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Oil Wealth and Economic Behavior: The Case of Venezuela, 1965-81

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Abstract

A short-run macroeconomic model is estimated for Venezuela, in order to examine the hypothesis that the availability of oil resources may entail a confidence effect--on perceived future incomes--that influences the expenditure and portfolio behavior of economic agents. Such confidence effect is found to be empirically significant. Model simulations reveal that the impact of oil price changes on the level and variability of money demand, balance of payments and inflation are significantly more pronounced in the presence of the confidence effect than in its absence. This has significant implictions for the size and structure of the needed policy interventions.

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I. Introduction

The purpose of this paper is to examine the short-run, macroeconomic implications of natural resource availability as well as its exhaustibility in the case of Venezuela. Although considerable attention has been paid in the economic literature to the manner in which the economies of oil producers such as Venezuela are influenced by variations in the flow of income generated by oil resources, the models used in the studies have generally ignored two important distinguishing characteristics of oil-based economies. The first relates to the possible confidence effect of resource availability on the behavior of economic agents. This effect has been highlighted by the studies of the so-called "Dutch disease", i.e., the problem of deindustrialization due to a booming export sector. 1/ It arises from the impact of resource availability on future expected income which can, in turn, influence saving behavior, the pattern of expenditure, and the composition of asset portfolios. The second important characteristic is the exhaustibility of oil resources. Although the economic literature is replete with studies on the implication of the exhaustibility of petroleum resources for optimal production and price strategies of petroleum-based economies, the short-run macromodels of such economies have generally sidestepped the question of depletability of the main source of income. 2/ Although these models do recognize that exhaustibility of oil has major implications from the point of view of economic management--since the exploitation of a depletable resource represents a loss of national wealth that needs to be replaced through the use of the income it generates--they generally consider exhaustibility as a long-run concept with little or no consequences in the short run. The validity of such a position is questionable, however, as exhaustibility is likely to influence expectations regarding future income, thus inducing shifts in perceived wealth that may, in turn, affect private sector confidence and its behavior in the short run.

The analytical framework of this paper explicitly incorporates these key characteristics of major oil-based developing countries. 3/

1/ See, for example, Buiter and Purvis (1982), Cordon and Neary (1982), Eastwood and Venables (1982), Neary and van Wijnbergen (1984), and van Wijnbergen (1984).

2/ See, for example, Aghevli (1977), Aghevli and Sassanpour (1982), Khan (1976), Knight and Mathieson (1980), Lipschitz (1984), and Nsouli (1978).

3/ For a detailed discussion of other characteristics of oil-producing developing countries, see Amuzegar (1983).

The analysis suggests that in the case of Venezuela, once these features are taken into account, the impact of an oil-price shock on the economy becomes considerably more pronounced. In particular, such a disturbance would lead to significantly greater variations in both the balance of payments and domestic prices than is suggested by earlier models that ignore these features of resource-based economies. Consequently, remedial policies adopted in the face of such disturbances would need to be greater in intensity, and sometimes, longer in duration than those suggested by previous studies.

The model is applied to the Venezuelan economy over the period 1965-81. The choice of country was dictated by both data availability and a desire to preserve the general characteristics of the model as far as possible so as to make it applicable to other oil-producing LDCs. Venezuela seems especially suitable for this purpose since it is a small and relatively liberal economy where the generality of the model specification could be preserved.

The rest of this paper is organized as follows. The specification of the model is presented in the next section. This is followed in Section III by a discussion of the estimation results and their policy implications. Some simulation exercises are carried out in Section IV to highlight the impact of exogenous shocks on the economy and the conclusions of the study are summarized in Section V.

II. Model Specification

Following the tradition of the so-called "warehouse" models of oil supply, we assume that oil is stored in a warehouse so that the costs or technical difficulties associated with its production or exportation are negligible. The usage rate is also assumed not to be constrained by any conservation motive. We thus abstract from the issues related to optimal pricing and production strategies over time, on which much of the literature on exhaustible resources has focused. This implies that, given an exogenous foreign price of oil, the rate of depletion is always equal to the quantity demanded at the going price; oil revenues can thus be treated as exogenous. This assumption is not too restrictive since it is not always possible for a country such as Venezuela, which is a member of OPEC, to individually vary its price or output sufficiently to achieve a targeted income. 1/

The role of oil as an intermediate input is left out of the model. As a result, nonoil-producing sectors are not directly influenced by changes in oil prices. 2/ Such an omission is not too restrictive if the size of the nonoil (including petrochemical) sector is small in relation to the size of the economy, or if the domestic use of oil is relatively unimportant, as is the case in many petroleum-exporting developing countries. Moreover, in such countries, the domestic production sector is generally insulated from movements in the export price of oil as a matter of policy. The cost of oil input in domestic production is thus not sensitive to developments in the oil price, and the impact on domestic production of higher oil revenues generated through price hikes does not work through the oil input component of domestic production.

1/ Moreover, so long as the price elasticity of demand for oil from a particular country is infinitely large, an output restriction is sufficient to render oil revenues exogenous. Although the global elasticity of demand for oil may be low, demand for a specific country's oil exports need not necessarily be low. An approximate measure of this elasticity is given by:

$$\varepsilon = [\varepsilon_{\omega} + (1 - s)\eta]/s$$

where: ε = price elasticity of world demand for oil from country i

ε_{ω} = price elasticity of world demand for oil

η = supply elasticity of other producers

s = share of country i in world oil market.

Although this is an approximate measure, as it assumes that there is excess capacity in the combined production of competitors, it shows that the price elasticity of demand for oil from country i is larger, the smaller its share of the market. In the case of Venezuela, this share has varied between 3 and 5 percent. In the limiting case when supply elasticity of other producers (η) is zero, the elasticity of demand for Venezuelan oil can be between 20 to 33 times larger than the elasticity of world demand for oil. Given a large elasticity of demand for Venezuelan oil, the assumption of exogenous oil revenue is not too restrictive.

2/ Allowing for oil as an intermediate input may be tantamount to building an automatic Dutch disease process into the model with the nonoil export sector being adversely affected whenever oil export prices increase. This procedure may, of course, be justified in some countries such as Canada. See Knight and Mathieson (1980).

However, the impact of the oil resources enters the model on the demand side. Both the demand for real balances and the private demand for consumption and investment goods are influenced by these resources. In contrast to some recent theoretical models that recognize the separate impact of oil resources on demand but implicitly assume that these revenues accrue directly to the private sector, 1/ in the present model the influence of these resources on private behavior is indirect as oil revenues are assumed to be received entirely by the government. This indirect influence can be interpreted as the confidence effect of the oil wealth. It arises because the stock of oil may be viewed by the society as accumulated savings or a source of wealth to be drawn upon in the future. The knowledge of the existence of this source of wealth, from which eventually all the inhabitants of a country can be expected to benefit, affects the public's confidence regarding prospects for future income, leading to adjustment in their permanent income. This will, in turn, have an influence on saving behavior, expenditure patterns, and the composition of asset portfolios. In other words, the indirect impact of oil wealth on current expenditures and desired holdings of real balances works, not through a rise in the current disposable income, but through the expectation about future income.

In the oil-based economies, the large size of export earnings accruing to the government relative to the size of the economy imparts more importance to the operations of the government than is the case in other LDCs. Since the oil sector is typically characterized as an enclave sector, the government's operations serve as the main linkage between that sector and the rest of the economy. This implies that the loss of oil export proceeds will not automatically lead to a decline in aggregate demand as it falls entirely on the government. Specific adjustment measures will then be required to bring demand in line with resource availability. In contrast, where the economy is dependent on the export of a single agricultural crop, reduced crop prices abroad will result in lower incomes for many households as well as for the government. This will, by itself, lead to a decline in aggregate demand, thereby reducing the extent of required adjustment in financial policy. 2/

The collection of government receipts from oil exports, all of which is denominated in foreign currency, entails no deflationary impact, as it does not represent a withdrawal from the domestic income stream. Similarly, the expenditure of these revenues on imports of

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1/ See, for example, Eastwood and Venables (1982), Buiter and Purvis (1982), and Neary and van Wijnbergen (1984).

2/ A fall in the relative price of the crop induces a shift to other profitable crops. In oil-exporting countries a switch to other exports that could adequately substitute for oil is clearly not feasible in the short run.

goods and services does not immediately increase domestic liquidity and is not inflationary. On the other hand, there is an immediate coincidence of oil-financed domestic expenditure with increases in domestic liquidity which may to some extent blur the distinction between monetary and fiscal policies. 1/ The rate of growth of the money supply is, therefore, greatly influenced by the government's domestic operations. The domestic budget balance, i.e., the difference between the government's domestic revenues and domestic expenditures, becomes a more useful concept in analyzing the impact of government operations on domestic liquidity.

Unlike much of the earlier work on macroeconomic models undertaken at the IMF, the model of this paper does not follow a purely monetarist tradition but takes into account structural factors underlying inflationary and growth impulses. The model recognizes the interdependence of commodity and money markets by explicitly allowing for spillover of disequilibrium effects across different markets. The level of absorption and prices are thus influenced by disequilibrium in both money and commodity markets. Moreover, in contrast to earlier models that focus on aggregate private expenditures, an explicit investment function is incorporated in order to isolate the impact of oil resources on productive potential. The specification of the model in disequilibrium form also helps to provide information on the lag structure of the economy.

The model consists of 9 behavioral equations and 8 identities explaining 17 endogenous variables. The definition of variables is given in Appendix Table 1, and the model is reproduced in Appendix Table 2. Lower case letters denote the logarithm of the corresponding variable in upper case deflated by the price index, i.e., $y = \log(Y/P)$; p, p^t, and p^n denote the logarithm of the corresponding price index (P, P^t, and P^n), and i and i_f represent, respectively, domestic and foreign interest rates measured in percent.

1. <u>Demand for real balances</u> (m^d)

The demand for real balances is assumed to depend on real nonoil income (y), the expected oil wealth (f) and interest rate. 2/ The

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1/ If the country is small so that its import supply function is inelastic, and if domestic and foreign goods are perfect substitutes and no import restrictions exist, it makes no difference whether the government initially spends oil revenues on domestic or on foreign goods and services. Rather than influencing domestic prices, any excess liquidity created through government operations will initially leak out through imports.

2/ As oil income accrues to the Government, its impact on the money demand (and other private demand variables) works indirectly through the government expenditure function. Thus, it has not been included as an independent variable in money demand and private expenditure equations.

relationship between the expected oil wealth and demand for money represents a confidence or psychic factor, as discussed earlier, but it is also consistent with Friedman's hypothesis that demand for real balances depends on permanent rather than actual income. 1/ The inclusion of both nonoil income and expected oil wealth in the demand for money equation also permits a test of the plausible hypothesis that the elasticity of demand for money with respect to oil and nonoil income should differ substantially, reflecting the dominant role of government in oil-related transactions.

