AN ECONOMETRIC STUDY OF THE VENEZUELAN ECONOMY WITH EMPHASIS ON THE PETROLEUM SECTOR

by

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To Vita,

To Pablo and Magdalena,

To Jeannnette and Camille.

ABSTRACT

This dissertation analyzes and measures the contributions and impact of the petroleum sector, in general, and the petroleum export sector, in particular, on the economic development of Venezuela. The sample period of this study spans thirty years, from 1950 to 1979, and we extend its analysis up to 1982.

The 18-equation-model constructed and used in this study is a simple Keynesian structure of aggregate demand and income determination. The important feature of the model is the petroleum sub-model, which consists of four equations, containing two behavioural and two identity equations, and in which the petroleum export sector has been endogenized and linked to major regional international economic variables. To accomplish this, the Venezuelan petroleum export market was conveniently divided into three major regions: North-America, Latin-America and Western Europe, with residual exports to other parts of the world.

The basic objectives of the study are:

(1) to analyze the direct contributions of the Venezuelan petroleum sector to the other sectors of the domestic economy, and (2) to analyze the impacts that changes in the variables of the petroleum export sector may have on the govern-

ment revenues and also on the rest of the Venezuelan economy.

The methodology applied in this study employs both theoretic-empirical analysis and regression analysis to establish the relationships between the petroleum sector and the main economic variables of the Venezuelan economy. The estimation of the parameters of the model was done by the least squares method.

It was found, in Chapter II, that Venezuela has become increasingly dependent on the petroleum sector for its economic development, during the period 1950-1979. In fact, the linkage between the petroleum sector and the economic development is from abroad and not from within, meaning that the Venezuelan domestic market is too small to affect the petroleum sector, while the economies of the major trading partners do affect it, and this in turn affects the Venezuelan economic development.

It was also found that through the tax structure, the petroleum sector seems to have some degree of interdependence with the other sectors of the domestic economy. Direct inter-industry relationship was impossible to obtain due to the absence of an input-output table. To dampen any adverse impact, the government plays an important role by recycling back into the economy the huge petroleum tax revenues, mainly, through a major push program towards industrialization together with a labour development program. The public component of consumption has also been increasing quite significantly.

The results obtained in the forecasts for 1982, in Chapter VI, also support the underlying hypothesis that the major trading partners of Venezuela strongly affect the petroleum sector of Venezuela, which in turn has shown adverse impacts on the domestic economy.

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Chapter I

INTRODUCTION

1.1 A PETROLEUM ECONOMY

Natural resources can play an important role in the economic development process of Venezuela.[1] The low comparative cost of production, the domestic inelasticity of demand and the high foreign demand for some primary products create the surpluses that enable Venezuela to engage in extensive trade with the rest of the world. This is the case for petroleum in Venezuela, the only real sector of the economy taken into account in this study.[2] The petroleum sector is not only the most advanced and capital -intensive enterprise in the country, but it is in Rostowian terms the leading sector of the

[1] These natural resources comprise reproducible resources such as agriculture, fisheries, forestry, water and hydroelectric power and non-renewable resources from mineral deposits, such as iron ore, bauxite, to energy sources, such as petroleum, natural gas and coal. There is an extensive literature on the role that natural resources as well as population and labour supply can play along the lines with the development of social and political institutions. We have selected three books by authors well identified on the subject: R. T. Gill, _Economic Development Past and Present_, (Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1967). W. A. Lewis, _The Theory of Economic Growth_, (Cambridge University Press, London, 1955) and W. W. Rostow, _The Stages of Economic Growth_, (Cambridge University Press, London, 1971).

[2] The term 'petroleum' refers here in this study to crude petroleum and by-products, unless otherwise specified.

economy.[3] For the thirty years of the sample period of this study: 1950-1979, the export of petroleum accounts for about 93 percent average of total annual exports of goods and services, and about 97 percent of the foreign exchange earnings[4] by which Venezuela finances her heavy dependence on imports of intermediate and capital goods for her expanding industrial base and consumer goods to supplement the domestic production. Obviously, this pattern of trade reflects the vulnerability of the Venezuelan economy, depending as it does on the economic conditions of the major importing countries of the industrialized free world,[5] as is the case for the less developed countries[6] that depend on a major primary product line for export. Accordingly, any event affecting such exports will immediately affect the whole domestic

[3] The expansion of the export of a main primary product does not necessarily imply by itself the promotion of economic development for a less developed country, as it requires a conscious attempt by its government to coordinate and implement an appropriate public economic policy to allow the transmission of economic growth and development. See Jorge Salazar-Carrillo , _Oil in the Economic Development of Venezuela_, (Praeger Publisher, New York, 1976), Chapters 1, 2 and 7. See also G. Myrdal, _Beyond The Welfare State_, (Yale University Press, New Haven, 1964), p. 20.

