are explained endogenously as a function of public current consumption and investment, which in turn are calculated in the block of public finance equations, on the basis of current spending and capital formation by the different public entities.

Stock variations. The variable for real stock variations (VER) is exogenous, since in many cases its historic values do not reflect rational economic behaviour; they are determined as an adjustment in the national accounts. The exogenous assumptions therefore reflect the likelihood of contraction or expansion of inventories, determined in turn by the potential for importing and the predicted level of economic activity and demand.

Exports. One of the most important equations explaining real exports is that of oil exports ($XPCDGB$), which depends on production of liquid hydrocarbons ($PHIDLB$) and internal consumption of petroleum products ($UDOMPB$). This new equation introduces an important change into the model; in the previous versions, the volume of hydrocarbon exports expressed in barrels was an exogenous variable, whose values were established based on the state of the world economy, international demand, and Venezuela's market share. This exogenous variable was the most important determinant of the level of oil production.

However, with the new OPEC policy of imposing oil production quotas on its members – Venezuela among them – the situation has changed. Now the country's export opportunity is determined by pre-established production levels and local consumption.

Other equations explaining minor exports, such as coffee and cocoa, are also included; these exports depend on the surplus production after local consumer demand has been satisfied. Despite the fact that aluminium is the country's second largest export product, a behavioural equation explaining its external sales could not be generated, since it only began to be exported at the end of the 1970s and there are not enough historical observations as yet.

Total real exports of goods and services (XR) are estimated as the sum of their components. Their nominal values (X) expressed in national currency (bolivars) are obtained by multiplying the real exports by the export price index (IPX).

Imports. A set of equations explaining different categories of real merchandise imports has been introduced into the model. This was done to satisfy the disaggregation requirements of the import equations in the models included in Project LINK (see Klein [5], Chapter 7), of which MODVEN is one. Under these requirements, the equations for real imports must be subdivided into at least four blocks, covering the ten types of imports of the Standard International Trade Classification (SITC):

Group	*Type of product*
0	Foods
1	Beverages and tobacco
2	Non-fuel raw materials
3	Fuels
4	Oils
5	Chemical products
6	Manufactured products, classified according to their materials
7	Transportation machinery
8	Miscellaneous manufactured products
9	Other merchandise

The four groups required for the LINK project models are: food, beverages and tobacco (0–1); basic materials (2 and 4); fuels (3); and manufactured products and others (5–9).

In the specific case of MODVEN VII, three behavioural equations are included to explain these real imports, except for fuel, since as an oil exporting country, Venezuela's fuel imports (metal-grade coke and certain other specific products) are insignificant and the estimation of an equation to explain them is not justified.

In the equations explaining real merchandise imports,

the dependent variables lagged one period, relative prices, real production levels, the relationship between demand and production, and the levels of internal aggregate demand, as well as a dummy variable representing the exchange controls in force since 1983, all appear as explanatory variables.

Certain service imports are explained endogenously. This is the case with transport and insurance, which vary with the volume of merchandise imports, and travellers' expenses, which reflect the exchange and inflation rates. Once the magnitudes of real imports of goods and services (MR) have been determined, the current imports in those categories (M), expressed in national currency, can be derived by multiplying the real magnitudes by their respective deflators.

Balance of payments and foreign debt

This block of the model contains equations explaining the variables of the balance of payments. The different components of the current account are calculated on the basis of the estimates of exports and imports of goods and services expressed in national currency as discussed above, and the values are converted to dollars by dividing the current bolivar estimates by the exchange rate applicable to each type of transaction.

A set of identities determine the income earned by Venezuelan capital invested abroad, interest payments on the country's public and private foreign debts, and foreign investment dividends. These estimations yield the credits and debits for the investment income entry.

With that information it is possible to estimate the combined balance of the goods and services accounts. Adding the net balance of unrequited transfers to that figure gives the current account balance.

In the capital account two identities define the credits and debits corresponding to the financial capital flows. The identity of the credits is composed of exogenous variables such as new indebtedness by the public sector (*DPBXNEW*$) and the private sector (*DPVXNEW*$), foreign investment (*CKINVEX*) and other credits (*CKOCRE*). The debits are composed of two exogenous variables representing capital flight (*CKFUGA*) and other debits corresponding to the capital account (*CKOSPB*), as well as two endogenous variables representing amortization payments on the public foreign debt (*DPBXAM*$) and private foreign debts (*DPVXAM*$), which are estimated in the external debt equations.

The international reserve variations, or overall balance of the balance of payments, can be obtained by adding the current and capital balances plus an exogenous variable (*ERROMISI*) that includes the official creation of reserves and the errors and omissions. Total international reserves at the end of each year are estimated by adding to the previous year's reserves the estimated overall balance of current year.

The foreign debt block of equations is one of the most important of the model. It includes a set of identities which calculate interest and principal payments on the public and private external debts, the assumption of new indebtedness, and the balances of all these external financial commitments at the beginning and end of each year.

Sectoral production

The total real GDP is estimated on the basis of demand ($C + I + G + X - M$). However, the real value-added of the different sectors of the economy is established through behavioural equations which include the lagged dependent variables, demand variables such as consumption, investment, and exports, and price variables as explanatory ones.

Variables defining the technical limits of production, such as full employment, use of existing capital etc are not made explicit in these equations (see Adams [1]). Those variables may be introduced into future versions of the model by estimating a technical production function – such as Cobb–Douglas, CES etc – in which potential output is made a function of the existing levels of capital and labour force.

This block of the model contains equations which explain the GDP of the agricultural, oil, manufacturing, construction, electricity and service sectors. The production of the service sector is not a function of demand or prices, but is derived through an identity in which its GDP is equal to the difference between the total gross domestic product, estimated on the basis of demand as noted above, and the sum of other sectors' GDP. This procedure avoids statistical discrepancy problems which occur when the total gross domestic product is estimated on the basis of both demand and sectoral production.

Employment

As in the production section, the employment block contains a set of behavioural equations which explain the demand for labour in the different sectors of the economy. The explanatory variables appearing in these equations are levels of employment in the preceding years, levels of production, investment spending (in the form of distributed lags in the case of the oil sector), and the average wage rate (also introduced in the form of distributed lags in the equation explaining employment in the manufacturing sector).

This section includes behavioural equations which explain employment in manufacturing (LM), construction (LC), electricity (LE), oil (LP) and services

(*LS*). Total employment is determined by adding the sectoral employment figures, including those for agriculture and mining, which are exogenous.

The labour force (*POBA*) is estimated through an identity in which it is defined as that in existence at the end of the previous year multiplied by a rate of annual growth closely linked to: (i) the rate of growth of the population 15 years prior to the period under analysis; (ii) the current level of economic activity; and (iii) immigration. Once the levels of the labour force and employment have been determined, the number of unemployed workers (*U*) and the unemployment rate (*UR*) can be estimated.

Wages, income and distribution

This section of the model contains a set of equations which explain income variables. A behavioural equation determines the average wage rate in the secondary and tertiary sectors (*WR*23), as a function of the unemployment rate (*UR*), average labour productivity (*PR*23), current and lagged inflation rates (*APORIDCP*), the wage rate of preceding year, and a dummy variable (*DWR*23), which explains a typical salary behaviour responding to compulsory wage increases, as occurred in 1974 and 1980.

Once the average wage rate has been determined, the labour remuneration in the secondary and tertiary sectors (*RT*23*C*) can be determined by multiplying that rate by the level of employment. Total wage income (*RETC*) is obtained by adding the wage remuneration in the primary sector (*RTSPC*), basically exogenous, to that of the secondary and tertiary sectors.

The next step is to compute current personal disposable income (*YPDC*) by adding non-wage personal revenues, also known as property income (*RPROP*) – rentals, interest, income of self employed professionals etc – to total wage income. Once wage and non-wage remunerations have been established, personal disposable income is obtained by adding the transfers received by persons from private firms, the state, and the rest of the world (*TRANF*) to those two magnitudes and deducting direct personal taxes (*TDCUC*). Real personal disposable income (*YPDR*) is obtained by deflating the current magnitude by the private consumption deflator.

Other equations in this block explain current national income (*YNC*), which is a function of the GDP in nominal terms (*PTBC*), real national income (*YNR*), and income distribution, the last one by relating property income to wage income (*RP*/*RT*), introduced as an important explanatory variable in the consumption equations.

Public finance

In this section a set of equations explain the revenues and outlays of the different parts of the public sector, permitting the calculation of its overall surplus or deficit. Separate estimates are made for the central government, the Venezuelan Investment Fund (VIF), the oil industry, the independent public agencies, and the state owned enterprises.

With respect to the central government revenues, there is a behavioural equation to explain non-oil direct taxes (*TDNPC*), estimated as a function of wage and non-wage personal revenues, and the lagged dependent variable. Other behavioural equations explain indirect taxes, such as customs duties (*TFA-DUANA*) and other import taxes (*TFDIMP*), as a function of merchandise imports (*MBTC*). Another important equation of this group is the one which explains the exchange profits earned by the government (*UTCFIS*), resulting from the differences among the exchange rates applicable to different external transactions; this variable is explained as a function of the foreign currency income and outlays of the Central Bank, expressed in terms of local currency.

A group of equations explains the central government revenues generated by the oil industry in the form of income tax and royalty payments, both assessed (*TUPCCAU* and *REGALIAC*) and actually collected (*TUPCREC* and *REGALIAR*). The magnitude of the assessed taxes varies with the profits earned by the oil industry (*UINDPET*) – calculated on the basis of tax reference export prices (*VEXPRO*) higher than the actual sale prices – the effective tax rates (*TEISPRET* and *PREGALBS*) and the volume of oil production.

The sum of all these revenue magnitudes, combined with other exogenous variables, such as liquor and cigarette taxes, fees, and other revenues of different kinds, defines the central government current revenues (*IOGC*). Government spending (*GTFIS*) is calculated as the sum of the different types of central government outlays, broken down into current spending (*GFISCTE*), capital formation (*GFISCAP*) and transfers (*GFTR*). The components which define these expenditures also serve as the basis for the computation of the magnitudes of public sector consumption and investment included in the aggregate demand block.

To estimate the oil industry's tax obligations, its financial balance is determined through a set of equations explaining its income as a function of export sales, valued at the tax reference prices (*XPDCPRF*), domestic sales (*VTINTPET*), and other income (*OIPDVSA*), as well as its costs (*COSINPET*). The difference between income and costs yields the industry's taxable profit (*UINDPET*) which is used to calculate its income tax obligation (*TUPCCAU*). This, plus the

operation tax or royalty (*REGALIAC*) determines the oil industry's assessed taxes, and it is on the basis of that figure that the taxes actually paid by the industry or collected by the Treasury (*TUPCREC* and *REGALIAR*) are determined.

A similar scheme, though adapted to each case in particular, is used to determine the financial balance of the independent agencies of the public sector, the state owned enterprises, and the VIF. With these figures, the financial balance of the public sector as a whole, excluding public debt principal payments, can be determined. By adding the latter to the preceding figure, the overall public sector financial balance and requirements are established.

Prices

One of the areas in which substantial improvements have been made in this version of the model is that of prices. Behavioural equations have been added to explain producer, wholesale and retail prices in a highly disaggregated form.

Two behavioural equations explaining the producer prices in the agricultural (*IPPA*) and manufacturing (*IPPM*) sectors as a function of costs, such as salaries (*WR*23), imports (*IPM*), other internal costs, average labour productivity, wholesale prices, and the lagged dependent variables, have been introduced.

As is common in several developing economy models (van Frausum [8]), in this case producer price variations depend basically on production cost fluctuations rather than on the behaviour of monetary, financial or demand variables. In the specific case of Venezuela, inflation has historically been a minor problem. It was only at the time of the oil boom (1974–77) that a moderate demand pull inflation materialized. However, since then, the main factor driving prices upward has been the constant increase in production costs (see Palma [7]).

In the equations explaining wholesale prices in agriculture (*IPMA*) and industry (*IPMM*), the determining factors are, on the one hand, the lagged dependent variables, and on the other, producer prices, which are introduced into the equations with Almon's polynomial distributed lag schemes. Likewise, the wholesale price index for imported products (*IPMT*) varies with import prices (*IPMB*), which in turn depend on international inflation rates and the exchange rates applicable to imports. Consequently these prices are also explained on the basis of costs, with no monetary or demand variables among their determinants.

In the case of consumer prices, there are behavioural equations which explain the consumer price index for the Caracas Metropolitan Area, broken down into its different components: food, beverages, and tobacco (*ICVABT*); household articles (*ICVHOG*); services (*ICVSER*); and clothing and footwear (*ICVVYC*). They are explained by wholesale prices, the lagged dependent variables and the velocity of money (*PTEPC/LIQC*); these are among the few price equations which include monetary variables in an explanatory role. Furthermore, a dummy variable (*DUMLIBP*) is introduced into these equations to reflect the greater or lesser severity of the price controls which have been in effect throughout the historical sample period. The overall cost of living index for the Caracas Metropolitan Area (*IDCPR*) is calculated through a behavioural equation as a function of the four indices indicated above.

Another group of equations explains the behaviour of the non-oil GDP deflator (*IDPTEP*), the oil GDP deflator (*IDPTP*), and the total GDP deflator (*IDPT*). These are functions of themselves with a one year lag, and of wholesale prices (*IGPM*), in the case of the non-oil GDP deflator, or of oil prices expressed in national currency (*PXHIDPRO*) in the case of the oil GDP deflator. The equation defining the total GDP deflator includes the non-oil and oil GDP deflators as explanatory variables. As will be explained below, the equation for the non-oil GDP deflator was re-estimated thereafter, with the inclusion of the velocity of circulation of money as an explanatory variable.

Import prices, which also serve as deflators to generate estimates of current imports in each of the groups (0–1, 2 and 4, 3, and 5–9), are estimated with identity equations. These depend on their own lagged values, on the average world export prices of those products, and the variations in the exchange rates applicable to the different kinds of imports.

Two additional equations explain the prices of non-oil merchandise exports (*IPXBNP*) and service exports (*IPXS*) as functions of the non-oil GDP deflator (*IDPTEP*) and the modifications of the average exchange rate applicable to those exports.

Monetary and financial sector

In the previous versions of MODVEN, the monetary base was determined endogenously on the side of its sources, by calculating the Central Bank's non-monetary assets and liabilities. For example, the variations of the Central Bank's foreign reserves depended on the balance of payments outcomes and the exchange rates in effect, while the variations of the government's securities portfolio and the Treasury account at the Central Bank were influenced by the budget results, and the balances of the Venezuelan Oil Corporation's deposit account in the Central Bank depended on the oil industry's liquid profits.

The monetary base specified in that way, combined with the monetary multipliers, also endogenously

determined, made possible the calculation of the money supply (M1 and M2), which in turn influenced the determination of demand and price variables. The public's deposits in the banking system, for their part, were explained in behavioural equations as a function of real variables such as production and price variations, and financial variables such as interest rates and loans.

However, experience demonstrated that the estimation of the monetary base in the manner described above yielded seriously distorted results, since the variation of the Central Bank's assets and liabilities often depended on variables obtained by the difference (balance) method, which are affected in turn by errors in the estimation of the variables which determine them. These problems resulted in severe dislocations in the model's estimations, as a result of which it was decided to incorporate a different method of estimation of the monetary variables, itself not free of limitations.

In this case, the logarithms of monetary liquidity (M2) (*LIQCL*) and of existing cash (coins and bills) (*MBEMIL*) are explained in two behavioural equations in which the explanatory variables are the logarithms of non-oil production (*PTEP*) and the non-oil GDP deflator (*IDPTEP*). These equations determine the required volumes of liquidity and cash, given the level of economic activity and prices. Once the monetary values of those variables have been obtained, the level of total deposits in the banking system (*MDTPUB*) is calculated as the difference between those two magnitudes.

The monetary base (*BASE*), for its part, is estimated through the quotient between monetary liquidity (*LIQC*) and its respective multiplier (*MULTLIQC*), the latter variable being calculated in the following identity:[2]

$$MULTLIQC = [1/(MCOEPE + MCOERB - (MCOEPE * MCOERB))]$$

where

MCOEPE is the coefficient of the public's preference for cash (*MBEMI/LIQC*)

MCOERB is the relationship between the banks' reserve deposits at the Central Bank and the total deposits in the banking system

Money supply variations depend on the net Central Bank's foreign exchange transactions with the private sector (*MOCAM*), the fiscal effect (*MGINL*), the credit effect (*MESCR*), and the Central Bank net internal asset variations (*ABCVAIN*).

Once the increase in monetary liquidity (*ALIQC*), the Central Bank's foreign exchange transactions with the private sector (*MOCAM*, which depend on the external transactions of the private sector), the public sector's balance not financed by securities purchased by the Central Bank (*MGINL*), and the variation of the Central Bank's net internal assets (*ABCVAIN*) are known, the money supply creation through credit activity (*MESCR*) can be determined as the difference between liquidity variation and the sum of all the other variable variations.

Given that interest rates are determined unilaterally by the monetary authorities and are often set at levels determined not by pure economic rationality, but largely reflecting political criteria, no equations can be developed to provide a satisfactory explanation of them. Consequently, both internal and external interest rates are introduced into the model as exogenous factors.

The exogenous character of interest rates and the simple method for the determination of the secondary expansion of the money supply constitute obvious restrictions on the model's ability to analyse the disequilibrium in the money market. The model implicitly assumes that both monetary policy and the banking system's credit activity will guarantee an automatic equilibrium between the supply and demand of money.

In spite of the fact that this is an annual model, it would be desirable in future versions to explore the behaviour of speculative demand for money and its impact on the free foreign exchange market, the formation of savings and capital and the velocity of money.

Other equations

As a complement to the seven blocks of equations which compose the core of the model, there are a number of identities made up of ratios among variables, many of which are oriented by the rationality of the results of the simulations. Among the most important of these are the ratios of personal disposable income to private consumption (*YPDR/CPTR*), real imports to domestic product (*MR/PTBR*), investment to production (*IBFR/PTBR*), gross domestic product per capita (*PTBR/POB*), and many others.

Comparative sensitivity analysis and other validations of the model

The first experiment for the validation of econometric models estimated on the basis of historical series is usually the performance of simulation exercises within

[2] For more detailed information on the methodology for calculating the Venezuelan monetary multipliers, see Central Bank of Venezuela [2].

the sample period and the comparison of the results with actual data. However, since historical data for certain key variables appearing in the model's equations are missing, due to modifications in the calculation methodology, it was not possible to carry out exercises of this kind.

However, a number of simulations were made for the 1985–91 period, the results of which can be compared to similar simulations made with models for other countries and which served as the basis for analysis at the Conference on Performance of Econometric Models of NICs and Developing Countries, held in Taipei late in May 1987.

At that time several economists were asked to perform forecast simulations for the 1985–91 period with their national models, testing eight alternative scenarios, the results of which were to be compared with those of a base simulation for the same period. This would make it possible to determine the sensitivity or degree of reaction of each model to different economic policy stimuli.

The results obtained in the simulations performed with the different models were subsequently compared and analysed together, so as to determine: (i) their degree of similarity or disparity; (ii) the capacity of the different models to react to differing economic policy scenarios; and (iii) the problems or limitations of the models, in order to make the necessary corrections (see Vial [9]). We will now outline the alternative scenarios simulated.

In simulation 1 the scenario was an increase in the public sector's real consumption equal to 1% of the real gross domestic product during the entire period of the simulation, the higher spending being financed by foreign loans. Two variants of the scenario were considered, scenario 1A (with monetary sterilization – Figure 2), in which it was established that the money supply does not vary with respect to the base solution, on the assumption that the monetary authorities take all the actions required to offset the expansive effect on the monetary base of the entry into the country of the funds coming from the foreign loans used to finance the larger public consumption, and scenario 1B (without monetary sterilization – Figure 3), in which the money supply was allowed to expand because of foreign loans.