In a relatively open economy such as that of Venezuela, both foreign and domestic interest rates (i_f and i, respectively) should be included in the demand for money equation to represent the yield on foreign and domestic assets. In a completely open economy, these assets are perfectly substitutable, so that the movements in their yields are correlated and there is no need to include both interest rates in the equation. However, since the degree of openness is an empirical question, the demand function is specified to include both interest rates: 2/

$$m^d = m^d(\overset{+}{y}, \overset{+}{f}, \overset{+}{i}, \overset{-}{i_f})$$

The actual stock of real balances is assumed to adjust with a lag to the desired stock:

$$\Delta m = \upsilon(m^d - m_{t-1})$$
$$0 \leq \upsilon \geq 1$$

where υ is the speed of adjustment, and Δ is the first difference operator:

$$\Delta X = X_t - X_{t-1}.$$

The above relationships result in the following estimating equation:

$$m = a_1 + a_2y + a_3f + a_4i + a_5i_f + a_6m_{t-1} \qquad (1)$$
$$a_2, a_3, a_4, a_6 > 0, a_5 < 0$$

2. Private consumption expenditures (con)

The level of aggregate private consumption rises whenever there is an excess private demand for consumer goods:

1/ See Friedman (1959).
2/ The time subscripts (t) have been suppressed throughout the paper for ease of presentation.

$$\Delta con = b_0(con^d - con_{t-1})$$

$$0 \leq b_0 \leq 1$$

where con^d denotes the desired level of private consumption. It is assumed to vary directly with nonoil real income (y) and expected oil wealth (f), and inversely with the level of monetary disequilibrium in the previous period.

$$con^d = con^d(\overset{+}{y}, \overset{+}{f}, \overset{-}{EFD}_{t-1})$$

Where EFD denotes the level of disequilibrium in the money market, as defined in Section 11. Eliminating con^d from the above relationships, gives the estimating equation:

$$con = b_1 + b_2y + b_3f + b_4EFD_{t-1} + b_5con_{t-1} \qquad (2)$$

$$b_2 > 0,\ b_3 > 0,\ b_4 < 0,\ b_5 < 0.$$

3. Private investment (KF)

The desired level of real private capital stock $(K/P)^d$ is assumed to be a linear function of real nonoil income (Y/P), expected real oil wealth (F/P), and the opportunity cost of capital (q):

$$(K/P)^d = K[\overset{+}{Y/P}), \overset{-}{q}, F/P]$$

q is measured by the rental wage ratio:

$$q = P(i - \pi)/W$$

where W represents the nominal wage index and π denotes the rate of change in capital goods prices.

An expansion in nonoil income could raise the level of desired capital stock, while an increase in the rental-wage ratio would lower it by encouraging substitution of labor for capital. However, the impact of an increase in the expected oil wealth on desired private capital stock is ambiguous. As the immediate beneficiary of higher income from oil is the government, the direction of the impact would depend on the expected pattern of government expenditure. That is, the desired private capital stock may rise if government expenditures are viewed as complementary to private investment (as could be the case with government expenditures channeled to infrastructural investment). It will decline if government expenditures are expected to be of a competing nature, concentrated on projects usually undertaken by the private sector. The sign of the coefficient of F/P is therefore indeterminate, a priori.

In each period the actual level of capital stock adjusts partially to the desired level. 1/

$$\Delta(K/P) = u[(K/P)^d - (K/P)_{t-1}]$$

$$0 \leq u \leq 1.$$

The level of real gross fixed capital formation (KF/P) is given by:

$$KF/P = \Delta(K/P) + DEP$$

where DEP denotes depreciation of capital stock assumed to be a constant proportion, θ, of capital stock in the previous period:

$$DEP = \theta(K/P)_{t-1}$$

The estimating relationship for KF/P is thus given by:

$$KF/P = u_0 + u_1(Y/P) + u_2q + u_3(F/P) + u_4(K/P)_{t-1} \qquad (3)$$

$$u_1 > 0,\ u_2 < 0,\ u_4 = \theta - u$$

4. Domestic price inflation

The domestic price level (p) is assumed to be a weighted average of the prices of traded and nontraded goods (p^t and p^n, respectively):

$$p = \omega p^n + (1 - \omega)p^t$$

$$0 \leq \omega \leq 1$$

Movements in prices of nontraded goods result from variations in money market disequilibrium or from changes in the excess of demand over potential supply in the goods market (ECD): 2/

1/ Some studies have postulated an increasing relationship between the speed of adjustment (u) and the availability of resources for private capital formation (see, for example, Sundararajan and Thakur, 1980). The availability variable, measured by the difference between aggregate savings and government investment, was not found to be a significant factor determining private investment in Venezuela.

2/ The possibility that the divergence of relative prices from their long-run equilibrium value could also influence nontraded goods prices was excluded from the price equation, as empirical tests showed that this was not significant.

$$\Delta p^n = p^n(\overset{+}{\Delta ECD}, \overset{+}{\Delta EFD})$$

Assuming potential output is proportional to real capital stock (k), we can write:

$$ECD = y^d - \alpha k; \qquad \alpha > 0$$

where y^d represents the level of demand in the goods market.

These relationships give the following estimating equation for domestic inflation:

$$\Delta p = c_1 + c_2\Delta y^d + c_3\Delta k + c_4\Delta EFD_{t-1} + \omega\Delta p^t \qquad (4)$$

where $c_2 > 0,\ c_3 = -\alpha c_2 < 0,\ c_4 < 0$

5. Growth of nonoil output (y)

The supply of nonoil output (y) responds to excess demand in the commodity market, to the disequilibrium in the money market (with a time lag), and to relative prices.

$$\Delta y = d_1 + d_2(y^d - y) + d_3EFD_{t-1} + d_4(p^n - p^t)$$

$$d_2 > 0,\ d_3 < 0.$$

An improvement in the terms of trade in favor of nontraded goods could be expected to stimulate the supply of nonoil output as nontraded goods comprise the bulk of the domestic nonoil production. However, the increase in the relative price of nontraded goods may shift the consumption pattern away from such commodities, thus inducing a cutback in production. The sign of the coefficient d_4 is, therefore, indeterminate a priori.

On rearrangement, we could derive the estimating equation:

$$\Delta y = D_1 + D_2y^d + D_3EFD + D_4(p^n - p^t) + D_5y_{t-1} \qquad (5)$$

where $D_2 > 0,\ D_3 < 0,\ 0 > D_5 = -d_2/(1 + d_2) > -1.$

The demand for domestic nonoil output (Y^d) comprises public (G) and private demand for goods and services and demand for nonoil exports (X^n):

$$Y^d = CON^d + KF + G + X^n \qquad (6)$$

6. Imports (im)

The level of actual real imports (im) rises whenever there is excess demand for imports:

$$\Delta im = k_0(im^d - im_{t-1})$$

$$0 \leq k_0 \leq 1$$

The desired level of imports (im^d) is assumed to depend on planned private expenditures (e), on government real expenditures (g), and on relative prices of traded and nontraded goods:

$$im^d = im(\overset{+}{e}, \overset{+}{g}, \overset{+}{p^n - p^t}).$$

The variables e and g enter the import function separately to account for the difference in the import content of private and government expenditures. The underlying demand for private expenditure is composed of desired consumption and planned investment:

$$e = \log (CON^d/P + KF/P) \qquad (7)$$

In the present formulation, the planned and actual levels of investment are assumed to be equivalent. In other words, plans to adjust to desired capital stocks at a given speed are assumed to be fully realized.

The following equation could thus be derived:

$$im = k_1 + k_2 (p^n - p^t) + k_3 e + k_4 g + k_5 im_{t-1} \qquad (8)$$

$$k_2 > 0,\ k_3 > 0,\ k_4 > 0,\ 1 \geq k_5 = 1 - k_0 \geq 0$$

7. Government revenue (GR) and expenditure (G)

Government revenues (GR) consist of oil revenues (OR) and nonoil revenues (DR):

$$GR = OR + DR \qquad (9)$$

Nonoil revenues are related to nonoil income:

$$dr = l_1 + l_2 y;\ l_2 > 0 \qquad (10)$$

Given the exogeneity of the price and demand for oil, the governments of oil-producing countries can exercise little discretionary control over the bulk of their revenues, particularly in the short run. As a result, they have attempted to a larger extent than is the case with other countries, to adjust their expenditures in line with revenues.

Studies of Iran and Indonesia have in fact shown that the level of government expenditure in each period is established in these countries in such a way as to move toward a balanced budget over time. 1/ Adopting such an assumption, we will have:

$$\Delta g = \lambda[gr - g_{t-1}]$$

$$0 \leq \lambda \leq 1$$

which results in the estimating equation

$$g = \lambda gr + (1 - \lambda)g_{t-1} \tag{11}$$

8. Nonoil exports (X^n)

These are determined as a residual from the income identity: 2/

$$X^n = Y - CON - KF - G + IM - \Delta INV + DOC \tag{12}$$

where ΔINV = change in inventories, and

DOC = domestic consumption of oil.

The nonoil exports are thus affected by the developments on both the demand and supply sides of the economy.

9. Capital flows (PKI)

Capital flows usually respond to a variety of factors that no single relationship can adequately capture. Nevertheless, in the present model it is assumed that the differential in expected returns on domestic and foreign assets and changes in domestic and foreign incomes bring about changes in desired asset holdings, generating capital flows. Since most capital movements are to and from the United States, foreign variables refer to that country.

$$PKI = w_0 + w_1(i - i_f) + w_2\Delta GDP + w_3\Delta YUS \tag{13}$$

where $GDP = Y + OR + DOC \qquad (14)$

YUS = Nominal GDP of the USA.

It should be noted that estimating a net capital flow equation of the type specified assumes that foreign and domestic assets are not perfect

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1/ See, for example, Aghevli and Sassanpour (1982), and Sassanpour (1985).

2/ Nonoil exports account for no more than 5 percent of total exports in Venezuela.

substitutes. 1/ If assets are perfectly substitutable, this equation should be replaced by an interest arbitrage equation linking i and i_f.

10. The money supply identity

As noted earlier, the impact of government operations on domestic liquidity can be measured by the Government's domestic budget balance, i.e., the difference between the domestic revenues and domestic expenditures (GDE). In other words, even if the overall budget is in balance or in surplus, the net impact of the Government's operations can be expansionary. It is more useful therefore to write the money supply identity in terms of domestic budget balance in the following way. 2/

$$\Delta M = GDE - DR + X^n - PIM + \Delta CP + PKI + BOP$$

where PIM denotes private imports, CP stands for credit to private sector and BOP represents a residual item in the balance of payments. Since complete data are not available on Government's domestic expenditures (GDE), the above identity is rearranged in terms of total government expenditure and total imports: 3/

$$\Delta M = G - DR + X^n - IM + \Delta CP + PKI + BOP \qquad (15)$$

In the above equation, BOP is exogenous and all the other variables except CP are determined from the relationships specified earlier. Therefore, this relationship now determines the flow of credit to the private sector.

11. Monetary disequilibrium

Two measures of monetary disequilibrium have been used in the literature. The first embodies a stock concept where disequilibrium is measured in terms of the deviation of the actual stock of real balances from demand: 4/

$$ESD = (M/P)^d - (M/P)_{t-1}$$

where ESD = excess stock demand for real balances.

1/ If assets are perfectly substitutable, net capital flows will be indeterminate and the estimates obtained from this equation cannot be interpreted meaningfully.

2/ Assuming that government foreign receipts equal oil exports plus its net foreign borrowing.

3/ See Aghevli and Sassanpour (1982).

4/ This difference between the two stocks can be viewed as the "flow" demand for real balances. See Sundararajan (1986).

This concept ignores the role of domestic credit expansion within the period in closing the real balance gap. Another measure, proposed by Blejer (1977) and Sundararajan (1986) among others, focuses on the concept of "flow disequilibrium" which makes appropriate allowances for the authorities' attempt to fill the real balance gap through credit creation. Accordingly, the flow excess demand (EFD) is defined as:

$$EFD = (M/P)^d - (M/P)_{t-1} - \Delta(DA/P) \cdot MM \qquad (16)$$

where MM is the money multiplier and ΔDA refers to the change in the net domestic asset of the central bank during the period.

The choice of the disequilibrium concept has important implications for the dynamic effect of monetary policy in empirical models dealing with small open economies. In this study, the disequilibrium concept represented in equation (16) is used.

12. The expected income from oil extraction

The expected oil wealth (F) in each period is defined as

$$F_t = E_t(PV_t) = E_t[\sum_{i=t}^{T} \pi_i Q_i/(1 + d_i)^{i-t}]$$

where PV = present value of the streams of income derived from oil over the life of the resource

d = rate of discount

Q_i = rate of exploitation at time i

π_i = price of oil at time i

T = time of depletion of oil stock

E_t = expectations operator.