[4] The state owned Petroleos de Venezuela S.A. (PDVSA) has been investing abroad some of its funds of foreign exchange earned from its petroleum exports in interest earning assets.

[5] The term 'free world' used here refers to market economies as opposed to centralized economies.

[6] The concept of 'less developed countries' is applied to economies in developing processes; that is, a process of transition from a stationary state to an active state of economic growth leading through time to higher social and economic structure and performance. See E. E. Hagen, _The_

economy. This is very strongly the case for Venezuela.

Venezuela, being a petroleum-based economy, is very conscious of the impact that a foreign, and even domestic, change of events may have on her economy.[7] More specifically, it must be desirable to quantify the impacts that the primary resource industry and the government expenditures of the primary export revenue taxes are having and quite likely will have on the economic development process of the country. This quantification approach may help economic planners to set economic targets by priority, in order to reach more rapidly their desired objectives in economic development.

The petroleum sector also accounts for about 30 percent of gross domestic product (GDPR) and about 76 percent of government tax revenues. It is precisely through government expenditures on consumption and investment that these taxes are channelled back into the economy. How effective the 'sowing-the-oil' policy has been on the economic development process of Venezuela remains a deep concern.[8]

<u>Economics of Development</u>, (Irwin, Homewood, Ill., 1968), p. 6

[7] Fluctuations in petroleum revenues, due to fluctuations of international prices and/or production levels before and after 1973, and the nationalization of the Venezuelan petroleum industry in January, 1976, are important changes of events that should be considered in the analyses of the economic development process of Venezuela.

[8] 'Sowing-the-oil', from Spanish 'Sembrar el Petroleo', is an expression coined by the writer Arturo Uslar-Pietri, <u>Ahora</u>, (Caracas, 1936). It has reflected, ever since, the deep concern of all generations over the use that should

The objective of this study is primarily to analyze and quantify the impacts that the petroleum sector in general and the government petroleum tax revenues, in particular, had on the economic growth and the development of Venezuela during a sample period of the last three decades from 1950 to 1979, and what shall be their possible effects in the future. To this purpose, an econometric model representative of the Venezuelan economy has been constructed.

1.2 ECONOMIC MODELS

At this point, it seems to be opportune to review briefly the concept and general nature of economic models.

A model, in this context, reflects a clear notion of a simplified structure representing an economic phenomenon that relates to a body of theoretical knowledge and to a set of observable events. In fact, all sciences make use of models, the natural sciences as well as the social science. From the point of view of their structural foundation, each of these types of models is a theoretic-empirical construction generally expressed in a mathematical relation as an abstraction of certain phenomena. However, these models differ in scope and nature. While in the natural science a model is a 'scientific law' that allows the reproduction of reality due essentially to its deterministic character,[9] in

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be made of the petroleum resources to eliminate the massive poverty in the country.

the social science and particularly in economics where the randomness of events and human behaviour itself have a probabilistic occurrence, an economic model cannot behave in quite the same way.[10] Also, economic models as theoretic-empirical structures cannot be accepted only on the merits of the economic laws that they purport to sustain, but they must be continuously tested against reality in both space and time. Therefore, an economic model is a concurrent process of analysis that confronts 'theory' and 'reality' as a fundamental instrument that allows either the acceptance or rejection of a given theory or a modification of it, according to its empirical validity.[11] This process allows the economist to be better equipped to understand the real world and, hence, to act on it more efficiently so that economics can serve mankind.

Economics, then, becomes a science for action, a turn from the positivism and strict concept of economics of the 1930's. This turn of events in economics really began with the Keynesian revolution in 1936.[12] Short-term fluctuations

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[9] Michael D. Intriligator, Econometric Models, Tecniques and Applications, (Prentice-Hall, Englewood Cliffs, New Jersey, 1978), p. 25.