In simulation 2 the effects of an increase of real public investment equivalent to 1% of the real gross domestic product during the entire period of the simulation were analysed. As in simulation 1 the larger investment was financed through foreign debt. The two variants outlined above (scenario 2A with monetary sterilization (Figure 4), and scenario 2B without it (Figure 5)) were also considered in this case. Simulation 3 involved a 10% devaluation of the national currency against the dollar in comparison

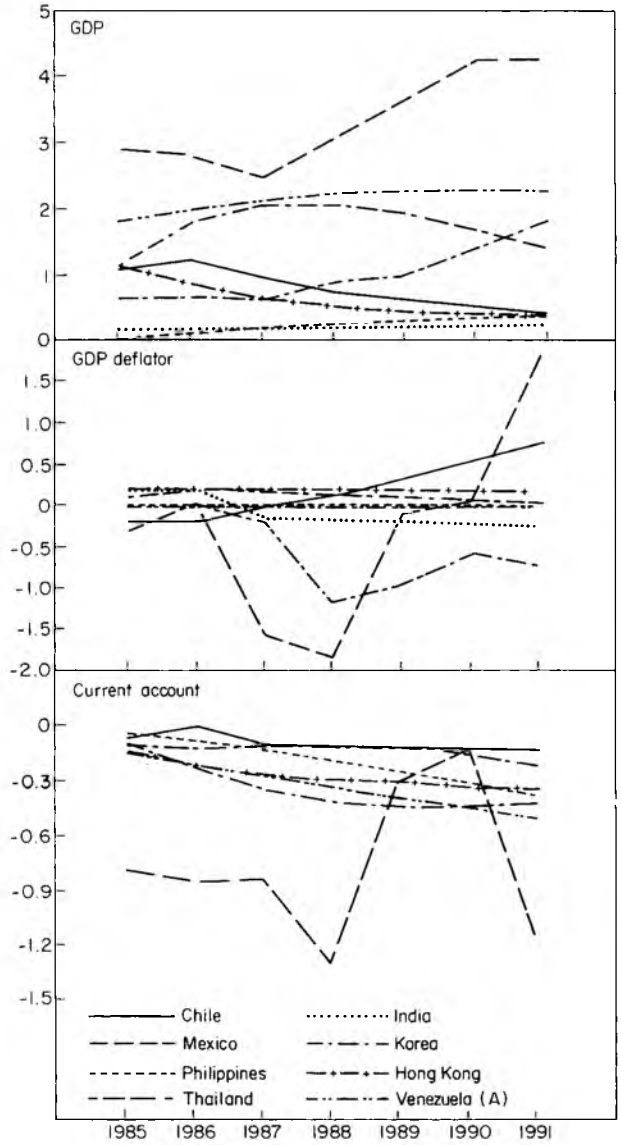

Figure 2. Simulation 1A: real public consumption increase with monetary sterilization.

with the base solution assumptions. Just as in the previous cases, the alternatives of monetary sterilization (scenario 3A – Figure 6) and absence thereof (scenario 3B – Figure 7) were considered.

Simulation 4 (Figure 8) expanded the money supply (M1) by 10% over the levels assumed in the base solution over the entire length of the period simulated, and simulation 5 (Figure 9) raised the London Interbank Offered Rate (LIBOR) by 1 percentage point over the level assumed in the base solution for the entire period simulated.

In all, eight alternative scenarios in addition to the base solution were simulated:

Simulation 1A Increase of real public consumption with monetary sterilization

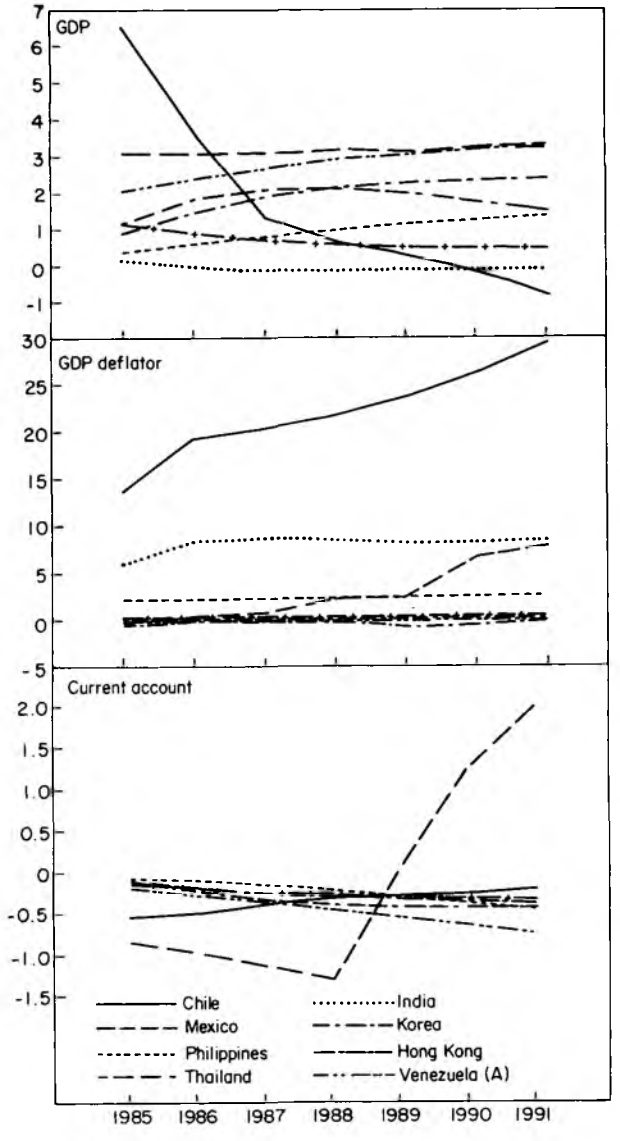

Figure 3. Simulation 1B: real public consumption increase without monetary sterilization.

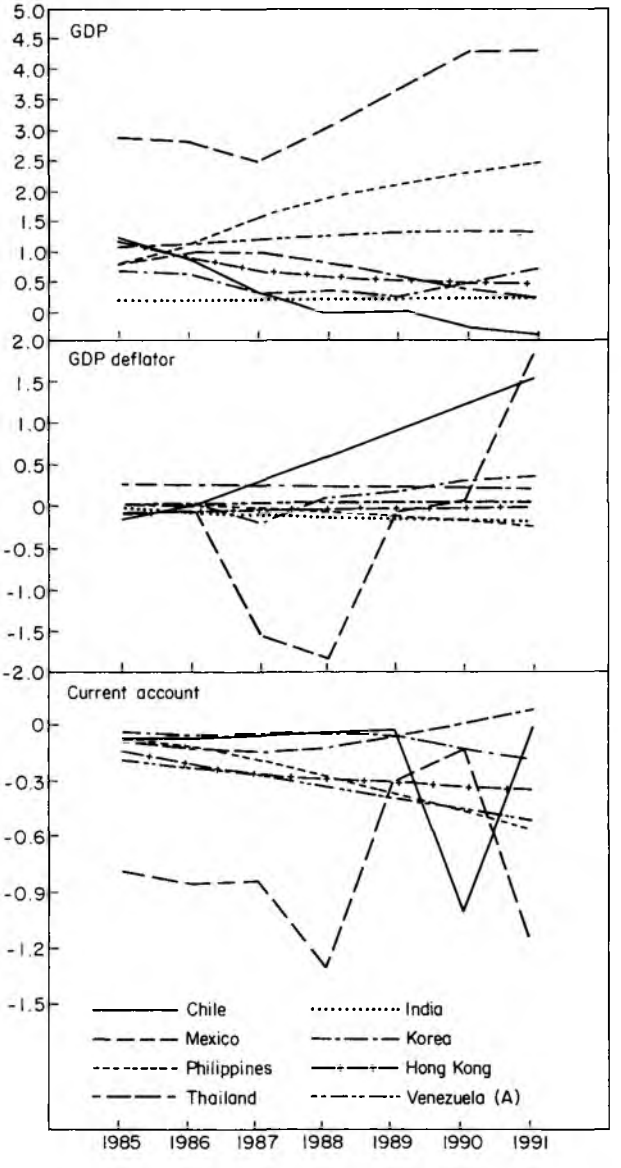

Figure 4. Simulation 2A: real public investment increase with monetary sterilization.

Simulation 1B	Increase of real public consumption without monetary sterilization
Simulation 2A	Increase of real public investment with monetary sterilization
Simulation 2B	Increase of real public investment without monetary sterilization
Simulation 3A	10% devaluation with monetary sterilization
Simulation 3B	10% devaluation without monetary sterilization
Simulation 4	10% increase in the money supply (M1)
Simulation 5	1% increase in the LIBOR

The base simulation

The base solution for the 1985–91 period was used to make a first test of the model's reaction and prediction capacity. The calculations for 1985 were equivalent to a static simulation for the last year of the sample period, while those for 1986 constituted an *ex post* forecast. Not only were satisfactory results achieved in both cases, but the tests yielded favourable indications of the model's ability to react to important changes in economic conditions (see Table 1).

For example, the policy change which took place throughout 1986, characterized by a strong expansion of public spending in spite of the collapse of oil prices, coming after the austerity policy followed in 1984 and 1985, produced a positive reaction in the country's gross domestic product of nearly 3%; this was fully reflected in the base simulation. Furthermore, the calculations for the price, monetary, external

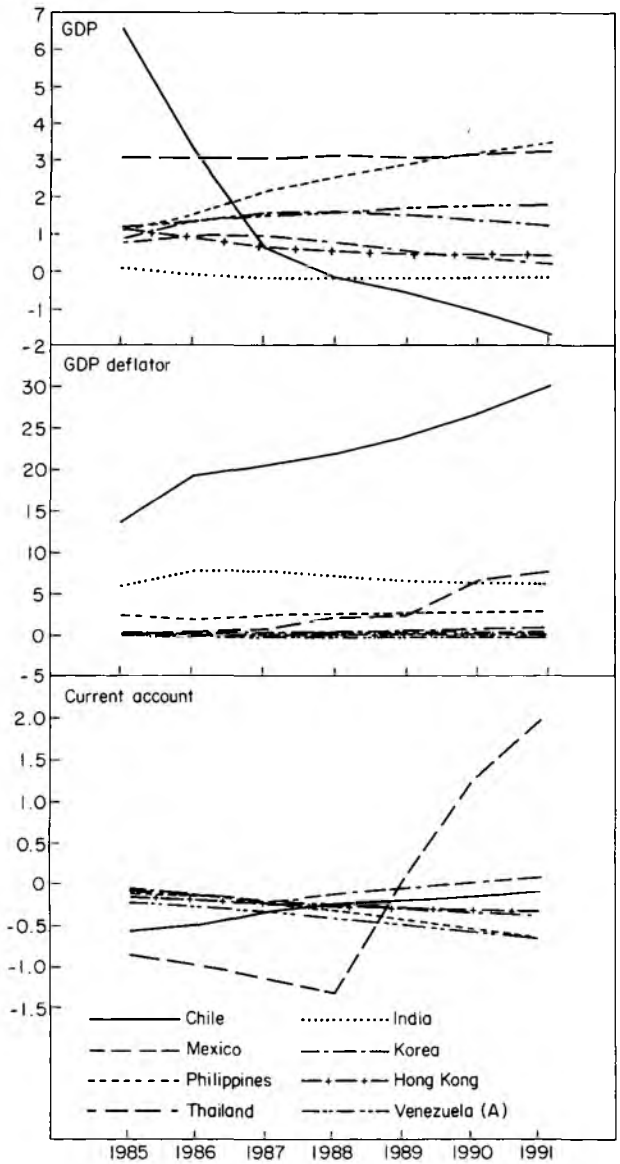

Figure 5. Simulation 2B: real public investment increase without monetary sterilization.

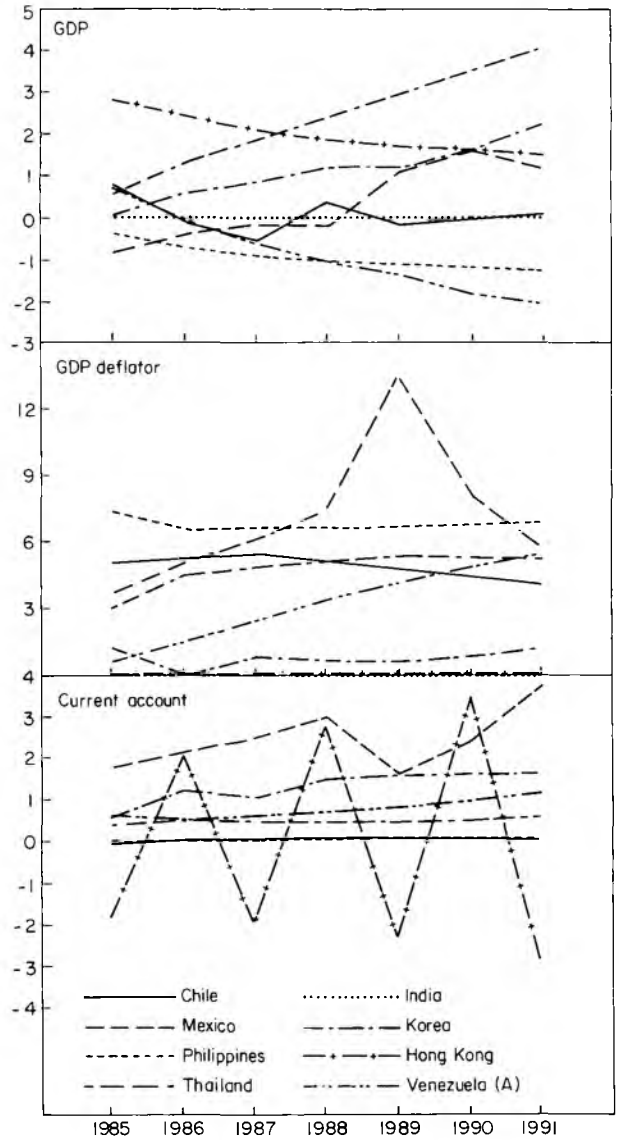

Figure 6. Simulation 3A: devaluation of 10% with monetary sterilization.

sector, sectoral production, employment and demand component variables showed only an acceptable degree of deviation from the observed figures.

The results for 1987 appear to be likewise acceptable, since they reflect the expected effects of a set of economic policy measures adopted in December 1986 and others taken during the course of this year, effects which have in fact occurred in the part of the year which has elapsed (up to July 1987). There is a substantial increase in the rate of price variations as a result of the 93% 'maxidevaluation' of the bolivar against the dollar for a large part of the country's imports.

There is also an initially positive reaction on the part of economic activity in 1987, in spite of the extreme devaluation, due to the simultaneous application of a stimulative fiscal policy and a general wage and salary increase decreed by the government, which has sustained internal demand in the face of accelerating inflation. However, for the following years, there is a slow down as a consequence of severe disequilibria in the monetary and public sector accounts, which will require the imposition of restrictive policies that will have a depressive effect on economic activity.

In summary, the base solution estimated in this exercise, while it cannot be taken as a prediction of the future of the Venezuelan economy (that was not the intention of the simulation), reveals that the model has a good reaction capacity.

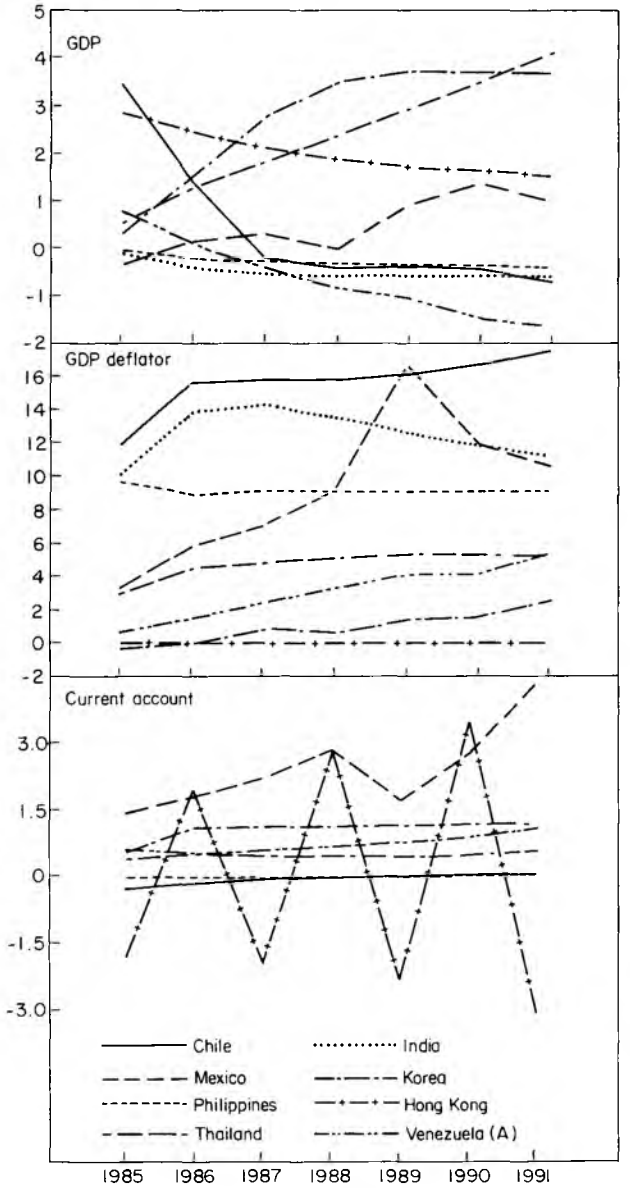

Figure 7. Simulation 3B: devaluation of 10% without monetary sterilization.

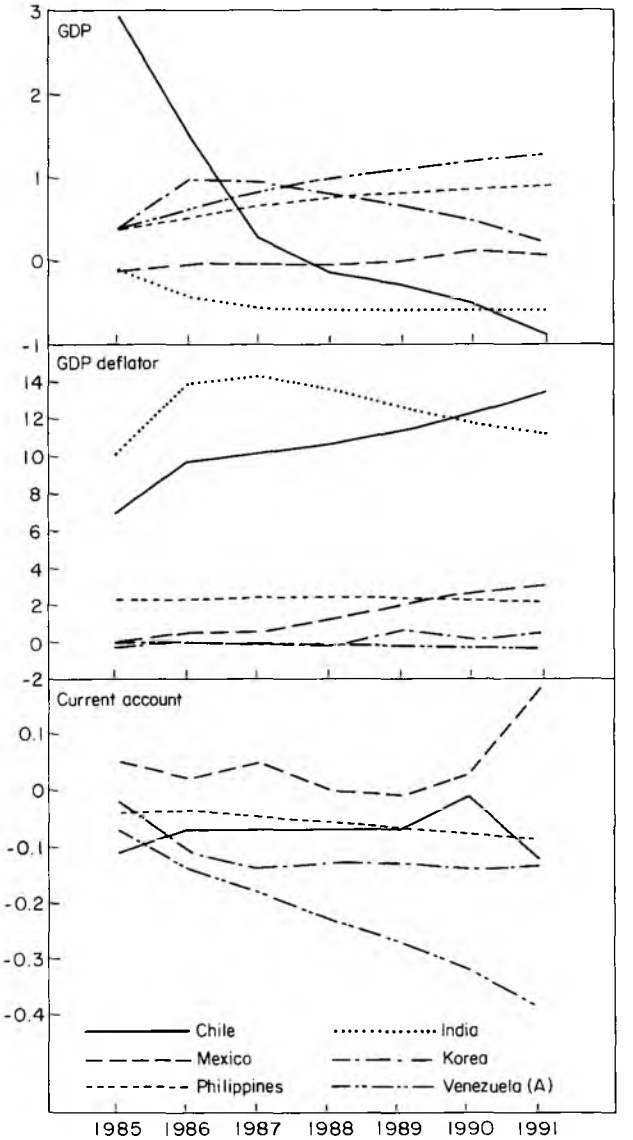

Figure 8. Simulation 4: 10% increase in money supply (M1).