Since T is unknown, this relationship cannot be readily incorporated into the model. A simplified version could be derived for empirical purposes on the assumption that the expected rate of oil price inflation is equal to the discount rate. In fact, it is well known from the theory of exhaustible resources that the optimal rate of extraction is determined at the point where the marginal productivity of the resource in all its uses is equalized. The expected rate of oil price inflation represents the marginal productivity of oil if left underground, while the rate of return on financial assets (or the interest rate) represents the marginal productivity of the resource if invested in financial assets. Thus, at the optimal rate of extraction, the rate of oil price inflation is equal to the interest rate. 1/ Otherwise, if

1/ See Hotelling (1931) and Davarajan and Fisher (1981).

expected oil price inflation is higher than the rate of interest, then the optimal policy dictates keeping the resource underground, and if it is lower, no equilibrium rate of extraction will exist since it would be optimal to exhaust the resource immediately. 1/ Assuming the social discount rate is equal to the rate of interest, 2/ and denoting the rate of oil price inflation in period (i) by r_i we can write:

$$F_t = E_t[\sum_{i=t}^{T} \pi_t(1 + r_i)^{i-t}Q_i/(1 + d_i)^{i-t}]$$

$$= E_t(\pi_t \sum_i Q_i) = E_t(\pi_t S_t) = S_t E_t(\pi_t)$$

where S = stock of proved oil reserves at time t. Assuming static oil price expectations: $E(\pi_t) = \pi_{t-1}$ we get:

$$F_t = \pi_{t-1} S_t \qquad (17)$$

This simple relationship represents the confidence or wealth effect of natural resource availability. It also embodies the concept of exhaustibility of oil (as S_t is declining over time) so that this important feature of the oil producing countries is built into the model, albeit admittedly in a crude fashion.

13. The dynamic process

To trace the dynamic process embodied in the model, consider the effect of an increase in F brought about through a resource discovery so that oil revenues do not necessarily rise immediately. 3/ Abstracting from the accompanying leads and lags, the immediate confidence effect of higher expected wealth directly increases demand for real balances and private consumption expenditures and also influences

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1/ The theory from which these decision rules are derived assumes, among other things, a monopolistic market structure, no binding technological constraints, and full information, none of which may hold in practice. In addition, the decision rules will be more complicated as the rate of return on financial assets may itself be affected by the variations in the price of oil. Given these considerations, the simplifying assumption in the text may be somewhat unrealistic.

2/ This assumption can be justified on the grounds that in a market economy, the most obvious indicator of time preference is the rate of interest. In other words, the interest rate is supposed to adjust until it simultaneously equates the rate of time preference of all individuals in the society and the rate of return on productive investment.

3/ Oil revenues (OR) rise if the extraction rate or the price of oil increases. A resource discovery does not necessarily lead to either of these developments.

private investment. These, in turn, will generate opposing forces that exert both upward and downward pressures on the level of income and prices, so that the final outcome cannot be established a priori and needs to be determined empirically.

Initially, the higher demand for money will widen the real balances gap (EFD) since $\nu < 1$. This will depress the prices of nontraded goods 1/ and hence both imports and domestic inflation. It will also dampen private demand for consumer goods and depress the growth of nonoil income. The excess of demand for nonoil commodities over potential output will then decline, further depressing nontraded goods prices and domestic inflation. 2/

Thus, through its impact on demand for real balances alone, an increase in expected real oil wealth would eventually lead to lower domestic inflation and income; it is also likely to lead to an improvement in the current account of the balance of payments as imports decline, while exports remain unchanged. The overall balance of payments may also improve if capital outflows, which result, according to equation (13), from a decline in income growth, are not too large.

These results do not, however, constitute the final outcome of an increase in F, as the larger F also stimulates private demand for goods and services (con^d). Consequently, aggregate demand (y^d) rises relative to supply, putting upward pressure on the prices of nontraded goods and dampening the demand for real balances. The resulting lower monetary disequilibrium will then help to weaken or offset the feedback effects generated through the initial impact of the larger expected oil wealth on demand for real balances.

The net effect of these forces on prices of nontraded goods will change relative prices. Given the fixed exchange rate, a decline (increase) in prices of nontraded goods with an unchanged level of traded goods prices will result in reduced (increased) demand for imports. Any change in relative prices will also have an impact on domestic output the direction of which is ambiguous a priori, as discussed earlier. The net result will feed into the dynamic system described above, strengthening or weakening some of feedback effects. The final outcome of the movements in the variables depends on leads and lags (that were ignored in the discussion above) as well as on the relative speeds of adjustment and the strength of impact multipliers.

1/ More precisely it will reduce their rate of change compared to what it would have been in the absence of a change in the real balance gap.

2/ The ensuing feedback effects will be strengthened or weakened, depending on whether private investment is stimulated or depressed due to a rise in F. That is, whether u_3 in equation (3) is positive or negative.

These also determine the stability characteristics of the system. The eventual outcome for nonoil income, public and private expenditures, and imports will determine GDP and nonoil exports. The capital account as well as the overall BOP outcome will then be established; and the level of credit to the private sector will be determined by the money supply identity. 1/

The distinguishing characteristic of the dynamic process embodied in the model of this paper can best be seen with respect to the impact of an increase in oil production (rather than oil wealth). In contrast to the earlier work on oil producing countries where an increase in oil production generally leads to a rise in prices and nonoil output, in the present model, the impact of an increase in oil production on prices and on nonoil output is ambiguous. The expansion of oil output results in lower availability of the resource (i.e., smaller S), and thereby a smaller expected oil wealth, F. This will tend to depress domestic output and prices provided that the impact of the oil wealth effect on private expenditures is stronger than its impact on demand for money, as discussed above. 2/ On the other hand, the expansion in oil revenues due to larger output will raise government expenditures that may serve to reverse this trend. The overall impact is therefore not clear, a priori.

III. The Estimation Results

The definition of variables and the complete model are reproduced in Appendix Tables I and II, respectively. The behavioral relationships of the model were estimated by two stage least squares method using annual data for the period 1965-1981. 3/ To ensure that cross equation restrictions on the parameters of the money demand equation were satisfied, the variable $(M/P)^d$ was replaced by the antilog of

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1/ Although the starting point of the above discussion is the effect of a change in F, the subsequent argument could be applied to changes in any other variable of the model. Clearly, however, the sequence of events as well as the final outcome will vary according to the nature of the original change. The feedback effects of movements in money supply and capital flows fall on credit to the private sector.

2/ This effect is absent from the previous empirical works on oil exporting countries.

3/ Data sources are given in Appendix II. The consumer price index P has been used as the deflator except in the case of imports for which an index of traded goods prices, calculated from partner country data has been used. A systems estimation method such as full information maximum likelihood would have been preferable for reducing the simultaneous equation bias and to ensure that the a priori restrictions on parameters were satisfied. However, such method could result in large specification errors especially for small samples.

$$(1/\upsilon)[\hat{m} - (1 - \upsilon)\hat{m}_{t-1}],$$

in all estimating equations, where $\hat{m}$ is the predicted value of $\hat{m}$ obtained from the estimated demand for money equation. 1/ Similarly, the unobservable variable con^d formulated from the estimated private consumption equation using the relationship:

$$con^d = (c\hat{o}n - b_5 c\hat{o}n_{t-1})/(1-b_5)$$

where b_5 is the estimated coefficient of $c\hat{o}n_{t-1}$. This variable was then used to calculate demand for domestic nonoil output (y^d) and for private expenditures (e). A dummy variable was introduced in the capital flow equation to account for unexplained variations in capital flows in 1980/81.

The estimation results are presented in Table 1. On the basis of the usual statistical criteria, the model performs well. The explanatory power of the model's equations is quite reasonable, and all coefficients have the expected sign. Moreover, of the 39 estimated coefficients all but 8 are significant at more than 90 percent confidence level, and one half are significant at the 99 percent level. 2/

1. The confidence effect of oil wealth

The estimation results clearly indicate the existence of an oil-wealth effect on the behavior of the economic agents, an aspect that has been neglected in the previous analyses of the economies of major oil producers. The variable f (or F) is highly significant in all the equations where it appears: demand for money, private consumption, and private investment. As expected, both money demand and private consumption respond positively to changes in expected oil wealth. A one percent increase in the expected oil wealth, everything else remaining equal, eventually raises both the real demand for money and private consumption by 0.2 percent. As demand for money is stimulated by resource availability, expansionary monetary policy would be less inflationary in the presence of oil wealth effect than in its absence.

The expected oil wealth tends to have an adverse impact on private investment (as the parameter u_3 is negative). As discussed earlier,

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1/ The coefficient of $\hat{m}_{t-1}$ in equation (1), Table 2, is equal to $1 - \upsilon$.

2/ These results should be interpreted with caution, since, for small samples, the properties of the probability distribution of coefficients estimated by two-stage least squares method are not well known. Goldfield (1966) believes that this procedure tends to produce conservative "t" statistics.

Table 1. Venezuela: Estimated Model 1/

Demand for real balances 2/

$$m = 8.362 + 1.228y + 0.154f - 0.011\, i_f + 0.327m_{t-1}$$

(-4.712) (4.457) (2.894) (-1.701) (2.021)

$\bar{R}^2 = 0.992$ H = 0.335 SEE = 0.045

Real private consumption

$$con = -0.632 + 0.229y + 0.063f - 0.000001\, EFD_{t-1} + 0.680\, con_{t-1}$$

(-2.754) (4.866) (2.900) (-0.592) (9.329)

$\bar{R}^2 = 0.997$ H = -1.183 SEE = 0.019

Real private investment

$$KF/P = -16459.4 + 1.071(Y/P) - 0.01(F/P) - 0.159(K/P)_{t-1}$$

(-2.101) (4.248) (-2.493) (-1.349)

$$- 1125.76q$$

(-2.666)

$\bar{R}^2 = 0.924$ DW = 1.449 SEE = 1586.0

Growth of nonoil income

$$\Delta y = +1.545 + 0.466y^d + 0.017(p^n - p^t) - 0.000001\, EFD_{t-1}$$

(-2.052) (5.078) (0.882) (-0.141)

$$- 0.622y_{t-1}$$

(-4.279)

$\bar{R}^2 = 0.795$ DW = 2.342 SEE = 0.02

1/ "t" ratios are in parentheses.

2/ Domestic interest rate was deleted from this equation as it did not prove to be significant and its inclusion did not improve the standard error of the equation. Moreover, since bolivares have been stable vis-a-vis the U.S. dollar for almost all the estimation period, the expected exchange rate change has been assumed to be zero. The foreign interest rate was proxied by three-month U.S. Treasury bill rate. Various formulations of actual and expected inflation were also included in this equation to reflect the opportunity cost of holding money compared to real assets but were dropped as their estimated coefficient was found invariably to carry the wrong sign, not to be statistically significant, or lead to unstable simulations. This does not necessarily imply, of course, that this opportunity cost of holding money is irrelevant to the money demand function in Venezuela, only that the mechanism for its measurement is more complicated.

Table 1 (concluded). Venezuela: Estimated Model

Domestic inflation

$$\Delta p = 0.115 + 0.265\Delta y^{d} - 0.410\Delta k - 0.000001\Delta EFD + 0.034\Delta^{pt}$$

(5.403) (3.385) (-7.243) (-0.967) (0.803)

$\bar{R}^2 = 0.966$ DW = 2.140 1/ SEE = 0.019

Imports

$$im = -5.585 + 0.316e + 0.835g + 0.878\ (p^{n} - p^{t}) + 0.418\ im_{t-1}$$

(-8.639) (1.510) (6.102) (13.895) (3.882)

$\bar{R}^2 = 0.993$ H = -0.562 SEE = 0.047

Government expenditure

$$g = 0.304gr + 0.698g_{t-1}$$

(4.499) (10.099)

$\bar{R}^2 = 0.976$ H = 0.158 SEE = 0.068

Government domestic revenues

$$dr = -8.608 + 1.605y$$

(-8.--7) (16.980)

$\bar{R}^2 = 0.954$ DW = 1.930 1/ SEE = 0.069

Private capital flows

$$PKI = -7121.360 + 1738.04\ (i - i_{f}) + 0.157\Delta GDP$$

(-2.223) (3.073) (2.333)

$$+\ 0.009\Delta YUS - 27070.8D$$

(2.500) (-10.733)

$\bar{R}^2 = 0.919$ DW = 2.073 1/ SEE = 2920

1/ Corrected for autocorrelation using the Cochrane-Orcutt transformation.

this may reflect the competing nature of private and government investment expenditures as perceived by private entrepreneurs. The availability of petroleum resources reduces the private sector's propensity to save and its demand for investment. As a result the growth prospects of the economy would depend, to a larger extent than in other countries, on the activities of the government. This finding highlights the importance of the composition of government expenditure for the growth prospects of oil-based economies. In fact, whether oil wealth will act as a stimulant or a barrier to economic growth in the long run would depend on the government's ability to take a leading role in expanding the productive capacity of the economy through appropriate expenditure policies and by devising appropriate incentive schemes for the private sector to help mitigate the adverse influence of oil wealth on private investment.