[10] E. Malinvaud, Statistical Methods of Econometrics, (North-Holland, Amsterdam, 1970), pp. 44-57. See also on this issue Camilo Dagum y E. M. Bee Dagum, Introduccion a la Econometria, (Siglo XXI, Mexico, 1971), pp. 6-16.

[11] L. R. Klein, An Introduction to Econometrics, (Prentice-Hall, Englewood Cliff., N. J., 1962), p. 2.

[12] J. M. Keynes, The General Theory of Employment, Interest and Money, (Harcourt Brace, New York, 1936). See also L.

in economic growth such as in the world depression of the 1930's were of a mild concern for the classical theory, but the Keynesian theory took deep concern for these phenomena by emphasizing the need for direct action on the sectoral level of the economy.[13] This new approach to economics called for further development of the mathematics applicable to social sciences both in probability theory and statistical methods in order to quantify economic analysis. But it was not until the works of Frisch and Tinbergen in the 1930's and Haavelmo in the early 1940's that a scientific basis for a quantitative approach to economics began to take form becoming what is known today as econometrics.[14]

R. Klein, The Keynesian Revolution, (Macmillan Co., New York, 1947).

[13] "The classical theory was not particularly concerned with phases of underemployment which were considered as temporary accidents. It was more interested in problems of equilibrium and long-term growth than in fluctuations in short-period. However, from 1930 to 1940, most industrial countries experienced a prolonged spell of underemployment. To allow prediction of the spontaneous behaviour of the economy and assessment of the different measures proposed for its guidance, it was essential to know how the level of production at any one time was determined, and why it was neither higher nor lower", E. Malinvaud, op.cit., p. 47.

[14] R. Frisch, "On the Notion of Equilibrium and Disequilibrium", Review of Economic Studies, Vol. III (1935) and Statistical Confluence Analysis by Means of Complete Regression Systems, (University Economics Institute, Oslo, 1934). T. Haavelmo, "The Probability Approach in Econometrics", Econometrica, Supplement, Vol. 12, (July, 1944), Chapters 2, 5 and 6.

1.3 ECONOMETRIC MODELS

P. A. Samuelson defines econometrics as:

> "The quantitative analysis of actual economic phenomena based on the concurrent development of the theory and observations related by appropriate methods of inference".[15]

The above definition supports the previous discussion of an economic model, but now we include an empirical content that allows us to quantify the actual economic phenomena by the use of statistical data and statistical analysis. The economic model and its new dimension of quantitative analysis may now be called an econometric model. Such a construct exhibits a system of well defined equations that relates observable economic variables to unobservable random variables, known as stochastic disturbance terms, and a set of assumptions about the stochastic properties of these disturbance terms.[16] The stochastic terms take into account the unpredictable character of much of human behaviour relating to social, political, environmental events and errors in the measurements of the economic observations (for the dependent variable) in an attempt to fully specify the model. The inclusion of these variables is a fundamental requirement in

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[15] P. A. Samuelson, "Report of the Evaluative Committee For Econometrica", Econometrica, Vol. 22, No. 2, (April, 1954), pp. 141-146. A more comprehensive definition is given by L. R. Klein: "The main objective of econometrics is to give empirical content to a priori reasoning in economics", op. cit., p. 1.

[16] Camilo Dagum and Estela Bee Dagum, op. cit., pp. 102-105 and 165-166.

the economic analysis (for both the statistical estimation and the testing of the model as well as for the economic meaning of their inclusion), which is a characteristic of the stochastic or probabilistic nature of the econometric models, in opposition to the deterministic mathematical economic models.

As an illustration of the above, we may consider the simple Keynesian consumption model fully specified. Besides the functional linear relationship to disposable income to which the theory refers, the model must take into account additional factors, which are partly unknown to us, but contribute to the determination of consumption. Such a model can be written in the following symbolic form:

(1) $$Y(t) = a + bX(t) + u(t), \quad \text{where} \quad t = 1,2,\ldots,T$$

$$a > 0 \quad \text{and} \quad 0 < b < 1$$

The simple model (1) defines a stochastic relationship between the endogenous variable $Y(t)$ and the exogenous variable $X(t)$. The variable $u(t)$ represents all unobservable random variables not explicitly incorporated in the model, and has an associated probability distribution.