Results of the alternative simulations and their comparison with those of other macroeconomic models for developing countries

In Tables 2–9 and the following figures, we present the results of the eight alternative scenarios simulated with the seven models participating in the comparative exercise. The said tables and figures show the percentage deviations of the results of each simulation from those of the base solution, thereby permitting an analysis of the effects of the changes introduced in the different simulations on three key variables: (i) the gross domestic product; (ii) the gross domestic product deflator; and (iii) the current account balance.

Just as in the case of rest of the models participating in the exercise (see Vial [9]), MODVEN VII supports the premise that the real effects of the fiscal policies are stronger than those of the monetary policies, since the impact of an increase of real public sector consumption or investment on production (GDP) is greater than that generated by an increase in the money supply.

However, as can be observed in several of the models, the medium-term reaction of production to an increase in public consumption is stronger than the reaction to a similar expansion of public investment. In the case of MODVEN VII this is due to the fact that the rising consumption is reflected in a corresponding growth in the wage remuneration of public employees and, therefore, of personal disposable

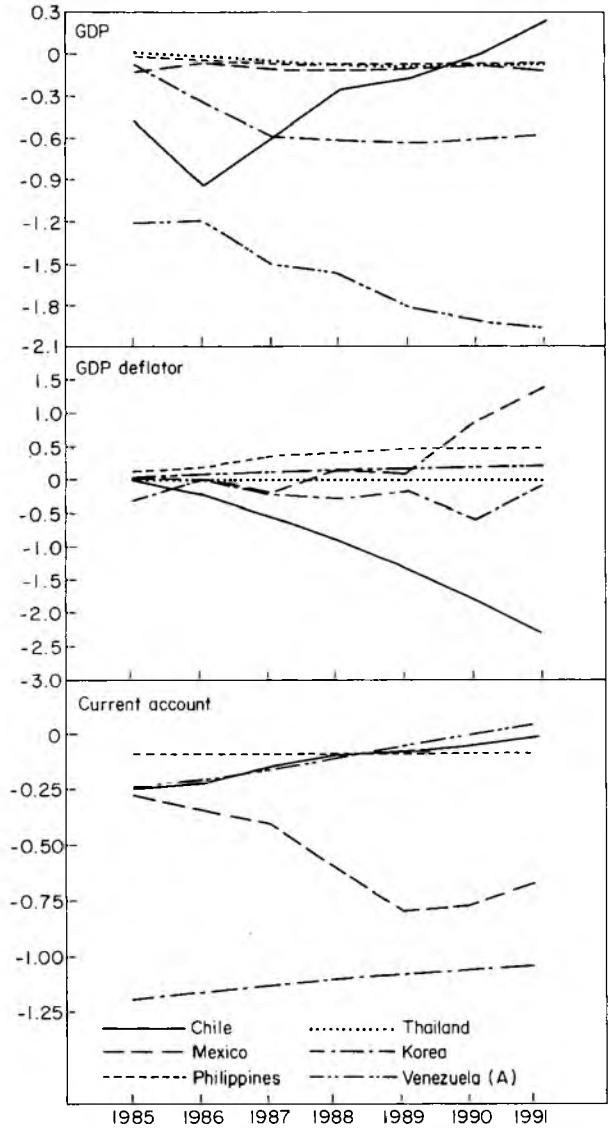

Figure 9. Simulation 5: an increase of 1 percentage point in LIBOR.

income. This has an important stimulative effect on private consumption. The increase in both forms of consumption is fully reflected in GDP since, as we have already mentioned, it is estimated on the basis of demand ($C + I + G + X - M$).

On the other hand, though an expansion of government investment has a positive impact on private consumption through the growth in employment it generates, the expansion of private consumption is somewhat smaller than that produced by rising public consumption. Consequently, public investment variation has a smaller effect on production.

This disparity may reflect a limitation in the structure of the model, since private investment should also react positively to larger capital formation spending by the public sector, adding another stimulus to production. However, the increase in private investment is negligible in these exercises since in the simulation of the alternative scenarios, the values of private capital formation (exogenous in the model with the exception of investment in the manufacturing sector) were not changed.

As in the cases of Chile, the Philippines and India, the effect of the devaluation on the level of economic activity is negative in the medium term. For Venezuela, that is because the modification of exchange rates has a strong (cost-push) inflationary effect which restricts demand, and particularly private demand, because of the contraction of the population's purchasing power. As a result, the domestic product declines in spite of the reduction of imports reflecting improved local competitiveness.

On the other hand, in countries with a more highly developed export sector, such as Korea, Hong Kong and Mexico, the effect of devaluation on production is very positive, since it strongly increases external sales. As expected, in the case of Venezuela the decline in imports brings about an improvement in the current account throughout the simulated period.

With respect to the effects of an increase in external interest rates (LIBOR), MODVEN VII reacts as expected, showing a contraction of production and a higher level of inflation. The current account also deteriorates as it can logically be expected to do, since rising interest rates produce a larger deficit in the investment income account.

However, and in contrast to the results of the other models, there is a slight improvement in the external current account toward the end of the period (1991). This is because the declining level of production reduces imports to the point where, in the sixth year of the exercise, that contraction equals and offsets the higher interest payments on the foreign debt, and exceeds those payments in the seventh year.

One of the most important conclusions of this exercise is that in MODVEN VII many of the price variables (particularly the non-oil GDP deflator and producer and wholesale prices) do not react to modifications of the monetary and demand variables, since their behaviour is explained in terms of costs (salaries, import prices etc) and labour productivity (product/employment) – see subsection above on prices (p 292).

Furthermore, it would seem that prices are extremely sensitive to variations in average productivity, since they decline in the event of any increase in production not accompanied by an equal change in employment. This does not correspond to the real economic situation of a country like Venezuela, in which any change that may occur in average labour productivity, generated

Table 1. Base simulation: comparison with historical data.

	1985		1986			1987	
	Estimated	Historic	% Difference[a]	Estimated	Historic	% Difference	Estimated
GDP (billion bolivars 1968)	65.9	65.4	−0.71	66.5	67.6	1.64	67.9
GDP deflator (%)[a]	445.5	441.6	−0.88	503.7	506.4	0.53	624.0
Wholesale prices (%)[a]	469.1	475.7	1.40	545.7	550.5	0.87	722.6
Cost of living (%)[a]	401.3	399.5	−0.46	453.6	445.8	−1.75	553.5
Trade balance (billion US dollars)	7.0	6.8		1.5	1.0		3.0
Current account (billion US dollars)	3.8	3.1		−1.4	−1.6		0.3

[a] % index 1968 = 100.

Table 2. Simulation 1A: real public consumption increase with monetary sterilization (deviation from base solution).

Years	1	2	3	4	5	6	7
Gross Domestic Product							
Chile	1.09	1.24	0.96	0.74	0.65	0.55	0.42
Mexico	2.88	2.79	2.46	3.02	3.65	4.26	4.27
Philippines	0.04	0.11	0.20	0.25	0.3	0.35	0.39
Thailand	1.15	1.79	2.05	2.05	1.91	1.67	1.38
India	0.19	0.19	0.19	0.2	0.21	0.24	0.26
Korea	0.65	0.68	0.62	0.89	1.01	1.42	1.83
Hong Kong	1.14	0.87	0.64	0.51	0.44	0.41	0.38
Venezuela (A)	1.83	2.00	2.14	2.24	2.28	2.3	2.27
GDP deflator							
Chile	−0.19	−0.19	−0.006	0.12	0.33	0.55	0.78
Mexico	0.00	0.00	−1.58	−1.86	−0.096	0.05	1.82
Philippines	0.00	0.01	0.01	0.00	0.00	−0.01	−0.04
Thailand	0.10	0.19	0.15	0.11	0.1	0.05	0.02
India	−0.03	−0.11	−0.16	−0.19	−0.2	−0.24	−0.26
Korea	−0.31	0.00	−0.22	−1.18	−0.97	−0.59	−0.75
Hong Kong	0.20	0.19	0.19	0.19	0.18	0.17	0.16
Venezuela (A)	−0.01	−0.02	−0.03	−0.03	−0.04	−0.03	−0.03
Current account							
Chile	−0.07	−0.1	−0.11	−0.12	−0.12	−0.13	−0.13
Mexico	−0.79	−0.86	−0.84	−1.31	−0.3	−0.13	−1.2
Philippines	−0.045	−0.088	−0.139	−0.194	−0.254	−0.319	−0.387
Thailand	−0.10	−0.24	−0.35	−0.42	−0.45	−0.45	−0.42
Korea	−0.11	−0.13	−0.11	−0.12	−0.12	−0.16	−0.22
Hong Kong	−0.14	−0.22	−0.28	−0.3	−0.31	−0.34	−0.35
Venezuela (A)	−0.15	−0.23	−0.27	−0.34	−0.4	−0.45	−0.52

by isolated circumstances, is unlikely to yield a change in prices in the opposite direction.

As a result, on simulating scenarios such as those herein analysed,[3] prices not only fail to react to increases in public spending, but they also tend to decline when it is assumed that such new expenditures are accompanied by a monetary expansion (scenarios 1B, 2B and 3B – Figure 3, Figure 5 and Figure 7). In structural terms, that is because an expansion of the money supply stimulates demand, and consequently the levels of production and productivity rise and prices go down.

In these circumstances, an attempt was made to re-estimate the price equations, introducing monetary variables and variables for excess demand in an explanatory role, and trying to reduce the influence of the average productivity variables in the determination of prices. Such new variables as liquidity and its variation, the relationship between an increase in the money supply and production, the relationship between variations in production and demand, the velocity of money ($PTEPC/LIQC$), and some others were used in the estimation process.

In addition, these equations were estimated with labour productivity moving average figures instead of simple average productivity figures as explanatory variables, with the aim of smoothing the series and reducing the short-term influence of productivity on prices.

In the case of producer and wholesale prices, it was

[3] The results of the simulations analysed up to now are given in Tables 2–9 as 'Venezuela (A)'.

Table 3. Simulation 1B: real public consumption increase without monetary sterilization (deviation from base solution).

Years	1	2	3	4	5	6	7
Gross Domestic Product							
Chile	6.51	3.69	1.3	0.61	0.25	−0.22	−0.89
Mexico	3.07	3.034	3.034	3.139	3.016	3.187	3.243
Philippines	0.36	0.59	0.76	0.92	1.07	1.18	1.29
Thailand	1.15	1.79	2.05	2.05	1.91	1.67	1.38
India	0.12	−0.09	−0.18	−0.2	−0.19	−0.18	−0.2
Korea	0.89	1.41	1.87	2.1	2.22	2.28	2.3
Hong Kong	1.14	0.87	0.64	0.51	0.44	0.41	0.38
Venezuela (A)	2.06	2.38	2.63	2.87	2.99	3.14	3.15
GDP deflator							
Chile	13.65	19.22	20.27	21.56	23.56	26.14	29.3
Mexico	−0.305	0.508	0.787	2.171	2.402	6.54	7.68
Philippines	2.23	2.13	2.17	2.28	2.35	2.33	2.49
Thailand	0.10	0.19	0.15	0.11	0.1	0.05	0.02
India	5.96	8.27	8.62	8.27	7.93	8.01	8.32
Korea	−0.31	0.00	−0.22	−0.27	−0.97	−0.59	−0.07
Hong Kong	0.2	0.19	0.19	0.19	0.18	0.17	0.16
Venezuela (A)	−0.01	−0.03	−0.07	−0.11	−0.14	−0.18	−0.2
Current account							
Chile	−0.55	−0.5	−0.39	−0.32	−0.29	−0.26	−0.21
Mexico	−0.85	−0.99	−1.15	−1.33	0.06	1.25	1.99
Philippines	−0.082	−0.12	−0.176	−0.242	−0.316	−0.39	−0.473
Thailand	−0.1	−0.24	−0.35	−0.42	−0.45	−0.45	−0.42
Korea	−0.12	−0.21	−0.28	−0.31	−0.34	−0.37	−0.41
Hong Kong	−0.14	−0.22	−0.28	−0.3	−0.31	−0.34	−0.35
Venezuela (A)	−0.2	−0.31	−0.38	−0.49	−0.57	−0.67	−0.78

Table 4. Simulation 2A: real public investment increase with monetary sterilization (deviation from base solution).

Years	1	2	3	4	5	6	7
Gross Domestic Product							
Chile	1.21	0.85	0.27	−0.07	−0.2	−0.31	−0.44
Mexico	2.88	2.79	2.46	3.02	3.65	4.26	4.27
Philippines	0.78	1.09	1.55	1.86	2.08	2.27	2.43
Thailand	0.79	0.98	0.94	0.77	0.54	0.33	0.16
India	0.19	0.18	0.17	0.17	0.18	0.19	0.2
Korea	0.67	0.6	0.27	0.32	0.2	0.46	0.69
Hong Kong	1.16	0.89	0.66	0.54	0.47	0.44	0.41
Venezuela (A)	1.06	1.12	1.2	1.24	1.3	1.29	1.26
GDP deflator							
Chile	−0.15	0.00	0.28	0.58	0.9	1.2	1.52
Mexico	0.00	0.00	−1.58	−1.86	−0.096	0.05	1.82
Philippines	0.00	−0.01	−0.04	−0.1	−0.15	−0.2	−0.27
Thailand	0.25	0.24	0.22	0.21	0.21	0.18	0.17
India	−0.03	−0.11	−0.13	−0.17	−0.18	−0.19	−0.22
Korea	0.00	0.00	−0.22	0.09	0.16	0.29	0.34
Hong Kong	−0.08	−0.07	−0.06	−0.06	−0.06	−0.06	−0.05
Venezuela (A)	0.01	0.02	0.02	0.03	0.03	0.03	0.03
Current account							
Chile	−0.07	−0.07	−0.05	−0.03	−0.02	−0.01	0.00
Mexico	−0.79	−0.86	−0.84	−1.31	−0.3	−0.13	−1.2
Philippines	−0.08	−0.12	−0.19	−0.28	−0.37	−0.47	−0.57
Thailand	−0.09	−0.14	−0.15	−0.12	−0.06	0.01	0.09
Korea	−0.04	−0.06	−0.04	−0.05	−0.06	−0.13	−0.19
Hong Kong	−0.14	−0.22	−0.27	−0.3	−0.31	−0.34	−0.35
Venezuela (A)	−0.19	−0.24	−0.27	−0.34	−0.4	−0.45	−0.52

Table 5. Simulation 2B: real public investment increase without monetary sterilization (deviation from base solution).

Years	1	2	3	4	5	6	7
Gross Domestic Product							
Chile	6.63	3.28	0.62	−0.18	−0.58	−1.11	−1.73
Mexico	3.07	3.034	3.034	3.139	3.016	3.187	3.243
Philippines	1.12	1.52	2.16	2.56	2.91	3.2	3.45
Thailand	0.79	0.98	0.94	0.77	0.54	0.33	0.16
India	0.12	−0.1	−0.18	−0.19	−0.17	−0.15	−0.15
Korea	0.92	1.36	1.6	1.62	1.52	1.38	1.22
Hong Kong	1.16	0.89	0.66	0.54	0.47	0.44	0.41
Venezuela (A)	1.22	1.37	1.53	1.63	1.74	1.78	1.78
GDP deflator							
Chile	13.69	19.39	20.63	22.07	24.18	26.87	30.12
Mexico	−0.305	0.508	0.787	2.171	2.402	6.54	7.68
Philippines	2.46	1.85	2.44	2.59	2.72	2.73	2.8
Thailand	0.25	0.24	0.22	0.21	0.21	0.18	0.17
India	5.96	7.82	7.71	7.1	6.45	6.19	6.13
Korea	0.00	−0.13	0.11	0.27	0.49	0.81	1.02
Hong Kong	−0.08	−0.07	−0.06	−0.06	−0.06	−0.06	−0.05
Venezuela (A)	0.01	0.02	0.01	0.00	−0.02	−0.04	−0.06
Current account							
Chile	−0.55	−0.48	−0.33	−0.23	−0.18	−0.14	−0.08
Mexico	−0.85	−0.99	−1.15	−1.33	0.06	1.25	1.99
Philippines	−0.116	−0.148	−0.237	−0.331	−0.439	−0.553	−0.674
Thailand	−0.09	−0.14	−0.15	−0.12	−0.06	0.01	0.09
Korea	−0.06	−0.15	−0.23	−0.27	−0.31	−0.35	−0.4
Hong Kong	−0.14	−0.22	−0.27	−0.3	−0.31	−0.34	−0.35
Venezuela (A)	−0.22	−0.3	−0.34	−0.43	−0.51	−0.58	−0.67

Table 6. Simulation 3A: devaluation of 10% with monetary sterilization (deviation from base solution).

Years	1	2	3	4	5	6	7
Gross Domestic Product							
Chile	0.78	−0.13	−0.55	0.37	−0.16	−0.01	0.11
Mexico	−0.829	−0.416	−0.163	−0.222	1.081	1.601	1.172
Philippines	−0.38	−0.74	−0.93	−1.07	−1.14	−1.22	−1.28
Thailand	0.54	1.29	1.83	2.4	2.96	3.52	4.13
India	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Korea	0.05	0.58	0.86	1.21	1.19	1.63	2.28
Hong Kong	2.83	2.42	2.09	1.85	1.69	1.62	1.5
Venezuela (A)	0.7	−0.07	−0.62	−1.08	−1.36	−1.83	−2.06
GDP deflator							
Chile	5.09	5.92	5.53	5.11	4.73	4.37	4.02
Mexico	3.66	5.08	6.1	7.44	13.45	8.14	5.8
Philippines	7.38	6.57	6.69	6.6	6.68	6.83	6.91
Thailand	3.02	4.51	4.9	5.15	5.38	5.24	5.26
India	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Korea	1.25	0.00	0.87	0.63	0.65	0.88	1.29
Hong Kong	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Venezuela (A)	0.67	1.53	2.49	3.41	4.21	4.9	5.51
Current account							
Chile	−0.05	0.07	0.09	0.1	0.09	0.08	0.06
Mexico	1.77	2.15	2.5	3.0	1.6	2.4	3.76
Philippines	0.04	0.04	0.05	0.06	0.08	0.09	0.1
Thailand	0.4	0.51	0.46	0.47	0.45	0.49	0.63
Korea	0.58	1.21	1.4	1.51	1.57	1.64	1.6
Hong Kong	−1.8	2.0	−1.91	2.77	−2.31	3.46	−2.96
Venuezela (A)	0.62	0.52	0.65	0.73	0.84	0.98	1.21

Table 7. Simulation 3B: devaluation of 10% without monetary sterilization (deviation from base solution).

Years	1	2	3	4	5	6	7
Gross Domestic Product							
Chile	3.46	1.41	−0.21	−0.42	−0.37	−0.45	−0.7
Mexico	−0.33	0.15	0.3	−0.01	0.93	1.37	0.98
Philippines	−0.05	−0.24	−0.29	−0.34	−0.36	−0.38	−0.41
Thailand	0.54	1.29	1.83	2.4	2.96	3.52	4.13
India	−0.11	−0.43	−0.57	−0.6	−0.59	−0.59	−0.6
Korea	0.32	1.51	2.78	3.49	3.72	3.67	3.69
Hong Kong	2.83	2.42	2.09	1.85	1.69	1.62	1.5
Venezuela (A)	0.78	0.06	−0.44	−0.85	−1.08	−1.5	−1.68
GDP deflator							
Chile	11.86	15.61	15.75	15.81	16.16	16.75	17.57
Mexico	3.35	5.84	7.09	9.15	16.62	11.93	10.61
Philippines	9.67	8.85	9.13	9.04	9.05	9.09	9.13
Thailand	3.02	4.51	4.9	5.15	5.38	5.24	5.26
India	10.07	13.82	14.29	13.53	12.55	11.74	11.2
Korea	−0.31	0.00	0.87	0.63	1.46	1.62	2.65
Hong Kong	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Venezuela (A)	0.66	1.51	2.45	3.36	4.13	4.81	5.4
Current account							
Chile	−0.28	−0.15	−0.07	−0.01	0.01	0.02	0.04
Mexico	1.43	1.8	2.22	2.85	1.72	2.76	4.32
Philippines	−0.002	0.008	0.007	0.011	0.014	0.016	0.019
Thailand	0.4	0.51	0.46	0.47	0.45	0.49	0.63
Korea	0.56	1.12	1.15	1.16	1.15	1.21	1.18
Hong Kong	−1.8	2.00	−1.91	2.77	−2.31	3.46	−2.96
Venezuela (A)	0.6	0.49	0.61	0.68	0.78	0.9	1.1

Table 8. Simulation 4: increase of 10% in monetary supply (M1) (deviation from base solution).