2. Monetary disequilibrium

The results indicate that monetary disequilibrium is not a significant variable in the determination of private expenditures. This implies that, given the financial structure of the economy, monetary disequilibrium probably affects the interest rate, the exchange rate (relative prices) or capital flows, and that has an indirect effect on expenditures through prices; direct effects are insignificant. Thus, the role of credit policy would be to influence the interest rate, the exchange rate, and capital flows, and, through them, expenditures.

3. Demand for money

The estimated results of the money demand equation indicate that the main determinants of money demand in Venezuela are nonoil income and the expected oil wealth. Contrary to expectations, the influence of foreign interest rate on the open economy of Venezuela is not highly significant (t probability of the estimated coefficient is 0.89), and the long-run interest elasticity of money demand is not very large; a one percent increase in the foreign interest rates, everything else remaining unchanged, reduces the demand for real balances by 0.02 percent. As can be expected in an open economy, equation (1) reveals the rapid adjustment of the actual to the desired level of the real money stocks ($\upsilon = 0.67$); 90 percent of all the adjustments occur in the first 24 months following a disturbance. 1/

1/ Adjustment over T periods is calculated as:

$$\sum_{t=0}^{T} \upsilon(1 - \upsilon)^t.$$

4. Private expenditures

The results show that real private consumption is also determined primarily by the income and wealth variables (y, and f, respectively). The influence of monetary disequilibrium on private consumption decisions seems to be negligible. 1/ The actual level of real private consumption exhibits substantial sluggishness in adjusting to the desired level; only 50 percent of the adjustment occurs in the first two periods following a disturbance.

In addition to expected oil wealth and nonoil income, the relative price of capital is also an important determinant of private investment demand as shown by the results. Since interest rate enters the calculation of the relative price variable, it could be argued that private investment is sensitive to changes in the interest rate so that the growth rate of the economy is also affected by movements in the rate of interest. The estimated coefficient of lagged capital stock does not turn out to be significant, pointing to the possibility that the positive effect arising from replacement investment is offset by the low speed of adjustment of actual investment to desired level.

5. Nonoil income

The estimated equation for the growth of nonoil income indicates that domestic output responds strongly to the disequilibrium in the home goods market, but is not significantly affected by monetary disequilibrium or terms of trade. 2/ The results indicate, however, that an improvement in the relative prices of the nontraded goods could stimulate the supply of domestic nonoil output in spite of a shift in demand from domestic to imported commodities.

6. Inflation

The rate of inflation is determined primarily by the level of disequilibrium in the commodity market, measured by the excess of demand over potential output (Table 1). The impact of this variable

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1/ A variable that does not appear to be significant in a particular equation, could however, be significant in the context of the model as a whole, and its omission could result in appreciable changes in other coefficients of the model.

2/ The coefficients of y^d and y_{t-1} (the variables that constitute the components of excess demand in the goods market) are significant at one percent level in equation 4. The results for this equation as well as those for domestic inflation are quite reasonable in view of the fact that these equations are estimated in the first difference form, and that even if original errors are independent, negative correlation could be introduced in first difference equations rendering both the standard error of the coefficients and $\bar{R}^2$ biased.

cannot be easily quantified since it enters the equation through its components y^d, and k. However, as indicated by relevant elasticities, the rate of inflation is more responsive to supply rather than demand factors; a one percent increase in the growth of potential output, everything else remaining equal, reduces the rate of inflation by 0.41 percent, while the same increase in the growth of demand raised the inflation rate by 0.27 percent.

7. Imports

The estimation result of the import equation indicates that government expenditure and relative prices are the main determinants of import demand. The elasticity of imports with respect to government expenditures is almost four times larger than that with respect to private expenditures, reflecting mainly the large import content of government outlays. The relative price elasticity of imports is estimated at 1.5 indicating that a one percent devaluation would reduce imports by 1.5 percent. However, the adjustment of actual imports to the desired level is very slow; mean lag of adjustment is shown to be 17 months. 1/

8. Government expenditure and revenue

The estimated equation for government expenditure indicates that the government's budgetary policy has been formulated as if to aim at a balanced budget over the long term. 2/ It also shows that government expenditures are adjusted slowly in response to changes in revenues; no more than 30 percent of any difference between government revenues and expenditures can be corrected in any one period. Government domestic revenues are shown to be strongly responsive to the nonoil income which alone explains 95 percent of their variations. Inclusion of oil revenues as a separate explanatory variable in this equation did not improve its explanatory power and the variable did not turn out to be significant. To the extent that oil receipts have any indirect impact on domestic revenues, this is therefore likely to be captured by the nonoil income variable.

9. Capital flows

The estimated equation for capital flows indicates that private short-term capital flows respond strongly to interest rate differentials between Venezuela and the United States and the GDP growth in both Venezuela and the United States. If the interest rate differential widens by one percentage point in favor of domestic rates, short-term capital flows would grow by Bs 1,738 million. The growth of domestic output results in larger movements in capital flows than the

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1/ Mean lag is calculated as $(1 - k_5)/k_5$.
2/ The estimated coefficients of g^r and g_{t-1} add up to unity.

growth of the U.S. GDP. 1/ A structural change in the behavior of capital flows seems to have occurred in 1980, as indicated by the strong statistical significance of the dummy variable. 2/

The above discussion focused on the direct impact of changes in explanatory variables on the dependent variables. It ignored the feedback effects from the rest of the model implied by a simultaneous system. Since the model is nonlinear in variables, it cannot be solved to obtain the impact and dynamic multiplier effects of the exogenous variables on the endogenous variables. The model is therefore simulated in order to examine the impact of exogenous shocks and changes in policy variables. The results are reported in the next section.

IV. Simulation Results

To test the reliability of the model in tracking the endogenous variables, the model was simulated over the sample period, using the estimated coefficients, the actual values of the exogenous variables and the lagged values generated by the model. 3/ Simulation results presented in the Annex, indicate that the model tracks the time path of the endogenous variables quite well. In almost all cases, the turning points are well captured by the simulated results. As shown in Table 2, correlation of the actual and simulated series of endogenous variables is quite high. The smallest correlation coefficient is obtained for the capital flow equation. Even in this case, however, the correlation is close to 0.9 which, given the volatility of such flows, is quite impressive.

In order to quantify the impact of the wealth effect and of a change in oil prices, the following experiments were conducted. In the first experiment, oil prices were assumed to increase by 25 percent in 1970 and to return to their historical level in the following year.

1/ These results are in contrast to those obtained by Khan (1974) where GDP growth in either country was not found to be a significant factor affecting capital movements in Venezuela.

2/ Given the wide fluctuations in these flows, the extent of variations explained by the capital flow equation (92 percent) is quite impressive. The results of this equation are superior to those obtained by Khan (1974), both in terms of the explanatory power of the equation and the significance of the variables. This could be partly attributable to the use of the change in U.S. interest rates as an explanatory variable in his study instead of interest rate differentials as in the present study.

3/ This is referred to as dynamic simulation. It provides a more rigorous test of stability of the model than the static simulation where actual values of the lagged endogenous variables are used, and hence errors can accumulate over time.

Table 2. Venezuela: Correlation Between Actual and Dynamically Simulated Values, 1966-81

y	0.985
con	0.999
p	0.996
m	0.992
KF/P	0.929
g	0.989
dr	0.959
im	0.990
PKI	0.909

This implies that both oil revenues (OR) and expected oil wealth (F) increase by 25 percent in 1970 and 1971, respectively. In the rest of this section this experiment is referred to as the full oil price shock. In the two succeeding experiments the impact of this type of disturbance was broken down into two separate components, namely income effect and confidence effect. First, oil revenues were allowed to increase by 25 percent in 1970, with the expected oil wealth remaining unchanged (referred to as the partial oil price shock). Although this is an unlikely possibility in practice, 1/ it serves to demonstrate the impact of an oil price hike on the economy as captured by earlier models of oil producing countries that concentrate on the income effect and exclude the expected wealth effect of such shocks. The final experiment attempts to record the latter effect represented by the influence of a temporary increase in F, not accompanied by a change in oil revenues (resource discovery shock). 2/

The results of these experiments are reported in Tables 3, 4 and 5 and Charts 1-11, which record the difference between the values of endogenous variables following the shock and those prior to the shock obtained from a base simulation. These differences are expressed in percent, except in the case of inflation (INF), relative prices (P^n/P^t), capital flows (PKI), and balance of payments (ΔR) for which the absolute difference between the values obtained from shock simulations and from base simulation has been presented.

1/ A price hike always affects expected oil wealth, even if it is accompanied by an equivalent expansion in oil output. In the latter case, expected oil wealth decreases in the period when output grows but remains unchanged in the subsequent periods ($F = \pi_{t-1} \cdot S_t$).

2/ Again this is an unlikely scenario as it implies a temporary increase in S. It is examined here in an attempt to isolate the impact of oil wealth on the economy.

Table 3. Venezuela: Impact of Full Oil Price Shock 1/

(In millions of bolivares and percent)

	GDP	y	con	KF/P	GE	DR
			(In percent)			
1970	3.40	1.79	1.53	-4.25	5.29	2.17
1971	0.75	2.10	1.27	0.38	3.86	2.78
1972	1.00	2.21	1.21	0.35	2.92	3.05
1973	0.98	2.18	1.18	0.15	2.27	3.05
1974	0.55	2.05	1.16	0.17	1.66	2.89
1975	0.66	1.80	1.12	0.43	1.22	2.57
1976	0.68	1.52	1.04	0.23	0.95	2.19
1977	0.60	1.26	0.93	0.15	0.77	1.83
1978	0.54	1.04	0.82	1.10	0.66	1.51
1979	0.42	0.87	0.72	0.05	0.56	1.26
1980	0.30	0.71	0.62	0.08	0.44	1.04
1981	0.20	0.58	0.53	0.13	0.34	0.85

	m	INF	IM	p^n/p^t	PKI	R
		(In percent)			(In millions of bolivares)	
1970	4.11	1.13	5.19	0.011	529.29	388.05
1971	2.54	-0.17	5.70	0.009	-390.20	-780.87
1972	2.38	-0.16	5.18	0.007	15.05	-174.80
1973	2.41	-0.10	4.41	0.005	14.18	-25.93
1974	2.38	-0.10	3.57	0.004	18.04	-14.37
1975	2.25	-0.15	2.85	0.003	11.82	-91.51
1976	2.03	-0.13	2.24	0.002	3.94	-130.15
1977	1.76	-0.09	1.78	0.001	-7.69	-180.73
1978	1.49	-0.07	1.46	0.001	-17.75	-236.76
1979	1.25	-0.05	1.21	0.000	-13.86	-269.89
1980	1.04	-0.04	1.00	0.000	-21.81	-336.21
1981	0.85	-0.04	0.81	0.000	-19.00	-402.93

1/ Impact of an increase of 25 percent in oil prices, measured as the difference between the values obtained from shock simulation and those obtained from the base simulation.

Table 4. Venezuela: Impact of Partial Oil Price Shock 1/

(In millions of bolivares and percent)

	GDP/P	y	con	KF/P	GE	DR
			(In percent)			
1970	3.46	0.86	0.14	-0.14	4.56	1.19
1971	0.75	1.46	0.36	-0.06	3.50	2.06
1972	0.96	1.75	0.57	-0.03	2.75	2.51
1973	0.95	1.83	0.74	-0.17	2.18	2.64
1974	0.58	1.79	0.85	-0.14	1.62	2.59
1975	0.67	1.63	0.90	0.12	1.23	2.37
1976	0.69	1.42	0.89	0.06	0.98	2.08
1977	0.61	1.21	0.84	0.03	0.81	1.78
1978	0.56	1.02	0.76	0.01	0.70	1.50
1979	0.44	0.86	0.68	-0.02	0.59	1.27
1980	0.32	0.72	0.60	-0.02	0.47	1.05
1981	0.22	0.59	0.52	---	0.36	0.87

	m	INF	IM	p^n/p^t	PKI	R
		(In percent)			(In millions of bolivares)	
1970	0.61	0.31	3.91	0.003	469.37	220.98
1971	1.35	0.14	4.79	0.004	-373.09	-427.53
1972	1.90	0.04	4.57	0.004	25.76	75.54
1973	2.18	0.00	4.02	0.003	19.42	143.62
1974	2.25	-0.02	3.33	0.003	21.69	122.79
1975	2.17	-0.08	2.71	0.002	16.38	45.83
1976	1.99	-0.08	2.19	0.001	9.52	-4.66
1977	1.76	-0.06	1.78	0.001	-2.30	-72.12
1978	1.51	-0.05	1.48	0.001	-13.55	-146.58
1979	1.28	-0.03	1.25	0.000	-10.98	-196.76
1980	1.07	-0.04	1.04	0.000	-20.22	-279.75
1981	0.89	-0.03	0.84	0.000	-18.15	-360.72

1/ Impact of a 25 percent increase in oil prices keeping expected oil wealth constant, as measured by the deviation of shock simulation from base simulation.

Table 5. Venezuela: Impact of a Resource Discovery 1/

(In millions of bolivares and percent)

	GDP/P	y	con	KF/P	GE	DR
			(In percent)			
1970	-0.04	0.92	1.39	-4.12	0.71	0.97
1971	---	0.64	0.91	0.45	0.36	0.71
1972	0.04	0.46	0.63	0.38	0.18	0.53
1973	0.03	0.34	0.44	0.32	0.10	0.40
1974	-0.03	0.25	0.31	0.31	0.04	0.30
1975	-0.01	0.17	0.22	0.31	---	0.20
1976	-0.01	0.10	0.15	0.17	-0.02	0.11
1977	-0.01	0.05	0.10	0.11	-0.03	0.05
1978	-0.01	0.02	0.06	0.09	-0.03	0.02
1979	-0.02	---	0.04	0.08	-0.03	---
1980	-0.02	---	0.02	0.10	-0.03	-0.01
1981	-0.02	-0.01	0.01	0.13	-0.02	-0.02

	m	INF	IM	p^n/p^t	PKI	R
		(In percent)			(In million of bolivares)	
1970	3.48	0.82	1.24	0.008	59.55	167.82
1971	1.18	0.30	0.88	0.005	-17.19	-353.10
1972	0.47	-0.19	0.59	0.003	-10.58	-249.81
1973	0.24	-0.10	0.39	0.002	-5.12	-168.89
1974	0.14	-0.07	0.24	0.001	-3.51	-136.36
1975	0.08	-0.07	0.13	0.001	-4.41	-136.35
1976	0.04	-0.05	0.06	0.000	-5.45	-124.54
1977	0.01	-0.03	0.01	0.000	-5.31	-107.91
1978	-0.01	-0.02	-0.02	0.000	-4.19	-89.83
1979	-0.03	-0.01	-0.03	0.000	-2.89	-73.07
1980	-0.03	-0.01	-0.03	0.000	-1.62	-56.71
1981	-0.04	-0.00	-0.03	0.000	-0.88	-42.74

1/ Impact of an increase of 25 percent in oil prices, measured by the deviation of shock simulations from the base simulation.

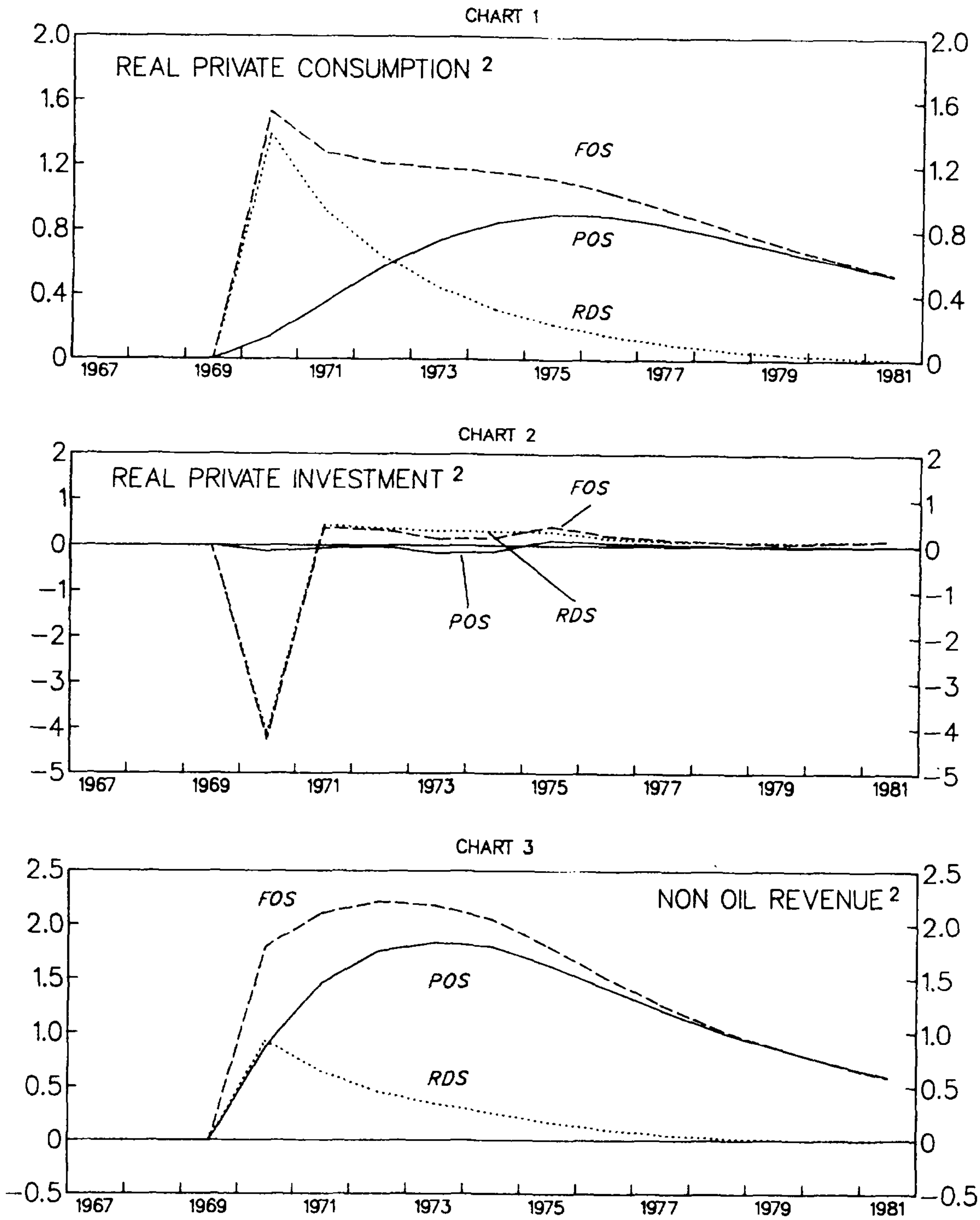
The results of the first two experiments clearly show that ignoring the wealth effect can have serious adverse implications for the design of economic policy in the face of disturbances. Consider the impact of various shocks on real private consumption expenditures. A temporary increase of 25 percent in the price of oil at an unchanged level of wealth effect (referred to in the rest of this section as partial oil price shock), would increase real private consumption by about 0.9 percent above the level it would have attained in the absence of the disturbance, within five periods following the shock (Chart 1). Thereafter the impact dissipates slowly, reflecting the sluggishness of the adjustment, but consumption remains slightly above the control level even 10 years following the original shock. The impact of a full oil price shock, i.e., a price shock when its associated wealth effect is not neutralized, is much more substantial. Real private expenditures rise by more than 1.5 percent within two years, and remain at a higher level than that resulting from a partial oil price shock. The steeper increase is attributable to the impact of wealth effect on private consumption. This is confirmed by the results of the third experiment where the shock consists of a resource discovery, so that only the oil wealth is increased (by 25 percent). This experiment also shows that the impact of a temporary increase in expected wealth, while substantial, tends to wear off rapidly, and, unlike the impact of an increase in oil revenues, dissipates completely about ten years after the original shock.

The significance of the oil wealth effect is more pronounced in the case of its impact on private capital formation (Chart 2). While changes in real private investment resulting from the partial oil price shock are almost imperceptible, those brought about by the full price shock are substantial. The wealth effect associated with the full price shock results in an immediate decline of about 4 percent in private real investment. This is corrected in the next period, however, as the growth of nonoil income--itself stimulated by the increase in expected oil wealth--compensates for the latter's adverse impact on investment. For the rest of the simulation period, the level of real private capital formation remains above the level it would have attained in the absence of the shock. The impact of two types of price shocks on nonoil income tend to converge, as the influence of higher expected oil wealth dissipates, leading eventually to the same proportionate expansion in nonoil output (Chart 3).

The confidence effect of the oil wealth influences primarily the behavior of the private sector. As a result, government expenditure responds in an almost identical manner irrespective of the nature of the oil price disturbance, and is only slightly affected by the resource discovery shock (Chart 4). Both types of oil price shocks lead to a sharp expansion of about 5 percent in expenditure in the first period, followed thereafter by a slow adjustment toward the historical level. On the other hand, government domestic revenues are affected differently by the two types of price shocks, reflecting their

VENEZUELA

IMPACT OF EXOGENEOUS DISTURBANCES[1]



[1] POS indicates Partial Oil price Shock.
FOS indicates Full Oil price Shock.
RDS indicates Resource Discovery Shock.

[2] *Percent deviation from control simulation.*

responsiveness to nonoil income. They rise more substantially if the oil wealth effect is present than if it is not (Chart 5).

Reflecting the dominant influence of government expenditures on imports, a pattern similar to that of the former emerges for imports in the aftermath of exogenous disturbances (Chart 6). However, the time path of imports is also affected by the impact of disturbances on relative prices. Because of the associated wealth effect, the full oil price shock results in a larger improvement in relative prices in favor of nontraded goods than the partial oil price shock (Chart 7). This outcome reinforces the indirect influence of the wealth (or confidence) effect on imports, so that the initial difference between the impacts of full and partial oil price shocks on imports is larger than that observed in the case of government expenditure. The time paths of imports resulting from the two types of shocks converge later in line with the diminishing influence of the temporary increase in wealth effect.

The oil price shocks have a sharp but ephemeral impact on capital flows (Chart 8). 1/ In the first period net inflows grow by almost Bs 530 million over the historical level in response to the full oil price shock, of which Bs 470 million is due to its confidence effect (indicated by partial price shock and the resource discovery shock, respectively). Thus, although the wealth effect has an appreciable impact on private capital flows, its impact is overshadowed by the influence of the growth in oil revenues (and hence in domestic GDP) on such flows. 2/ In the second period, net inflows decline as GDP growth slows down, and the impact of the shocks fades rapidly in the subsequent periods as GDP growth is restored to its historical level. 3/

These results imply that the failure to take the wealth effect of oil price hikes into account could lead to a substantial underestimation of their adverse effect on the balance of payments in the medium-term. This conclusion is confirmed by the results obtained for the balance of payments under various external disturbances (Chart 9). In the first period, both types of price shocks result in an improvement in the balance of payments as oil exports increase, but the impact of

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1/ The charts for capital flows and balance of payments record the time path of the *absolute (rather than percent) difference between the* shock simulations and the base run. This is necessary since these variables can be positive or negative during the sample period.