Years	1	2	3	4	5	6	7
Gross Domestic Product							
Chile	2.92	1.52	0.26	−0.14	−0.28	−0.51	−0.88
Mexico	−0.127	−0.04	−0.05	−0.05	0.008	0.15	0.07
Philippines	0.35	0.52	0.67	0.76	0.82	0.87	0.91
India	−0.11	−0.43	−0.57	−0.6	−0.59	−0.59	−0.6
Korea	0.38	0.96	0.94	0.8	0.66	0.48	0.22
Venezuela (A)	0.37	0.63	0.84	0.99	1.1	1.21	1.29
GDP deflator							
Chile	6.93	9.71	10.21	10.67	11.39	12.32	13.47
Mexico	0.00	0.51	0.59	1.24	2.11	2.75	3.15
Philippines	2.29	2.29	2.45	2.45	2.37	2.25	2.21
India	10.07	13.82	14.29	13.53	12.55	11.74	11.2
Korea	−0.31	0.00	−0.22	−0.27	0.65	0.15	0.61
Venezuela (A)	−0.02	−0.08	−0.15	−0.22	−0.29	−0.35	−0.39
Current account							
Chile	−0.11	−0.07	−0.07	−0.07	−0.07	−0.1	−0.12
Mexico	0.05	0.02	0.05	0.00	−0.01	0.03	0.18
Philippines	−0.04	−0.036	−0.048	−0.057	−0.068	−0.078	−0.086
Korea	−0.02	−0.11	−0.14	−0.13	−0.13	−0.14	−0.13
Venezuela (A)	−0.07	−0.14	−0.18	−0.23	−0.27	−0.32	−0.39

Table 9. Simulation 5: increase of 1 percentage point in LIBOR (deviation from base solution).

Years	1	2	3	4	5	6	7
Gross Domestic Product							
Chile	−0.48	−0.94	−0.6	−0.25	−0.17	0.00	0.25
Mexico	−0.13	−0.07	−0.12	−0.12	−0.1	−0.03	−0.13
Philippines	−0.03	−0.06	−0.08	−0.08	−0.07	−0.07	−0.07
Thailand	0.01	−0.02	−0.06	−0.08	−0.09	−0.08	−0.06
Korea	−0.08	−0.35	−0.59	−0.62	−0.64	−0.61	−0.57
Venezuela (A)	−1.21	−1.19	−1.5	−1.57	−1.81	−1.91	−1.96
GDP deflator							
Chile	−0.01	−0.22	−0.54	−0.89	−1.32	−1.79	−2.3
Mexico	0.00	0.00	−0.2	0.16	0.1	0.9	1.4
Philippines	0.12	0.19	0.35	0.41	0.47	0.48	0.49
Thailand	0.00	0.00	0.00	0.00	0.01	0.01	0.01
Korea	−0.31	0.00	−0.22	−0.27	−0.16	−0.59	−0.07
Venezuela (A)	0.03	0.08	0.11	0.15	0.17	0.2	0.21
Current account							
Chile	−0.25	−0.22	−0.15	−0.1	−0.08	−0.05	−0.01
Mexico	−0.28	−0.35	−0.41	−0.61	−0.8	−0.77	−0.67
Philippines	−0.092	−0.096	−0.096	−0.09	−0.088	−0.087	−0.089
Korea	−1.19	−1.16	−1.13	−1.1	−1.08	−1.06	−1.04
Venezuela (A)	−0.24	−0.21	−0.16	−0.11	−0.05	0.00	0.05

not possible to introduce the monetary variables in an explanatory role, since the distortion of signs and magnitude of the coefficients created by multicollinearity problems, or the low correlation between these variables and price behaviour, prevented the achievement of acceptable results. However, in the case of the equation for the producer prices of manufactured products (*IPPM*), the average productivity variable (*PR*23) could be substituted by the three-year moving average of labour productivity in the manufacturing sector, as a way of eliminating the overreaction of prices to sporadic variations of global productivity.

In this way, the equation that explains these prices changed from its original form,

$$IPPM = \underset{(3.825)}{64.1802} + \underset{(2.317)}{0.2617} * IPPM@1 - \underset{(-3.337)}{3.3472} * PR23 + \underset{(6.217)}{0.00448} * WR23 + \underset{(8.090)}{0.2591} * IPM$$

$R^2 = 0.998$ DW = 2.189 SE = 4.041

where

IPPM is the producer price index for manufactured goods
IPPM@1 is equal to *IPPM* lagged one period
*PR*23 is the average labour productivity of the secondary and tertiary sectors (*P*23*R*/*L*23)
*WR*23 is the average wage rate for the secondary and tertiary sectors
IPM is the price index for imports of goods and services

to another equation, whose structure is

$$IPPM = \underset{(2.674)}{74.4683} + \underset{(3.075)}{0.3569} * IPPM@1 + \underset{(4.855)}{0.00427} * WR23 + \underset{(6.830)}{0.2712} * IPM - \underset{(-2.366)}{5.3172} * [(PMR/LM + PMR@1/LM@1 + PMR@2/LM@2)/3]$$

$R^2 = 0.997$ DW = 2.079 SE = 4.578

where

PMR/*LM* is the average labour productivity in the manufacturing sector
the symbol @*i* indicates a lag of *i* periods

It was also possible to introduce the velocity of money (*PTEPC*/*LIQC*) as an explanatory variable of the non-oil GDP deflator (*IDTEP*), leading to the

Table 10. Reaction of prices in certain alternative simulations (deviations from base solution).[a]

Years	1	2	3	4	5	6	7
Simulation 1B	Increase in public consumption without monetary sterilization						
Venezuela (A)	−0.01	−0.03	−0.07	−0.11	−0.14	−0.18	−0.20
Venezuela (B)	0.01	0.02	0.01	−0.03	−0.07	−0.11	−0.15
Simulation 4	10% increase in money supply (M1)						
Venezuela (A)	−0.02	−0.08	−0.15	−0.22	−0.29	−0.35	−0.39
Venezuela (B)	0.05	0.06	0.00	−0.08	−0.16	−0.26	−0.35

[a] The figures identified as Venezuela (A) correspond to the initial simulations (Tables 2–9). The figures identified as Venezuela (B) correspond to the simulations made with the new price equations.

substitution of the following original equation

$$IDPTEP = \underset{(-3.933)}{-6.0717} + \underset{(4.340)}{0.2911}*IGPM + \underset{(10.133)}{0.7948}*IDPTEP@1 + \underset{(6.537)}{19.4759}*DUMLIBP$$

$R^2 = 0.999$ DW = 2.369 SE = 3.193

where

IGPM is the overall wholesale price index
DUMLIBP is a dummy variable reflecting the degree of price controls

by another whose structure is

$$IDPTEP = \underset{(0.357)}{1.7962} + \underset{(3.782)}{0.2562}*IGPM + \underset{(10.685)}{0.8197}*IDPTEP@1 + \underset{(6.373)}{18.5530}*DUMLIBP - \underset{(-1.636)}{2.1322}*(PTEPC/LIQC)$$

$R^2 = 0.999$ DW = 2.664 SE = 3.061

where

$(PTEPC/LIQC)$ is the velocity of money

Re-estimation of the alternative simulations

Once these new equations were incorporated into the model in substitution of the original ones, the base simulation and the eight alternative scenarios were calculated once again (Table 10).

In general, it can be said that the results obtained do not differ significantly from the previous ones, although the behaviour of prices is somewhat more logical. In certain simulations in which it is assumed that there is no monetary sterilization (exercises 1B and 4, for example), the non-oil GDP deflator reacts more strongly with the result that the deviation from the base solution is positive or stronger over the first few years of the simulation, as is to be expected, although the differences are very small.

This occurs because, on the one hand, the money supply is now reflected in the determination of the deflator (the velocity of money appears as an explanatory variable in the new equation), and on the other, average labour productivity now exerts less influence on the determination of producer prices for manufactured products, at least in the short term.

However, that logical reaction of prices is observed only during the early years of the exercise, and only to a very modest degree; thereafter, negative deviations from the base solution reappear in the final years, although not as strongly as in the original exercise. This can be attributed to the still slight degree of influence of the money supply in the determination of prices in the model and the considerable weight that average labour productivity continues to have in the medium term.

Conclusions and possible improvement to the model

Although we can conclude that MODVEN VII is a functional model which gives a logical response to different economic policy stimuli, and that that response is the result of significant improvements over the previous versions, it is still necessary to improve it further and make it still more versatile.

In that sense, we can mention a series of areas requiring more work in the future in order to continue improving the model. The first of these is the dis-

aggregation of the investment block, for both the public and private sectors, in order to endogenize the estimation of the levels of existing capital in the different sectors of the economy. This will allow us to estimate potential production levels through technical production functions such as those of Cobb–Douglas, CES, and others, and with those estimates we will be in a position to determine the levels of use of installed capacity, which will in turn aid in the estimation of investment needs and prices.

In addition, it would be desirable to provide more links between the external sector (balance of payments) and the public sector, on the one hand, and the creation of high power money, on the other; to determine the possible evolution and limits of the Central Bank's role in financing the public sector budget deficit; and to establish the banks' need for financial assistance that will have to be met by the Central Bank.

Finally, it is necessary to achieve a more explicit definition of the effects of variations in the money supply or situations of excess demand on prices, since even though these variables have not historically been very important in generating inflation in Venezuela, it is highly likely that they will have a decisive impact on price behaviour in the future.

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Appendix

MODVEN VII macroeconomic model for Venezuela

List of equations

I. Demand and external sector

I.1. Demand

I.1.1. Consumption

Real private consumption of food, beverages and tobacco

$$CPABTR = \underset{(3.238)}{1\,574.7234} + \underset{(3.911)}{0.06371511} * YPDR + \underset{(8.318)}{0.58477046} * CPABTR@1$$

$$+ \underset{(2.608)}{0.08214660} * LIQR - \underset{(-5.365)}{1\,599.914761} * DUMM80 \qquad (1)$$

$R^2 = 0.997 \quad DW = 1.389 \quad SE = 272.687$

Real private consumption of household expenses

$$CPGHOGR = \underset{(2.101)}{1\,200.710744} + \underset{(2.960)}{0.07450632} * YPDR + \underset{(1.922)}{17.38657} * APORIDCP$$

$$+0.6637223*CPGHOGR@1 - 18.55544*RPSRT \quad (2)$$
$$(5.246) \qquad (-2.095)$$

$R^2 = 0.992$ DW = 1.698 SE = 360.236

Real private consumption of services and other goods

$$CPSYOBR = -92.62476217 - 1\,158.0818386*(ICVSER/IDCPR - 0.81856967$$
$$(-1.011) \qquad (-1.051)$$

$$*ICVSER/IDCPR@1) + 0.33610802*(YPDR - 0.81856967*YPDR@1)$$
$$(17.113)$$

$$-1\,373.2383866*(DCTRCMB - 0.81856967*DCTRCMB@1)$$
$$(-4.255)$$

$$+0.81856967*CPSYOBR@1 \quad (3)$$
$$(3.727)$$

$R^2 = 0.994$ DW = 1.231 SE = 333.006 $\rho = 0.819$

Total real private consumption

$$CPTR = CPABTR + CPSYOBR + CPVCR + CNETONRR + CPGHOGR \quad (4)$$

Total current private consumption

$$CPTC = CPTR*((CPTC@1/CPTR@1)*(1 + (APORIDCP/100))) \quad (5)$$

Total current public consumption

$$CGC = REMFIS + CBYSFIS + REMADES + CBYSADES \quad (6)$$

Total real public consumption

$$CGR = CGR@1*(CGC/CGC@1)/(1 + (0.8*(APORWGPROM - 1)) \quad (7)$$
$$+ (0.2*(IGPM/IGPM@1 - 1)))$$

Total real consumption

$$CTR = CPTR + CGR \quad (8)$$

I.I.2 Investment

Real private gross fixed investment in primary sector

$$IFBP1R = IBFPAR + IBFPPR + IBFPMIR \quad (9)$$

Real private gross fixed investment in manufacturing

$$IBFPMR = -102.00286122 + 0.45037048*IBFPMR@1 - 0.20256095*KPM@1$$
$$(-1.064) \qquad (6.839) \qquad (-5.079)$$

$$-873.14657877*DUMM68 + 0.42602090*PMR@1$$
$$(-7.557) \qquad (5.401)$$

$$+0.30076231*PMR@2 - 0.47769583*PMR@3 \quad (10)$$
$$(2.650) \qquad (-4.574)$$

$R^2 = 0.956$ DW = 2.170 SE = 106.411 SUM bi = 0.24909

Real private gross fixed investment in secondary sector

$$IBFP2R = IBFPMR + IBFPCR + IBFPER \tag{11}$$

Total real private gross fixed investment

$$IBFPR = IBFP1R + IBFP2R + IBFP3R \tag{12}$$

Real gross public fixed investment in oil

$$IBFGPR = (IBFGPC/(IDPTEP*0.76 + INPXRM59*0.24*TCP/TCP@1))*100 \tag{13}$$

Total real gross fixed investment in oil

$$IBFTPR = IBFGPR + IBFPPR \tag{14}$$

Total real public gross fixed investment

$$IBFGR = IBFGC/DEFIBFPB*100 \tag{15}$$

Gross public fixed investment deflator

$$DEFIBFPB = DEFIBFPB@1*(IGPM/IGPM@1) \tag{16}$$

Current gross public fixed investment

$$IBFGC = IBFGCC + IBFADES + IBFEPB + IBFGPC \tag{17}$$

Total real gross fixed investment

$$IBFR = IBFPR + IBFGR \tag{18}$$

Total real investment

$$ITR = IBFR + VER \tag{19}$$

Real private capital in manufacturing

$$KPM = IBFPMR + 0.9541124*KPM@1 \tag{20}$$

Real internal private aggregate demand

$$DAIRP = CPTR + IBFPR \tag{21}$$

I.2. External sector

I.2.1. Exports

Annual hydrocarbon exports (million barrels)

$$XPCDGB = \underset{(-0.398)}{-10.38968144} + \underset{(54.356)}{0.97289454}*PHIDLB - \underset{(-7.102)}{0.84949281}*UDOMPB \tag{22}$$

$R^2 = 0.998$ DW = 2.899 SE = 10.745

Daily hydrocarbon exports (million barrels per day)

$$XPCDGBD = (XPCDGB/DIASANO)*1000 \tag{23}$$

Exports of oil products and gas (bolivars)

$$XPDC = XPDC\$ * TCP \tag{24}$$

Exports of crude oil, products and gas (US$)

$$XPDC\$ = XPCDGB * PXPD\$B \tag{25}$$

Real exports of crude oil, products and gas

$$XPDR = XPDC/IPXHID * 100 \tag{26}$$

Oil industry, cost of exports

$$XPETCOST = XPCDGBD * XPETCUNI * DIASANO/1000 \tag{27}$$

Oil industry, net income from exports

$$XPETNET = XPDC - XPETCOST \tag{28}$$

Hydrocarbon exports at tax reference prices

$$XPDCPRF = VEXPRO * XPCDGBD * DIASANO/1000 \tag{29}$$

Current exports of iron ore

$$\text{XHC} = (XHT * PXHT)/1000 \tag{30}$$

Real exports of coffee and cocoa

$$\underset{(3.256)}{\text{XCCR} = 19.91207549} + \underset{(3.892)}{0.74505384} * EPCC \tag{31}$$

$R^2 = 0.964$ DW = 1.624 SE = 5.279

Real exports of coffee

$$\underset{(1.734)}{\text{XCFR} = 11.28849424} + \underset{(4.616)}{0.72934455} * EPCF \tag{32}$$

$R^2 = 0.9734$ DW = 1.723 SE = 4.872

Real exports of cocoa

$$XCAR = \text{XCCR} - \text{XCFR} \tag{33}$$

Current exports of coffee

$$XCFC = (XCFR * IPXCF)/100 \tag{34}$$

Current exports of cocoa

$$XCAC = (XCAR * IPXCA)/100 \tag{35}$$

Agricultural exports except coffee and cocoa

$$XOAC = XOAC\$ * TCXBNP \tag{36}$$

Current non-traditional exports

$$XNTC = XNTC\$ * TCXBNP \tag{37}$$

Non-traditional exports (US$)

$$XNTC\$ = XBNOPET\$ - ((XHC + XCAC + XCFC)/TCXBNP) \tag{38}$$

Current non-oil merchandise exports

$$XBNOPETC = XBNOPET\$ * TCXBNP \tag{39}$$

Real non-oil merchandise exports

$$XBNOPETR = XBNOPETC/IPXBNP * 100 \tag{40}$$

Non-oil merchandise exports (US$)

$$XBNOPET\$ = XBNPPB\$ + XBNPPV\$ \tag{41}$$

Private non-oil merchandise exports (US$)

$$XBNPPV\$ = XBNPPV\$@1 * TCXBNP/TCXBNP@1 * 1.1 * (1 + INFLACEX - (IDPTEP/IDPTEP@1 - 1)) \tag{42}$$

Non-oil exports of state owned enterprises

$$XNPPBBS = TCXBNP * XBNPPB\$ \tag{43}$$

Net public exports

$$XNETPB = XPDC + XBNPPB\$ * TCXO - MBPB\$ * (0.4 * TCP + 0.2 * TCPR + 0.4 * TCMO) - MSPB\$ * TCMS + XSPB\$ * TCXS \tag{44}$$

Current exports, groups 0–4

$$X04C = XPDC + XHC + XCFC + XCAC + XOAC \tag{45}$$

Current exports, groups 5–9

$$X59C = XNTC - XOAC \tag{46}$$

Current merchandise exports

$$XBTC = XPDC + XHC + XCAC + XCFC + XNTC \tag{47}$$

Merchandise exports (US$)

$$XBTC\$ = XPDC\$ + (XHC + XCAC + XCFC)/TCXBNP + XNTC\$ \tag{48}$$

Real merchandise exports

$$XBTR = XPDR + XBNOPETR \tag{49}$$

Exports of services (transportation and insurance)

$$TRSEGCRE = TRSEGCRE@1 * (1 + INFLACEX) * 1.03 \tag{50}$$

Exports of services (other than transportation and insurance)

$$OTYSCRE = OTYSCRE@1*(1 + INFLACEX)*1.01 \tag{51}$$

Exports of other services

$$OSERVCRE = OSERVCRE@1*(1 + INFLACEX)*1.015 \tag{52}$$

Exports of services (travellers)

$$VIAJECRE = VIAJECRE@1*(1 + INFLACEX)*1.035 \tag{53}$$

Exports of services (US$)

$$XS\$ = TRSEGCRE + OTYSCRE + VIAJECRE + OSERVCRE \tag{54}$$

Public exports of services (US$)

$$XSPB\$ = XS\$ - XSPV\$ \tag{55}$$

Current exports of services

$$XSC = XS\$*TCXS \tag{56}$$

Real exports of services

$$XSR = XSC/IPXS*100 \tag{57}$$

Current exports of goods and services

$$X = XBTC + XSC \tag{58}$$

Real exports of goods and services

$$XR = XBTR + XSR \tag{59}$$

Exports of goods and services (US$)

$$X\$ = XBTC\$ + XS\$ \tag{60}$$

I.2.2. Imports

Real imports of food, beverages and tobacco (0–1)

$$\begin{aligned} M01R = {} & -733.59175516 + 543.3998834*CPABTR/PAR \\ & (-1.121) \qquad (2.544) \\ & + 0.48158302*M01R@1 - 675.99425054*DCTRCMB \\ & (3.076) \qquad\qquad (-3.570) \\ & + 753.70824113*DUM01R - 467.65944088*IPM01/IPMA \\ & (2.603) \qquad\qquad (-1.983) \end{aligned} \tag{61}$$