2/ GDP growth is an argument in the capital flows equation.

3/ Since oil is the dominant component of GDP in Venezuela, the latter grows rapidly in the first period as oil revenues increase. The second period witnesses a decline in GDP (compared to the historical trend) as oil revenues are restored to their original level. Thereafter, GDP growth reflects only the increase in nonoil output as oil income remains unchanged.

the full oil price shock is more pronounced, owing mainly to the influence of wealth effect on capital flows. This is followed by a sharp deterioration in the balance of payments reflecting the combined effects of the growth of imports, increase in capital outflows and reduction in export revenues (from the level achieved immediately following the shock). Again, the wealth effect has a substantial impact that results in a sharper deterioration in the balance of payments under the full price shock, compared to the partial shock. Moreover, while under the partial shock the balance of payments improves during several succeeding periods, this is not the case under the full price shock. In fact, the demand effect of the temporary increase in expected oil wealth wears off slowly, thus helping to raise the level of absorption and resulting in a larger deterioration in the balance of payments.

The time paths of inflation (INF) in response to different types of oil price shocks are markedly distinct (Chart 10). Initially the rate of inflation rises in relation to the historical level as a result of either type of price shock, reflecting the dominance of demand effects associated with higher oil revenues. The increase is considerably steeper in the case of the full oil price shock, however, owing to the impact of wealth effect associated with this type of disturbance on private expenditures. In the next period the supply effect of higher oil revenues becomes dominant, resulting in a decline in the inflation rate. Again the decline is steeper--and, in fact, inflation rate falls below the historical level--in the case of full price shock as the wealth effect leads to a greater monetary disequilibrium which, in turn, exerts a further dampening impact on domestic inflation. Eventually, as the impact of the higher expected oil wealth wears off, both types of shocks produce a similar trend in domestic prices with the inflation rate remaining below the historical level.

The discussion so far indicates that the presence of an oil wealth or confidence effect exacerbates the impact of oil price shocks on the economy of Venezuela. In particular, because of the wealth effect these disturbances entail, they are likely to affect the balance of payments more substantially and bring about wider fluctuations in domestic prices than previously thought. While their impact on domestic price inflation would be eventually dampened by the wealth effect, an oil price hike could generate stronger inflationary pressures in initial stages. Therefore, in periods of rising oil prices achieving balance of payments equilibrium or price stability would pose more significant policy challenges than previously recognized.

While an analysis of the nature and adequacy of different policy responses that may be called for in the face of oil price shocks is beyond the scope of this paper, monetary policy implications are evident from the simulation results. The demand for real balances, and hence the level of monetary disequilibrium, shift significantly as a result of the various shocks (Chart 11). However, failure to account

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IMPACT OF EXOGENEOUS DISTURBANCES[1]

CHART 4

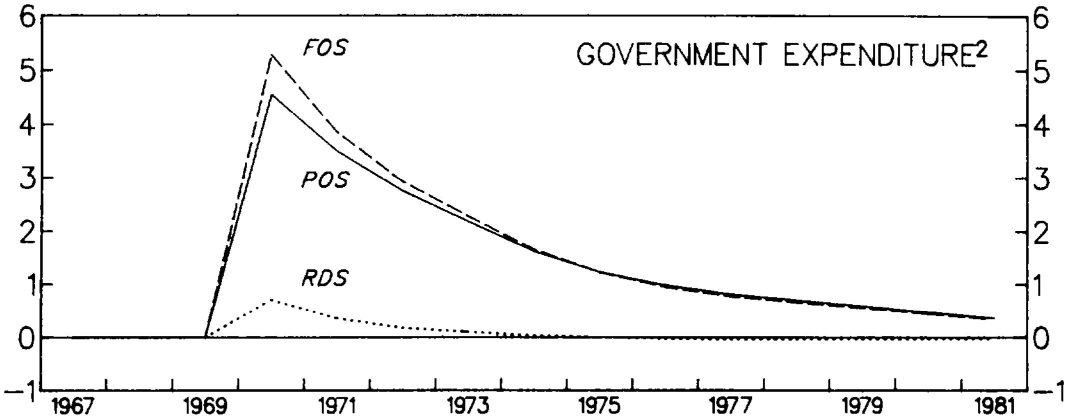


CHART 5

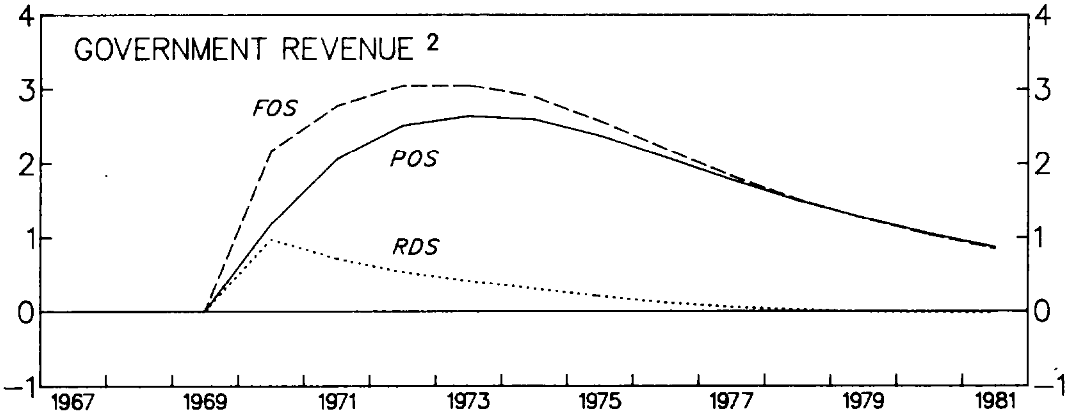
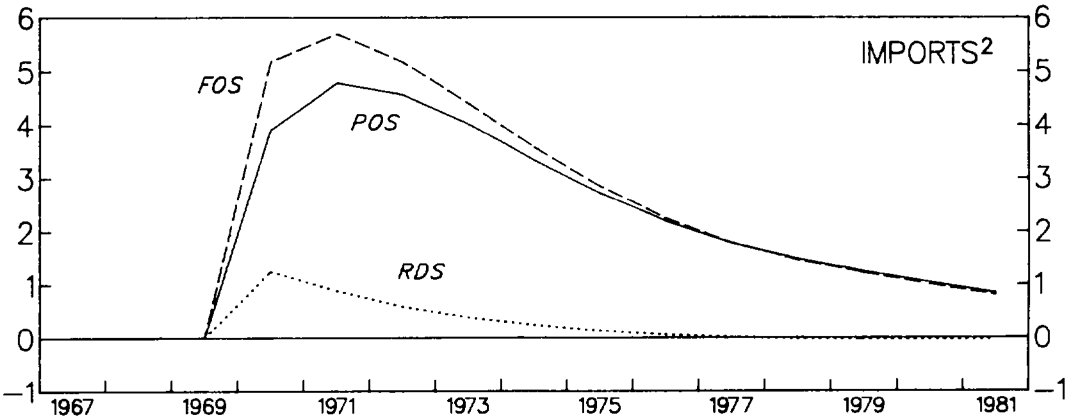


CHART 6



[1] POS indicates Partial Oil price Shock.
FOS indicates Full Oil price Shock.
RDS indicates Resource Discovery Shock.

[2] Percent deviation from control simulation.

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IMPACT OF EXOGENEOUS DISTURBANCES[1]

CHART 7

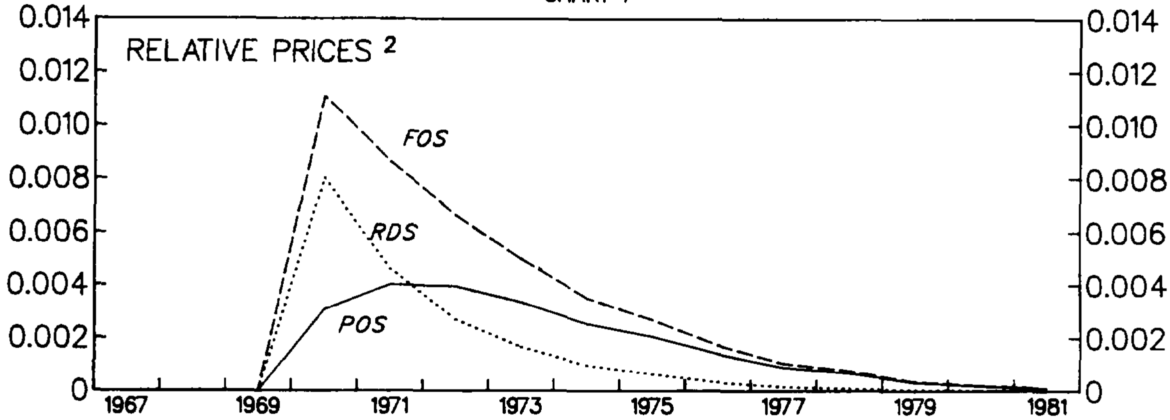


CHART 8

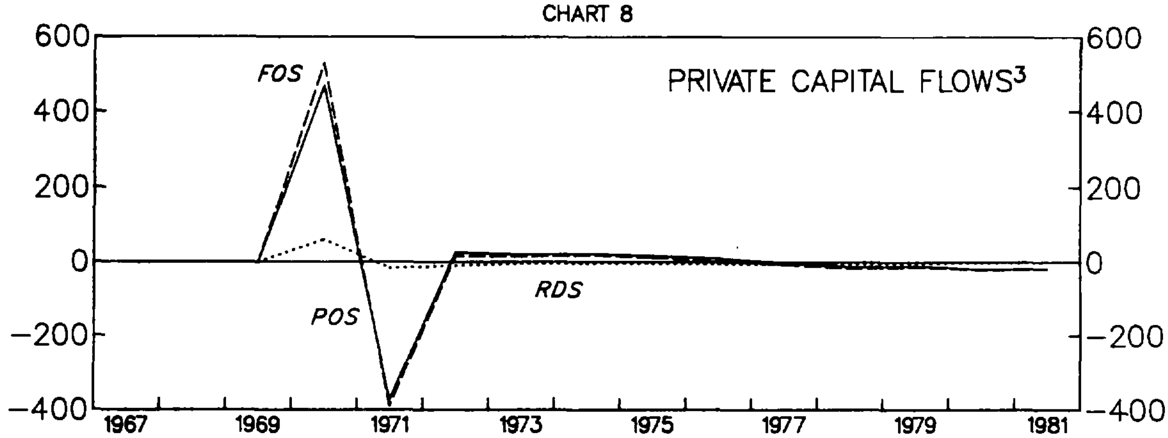
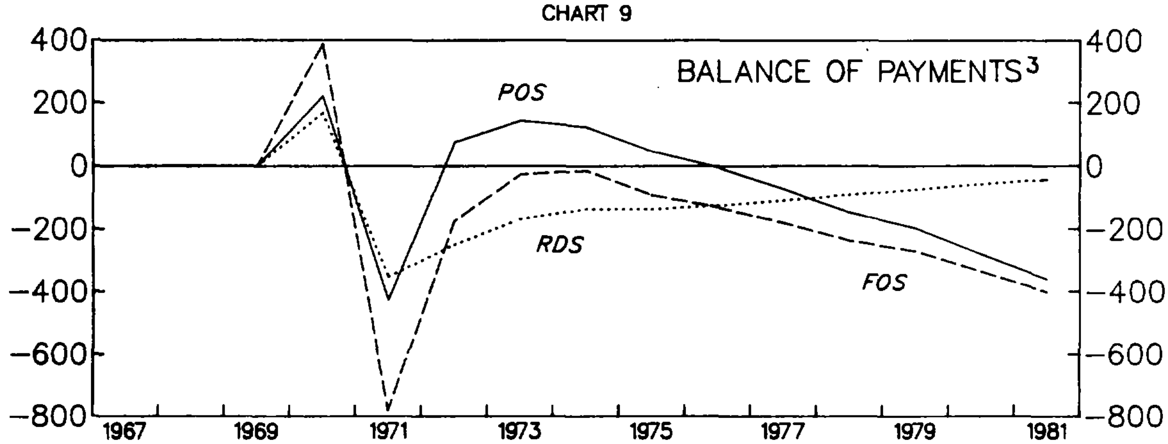


CHART 9



[1] POS indicates Partial Oil price Shock.
FOS indicates Full Oil price Shock.
RDS indicates Resource Discovery Shock.