$R^2 = 0.903$ DW = 2.028 SE = 260.237

Real imports of raw materials (2 and 4)

$$\begin{aligned} M24R = {} & -54.63769177 + 0.0328539*PMR + 0.65861496*M24R@1 \\ & (-2.294) \qquad (3.278) \qquad\qquad (4.575) \end{aligned}$$

$$-146.27608028*DUMM83 \quad (62)$$
$$(-2.544)$$

$R^2 = 0.968$ DW = 1.810 SE = 51.508

Real imports of manufactured goods (5–9) (logarithm)

$$M59RL = -7.122220 + 0.77710108*\ln(IGPM) - 1.222391*\ln(IPM59)$$
$$(-14.233)\ (2.675)\qquad(-4.680)$$

$$+1.709903*\ln(CPTR + IBFR) - 0.40261816*DUM59RL \quad (63)$$
$$(27.182)\qquad(-5.262)$$

$R^2 = 0.982$ DW = 1.133 SE = 0.070

Real imports of manufactured goods

$$M59R = \mathrm{EXP}(M59RL) \quad (64)$$

Real imports, groups 0–4

$$M04R = M01R + M24R + M3R \quad (65)$$

Real private merchandise imports (logarithm)

$$MBPVRL = -5.872281 + 1.566243*\ln(DAIRP) - 0.91240388*\ln(IPMB)$$
$$(-10.630)\ (24.398)\qquad(-5.824)$$

$$+0.55238873*\ln(IPMN) - 0.56529801*DUMM83 \quad (66)$$
$$(3.691)\qquad(-11.160)$$

$R^2 = 0.983$ DW = 1.607 SE = 0.045

Real private merchandise imports

$$MBPVR = \mathrm{EXP}(MBPVRL) \quad (67)$$

Real public merchandise imports

$$MBPBR = MBTR - MBPVR \quad (68)$$

Real merchandise imports

$$MBTR = M01R + M3R + M24R + M59R \quad (69)$$

Current imports of food, beverages and tobacco (0–1)

$$M01C = M01R*IPM01/100 \quad (70)$$

Current imports of raw materials (2 and 4)

$$M24C = M24R*IPM24/100 \quad (71)$$

Current imports of fuels (3)

$$M3C = M3R*IPM3/100 \quad (72)$$

Current imports of manufactured goods (5–9)

$$M59C = (M59R*IPM59)/100 \quad (73)$$

Current imports groups 0 to 4

$$M04C = M01C + M24C + M3C \tag{74}$$

Current private merchandise imports

$$MBPVBS = MBPVR/100 * IPMB \tag{75}$$

Current merchandise imports

$$MBTC = M01C + M24C + M3C + M59C \tag{76}$$

Private merchandise imports (US$)

$$MBPV\$ = MBPVBS/TCMB \tag{77}$$

Public merchandise imports (US$)

$$MBPB\$ = MBTC\$ - MBPV\$ \tag{78}$$

Total merchandise imports (US$)

$$\begin{aligned} MBTC\$ = (((&M01R * IPM01/100)/TCM01) + ((M24R * IPM24/100)/TCM24) \\ &+ ((M3R * IPM3/100)/TCM3) + ((M59R * IPM59/100)/TCM59)) \end{aligned} \tag{79}$$

Imports of services (transportation and insurance) (US$)

$$TRSEGDEB = 0.1 * MBTC\$ \tag{80}$$

Imports of services (other than transportation and insurance (US$))

$$OTYSDEB = OTYSDEB@1 * (1 + INFLACEX) \tag{81}$$

Imports of services (travellers) (US$)

$$VIAJEDEB = VIAJEDEB@1 * (1 + INFLACEX) * 0.995 \tag{82}$$

Imports of other services (US$)

$$OSERVDEB = OSERVDEB@1 * (1 + INFLACEX) \tag{83}$$

Other service imports by government (US$)

$$GOBNIOP = GOBNIOP@1 * 1.03 \tag{84}$$

Public imports of services (US$)

$$MSPB\$ = MS\$ - MSPV\$ \tag{85}$$

Total imports of services (US$)

$$MS\$ = TRSEGDEB + OTYSDEB + VIAJEDEB + GOBNIOP + OSERVDEB \tag{86}$$

Total imports of current services

$$MSEC = MS\$ * TCMS \tag{87}$$

Total real imports of services

$$MSER = (MSEC/IPMS) * 100 \tag{88}$$

Total current imports of goods and services

$$M = MBTC + MSEC \tag{89}$$

Total real imports of goods and services

$$MR = MBTR + MSER \tag{90}$$

I.2.3. Balance of payments

Trade balance (US$)

$$BALCOM\$ = XBTC\$ - MBTC\$ \tag{91}$$

Investment income, credits (US$)

$$ISICRE = ISIPBCRE + ISIPVCRE \tag{92}$$

Public sector investment income, credits (US$)

$$ISIPBCRE = ISIBCVCR + ISIFIVCR + ISIPDVCR \tag{93}$$

Investment income, debits (US$)

$$ISIDEB = DPBXINT\$ + DPVXINT\$ \tag{94}$$

Direct foreign investment income, debits (US$)

$$ISIEXDEB = ISIEXDEB@1*1.04 \tag{95}$$

Net investment income (US$)

$$SXFC\$ = ISICRE - ISIDEB - ISIEXDEB \tag{96}$$

Balance of goods and services (US$)

$$BMSC\$ = BALCOM\$ + XS\$ - MS\$ + SXFC\$ \tag{97}$$

Net unrequited transfers (US$)

$$TRANSEX\$ = -RETC*0.01638/TCLIB \tag{98}$$

Current account balance (US$)

$$BALCCTE\$ = BALCOM\$ + XS\$ - MS\$ + SXFC\$ + TRANSEX\$ \tag{99}$$

Capital account: total credits (US$)

$$CKCRE = DPBXNEW\$ + DPVXNEW\$ + CKINVEX + CKOCRE \tag{100}$$

Capital account: total debits (US$)

$$CKDEB = DPBXAM\$ + DPVXAM\$ + CKFUGA + CKOSPB \tag{101}$$

Capital account balance (US$)

$$CTAK\$ = CKCRE - CKDEB \tag{102}$$

Balance of payments, overall result (US$)

$$BPG\$ = CTAK\$ + BALCCTE\$ + ERROMISI \tag{103}$$

International reserves (US$)

$$RI\$ = RI\$@1 + BPG\$ \tag{104}$$

I.2.4. Exchange rates (bolivars per US$)

Exchange rate for imports, groups 0–1

$$TCM01 = TCP*PON01P + TCMO*PON01MO + TCPR*PON01PR + TCLIB*PON01L \tag{105}$$

Exchange rate for imports, groups 2 and 4

$$TCM24 = TCP*PON24P + TCMO*PON24MO + TCPR*PON24PR + TCLIB*PON24L \tag{106}$$

Exchange rate for imports, group 3

$$TCM3 = TCP*PON3P + TCMO*PON3MO + TCPR*PON3PR + TCLIB*PON3L \tag{107}$$

Exchange rate for imports, groups 5–9

$$TCM59 = TCP*PON59P + TCMO*PON59MO + TCPR*PON59PR + TCLIB*PON59L \tag{108}$$

Exchange rate for merchandise imports

$$TCMB = MBTC/MBTC\$ \tag{109}$$

Exchange rate for service imports

$$TCMS = TCP*PONMSP + TCMO*PONMSMO + TCPR*PONMSPR + TCLIB*PONMSL \tag{110}$$

Exchange rate for non-oil merchandise exports

$$TCXBNP = TCP*PONXNPP + TCXO*PONXNPXO + TCPR*PONXNPPR + TCLIB*PONXNPL \tag{111}$$

Exchange rate for merchandise exports

$$TCXB = XBTC/XBTC\$ \tag{112}$$

Exchange rate for service exports

$$TCXS = TCP*PONXSP + TCXO*PONXSXO + TCPR*PONXSPR + TCLIB*PONXSL \tag{113}$$

I.2.5. Foreign debt

Public foreign debt, amortization (US$)

$$DPBXAM\$ = DPBXAM\$V + DPBXAM\$N \tag{114}$$

Public foreign debt, interest (US$)

$$DPBXINT\$ = DPBXINT\$V + DPBXINT\$N \tag{115}$$

New public foreign debt, interest (US$)

$$DPBXINT\$N = (DPBXEND\$N@1 + DPBXEND\$N)/2*(SPREADPB + LIBOR) \tag{116}$$

Previously existing public foreign debt, interest (US$)

$$DPBXINT\$V = (DPBXEND\$V@1 + DPBXEND\$V)/2*(SPREADPB + LIBOR) \quad (117)$$

Public foreign debt, service (US$)

$$DPBXSERV\$ = DPBXSERV\$V + DPBXSERV\$N \quad (118)$$

New public foreign debt, service (US$)

$$DPBXSERV\$N = DPBXAM\$N + DPBXINT\$N \quad (119)$$

Previously existing public foreign debt, service (US$)

$$DPBXSERV\$V = DPBXAM\$V + DPBXINT\$V \quad (120)$$

Public foreign debt, balance at end of period (US$)

$$DPBXEND\$ = DPBXEND\$V + DPBXEND\$N \quad (121)$$

New public foreign debt, balance at end of period (US$)

$$DPBXEND\$N = DPBXEND\$N@1 - DPBXAM\$N + DPBXNEW\$ \quad (122)$$

Previously existing public foreign debt, balance at end of period (US$)

$$DPBXEND\$V = DPBXEND\$V@1 - DPBXAM\$V \quad (123)$$

Foreign debt, insurance premium for amortization

$$PRIMAA = PRIMAA@1*(1 + TIAVZLA/100) \quad (124)$$

Foreign debt, insurance premium for interest

$$PRIMAI = PRIMAI@1*(1 + TIAVZLA/100) \quad (125)$$

Private foreign debt, amortization (US$)

$$DPVXAM\$ = DPVXAM\$V + DPVXAM\$N \quad (126)$$

Private foreign debt, interest (US$)

$$DPVXINT\$ = DPVXINT\$V + DPVXINT\$N \quad (127)$$

New private foreign debt, interest (US$)

$$DPVXINT\$N = (DPVXEND\$N@1 + DPVXEND\$N)/2*(LIBOR + SPREADPV) \quad (128)$$

Previously existing private foreign debt, interest (US$)

$$DPVXINT\$V = (DPVXEND\$V@1 + DPVXEND\$V)/2*(LIBOR + SPREADPV) \quad (129)$$

Private foreign debt, service (US$)

$$DPVXSERV\$ = DPVXSERV\$V + DPVXSERV\$N \quad (130)$$

New private foreign debt, service (US$)

$$DPVXSERV\$N = DPVXAM\$N + DPVXINT\$N \quad (131)$$

Previously existing private foreign debt, service (US$)

$$DPVXSERV\$V = DPVXAM\$V + DPVXINT\$V \tag{132}$$

Private foreign debt, balance at end of period (US$)

$$DPVXEND\$ = DPVXEND\$V + DPVXEND\$N \tag{133}$$

New private foreign debt, balance at end of period (US$)

$$DPVXEND\$N = DPVXEND\$N@1 - DPVXAM\$N + DPVXNEW\$ \tag{134}$$

Previously existing private foreign debt, balance at end of period (US$)

$$DPVXEND\$V = DPVXEND\$V@1 - DPVXAM\$V \tag{135}$$

Total foreign debt, amortization (US$)

$$DXAM\$ = DPBXAM\$ + DPVXAM\$ \tag{136}$$

Total foreign debt, interest (US$)

$$DXINT\$ = DPBXINT\$ + DPVXINT\$ \tag{137}$$

Total foreign debt, service (US$)

$$DXSERV\$ = DPVXSERV\$ + DPBXSERV\$ \tag{138}$$

Total new foreign debt (US$)

$$DXNEW\$ = DPBXNEW\$ + DPVXNEW\$ \tag{139}$$

Total foreign debt, balance (US$)

$$DXEND\$ = DPBXEND\$ + DPVXEND\$ \tag{140}$$

I.2.5.1. Foreign debt in local currency (bolivars)

Public foreign debt, amortization

$$DPBXAM = DPBXAMV + DPBXAMN \tag{141}$$

New public foreign debt, amortization

$$DPBXAMN = DPBXAM\$N * TCKPB1 \tag{142}$$

Previously existing foreign debt, amortization

$$DPBXAMV = DPBXAM\$V * PONDPB * (TCKPB2 + PRIMAA) + DPBXAM\$V * (1 - PONDPB) * TCKPB1 \tag{143}$$

Public foreign debt, interest

$$DPBXINT = DPBXINTN + DPBXINTV \tag{144}$$

New public foreign debt, interest

$$DPBXINTN = DPBXINT\$N * TCKPB1 \tag{145}$$

Previously existing public foreign debt, interest

$$DPBXINTV = DPBXINT\$V * PONDPB * (TCKPB2 + PRIMAI) + DPBXINT\$V * (1 - PONDPB) * TCKPB1 \quad (146)$$

Total public foreign debt, service

$$DPBXSERV = DPBXSERVV + DPBXSERVN \quad (147)$$

New public foreign debt, service

$$DPBXSERVN = DPBXAMN + DPBXINTN \quad (148)$$

Previously existing public foreign debt, service

$$DPBXSERVV = DPBXAMV + DPBXINTV \quad (149)$$

New public foreign debt

$$DPBXNEW = DPBXNEW\$ * TCKPB1 \quad (150)$$

Net public foreign debt

$$DPBXNET = DPBXNEW - DPBXAM \quad (151)$$

Private foreign debt, amortization

$$DPVXAM = DPVXAMV + DPVXAMN \quad (152)$$

New private foreign debt, amortization

$$DPVXAMN = DPVXAM\$N * TCKPB1 \quad (153)$$

Previously existing private foreign debt, amortization

$$DPVXAMV = DPVXAM\$V * (TCKPB2 + PRIMAA) \quad (154)$$

Total private foreign debt, interest

$$DPVXINT = DPVXINTV + DPVXINTN \quad (155)$$

New private foreign debt, interest

$$DPVXINTN = DPVXINT\$N * TCKPB1 \quad (156)$$

Previously existing private foreign debt, interest

$$DPVXINTV = DPVXINT\$V * (TCKPB2 + PRIMAI) \quad (157)$$

Total private foreign debt, service

$$DPVXSERV = DPVXSERVV + DPVXSERVN \quad (158)$$

New private foreign debt, service

$$DPVXSERVN = DPVXAMN + DPVXINTN \quad (159)$$

Previously existing private foreign debt, service

$$DPVXSERVV = DPVXAMV + DPVXINTV \quad (160)$$

Total foreign debt, amortization

$$DXAM + DPBXAM + DPVXAM \tag{161}$$

Total foreign debt, interest

$$DXINT = DPVXINT + DPBXINT \tag{162}$$

Total foreign debt, service

$$DXSERV = DPBXSERV + DPVXSERV \tag{163}$$

II. Production

Real agriculture GDP

$$\begin{aligned} PAR = {} & 102.97888 + 0.99665 * PAR@1 + 0.056865 * (CPABTR - CPABTR@1) \\ & (2.094) \quad (63.416) \quad (1.458) \\ & - 310.09879019 * DUMM76 + 218.04851072 * DUMM85 \\ & (-2.877) \quad (1.862) \end{aligned} \tag{164}$$

$R^2 = 0.997 \quad \text{DW} = 2.005 \quad \text{SE} = 102.278$

Annual production of liquid hydrocarbons (million barrels)

$$\begin{aligned} PHIDLB = {} & 21.66144929 + 0.91500287 * PPB + 0.07881557 * PHIDLB@1 \\ & (2.038) \quad (32.012) \quad (2.557) \end{aligned} \tag{165}$$

$R^2 = 0.998 \quad \text{DW} = 1.287 \quad \text{SE} = 11.186$

Daily production of liquid hydrocarbons (million barrels per day)

$$PHIDLBD = PHIDLB / DIASANO \tag{166}$$

Annual domestic demand of refined products (excluding oil industry)

$$UDOMPB = (UDOMPBD * DIASANO)/1000 \tag{167}$$

Annual production of crude oil (million barrels)

$$\begin{aligned} PPB = {} & 23.360096 + 1.014869 * XPCDGB + 0.60354942 * UDOMPB \\ & (1.956) \quad (94.562) \quad (8.470) \end{aligned} \tag{168}$$

$R^2 = 0.997 \quad \text{DW} = 1.674 \quad \text{SE} = 14.951$

Daily production of crude oil (million barrels per day)

$$PPBD = PPB / DIASANO \tag{169}$$

Real oil GDP

$$\begin{aligned} PTPR = {} & -31.9128468 + 6.18596876 * (PHIDLB - 0.728033 * PHIDLB@1) \\ & (-0.443) \quad (23.953) \\ & + 5.4401482 * (PETPROCB - 0.728033 * PETPROCB@1) \\ & (16.366) \\ & + 0.728033 * PTPR@1 \\ & (6.428) \end{aligned} \tag{170}$$

$R^2 = 0.999$ DW = 1.514 SE = 121.341 $\rho = 0.7280$

Current oil GDP

$$PTPC = PTPR * IDPTP/100 \tag{171}$$

Real manufacturing GDP

$$\begin{aligned} PMR = {} & 549.62511 + 0.04424*((CPTR + IBFR) - 0.9636*(CPTR@1 + IBFR@1)) \\ & (7.645) \quad (3.526) \\ & + 23.36259738*(APORIPPM - 0.963581*APORIPPM@1) \\ & (32.382) \\ & + 0.963581*PMR@1 \\ & (5.653) \end{aligned} \tag{172}$$

$R^2 = 0.996$ DW = 1.984 SE = 255.168 $\rho = 0.9636$

Real construction GDP

$$\begin{aligned} PCR = {} & 15.6097795 + 0.65013293*PCR@1 + 0.11329725*IBFR \\ & (0.255) \quad (3.698) \quad (8.299) \\ & + 0.0049323*IBFR@1 - 0.0526464*IBFR@2 \\ & (2.493) \quad (-12.598) \end{aligned} \tag{173}$$

$R^2 = 0.987$ DW = 2.049 SE = 157.773 Sum bi = 0.0656

Real electricity GDP

$$\begin{aligned} PER = {} & -62.2577031 + 0.00381383*PTBR + 0.95437118*PER@1 \\ & (-1.673) \quad (2.888) \quad (27.797) \end{aligned} \tag{174}$$

$R^2 = 0.995$ DW = 2.218 SE = 64.009

Real services (tertiary) sector GDP

$$PSR = PTBR - PAR - PTPR - PMIR - PMR - PCR - PER \tag{175}$$

Real secondary and tertiary sector GDP

$$P23R = PMR + PCR + PER + PSR \tag{176}$$

Total real GDP except oil and mining

$$PEPM = PTBR - PTPR - PMIR \tag{177}$$

Real non-oil GDP

$$PTEP = PTBR - PTPR \tag{178}$$

Total real GDP

$$PTBR = CPTR + IBFPR + VER + CGR + IBFGR + XR - MR \tag{179}$$

Real GDP per capita

$$PTPCR = PTBR/POB \tag{180}$$

Real mean labour productivity, secondary and tertiary sectors

$$PR23 = P23R/L23 \tag{181}$$

Current GDP

$$PTBC = PTEPC + PTPC \tag{182}$$

Absolute variation of total current GDP

$$APTBC = PTBC - PTBC@1 \tag{183}$$

Current GDP per capita

$$PTPCC = PTBC/POB \tag{184}$$

Current non-oil GDP

$$PTEPC = (PTEP*IDPTEP)/100 \tag{185}$$

III. Employment

Employment in oil industry

$$\begin{aligned} LP = &-0.35273028 + 0.9491755*LP@1 + 5.43723456*DUMM76 \\ &(-0.431) \quad (30.827) \quad (4.600) \\ &+0.002203*IBFTPR - 0.00055*IBFTPR@1 - 0.0006351*IBFTPR@2 \\ &(5.500) \quad (-2.140) \quad (-1.398) \end{aligned} \tag{186}$$