[2] Deviation from control simulation; in percentage points.

[3] Deviation from control simulation; in millions of Bolivares.

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IMPACT OF EXOGENEOUS DISTURBANCES[1]

CHART 10

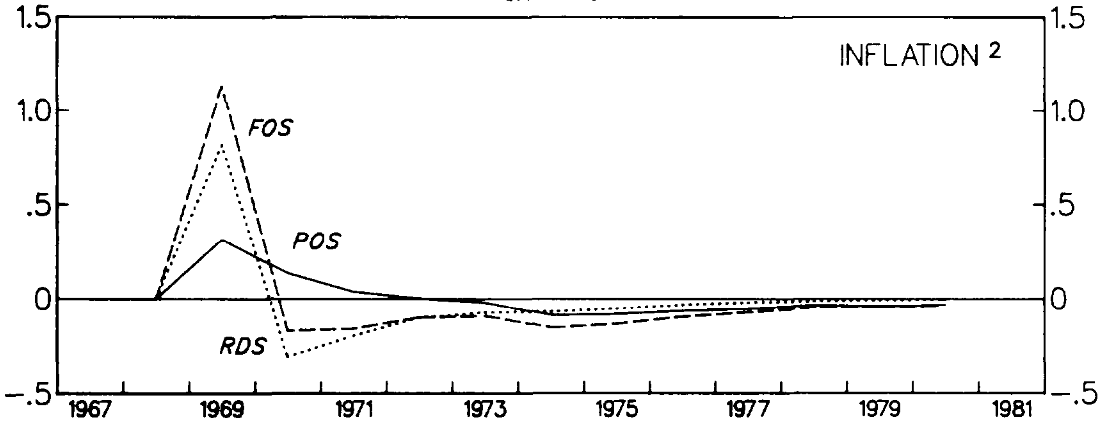
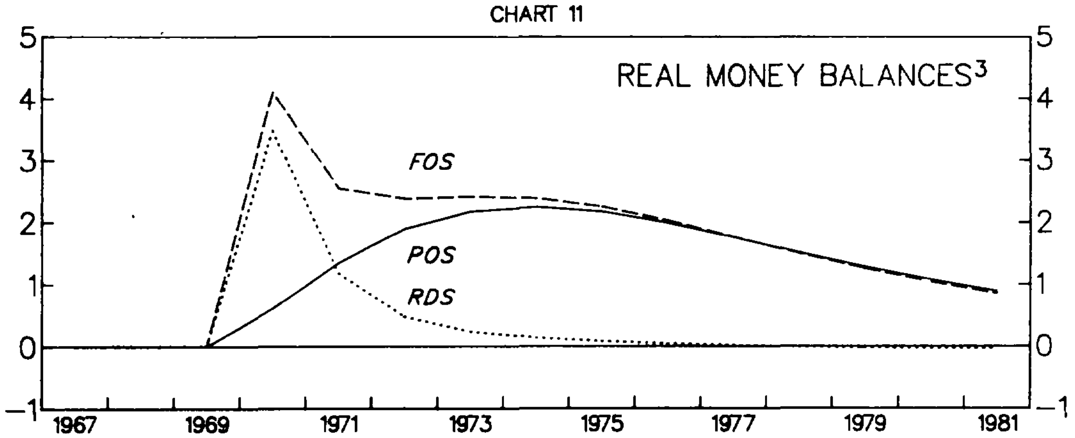


CHART 11



[1] POS indicates Partial Oil price Shock.
FOS indicates Full Oil price Shock.
RDS indicates Resource Discovery Shock.
[2] Deviations from control simulation; in percentage points.
[3] Percent deviation from control simulation.

for wealth or confidence effect of oil price shocks leads to a serious underestimation of the shift in demand for real money balances; while the full oil price shock leads to an increase of more than 4 percent in the demand for money in the first period following the shock, the partial oil price shock causes an increase of no more than one percent. The magnitude of the shift in monetary disequilibrium, and that of the task confronting monetary policy makers are thus substantially larger when the wealth effect of resource availability is taken into account. In addition to its implication for the magnitude of policy response, the wealth effect has significant implications for the timing of monetary policy. The results show, for instance, that failure to take wealth effect into account may result in a gradualist policy in the face of shocks, with the magnitude of intervention increasing slowly and reaching its peak five to six years following the original shock. On the other hand, once the wealth effect is recognized, the appropriate policy response would consist of a massive initial intervention which diminishes in intensity in subsequent periods.

V. Concluding Remarks

This paper has examined the implications of the availability and exhaustibility of oil resources for the economy of Venezuela in the framework of a model that incorporated the concept of exhaustibility and specified the main channels through which the availability of the resource (and the flow of income generated by it) affects economic variables. The estimation and simulation results confirmed that the availability of the resource entails a confidence effect that influences the behavior of the private sector. It was also confirmed that this effect is transmitted through demand for real balances and private expenditures (consumption and investment).

The empirical results indicated that, through its impact on money demand, the confidence effect associated with the availability of oil eventually dampens the inflationary consequences of expansionary policy. However, it adversely influences private saving and investment, and imparts more significance to the pattern of government expenditures in the oil producing countries compared to other LDCs. This implies that the growth prospects of the economy would depend on the ability of the government, which is the recipient of oil revenues, to embark on adequately productive projects that not only compensate for the adverse effect of expected oil wealth on the willingness of the private sector to undertake investment, but also prepare the country for the eventual depletion of oil resources. A further implication is that private investment would need to be encouraged through incentive schemes that compensate for the adverse influence of oil wealth.

The speed of adjustment in money demand was found to be rapid while that in the real sector tended to be sluggish, implying that changes in monetary disequilibrium are transmitted to the rest of the economy more quickly than movements in the level of disequilibrium in the goods market. The authorities may thus have more time in containing the impact of real shocks to the economy than they will have in containing the consequences of financial disturbances.

The simulation results also showed that the impact of an increase in oil prices on the economy can be substantially more pronounced in the presence of an oil wealth effect than in its absence. In particular, failure to take the confidence effect of resource availability into account could lead to serious underestimation of the adverse influence of an oil price hike on balance of payments and inflation. Moreover, it was shown that wealth effect tends to eventually dampen the inflationary impact of rising oil prices, it continues to exacerbate the adverse impact of such developments on the balance of payments. Thus, a major policy challenge facing the authorities during periods of rising oil prices would be that of devising a response that reconciles the dual objectives of balance of payments equilibrium and price stability. Moreover, in designing their policies in the face of disturbances, the authorities would have to keep in mind not only the nature of the shock but also the extent of the wealth effect associated with the country's petroleum resources.

Although the nature and effectiveness of various policy responses that could be initiated to achieve balance of payments equilibrium and price stability in the aftermath of exogenous shocks were not discussed, the simulation results indicated that at least in the case of monetary policy, the magnitude of the required response is substantially larger if the wealth effect is taken into account. It was also shown that the timing of intervention could be critical to the success of any monetary policy initiative. In order to devise an appropriate policy response, the authorities would need to know the time paths of the target variables that are likely to emerge both following an exogenous disturbance and in response to a policy intervention. Experiments similar to those conducted in this paper could serve to shed some light on these outcomes.

Although the model performed well in terms of usual statistical criteria, the policy implications mentioned above need to be cautiously interpreted, primarily because of the small size of the sample, and the large number of exogenous variables. In addition, the relevance and robustness of the model need to be tested against the developments in the Venezuelan economy during the post-sample period. The model could be rendered more appropriate for policymaking purposes by endogenizing such important variables as the behavior of banks, represented by the excess reserves ratio, and the behavior of the private sector, such as the cash deposit ratio. The model could also be extended to incorporate more explicitly other policy variables such as the exchange rate.

Appendix Table 1. List of Variables

Endogenous variables

CON = actual private consumption expenditures

CON^d = private demand for consumer goods

CP = credit to private sector

DR = government domestic revenues

E = desired private expenditures

G = government expenditures

GDP = gross domestic product

GR = government revenues

IM = imports of goods and services

IM^d = desired imports of goods and services

KF = private investment (capital formation)

M^d = demand for money balances

MS = nominal money stock broadly defined (M2)

NFAB = net foreign assets of the banks

FNACB = net foreign assets of the central bank

PKI = net private capital inflow

P = domestic price level (index)

P^n = price of nontraded goods (index)

X^n = real exports of goods and services, other than oil

Y = nonoil GDP

Y^d = demand for nonoil output

Appendix Table 1 (concluded). List of Variables

Exogenous variables

BOP = residual item in the balance of payments (including on a net basis all the above line variables, except trade balance, nonfactor services, government capital inflow, short-term private capital inflows)

DA = net domestic assets of the central bank

DOC = domestic consumption of oil

F = expected oil wealth

GDE = government domestic expenditures

i = expected domestic interest rate

i_f = foreign interest rate adjusted for expected exchange rate change

INV = inventories calculated from national accounts data

MM = money multiplier

OR = oil revenues

P^t = prices of traded goods

PIM = private imports

UCB = change in cash balances of the Treasury

YUS = nominal GDP of the U.S.

π = price of oil

Appendix Table 2. List of Equations

Behavioral equations

$$m = a_1 + a_2 y + a_3 f + a_4 i + a_5 i_f + a_6 m_{t-1} \quad (1)$$

$$con = b_1 + b_2 y + b_3 f + b_4 EFD_{t-1} + b_5 con_{t-1} \quad (2)$$

$$KF/P = u_0 + u_1(Y/P) + u_2 q + u_3(F/P) + u_4(K/P)_{t-1} \quad (3)$$

$$\Delta p = c_1 + c_2 \Delta y^d + c_3 \Delta k + c_4 \Delta EFD_{t-1} + \omega \Delta p^t \quad (4)$$

$$\Delta y = D_1 + D_2 y^d + D_3 EFD + D_4(p^n - p^t) + D_5 y_{t-1} \quad (5)$$

$$im = k_1 + k_2(p^n - p^t) + k_3 e + k_4 g + K_5 im_{t-1} \quad (8)$$

$$dr = 1_1 + 1_2 y \quad (10)$$

$$g = \lambda gr + (1 - \lambda) g_{t-1} \quad (11)$$

$$PKI = w_0 + w_1(i - i_f) + w_2 \Delta GDP + w_3 \Delta YUS \quad (13)$$

Identities

$$Y^d = CON^d + KF + G + X^n \quad (6)$$

$$e = \log (CON^d/P + KF/P) \quad (7)$$

$$GR = OR + DR \quad (9)$$

$$X^n = Y - CON - KF - G + IM - \Delta INV + DOC \quad (12)$$

$$GDP = Y + OR + DOC \quad (14)$$

$$\Delta M = G - DR + X^n - IM + \Delta CP = PKI + BOP \quad (15)$$

$$EFD = (M/P)^d - (M/P)_{t-1} - \Delta(DA/P) \cdot MM \quad (17)$$

$$F = \pi_{t-1} \cdot S \quad (18)$$

Appendix III: Data Sources

All the data used in the study, except for those mentioned below, have been obtained from IMF, International Financial Statistics.

The index of traded goods prices (p^t) was calculated as the weighted average of trading partners' export prices adjusted for exchange rate. The countries and weights used are the following: United States (0.33), Netherlands Antilles (0.14), Canada (0.08), Japan (0.06), Italy (0.06), Brazil (0.04), Germany (0.03) Other (0.26).

The level of oil production (OP) and the stock of proved oil reserves (S) in 1982 were obtained from various issues of the Petroleum Economist. The stock of oil for other periods was obtained as:

$$S_t = S_{1982} + \sum_{i=t+1}^{1982} OP_i; \; t = 1963 - 1981$$

This procedure implies that the stock of proved oil reserves is known with certainty at the beginning of the sample period.