$R^2 = 0.983$ DW = 1.312 SE = 1.086

Employment in primary sector

$$L1 = LA + LP + LMI \tag{187}$$

Employment in manufacturing

$$\begin{aligned} LM = &34.20005 + 0.03084*PMR + 0.62418*LM@1 - 71.74118335*DUMLM \\ &(4.167) \quad (5.744) \quad (7.733) \quad (-4.921) \\ &-0.005938*WR23 - 0.0070433*WR23@1 + 0.0090555*WR23@2 \\ &(-1.466) \quad (-1.881) \quad (2.465) \end{aligned} \tag{188}$$

$R^2 = 0.997$ DW = 1.959 SE = 11.951 Sum bi = −0.00393

Employment in construction

$$\begin{aligned} LC = &7.24752787 + 0.0181275*PCR + 0.79739873*LC@1 \\ &(1.282) \quad (6.309) \quad (20.803) \\ &+52.45228982*DUMMLC \\ &(5.649) \end{aligned} \tag{189}$$

$R^2 = 0.985$ DW = 1.809 SE = 13.017

Employment in electricity

$$\begin{aligned} LE = &2.33959089 + 0.00445801*PER + 0.82526825*LE@1 \\ &(3.042) \quad (2.463) \quad (9.902) \end{aligned}$$

$$-7.96168354*DUMLE \quad (190)$$
$$(-7.088)$$

$R^2 = 0.993$ DW = 2.009 SE = 1.547

Employment in secondary sector

$$L2 = LM + LC + LE \quad (191)$$

Employment in services (tertiary) sector

$$LS = 42.87374349 + 0.00367181*PSR + 0.95831617*LS@1 \quad (192)$$
$$(3.049) \qquad (2.425) \qquad (33.313)$$

$R^2 = 0.998$ DW = 2.012 SE = 30.028

Employment in secondary and tertiary sectors

$$L23 = L2 + LS \quad (193)$$

Total employment except in oil and mining

$$LEPM = L23 + LA \quad (194)$$

Total employment

$$L = L1 + L2 + LS \quad (195)$$

Labour force

$$POBA = POBA@1*(1 + (APORPOBA/100)) \quad (196)$$

Unemployment

$$U = POBA - L \quad (197)$$

Unemployment rate

$$UR = (U/POBA)*100 \quad (198)$$

IV. Wages, income, and its distribution

Average unemployment rate in agriculture

$$WRA = (RTAC/LA)*1000 \quad (199)$$

Average wage rate in secondary and tertiary sectors

$$WR23 = -837.60835723 - 66.04101995*UR + 0.92621906*WR23@1$$
$$(-1.476) \qquad (-2.718) \qquad (52.192)$$

$$+ 142.96278257*PR23 + 142.68893054*APORIDCP$$
$$(3.584) \qquad (6.260)$$

$$+ 37.26808663*APORIDCP@1 + 1\,317.159049*DWR23 \quad (200)$$
$$(1.490) \qquad (3.045)$$

$R^2 = 0.998$ DW = 1.688 SE = 368.952

Real average wage rate in secondary and tertiary sectors

$$W23R = (WR23/IDCPR)*100 \tag{201}$$

Average wage rate in the economy

$$WRT = RETC/L*1000 \tag{202}$$

Real average wage rate in the economy

$$WRTR = WRT/IDCPR*100 \tag{203}$$

Current remuneration to labour in primary sector

$$RTSPC = RTAC + RTPC + RTMIC \tag{204}$$

Remuneration to labour in secondary and tertiary sectors

$$RT23C = (L23*WR23)/1000 \tag{205}$$

Wage remuneration in public sector

$$RETPBC = RTPC + REMFIS + REMADES + REMEPB \tag{206}$$

Wage remuneration in private sector

$$RETPVC = RETC - RETPBC \tag{207}$$

Total current wage remuneration

$$RETC = RTSPC + RT23C \tag{208}$$

Private sector remuneration/total remuneration

$$PARTRTPV = (RETPVC/RETC)*100 \tag{209}$$

Public sector remuneration/total remuneration

$$PARTRTPB = (RETPBC/RETC)*100 \tag{210}$$

Current property income

$$RPROP = YPDC*PARTRPRO \tag{211}$$

Current personal disposable income

$$YPDC = RETC + RPROP + TRANF - TDCUC \tag{212}$$

Real personal disposable income

$$YPDR = YPDC/((CPTC@1/CPTR@1)*(1 + (APORIDCP/100))) \tag{213}$$

Real per capita personal disposable income

$$YPCR = YPDR/POB \tag{214}$$

Property income/wage remuneration

$$RPSRT = (RPROP/RETC)*100 \tag{215}$$

Current national non-wage remuneration

$$REKC = YNC - RETC \tag{216}$$

Current national income

$$\begin{aligned} YNC = {} & 426.5889 + 0.79905794*(PTBC - 0.870315*PTBC@1) \\ & (0.632) \quad (70.963) \\ & + 0.19085237*(APTBC - 0.870315*APTBC@1) + 0.870315*YNC@1 \\ & (4.026) \qquad\qquad\qquad\qquad\qquad\qquad (4.912) \end{aligned} \tag{217}$$

$R^2 = 0.998 \quad DW = 1.405 \quad SE = 3\,854.964 \quad \rho = 0.8703$

Current national income per capita

$$YNPC = YNC/POB \tag{218}$$

Real national income

$$YNR = (YNC/IDPT)*100 \tag{219}$$

V. Public finance

Oil industry income tax collection

$$TUPCREC = TUPCCAU*11/12 + TUPCCAU@1/12 \tag{220}$$

Oil industry royalty tax collection

$$REGALIAR = REGALIAC*11/12 + REGALIAC@1/12 \tag{221}$$

Oil industry, total taxes paid

$$TTPCREC = TUPCREC + REGALIAR \tag{222}$$

Central government, import tax

$$TFDIMP = 0.055*MBTC\$*TCMB*0.93 + 0.055*MBTC\$*TCLIB*0.07 \tag{223}$$

Internal consumption of gasoline

$$COINGASO = COINGASO@1*(PTEP/PTEP@1) \tag{224}$$

Internal price of oil products (bolivars)

$$PINTPBSB = PINTPBSB@1*(IDPTEP/IDPTEP@1) \tag{225}$$

Tax rate on gasoline

$$TRDERPET = TRDERPET@1*PINTPBSB/PINTPBSB@1 \tag{226}$$

Central government, gasoline tax

$$TFDERPET = COINGASO*TRDERPET \tag{227}$$

Central government, customs duties

$$TFADUANA = 0.039*MBTC\$*TCMB*0.93 + 0.039*MBTC\$*TCLIB*0.07 \tag{228}$$

Surplus of private business

$$EXCEP = \underset{(-11.728)}{-23\,623.6906} + \underset{(8.610)}{0.39275430}*PTEP + \underset{(40.067)}{215.6327}*IDPTEP + \underset{(4.529)}{8\,296.5988}*DUEXCEP \quad (229)$$

$R^2 = 0.996$ DW = 1.840 SE = 1 712.498

Direct non-oil taxes

$$TDNPC = \underset{(-2.121)}{-607.1705} + \underset{(1.929)}{0.05090246}*RETC + \underset{(1.942)}{0.08385740}*EXCEP - \underset{(-1.233)}{0.29572072}*TDNPC@1 \quad (230)$$

$R^2 = 0.978$ DW = 2.159 SE = 547.043

Central government, exchange profits

$$UTCFIS = -(TCXB*XBTC\$ + TCXS*XS\$ + DXNEW\$*TCKPB1 + SXFC\$*TCKPB2) + (TCMB*MBTC\$ + TCMS*MS\$ + DXSERV) \quad (231)$$

Central government, current revenues

$$IOGC = TFDIMP + TFDERPET + TFADUANA + TTPCREC + TDNPC + TFLICOR + TFCIGARR + UTCFIS + TFREST \quad (232)$$

Central government, current spending

$$GFISCTE = REMFIS + CBYSFIS + GFSUBS \quad (233)$$

Central government, direct investment

$$GFISCAP = IBFGCC/0.95 \quad (234)$$

Central government transfers to Venezuelan Investment Fund

$$FIV5POR = (0.05*TTPCCAU) \quad (235)$$

Central government transfers to states

$$GFSITUAD = 0.15*IOGC \quad (236)$$

Central government transfers to public sector

$$GFTR = FIV5POR + GFSITUAD + GFTROT \quad (237)$$

Central government, total spending

$$GTFIS = GFISCTE + GFISCAP + GFTR \quad (238)$$

Central government deficit (surplus)

$$DEFIS = IOGC - GTFIS \quad (239)$$

Non-oil state owned enterprises, internal sales

$$VTIEPB = VTIEPB@1*(PTEP/PTEP@1)*(IPMN/IPMN@1) \quad (240)$$

Non-oil state owned enterprises, total sales

$$VTEPB = VTIEPB + XNPPBBS \quad (241)$$

Non-oil state owned enterprises, current income

$$IEPB = IEPBOTR + VTEPB + IEPBINT \quad (242)$$

State owned enterprises, purchases of goods and services

$$GEPBINS = GEPBCOIN*VTEPB \quad (243)$$

State owned enterprises, income tax

$$GEPBISR = GEPBSAI*0.03 \quad (244)$$

State owned enterprises, current outlays

$$GEPBCTE = REMEPB + GEPBINS + GEPBTRPV + GEPBTRPB + GEPBTM \quad (245)$$

State owned enterprises, balance before income tax

$$GEPBSAI = IEPB - GEPBCTE \quad (246)$$

Non-oil state owned enterprises, outlays

$$GEPBTOT = GEPBCTE + GEPBCAP \quad (247)$$

State owned enterprises, current balance

$$GEPBSCTE = GEPBSAI - GEPBISR \quad (248)$$

Non-oil state owned enterprises, direct investment

$$GEPBCAP = IBFEPB/0.9 \quad (249)$$

State owned enterprises, income from transfer of capital

$$IEPBTK = IEPBTKGC + IEPBTKF \quad (250)$$

State owned enterprises, income from real transfers

$$IEPBTR = IEPBTK + IEPBTC \quad (251)$$

Non-oil state owned enterprises, deficit (surplus)

$$DEFEPB = GEPBSCTE - GEPBCAP + IEPBTR + IEPBVAF \quad (252)$$

Oil industry, internal consumption of oil and products

$$COITPBD = COITPBD@1*COINGASO/COINGASO@1 \quad (253)$$

Oil industry, income from internal sales

$$VTINTPET = PINTPBSB*COITPBD*DIASANO/1000 \quad (254)$$

Oil industry, income from sales

$$VTAPDVPR = XPDC + VTINTPET \tag{255}$$

Oil industry, interest income

$$INTPET = ISIPDVCR * TCP + PDVBONOS * TIAVZLA/100 \tag{256}$$

Venezuelan Oil Corporation, current income

$$IPDV = VTAPDVPR + INTPET \tag{257}$$

Oil industry, outlays

$$PDVEGRES = REMPET + CBYSPET + TECPET + TRPVPET \tag{258}$$

Venezuelan Oil Corporation, sales at tax reference prices

$$VTAPDVPF = XPDCPRF + VTINTPET \tag{259}$$

Oil industry, exchange profit

$$PDVUC = XPDC\$/6 * (TCP - TCP@1) \tag{260}$$

Oil industry, other financial income

$$OIPDVSAF = PDVBONOS * (DPBITASA + 0.01) + 300 * (LIBOR - 0.013) * TCP \tag{261}$$

Oil industry, other income

$$OIPDVSA = PDVUC + OIPDVSAF \tag{262}$$

Oil industry, net investment

$$INFPDV = IBFGPC - PDVDEPRE \tag{263}$$

Venezuelan Oil Corporation, cost of capital

$$CFPDVSA = CFPDVSA@1 + INFPDV \tag{264}$$

Oil industry, depreciation

$$PDVDEPRE = CFPDVSA * 0.037073 \tag{265}$$

Oil royalty per barrel

$$PREGALBS = PREGALI\$ * TCP \tag{266}$$

Oil industry, other assessed taxes

$$REGALIAC = PREGALBS * PPBD * DIASANO \tag{267}$$

Oil industry, other costs

$$\begin{aligned} PDVOTCOS = {} & PDVOTCOS@1 * (IDPTEP/IDPTEP@1) * 0.85 \\ & + PDVOTCOS@1 * 0.15 * (TCP/TCP@1) * (1 + INFLACEX) \end{aligned} \tag{268}$$

Oil industry, contributions to government

$$PDVAPORT = XPETNET * 0.1 \tag{269}$$

Oil industry, total costs

$$COSINPET = REMPET + PDVDEPRE + REGALIAC + PDVOTCOS + PDVAPORT \quad (270)$$

Oil industry, unit cost of exports

$$XPETCUNI = ((COSINPET - REGALIAC))/(PHIDLBD * DIASANO) \quad (271)$$

Oil industry, profit

$$UINDPET = VTAPDVPF + OIPDVSA - COSINPET \quad (272)$$

Oil industry, assessed income tax

$$TUPCCAU = UINDPET * TEISRPET/100 \quad (273)$$

Oil industry, total assessed taxes

$$TTPCCAU = TUPCCAU + REGALIAC \quad (274)$$

Oil industry, indirect taxes

$$PDVTI = TFDERPET + PDVOTI \quad (275)$$

Oil industry, balance before taxes

$$PDVSAI = IPDV - PDVEGRES \quad (276)$$

Oil industry, current balance

$$PDVSCTE = PDVSAI - TTPCREC - PDVTI \quad (277)$$

Oil industry, capital income

$$PDVICAP = PDVVAF + PDVUC \quad (278)$$

Oil industry, capital outlays

$$PDVCAP = IBFGPC/0.97 \quad (279)$$

Venezuelan Oil Corporation deficit (surplus)

$$DEFPDV = PDVSCTE + PDVICAP - PDVCAP \quad (280)$$

Venezuelan Investment Fund (VIF)

$$FIVICAP = FIV5POR \quad (281)$$

VIF, internal assets

$$FIVACTIN = FIVACTIN@1 + GFIVCAP * 0.9 \quad (282)$$

VIF, income from internal interest

$$FIVINTI = FIVACTIN * (TIAVZLA - ALFAFIV)/100 \quad (283)$$

VIF, income from external interest

$$FIVINTX = ISIFIVCR * TCP \quad (284)$$

VIF, current income

$$FIVICTE = FIVINTI + FIVINTX + FIVOIC \tag{285}$$

VIF, total income

$$FIVING = FIVICTE + FIVICAP \tag{286}$$

VIF, total expenditures

$$GFIV = GFIVCTE + GFIVCAP \tag{287}$$

VIF, financial balance

$$FIVSAL = FIVING - GFIV \tag{288}$$

Consolidated public sector deficit (surplus)

$$DEFCON = DEFIS + DEFEPB + DEFPDV + FIVSAL - DPBXINT - DPBIINT \tag{289}$$

State owned enterprises, capital formation

$$GEPBK = IBFEPB/0.9 \tag{290}$$

Oil industry, inventories and real estate

$$PDVKSYT = PDVCAP - IBFGPC \tag{291}$$

Central government, external interest payments

$$GFINTEXT = 0.7966 * DPBXINT \tag{292}$$

Central government, current spending for interest

$$GFINTDEU = GFINTEXT + DPBIINT \tag{293}$$

Internal public debt, balance at beginning of period

$$DPBIBEG = DPBIEND@1 \tag{294}$$

Internal public debt, balance at end of period

$$DPBIEND = DPBIBEG + DPBINEW \tag{295}$$

Internal public debt, interest

$$DPBIINT = (DPBIBEG + DPBIEND)/2 * DPBITASA \tag{296}$$

New internal public debt

$$DPBINEW = -DEFIS - DPBXNEW - FIVFINAN \tag{297}$$

VI. Prices

Producer price index (agriculture)

$$IPPA = \underset{(2.415)}{18.65961989} + \underset{(13.773)}{1.0083855} * IPMM - \underset{(-7.848)}{12.43926973} * PAR/LA$$

$$+ 0.01816024 * WRA \qquad (298)$$
$$(7.453)$$

$R^2 = 0.999 \quad DW = 1.783 \quad SE = 5.338$

Producer price index (manufacturing)

$$IPPM = 74.468295 + 0.35687888 * IPPM@1 + 0.00426565 * WR23$$
$$(2.674) \qquad (3.075) \qquad (4.855)$$

$$+ 0.27120114 * IPM - 5.317161 * (PMRSLM + PMRSLM@1 + PMRSLM@2)/3 \qquad (299)$$
$$(6.830) \qquad (-2.366)$$

$R^2 = 0.998 \quad DW = 2.079 \quad SE = 4.578$

Wholesale price index (manufacturing), % variation

$$APORIPPM = (IPPM/IPPM@1 - 1) * 100 \qquad (300)$$

Wholesale price index (agriculture)

$$IPMA = -7.14962524 + 1.00924402 * IPMA@1 + 0.83412945 * IPPA$$
$$(-1.768) \qquad (5.477) \qquad (6.538)$$

$$- 0.6869246 * IPPA@1 - 0.1029898 * IPPA@2 \qquad (301)$$
$$(-3.850) \qquad (3.190)$$

$R^2 = 0.997 \quad DW = 2.849 \quad SE = 8.108 \quad SUM\ bi = -0.687$

Wholesale price index (manufacturing)

$$IPPM = -1.30596944 + 0.75936097 * IPPM@1 + 0.9165898 * IPPM$$
$$(-0.567) \qquad (4.090) \qquad (9.482)$$

$$- 0.4602367 * IPPM@1 - 0.2024241 * IPPM@2 \qquad (302)$$
$$(-4.043) \qquad (3.002)$$

$R^2 = 0.999 \quad DW = 1.154 \quad SE = 3.622 \quad SUM\ bi = -0.460$

Wholesale price index (imported products)

$$IPMT = 2.7249155 + 0.29230942 * IPMB + 0.70082646 * IPMT@1$$
$$(1.425) \qquad (9.331) \qquad (14.158)$$

$$+ 15.7926119 * DUMLIBP@1 \qquad (303)$$
$$(4.305)$$

$R^2 = 0.999 \quad DW = 2.021 \quad SE = 3.479$

Wholesale price index (national products)

$$IPMN = 1.079273 * (IGPM - 0.969349 * IGPM@1) + 0.969349 * IPMN@1 \qquad (304)$$
$$(246.14) \qquad (21.470)$$

$R^2 = 0.999 \quad DW = 1.342 \quad SE = 2.124 \quad \rho = 0.969$

Wholesale price index

$$IGPM = 5.12582551 + 0.26754900 * IPMA + 0.68757328 * IPMM \qquad (305)$$
$$(7.521) \qquad (26.116) \qquad (43.946)$$

$R^2 = 0.999$ DW = 1.903 SE = 0.876

Wholesale price index (oil products)

$$IGPMDP = IGPMDP@1*(1 + (IGPM/IGPM@1 - 1)*0.85) \tag{306}$$

Consumer price index (food, beverages and tobacco)

$$\begin{aligned} ICVABT = {} & 2.29878049 + 0.29436314*IPMA + 0.79449065 + ICVABT@1 \\ & (0.249) \qquad (2.821) \qquad\quad (6.766) \\ & - 2.42071733*(PTEPC/LIQC) + 37.56778264*DUMLIBP \\ & (-0.977) \qquad\quad (5.297) \end{aligned} \tag{307}$$