Domestic oil consumption (DOC) was obtained from various "Recent Economic Developments" reports on Venezuela.

The following variables were derived residually:

Nonoil GDP, Y:

$$Y = GDP - \text{oil exports} - \text{domestic consumption of oil (DOC)}$$

Private expenditures, E:

$$E = Y - GE - X^n + IM - DINV$$

Private capital inflows (net), PKI:

$$PKI = \Delta M - GE + DR - X^n + IM - \Delta CP$$

Domestic government revenues, DR:

$$DR = GR - OR$$

The dummy variable (D) was made equal to 1 for the 1980-81 period and zero otherwise. Domestic and foreign interest rates were measured by the rate offered on one-year deposits in Venezuela and by the 3-month U.S. Treasury bill rate, respectively.

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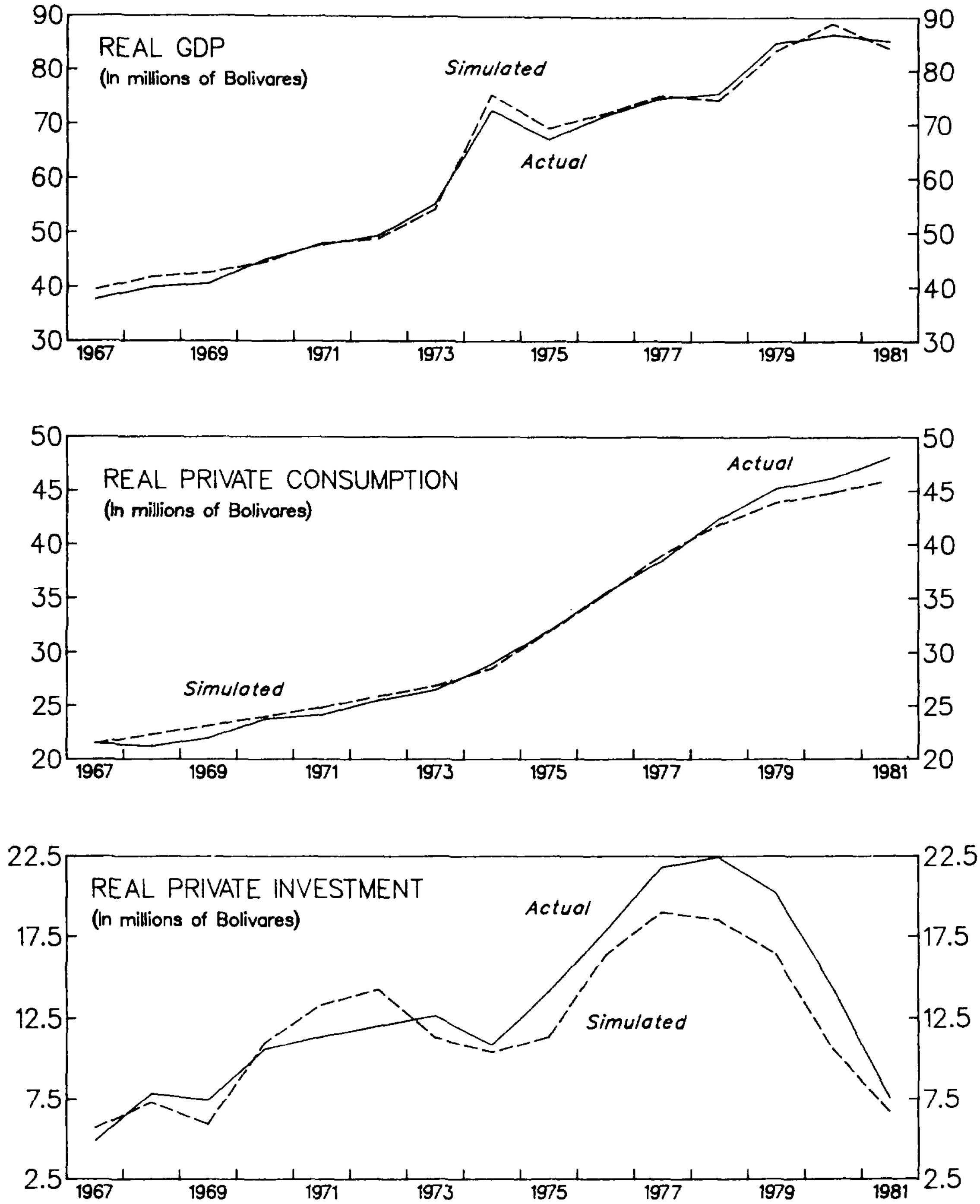

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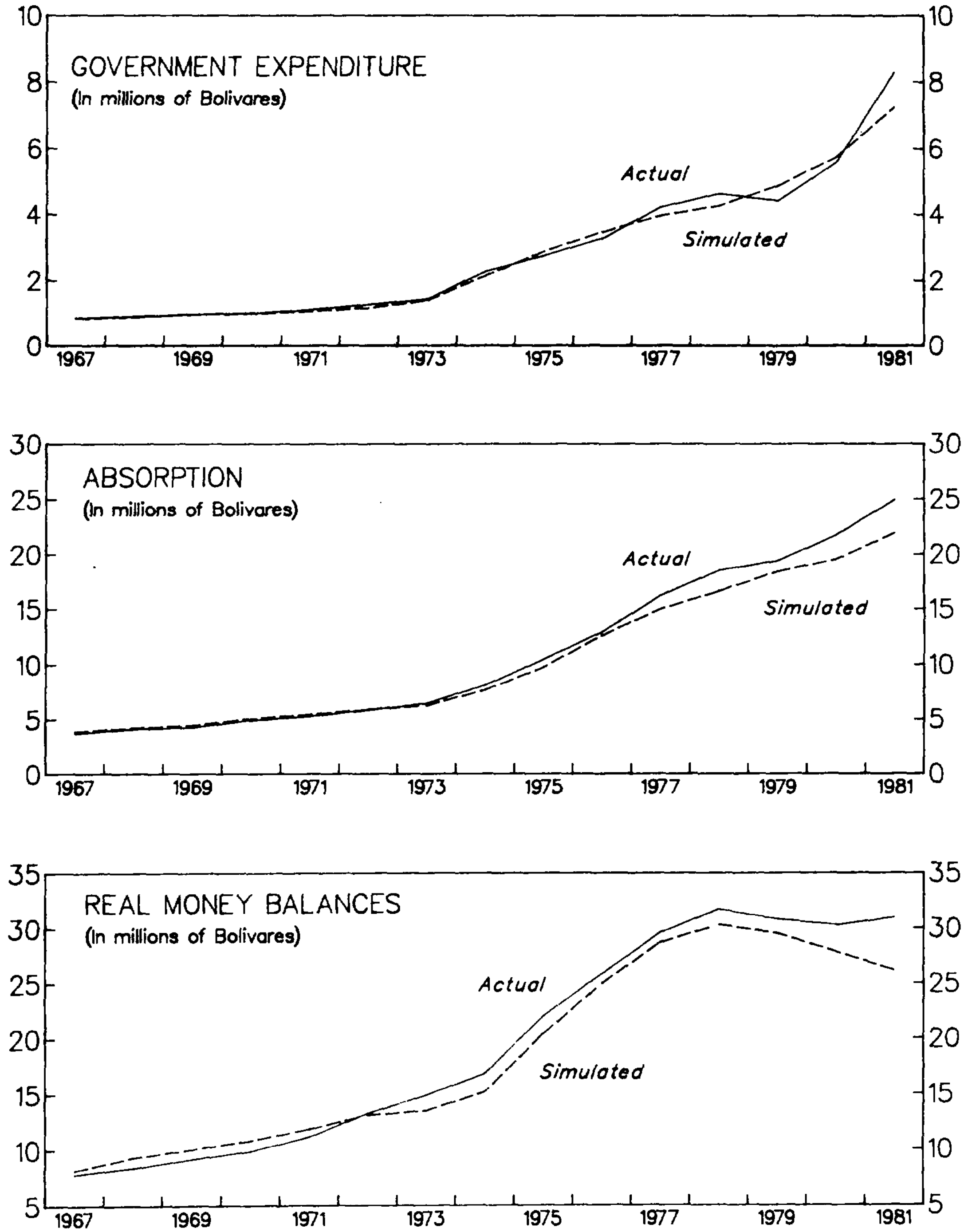

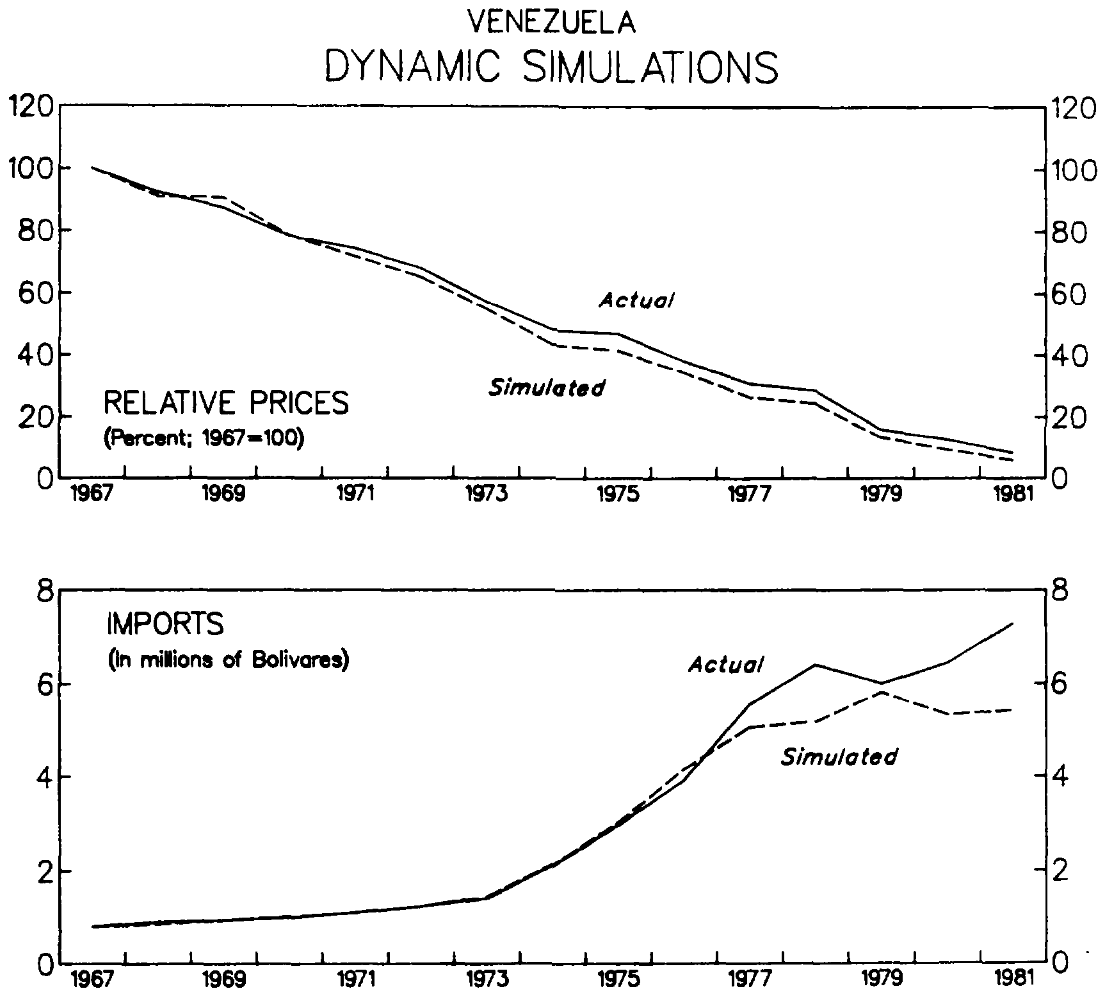
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40
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(Percent; 1967=100)
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Simulated
1967
1969
1971
1973
1975
1977
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1981
8
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IMPORTS
(In millions of Bolivares)
Actual
Simulated

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