$R^2 = 0.998$ DW = 2.844 SE = 6.662

Consumer price index (household expenses)

$$\begin{aligned} ICVHOG = {} & -0.69398443 + 0.03281810*IPMM + 0.98566961*ICVHOG@1 \\ & (-0.206) \quad (1.412) \qquad\quad (17.038) \\ & - 0.22281778*AICVHOG1 + 19.30992953*DUMLIBP \\ & (2.351) \qquad\quad (8.857) \end{aligned} \tag{308}$$

$R^2 = 0.999$ DW = 2.528 SE = 1.740

Consumer price index (miscellaneous expenses)

$$\begin{aligned} ICVSER = {} & 0.98527903 + 0.36718530*IGPM + 0.64562238*ICVSER@1 \\ & (0.332) \qquad (5.711) \qquad\quad (6.958) \\ & - 6.38613507*DUMLIBP \\ & (-2.021) \end{aligned} \tag{309}$$

$R^2 = 0.999$ DW = 1.881 SE = 2.948

Consumer price index (clothing and footwear)

$$\begin{aligned} ICVVYC = {} & 22.83689442 + 0.24449037*IPMM + 0.82139753*ICVVYC@1 \\ & (1.425) \qquad (2.924) \qquad\quad (16.775) \\ & - 7.84115527*(PTEPC/LIQC) + 110.28215684*DUMLIBP \\ & (-2.067) \qquad\quad (14.111) \end{aligned} \tag{310}$$

$R^2 = 0.997$ DW = 2.347 SE = 8.446

Consumer price index

$$\begin{aligned} IDCPR = {} & 8.587037 + 0.22685989*ICVABT + 0.18712103*ICVHOG \\ & (1.645) \quad (8.898) \qquad\quad (2.494) \\ & + 0.43554698*ICVSER + 0.06519787*ICVVYC \\ & (14.942) \qquad\quad (6.355) \end{aligned} \tag{311}$$

Consumer price index, % variation

$$APORIDCP = ((IDCPR - IDCPR@1)/IDCPR@1)*100 \tag{312}$$

Private consumption deflator (1968 = 100)

$$IPCPV = CPTC/CPTR*100 \tag{313}$$

Non-oil GDP deflator (1968 = 100)

$$IDPTEP = \underset{(0.360)}{1.796197} + \underset{(3.782)}{0.25624352}*IGPM + \underset{(10.685)}{0.81972384}*IDPTEP@1$$
$$+ \underset{(6.373)}{18.553022}*DUMLIBP - \underset{(-1.636)}{2.132181}*(PTEPC/LIQC) \tag{314}$$

$R^2 = 0.999$ DW = 2.664 SE = 3.061

Oil GDP deflator (1968 = 100)

$$IDPTP = \underset{(0.625)}{2.41093171} - \underset{(-5.778)}{0.13789071}*(IDPTP@1 - 0.81165125*IDPTP@2)$$
$$+ \underset{(46.214)}{10.69657407}*(PXHIDPRO - 0.81165125*PXHIDPRO@1)$$
$$+ \underset{(3.938)}{0.81165125}*IDPTP@1 \tag{315}$$

$R^2 = 0.998$ DW = 1.349 SE = 18.597 $\rho = 0.812$

GDP deflator (1968 = 100)

$$IDPT = PTBC/PTBR*100 \tag{316}$$

Price index for non-oil merchandise exports

$$IPXBNP = IPXBNP@1*(IDPTEP/IDPTEP@1)*(TCXBNP/TCXBNP@1) \tag{317}$$

Price index for hydrocarbon exports

$$IPXHID = IPXHID@1*(PXHIDPRO/PXHIDPRO@1) \tag{318}$$

Price index for merchandise exports

$$IPXB = XBTC/XBTR*100 \tag{319}$$

Price index for service exports

$$IPXS = IPXS@1*(IDPTEP/IDPTEP@1)*(TCXS/TCXS@1) \tag{320}$$

Price index for exports of goods and services

$$IPX = X/XR*100 \tag{321}$$

Price index for imports, groups 0–1

$$IPM01 = IPM01@1*IPXRM01*(TCM01/TCM01@1) \tag{322}$$

Price index for imports, groups 2 and 4

$$IPM24 = IPM24@1*IPXRM24*(TCM24/TCM24@1) \tag{323}$$

Price index for imports, group 3

$$IPM3 = IPM3@1*IPXRM3*(TCM3/TCM3@1) \tag{324}$$

Price index for imports, groups 5–9

$$IPM59 = IPM59@1*IPXRM59*(TCM59/TCM59@1) \tag{325}$$

Price index for imports, groups 0–4

$$IPM04 = M04C/M04R*100 \tag{326}$$

Price index for merchandise imports

$$IPMB = MBTC/MBTR*100 \tag{327}$$

Price index for service imports

$$IPMS = IPMS@1*IPXRMS*(TCMS/TCMS@1) \tag{328}$$

Price index for imports of goods and services

$$IPM = (IPMB*(MBTR/MR)) + (IPMS*(MSER/MR)) \tag{329}$$

Price index for worldwide exports, groups 5–9

$$INPXRM59 = INPXRM59@1*IPXRM59 \tag{330}$$

Hydrocarbon sale price (bolivars per barrel)

$$PXHIDPRO = PXPD\$B*TCP \tag{331}$$

Hydrocarbon tax reference price (bolivars per barrel)

$$VEXPRO = PXHIDPRO*(1 + MAXVEXPRO) \tag{332}$$

VII. Monetary and financial sector

Money supply, M2 (logarithm)

$$LIQCL = \underset{(-15.910)}{-14.674893} + \underset{(16.750)}{1.727321}*\ln(PTEP) + \underset{(24.875)}{1.262320}*\ln(IDPTEP) \tag{333}$$

$R^2 = 0.996 \quad DW = 1.526 \quad SE = 0.061$

Money supply (liquidity = M2)

$$LIQC = \text{EXP}(LIQCL) \tag{334}$$

Real money supply

$$LIQR = LIQC/IGPM*100 \tag{335}$$

Coins and bills in circulation (logarithm)

$$MBEMIL = \underset{(-20.134)}{-11.913513} + \underset{(22.314)}{1.476141}*\ln(PTEP) + \underset{(27.530)}{0.89536492}*\ln(IDPTEP) \tag{336}$$

$R^2 = 0.998 \quad DW = 2.141 \quad SE = 0.039$

Coins and bills in circulation (monetary base)

$$MBEMI = \text{EXP}(MBEMIL) \tag{337}$$

Deposits by the public in the banking system

$$MDTPUB = LIQC - MBEMI \tag{338}$$

Coefficient of preference for cash

$$MCOEPE = MBEMI/LIQC \tag{339}$$

Liquidity multiplier

$$MULTLIQC = 1/(MCOEPE + MCOERB - MCOEPE * MCOERB) \tag{340}$$

Monetary base

$$BASE = LIQC/MULTLIQC \tag{341}$$

Bank reserves deposited in the central bank

$$MRESER = MCOERB * MDTPUB \tag{342}$$

Ratio of cash to current non-oil GDP (logarithm)

$$\begin{aligned} LM1SP = {} & 1.328429 + 0.92312935 * \ln(LIQC/PTEPC) \\ & (8.789) \quad (25.234) \\ & - 0.68670308 * \ln(TIAPROM) + 0.67658890 * \ln(RETC/PTEPC) \\ & (-12.828) \qquad\qquad (4.446) \\ & + 0.05952430 * DUMM1 \\ & (2.797) \end{aligned} \tag{343}$$

$R^2 = 0.986 \quad \text{DW} = 1.517 \quad \text{SE} = 0.027$

Ratio of cash to non-oil GDP (current)

$$M1SP = \text{EXP}(LM1SP) \tag{344}$$

Currency (M1)

$$CIRC = M1SP * PTEPC \tag{345}$$

Ratio of cash (M1) to liquidity (M2)

$$MCOES = CIRC/LIQC \tag{346}$$

Cash multiplier

$$MULTMON = MCOES * MULTLIQC \tag{347}$$

Monetary base by uses

$$BASEU = MRESER + MBEMI \tag{348}$$

Central bank internal assets, balance at end of year

$$MAIBCV = MAIBCV@1 + BCVBOBUY + AREDANT + AOACTBCV \tag{349}$$

Central bank liabilities, balance at end of year

$$MPASBCV = MPASBCV@1 + PDVBM + AOPASBCV \tag{350}$$

Monetary base by sources

$$BASEF = MRIBS + MAIBCV - MPASBCV - MCAPBCV \tag{351}$$

Absolute variation of monetary liquidity

$$ALIQC = LIQC - LIQC@1 \tag{352}$$

Foreign exchange operations

$$\begin{aligned} MOCAM = {} & TCXO*(XBNPPV\$ + XSPV\$) + TCKPB1*(DPVXNEW\$ + CKINVEX) \\ & - MBPVBS - TCMS*MSPV\$ - FUGAKN\$*TCLIB - DPVXSERV \end{aligned} \tag{353}$$

Absolute variation of central bank internal assets

$$BCVACTIN = BCVBOBUY + AREDANT + AOACTBCV \tag{354}$$

Absolute variation of central bank liabilities

$$BCVPAS = PDVBM + AOPASBCV \tag{355}$$

Absolute variation of central bank net internal assets

$$ABCVAIN = BCVACTIN - BCVPAS \tag{356}$$

Monetary financing

$$MFMON = BCVBOBUY - BCVPAS \tag{357}$$

Net (monetary) internal public spending

$$MGIN = XNETPB + DPBXNET + MFMON + GFIVCAP - FIV5POR - DPBXINT \tag{358}$$

Net internal spending free of monetary financing

$$MGINL = MGIN - MFMON \tag{359}$$

Secondary expansion of money supply

$$MESCR = ALIQC - MOCAM - ABCVAIN - MGINL \tag{360}$$

VIII. Ratios

Ratio real private consumption/real GDP

$$CPTRSPTBR = CPTR/PTBR \tag{361}$$

Ratio real private consumption/personal disposable income

$$CPTRSYPDR = CPTR/YPDR \tag{362}$$

Ratio real gross fixed public investment/real GDP

$$IBFGRSPTBR = IBFGR/PTBR \tag{363}$$

Ratio real gross fixed private investment/real GDP

$$IBFPRSPTBR = IBFPR/PTBR \tag{364}$$

Ratio real gross fixed investment/real GDP

$$IBFRSPTBR = IBFR/PTBR \tag{365}$$

Ratio imports of food, beverages, and tobacco/merchandise imports (real)

$$M01RSMBTR = M01R/MBTR \tag{366}$$

Ratio raw material imports/merchandise imports (real)

$$M24RSMBTR = M24R/MBTR \tag{367}$$

Ratio merchandise imports/GDP (real)

$$MBTRSPTBR = MBTR/PTBR \tag{368}$$

Ratio imports of goods and services/GDP (real)

$$MRSPTBR = MR/PTBR \tag{369}$$

Ratio total imports/monetary liquidity

$$MSLIQC = M/LIQC \tag{370}$$

Ratio total imports/current GDP

$$MSPTBC = M/PTBC \tag{371}$$

Mean labour productivity in construction

$$PCRSLC = PCR/LC \tag{372}$$

Mean labour productivity in manufacturing sector

$$PMRSLM = PMR/LM \tag{373}$$

Mean labour productivity in service sector

$$PSRSLS = PSR/LS \tag{374}$$

Mean labour productivity

$$PTBRSL = PTBR/L \tag{375}$$

Real GDP per capita (1968 = 100)

$$PTBRSPOB = PTBR/POB \tag{376}$$

Non-oil GDP per capita (1968 = 100)

$$PTEPSPOB = PTEP/POB \tag{377}$$

Ratio non-wage remunerations/national income (current)

$$REKCSYNC = REKC/YNC \tag{378}$$

Ratio wage remuneration/national income (current)

$$RETCSYNC = RETC/YNC \tag{379}$$

Ratio wage remuneration/disposable income (current)

$$RETCSYPDC = RETC/YPDC \tag{380}$$

Ratio public sector wage remuneration/total wage remuneration (current)

$$RETPBCSRET = RETPBC/RETC \tag{381}$$

Ratio public sector wage remuneration/personal disposable income (current)

$$RETPBCSYPD = RETPBC/YPDC \tag{382}$$

Ratio private sector wage remuneration/total wage remuneration (current)

$$RETPVCSRET = RETPVC/RETC \tag{383}$$

Ratio private sector wage remuneration/property income (current)

$$RETPVCSRPR = RETPVC/RPROP \tag{384}$$

Ratio private sector wage remuneration/personal disposable income (current)

$$RETPVCSYPD = RETPVC/YPDC \tag{385}$$

Ratio property income/national income (current)

$$RPROPSYNC = RPROP/YNC \tag{386}$$

Ratio property income/personal disposable income (current)

$$RPROPSYPDC = RPROP/YPDC \tag{387}$$

Ratio non-oil direct taxes to current GDP

$$TDNPCSPTBC = TDNPC/PTBC \tag{388}$$

Current national income per capita

$$YNCSPOB = YNC/POB \tag{389}$$

Ratio national income/GDP (current)

$$YNCSPTBC = YNC/PTBC \tag{390}$$

Real national income per capita

$$YNRSPOB = YNR/POB \tag{391}$$

Current personal disposable income per capita

$$YPDCSPOB = YPDC/POB \tag{392}$$

Ratio personal disposable income/national income (current)

$$YPDCSYNC = YPDC/YNC \tag{393}$$

Real personal disposable income per capita

$$YPDRSPOB = YPDR / POB \quad (394)$$

Description of the endogenous variables

Name	*Description*
ABCVAIN	Absolute variation Central Bank of Venezuela (CBV) net internal assets
ALIQC	Absolute variation monetary liquidity
APORIDCP	% variation consumer prices
APORIPPM	% variation wholesale prices manufacturing
APTBC	Absolute variation total current GDP
ARIBS	Absolute variation foreign reserves
BALCCTE$	Current account balance ($)
BALCOM$	Trade balance ($)
BASE	Monetary base
BASEF	Monetary base by sources
BASEU	Monetary base by uses
BCVACTIN	Absolute variation CBV internal assets
BCVPAS	Absolute variation CBV liabilities
BMSC$	Balance of goods and services ($)
BPG$	Overall balance of payments ($)
CFPDVSA	Venezuelan Oil Corporation (VOC) cost of capital
CGC	Total current public consumption
CGR	Total real public consumption
CIRC	Currency (M1) (money supply)
CKCRE	Capital account: total credits
CKDEB	Capital account: total debits
COINGASO	Internal consumption of gasoline
COITPBD	Oil industry: consumption of oil and products
COSINPET	Oil industry: total costs
CPABTR	Real private consumption food, beverages and tobacco
CPGHOGR	Real private consumption of household expenses
CPSYOBR	Real private consumption of services and other goods
CPTC	Total current private consumption
CPTR	Total real private consumption
CPTRSPTBR	Real private consumption/real GDP
CPTRSYPDR	Real private consumption/personal disposable income
CTAK$	Capital account balance ($)
CTR	Total real consumption
DAIRP	Real internal private aggregate demand
DEFCON	Consolidated government deficit (surplus)
DEFEPB	Non-oil state owned enterprises, deficit (surplus)
DEFIBFPB	Public gross fixed investment deflator
DEFIS	Central government deficit (surplus)
DEFPDV	VOC deficit (surplus)
DPBIBEG	Public internal debt, balance at beginning of period
DPBIEND	Public internal debt, balance at end of period
DPBIINT	Public internal debt, interest
DPBINEW	New public internal debt
DPBXAM	Public foreign debt, amortization
DPBXAM$	Public foreign debt, amortization ($)
DPBXAMN	New public foreign debt, amortization
DPBXAMV	Old public foreign debt, amortization
DPBXEND$	Public foreign debt, balance at end of year ($)
DPBXEND$N	New public foreign debt, balance at end of year ($)

DPBXEND$V	Old public foreign debt, balance at end of year ($)
DPBXINT	Public foreign debt, interest
DPBXINT$	Public foreign debt, interest ($)
DPBXINT$N	New public foreign debt, interest ($)
DPBXINT$V	Old public foreign debt, interest ($)
DPBXINTN	New public foreign debt, interest
DPBXINTV	Old public foreign debt, interest
DPBXNET	Net public foreign debt
DPBXNEW	New public foreign debt
DPBXSERV	Public foreign debt, service
DPBXSERV$	Public foreign debt, service ($)
DPBXSERV$N	New public foreign debt, service ($)
DPBXSERV$V	Old public foreign debt, service ($)
DPBXSERVN	New public foreign debt, service
DPBXSERVV	Old public foreign debt, service
DPVXAM	Private foreign debt, amortization
DPVXAM$	Private foreign debt, amortization ($)
DPVXAMN	New private foreign debt, amortization
DPVXAMV	Old private foreign debt, amortization
DPVXEND$	Private foreign debt, balance at end of year ($)
DPVXEND$N	New private foreign debt, balance at end of year ($)
DPVXEND$V	Old private foreign debt, balance at end of year ($)
DPVXINT	Private foreign debt, interest
DPVXINT$	Private foreign debt, interest ($)
DPVXINT$N	New private foreign debt, interest ($)
DPVXINT$V	Old private foreign debt, interest ($)
DPVXINTN	New private foreign debt, interest
DPVXINTV	Old private foreign debt, interest
DPVXSERV	Private foreign debt, service
DPVXSERV$	Private foreign debt, service ($)
DPVXSERV$N	New private foreign debt, service ($)
DPVXSERV$V	Old private foreign debt, service ($)
DPVXSERVN	New private foreign debt, service
DPVXSERVV	Old private foreign debt, service
DXAM	Total foreign debt, amortization
DXAM$	Total foreign debt, amortization ($)
DXEND$	Total foreign debt, balance ($)
DXINT	Total foreign debt, interest
DXINT$	Total foreign debt, interest ($)
DXNEW$	Total new foreign debt ($)
DXSERV	Total foreign debt, service
DXSERV$	Total foreign debt, service ($)
EXCEP	Private surplus
FIV5POR	Venezuelan Investment Fund (VIF) transfers from central government
FIVACTIN	VIF internal assets
FIVICAP	VIF capital income
FIVICTE	VIF current income
FIVING	VIF total income
FIVINTI	VIF income from internal interest
FIVINTX	VIF income from external interest
FIVSAL	VIF financial balance
GEPBCAP	Non-oil state owned enterprises, direct investment
GEPBCTE	State owned enterprises, current outlays
GEPBINS	State owned enterprises, purchases of goods and services
GEPBISR	State owned enterprises, income tax
GEPBK	State owned enterprises, capital formation
GEPBSAI	State owned enterprises, balance before income tax
GEPBSCTE	State owned enterprises, current balance
GEPBTOT	Non-oil state owned enterprises, outlays
GFINTDEU	Central government, current spending for interest

GFINTEXT	Central government, external interest payments
GFISCAP	Central government, direct investment
GFISCTE	Central government, current spending
GFIV	VIF total spending
GFSITUAD	Central government, constitutional assignment to states
GFTR	Central government, transfers to public sector
GOBNIOP	Other imports of services by government
GTFIS	Central government, total spending
IBFGC	Current public gross fixed investment
IBFGPR	Real public gross fixed investment in oil
IBFGR	Total real public gross fixed investment
IBFGRSPTBR	Real public gross fixed investment/real GDP
IBFP1R	Real private gross fixed investment in primary sector
IBFP2R	Real gross fixed private investment in secondary sector
IBFPMR	Real private gross fixed investment in manufacturing
IBFPR	Total real private gross fixed investment
IBFPRSPTBR	Real private gross fixed investment/real GDP
IBFR	Total real gross fixed investment
IBFRSPTBR	Real gross fixed investment/real GDP
IBFTEPR	Total gross fixed investment except oil
ICVABT	Consumer price index: food, beverages, and tobacco
ICVHOG	Consumer price index: household expenses
ICVSER	Consumer price index: miscellaneous expenses
ICVVYC	Consumer price index: clothing and footwear
IDCPR	Consumer price index
IDPT	GDP deflator (1968 = 100)
IDPTEP	Non-oil GDP deflator (1968 = 100)
IDPTP	Oil GDP deflator (1968 = 100)
IEPB	Non-oil state owned enterprises, current income
IEPBTK	State owned enterprises, income from capital transfer
IEPBTR	State owned enterprises, real income from transfers
IGPM	Wholesale price index
IGPMDP	Wholesale price index, oil products
INFPDV	Oil industry, net investment
INPXRM59	World export price index 5 to 9
INTPET	Oil industry, income from interest
IOGC	Central government, current revenues
IPCPV	Private consumption deflator (1968 = 100)
IPDV	VOC current income
IPM	Price index for imported goods and services
IPM01	Price index for imports, sectors 0–1
IPM04	Price index for imports, sectors 0–4
IPM24	Price index for imports, sectors 2 and 4
IPM3	Price index for imports, sector 3
IPM59	Price index for imports, sectors 5–9
IPMA	Wholesale price index, agriculture
IPMB	Price index for merchandise imports
IPMM	Wholesale price index, manufacturing
IPMN	Wholesale price index, national products
IPMS	Price index for service imports
IPMT	Wholesale price index, imported products
IPPA	Producer price index, agriculture
IPPM	Producer price index, manufacturing
IPX	Price index for exports of goods and services
IPXB	Price index for merchandise exports
IPXBNP	Price index for non-oil merchandise exports
IPXHID	Price index for hydrocarbon exports
IPXS	Price index for service exports
ISICRE	Investment income: credits
ISIDEB	Investment income: debits

ISIEXDEB	Direct foreign investment income: debits
ISIPBCRE	Public sector investment income: credits
ITR	Total real investment
KPM	Real private capital in manufacturing
L	Total employment
L1	Employment in primary sector
L2	Employment in secondary sector
L23	Employment in secondary and tertiary sectors
LC	Employment in construction
LE	Employment in electricity
LEPM	Employment except in oil and mining
LIQC	Money supply (liquidity = M2)
LIQCL	Money supply (logarithm)
LIQR	Real money supply
LM	Employment in manufacturing
LM1SP	Currency/current non-oil GDP (logarithm)
LP	Employment in oil industry
LS	Employment in services
M	Current imports of goods and services
M01C	Current imports of food, beverages, and tobacco
M01R	Real imports of food, beverages, and tobacco
M01RSMBTR	Imports of food, beverages, and tobacco/merchandise imports (real)
M04C	Current imports, groups 0–4
M04R	Real imports, groups 0–4
M1SP	Currency/non-oil GDP (current)
M24C	Current imports of raw materials
M24R	Real imports of raw materials
M24RSMBTR	Raw materials imports/merchandise imports (real)
M3C	Current imports of fuels
M3R	Real imports of fuels
M59C	Current imports of manufactured goods
M59R	Real imports of manufactured goods
MA1BCV	CBV internal assets, balance at end of year
MBEMI	Coins and bills issued (monetary base)
MBEMIL	Coins and bills issued (logarithm)
MBPB$	Public merchandise imports ($)
MBPBR	Real public merchandise imports
MBPV$	Private merchandise imports ($)
MBPVBS	Current private merchandise imports
MBPVR	Real private merchandise imports
MBPVRL	Real private merchandise imports (logarithm)
MBTC	Current merchandise imports
MBTC$	Merchandise imports ($)
MBTR	Real merchandise imports
MBTRSPTBR	Merchandise imports/GDP (real)
MCOEPE	Coefficient of cash preference
MCOES	Ratio currency (M1)/liquidity (M2)
MDTPUB	Deposits by the public in banking system
MESCR	Credit expansion of money supply
MFMON	Monetary financing
MGIN	Net internal public spending (monetary)
MGINL	Net internal spending free of monetary financing
MOCAM	Foreign exchange flow
MPASBCV	CBV liabilities, balance at end of year
MR	Real imports of goods and services
MRESER	Deposits of bank reserves in CBV
MS$	Service imports ($)
MSEC	Current service imports
MSER	Real service imports
MSLIQC	Total imports/monetary liquidity

MSPB$	Public imports of services ($)
MSPTBC	Total imports/current GDP
MULTLIQC	Liquidity multiplier
MULTMON	Currency multiplier
OIPDVSA	Oil industry, other income
OIPDVSAF	Oil industry, other financial income
OSERVCRE	Other exports, services
OSERVDEB	Other imports, services
OTYSCRE	Other exports, transportation and insurance
OTYSDEB	Other imports, transportation and insurance
P23R	Real GDP, secondary and tertiary sectors
PAR	Real GDP, agriculture
PARTRTPB	Public sector wage bill/total wage remuneration
PARTRTPV	Private sector wage bill/total wage remuneration
PCR	Real GDP, construction
PCRSLC	Average labour productivity, construction
PDVAPORT	Oil industry, contributions to government
PDVCAP	Oil industry, capital outlays
PDVDEPRE	Oil industry, depreciation
PDVEGRES	Oil industry, outlays
PDVICAP	Oil industry, capital income
PDVKSYT	Oil industry, inventories and lands
PDVOTCOS	Oil industry, other costs
PDVSAI	Oil industry, balance before taxes
PDVSCTE	Oil industry, current balance
PDVTI	Oil industry, indirect taxes
PDVUC	Oil industry, exchange profits
PEPM	Real GDP except oil and mining
PER	Real GDP, electricity
PHIDLB	Annual production of liquid hydrocarbons (million barrels)
PHIDLBD	Daily production of liquid hydrocarbons (million barrels per day)
PINTPBSB	Internal price of oil and products (bolivars)
PMR	Real GDP, manufacturing
PMRSLM	Average labour productivity in manufacturing
POBA	Labour force
PPB	Annual production of crude oil (million barrels)
PPBD	Daily production of crude oil (million barrels per day)
PR23	Average labour productivity sectors 2 and 3
PREGALBS	Oil royalty per barrel
PRIMAA	Foreign debt, insurance premium for amortization
PRIMAI	Foreign debt, insurance premium for interest
PSR	Real GDP, services
PSRSLS	Average labour productivity, services
PTBC	Current GDP
PTBR	Real GDP (1968 = 100)
PTBRSL	Average labour productivity
PTBRSPOB	Real GDP per capita (1968 = 100)
PTEP	Real non-oil GDP (1968 = 100)
PTEPC	Current non-oil GDP
PTEPSPOB	Non-oil GDP per capita (1968 = 100)
PTPC	Current oil GDP
PTPCC	Current GDP per capita
PTPCR	Real GDP per capita (1968 = 100)
PTPR	Real oil GDP (1968 = 100)
PXHIDPRO	Export market price of hydrocarbons (bolivars per barrel)
REGALIAC	Oil industry, other assessed taxes
REGALIAR	Central government, revenues from oil royalty
REKC	Current non-wage remunerations
REKCSYNC	Non-wage remuneration/national income (current)
RETC	Current wage remunerations

RETCSYNC	Wage remuneration/national income (current)
RETCSYPDC	Wage remuneration/personal disposable income
RETPBC	Wage remuneration of public sector
RETPBCSRET	Wage remuneration of public sector/wage remuneration
RETPBCSYPD	Wage remuneration of public sector/personal disposable income (current)
RETPVC	Wage remuneration of private sector
RETPVCSRET	Wage remuneration of private sector/wage remuneration (current)
RETPVCSRPR	Wage remuneration of private sector/return to property (current)
RETPVCSYPD	Wage remuneration of private sector/personal disposable income (current)
RI$	Foreign reserves ($)
RPROP	Current property income
RPROPSYNC	Property income/national income (current)
RPROPSYPDC	Property income/personal disposable income
RPSRT	Property income/wage remuneration (current)
*RT*23*C*	Current wage revenue, sectors 2 and 3
RTSPC	Current wage revenue, primary sector
SXFC$	Net investment income ($)
*TCM*01	Exchange rate for imports, groups 0–1
*TCM*24	Exchange rate for imports, groups 2 and 4
*TCM*3	Exchange rate for imports, group 3
*TCM*59	Exchange rate for imports, groups 5–9
TCMB	Exchange rate for merchandise imports
TCMS	Exchange rate for service imports
TCXB	Exchange rate for merchandise exports
TCXBNP	Exchange rate for non-oil merchandise exports
TCXS	Exchange rate for service exports
TDNPC	Direct non-oil taxes
TDNPCSPTBC	Direct non-oil taxes/current GDP
TFADUANA	Central government, customs duties
TFDERPET	Central government, gasoline tax
TFDIMP	Central government, import taxes
TRANSEX$	Net unrequited transfers ($)
TRDERPET	Tax rate on gasoline
TRSEGCRE	Exports of transportation and insurance
TRSEGDEB	Imports of transportation and insurance
TTPCCAU	Oil industry, total assessed taxes
TTPCREC	Oil industry, total collected taxes
TUPCCAU	Oil industry, assessed income tax
TUPCREC	Oil industry, collected income tax
U	Unemployment
UDOMPB	Annual domestic use of refined products (except national oil industry)
UINDPET	Oil industry, profits
UR	Unemployment rate
UTCFIS	Central government, revenues from exchange profits
VEXPRO	Tax reference price of hydrocarbons (bolivars per barrel)
VIAJECRE	Exports, travellers
VIAJEDEB	Imports, travellers
VTAPDVPF	VOC sales at tax reference prices
VTAPDVPR	Oil industry, income from sales
VTEPB	Non-oil state owned enterprises, total sales
VTIEPB	Non-oil state owned enterprises, internal sales
VTINTPET	Oil industry, income from internal sales
*W*23*R*	Average real wage rate, sectors 2 and 3
*WR*23	Average wage rate, sectors 2 and 3
WRA	Average wage rate, agriculture
WRT	Average overall wage rate
X	Current exports of goods and services
X$	Exports of goods and services ($)
*X*04*C*	Current exports, groups 0–4
*X*59*C*	Current exports, groups 5–9

XBNOPET$	Non-oil merchandise exports ($)
XBNOPETC	Current non-oil merchandise exports
XBNOPETR	Real non-oil merchandise exports
XBNPPV$	Private non-oil merchandise exports ($)
XBTC	Current merchandise exports
XBTC$	Merchandise exports ($)
XBTR	Real merchandise exports
XCAC	Current exports of cocoa
XCAR	Real exports of cocoa
XCCR	Real exports of coffee and cocoa
XCFC	Current exports of coffee
XCFR	Real exports of coffee
XHC	Current exports of iron ore
XNETPB	Net public exports
XNPPBBS	Exports of non-oil state owned enterprises
XNTC	Current non-traditional exports
XNTC$	Non-traditional exports ($)
XOAC	Agricultural exports except coffee and cocoa
XPCDGB	Annual hydrocarbon exports (million barrels)
XPCDGBD	Daily hydrocarbon exports (million barrels per day)
XPDC	Exports of crude oil, products and gas (bolivars)
XPDC$	Exports of crude oil, products and gas ($)
XPDCPRF	Hydrocarbon exports at tax reference prices
XPDR	Real exports of crude oil, products and gas
XPETCOST	Oil industry, cost of exports
XPETCUNI	Oil industry, unit cost of exports
XPETNET	Oil industry, net income from exports
XR	Real exports of goods and services
XS$	Exports of services ($)
XSC	Current exports of services
XSPB$	Public exports of services ($)
XSR	Real exports of services
YNC	Current national income
YNCSPOB	Current national income per capita
YNCSPTBC	National income/GDP (current)
YNPC	Current national income per capita
YNR	Real national income
YNRSPOB	Real national income per capita
YPCR	Real personal disposable income per capita
YPDC	Current personal disposable income
YPDCSPOB	Current personal disposable income per capita
YPDCSYNC	Personal disposable income/national income (current)
YPDR	Real personal disposable income
YPDRSPOB	Real personal disposable income per capita

Description of the exogenous variables

Name	*Description*
ALFAFIV	VIF, yield less loan rate
AOACTBCV	CBV, changes in other internal assets
AOPASBCV	CBV, changes in other liabilities (excluding VOC)
APORPOBA	% variation of labour force
APORWGPROM	% variation of nominal wages, public sector
AREDANT	CBV, changes in internal assets (rediscounts and advances)
BCVBOBUY	CBV, changes in internal assets (public bonds)
CBYSADES	Consumption of independent public agencies
CBYSFIS	Consumption of central government

CBYSPET	Consumption of oil industry
CKFUGA	Capital flight
CKINVEX	New foreign investment
CKOCRE	Capital account: other credits
CKOSPB	Capital account: flight and other outflows
CNETONRR	Real net private consumption of non-residents
CPVCR	Real private consumption of clothing and footwear
DCTRCMB	Dummy for foreign exchange control
DIASANO	Days of the year
DPBITASA	Public internal debt, effective interest rate
DPBXAM$N	Public foreign debt, new amortization ($)
DPBXAM$V	Previously existing public foreign debt, amortization ($)
DPBXNEW$	New public foreign debt ($)
DPVXAM$N	New private foreign debt, amortization ($)
DPVXAM$V	Previously existing private foreign debt, amortization ($)
DPVXNEW$	New private foreign debt ($)
DUM01R	Dummy for imports, groups 0–1
DUM59RL	Dummy for imports, groups 5–9 (logarithm)
DUMLE	Dummy for employment in electricity
DUMLIBP	Dummy price liberalization 1979–81
DUMLM	Dummy for employment in manufacturing
DUMM68	Dummy 1968 = 1 others = 0
DUMM76	Dummy 1976 = 1 others = 0
DUMM80	Dummy 1980 = 1 others = 0
DUMM83	Dummy 1983 = 1 others = 0
DUMM85	Dummy 1985 = 1 others = 0
DUMMLC	Dummy for employment in construction
DWR23	Dummy wages, secondary and tertiary sectors
EPCC	Surplus production of coffee and cocoa
EPCF	Surplus production of coffee
ERROMISI	Errors and omissions in balance of payments
FIVFINAN	VIF financing
FIVOIC	VIF other current income
FUGAKN$	Net capital flight ($)
GEPBCOIN	State owned enterprises, internal consumption
GEPBTM	State owned enterprises, municipal taxes
GEPBTRPB	state owned enterprises, current transfers, public sector
GEPBTRPV	State owned enterprises, current transfers, private sector
GFIVCAP	VIF, capital spending
GFIVCTE	VIF, current spending
GFSUBS	Central government, subsidies
GFTROT	Central government, other transfers to public sector
IBFADES	Gross fixed investment, independent public agencies
IBFEPB	Gross fixed investment, state owned enterprises
IBFGCC	Current gross fixed investment, central government
IBFGPC	Current public gross fixed investment in oil
IBFP3R	Real private gross fixed investment in tertiary sector
IBFPAR	Real private gross fixed investment in agriculture
IBFPCR	Real private gross fixed investment in construction
IBFPER	Real private gross fixed investment in electricity
IBFPMIR	Real private gross fixed investment in mining
IBFPPR	Real private gross fixed investment in oil
IEPBINT	State owned enterprises, interest income
IEPBOTR	Non-oil state owned enterprises, other income
IEPBTC	State owned enterprises, current transfer income
IEPBTKF	State owned enterprises, income from capital transfers by VIF, other sources
IEPBTKGC	State owned enterprises, income from capital transfers
IEPBVAF	State owned enterprises, sale of fixed assets
INFLACEX	Average external inflation
IPXCA	Price index for cocoa exports

IPXCF	Price index for coffee exports
*IPXRM*01	Increase in prices of worldwide exports, groups 0 and 1
*IPXRM*24	Increase in prices of worldwide exports, groups 2 and 4
*IPXRM*3	Increase in prices of worldwide exports, group 3
*IPXRM*59	Increase in prices of worldwide exports, groups 5 to 9
IPXRMS	Increase in prices of worldwide exports of services
ISIBCVCR	Investment income, CBV credits
ISIFIVCR	Investment income, VIF credits
ISIPDVCR	Investment income, VOC credits
ISIPVCRE	Investment income, private sector credits
LA	Employment in agriculture
LIBOR	London interbank offered rate (LIBOR) %
LM	Employment in manufacturing
LMI	Employment in mining
M3R	Real imports of fuel
MCAPBCV	CBV, capital at end of year
MCOERB	Coefficient of reserves for deposits
MRIBS	Net international reserves, balance year end (bolivars)
MSPV$	Private imports of services ($)
PARTRPRO	Property income/personal disposable income
PDVBM	CBV, changes in liabilities (VOC deposits)
PDVBONOS	Oil industry, public bonds acquired
PDVOTI	Oil industry, other indirect taxes
PDVVAF	Oil industry, sale of fixed assets
PETPROCB	Oil processed in refineries
PMIR	Real mining GDP
POB	Population (thousands of inhabitants)
*PON*01*L*	Weighting of groups 0–1 for *TCLIB*
*PON*01*MO*	Weighting of groups 0–1 for *TCMO*
*PON*01*P*	Weighting of groups 0–1 for *TCP*
*PON*01*PR*	Weighting of groups 0–1 for *TCPR*
*PON*24*L*	Weighting of groups 2–4 for *TCLIB*
*PON*24*MO*	Weighting of groups 2–4 for *TCMO*
*PON*24*P*	Weighting of groups 2–4 for *TCP*
*PON*24*PR*	Weighting of groups 2–4 for *TCPR*
*PON*3*L*	Weighting of group 3 for *TCLIB*
*PON*3*MO*	Weighting of group 3 for *TCMO*
*PON*3*P*	Weighting of group 3 for *TCP*
*PON*3*PR*	Weighting of group 3 for *TCPR*
*PON*59*L*	Weighting of groups 5–9 for *TCLIB*
*PON*59*MO*	Weighting of groups 5–9 for *TCMO*
*PON*59*P*	Weighting of groups 5–9 for *TCP*
*PON*59*PR*	Weighting of groups 5–9 for *TCPR*
PONDPB	Share of public debt with insurance
PONMSMO	Weighting of group *MS* for *TCMO*
PONMSP	Weighting of group *MS* for *TCP*
PONMSPR	Weighting of group *MS* for *TCPR*
PONXNPL	Weighting of group *XNP* for *TCLIB*
PONXNPP	Weighting of group *XNP* for *TCP*
PONXNPPR	Weighting of group *XNP* for *TCPR*
PONXNPXO	Weighting of group *XNP* for *TPXO*
PONXSL	Weighting of group *XS* for *TCLIB*
PONXSP	Weighting of group *XS* for *TCP*
PONXSPR	Weighting of group *XS* for *TCPR*
PONXSXO	Weighting of group *XS* for *TCXO*
PREGALI$	Oil royalty per barrel ($)
PXPD$*B*	Export market price of hydrocarbons (US$ per barrel)
REMADES	Remuneration in independent public agencies
REMEPB	Remuneration in state owned enterprises
REMFIS	Remuneration in central government

REMPET	Remuneration in oil industry
RTAC	Wage remuneration for labour in agriculture
RTMIC	Wage remuneration for labour in mining
RTPC	Wage remuneration for labour in oil industry
SPREADPB	Spread over LIBOR for public debt
SPREADPV	Spread over LIBOR for private debt
TCKPB1	Exchange rate for new debt
TCKPB2	Exchange rate for debt with insurance
TCLIB	Exchange rate on free market
TCMO	Exchange rate for official imports
TCP	Exchange rate for oil
TCPR	Preferential exchange rate
TCXO	Exchange rate for exports
TDCUC	Direct personal taxes
TECPET	Oil industry, technological support
TEISRPET	Oil industry, effective income tax rate
TFCIGARR	Central government, cigarette tax
TFLICOR	Central government, liquor tax
TFREST	Central government, other current revenues
TIAPROM	Average internal loan rate
TRANF	Transfers to persons
TRPVPET	Oil industry transfers to private sector
UDOMPBD	Domestic use of refined oil products per day (except oil industry)
VER	Real stock variations
XBNPPV$	Private non-oil merchandise exports ($)
XHT	Iron ore exports (tonne)
XOAC$	Agricultural exports except coffee and cocoa ($)
XSPV$	Private exports of services ($)