Suppose further that there exist n endogenous variables $Y(i,t)$, $(i=1,2,\ldots,n$ equations) and k exogenous (or predetermined) variables $X(j,t)$ $(j=1,2,\ldots,k)$, at time t

$(t=1,2,\ldots,T)$. In a compact matrix form we can write:[17]

$$(2) \quad By(i,t) = Ax(j,t) + u(i,t)$$

where B is a non-singular $n \times n$ matrix of the coefficients of the n-vector $y(i,t)$ endogenous variables, A is an $n \times k$ matrix of the k-vector $x(j,t)$ exogenous (or predetermined) variables including $x = 1$ when corresponding to the constant terms in A. The $u(i,t)$ is the unobservable random n-vector of the same order as the vector $y(i,t)$.

A linear model, such as (1) or (2), is based on a set of assumptions, known as classical assumptions, which takes into account the behaviour of the stochastic terms and the criteria for the estimators specified in the model.

1.3.1 Statistical Analysis

Once the structural parameters of the model have been estimated by the method of least squares, including of course the stochastic terms, then we proceed with the ex-post analysis of the model; that is, the model must be submitted to empirical critical tests in order to establish criteria for judging the 'goodness' of the parameter estimates. Then, the statistical tests of significance that must be carried out will tell whether the model may or may not be accepted, or whether it may be rejected or modified. Therefore, we

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[17] E. Malinvaud, op. cit., pp. 597-601, and Camilo Dagum and Estela Bee Dagum, op. cit., pp. 66-70 and 164-166.

need to test the significance of the parameter estimates, all subject to the problem of measurement error:

(1) The squared multiple correlation coefficient, also known as the coefficient of determination (R2), is a measure of the goodness of fit of the regression plane to the sample observations.[16] However, the usefulness of this statistic depends on the causal relationship that should exist between the dependent and the independent variables, which is basic to a well specified model. In this respect, the least-squares regression techniques serve the purpose of validating such a model.

(2) The F-statistic tests the null hypothesis that all coefficients of the regression other than the constant term are zero, that is, Ho: b(j) equals zero, where j=1,2,...,k parameters, against the alternative hypothesis, H1: b(j) is different from zero. It should be noted that the F-ratio is a test of significance of the R2, since

$$F = [R2/(1-R2)][(n-k)/(k-1)]$$

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[16] A high R2 alone does not necessarily imply a high degree of verisimilitude, particularly when it is associated with a very low Durbin-Watson statistic. The only conclusion that can be inferred from this relationship is that the model is mis-specified. See C.W.J. Granger, P. Newbold, 'Spurious Regressions in Econometrics', Journal of Econometrics, Vol. 2, (1974), pp. 111-120.

where n is the number of observations and k is the number of parameter estimates. If R2 is statistically not different from zero, then we accept the null hypothesis.

(3) The Student's t-test of the null hypothesis: The computed t-statistic for each parameter estimate tests the null hypothesis for each individual coefficient by comparing it to the theoretical value given by the t-table, at a chosen level of significance and with n-k degrees of freedom. A significant t-statistic on the regression slope parameter validates the model while an insignificant statistic invalidates it.

(4) Testing for autocorrelation (or serial correlation) to find out whether or not the stochastic disturbance terms are independent of one another. The most important type of autocorrelation is the first-order linear serial correlation, in which case we apply the Durbin-Watson statistic test:

(4.a) The Durbin-Watson statistic (D-W) tests the null hypothesis, Ho: RHO equals zero, in which case the error terms are not serially correlated, against the alternative hypothesis, H1: RHO is not zero, implying that these disturbances are not independent. Four cases may arise in testing for first-order serial correlation:

(a) If D-W < dl -reject the null hypothesis,

(b) If D-W > (4 - dl) -reject the null hypothesis,

(c) If du < D-W < (4 - du) -accept the null hypothesis,

(d) If $dl < D\text{-}W < du$, or

If $(4 - du) < D\text{-}W < (4 - dl)$ -inconclusive test.

The Durbin-Watson statistic is not an appropiate measure of autocorrelation when lagged dependent variables are amongst the explanatory variables in the regression equation. In this case the Durbin-h test is applied:[19]

(4.b) The Durbin h statistic is defined as

$$h = [1 - (D\text{-}W/2)][T/(1 - T(var(b))]**1/2$$

where T is the number of observations and var(b) is estimated as the square of the standard error of the coefficient of the lagged endogenous variables. The notation ** is a fortran convension implying 'to the power'. At a 5 percent level, the critical value of the h-statistic (which is approximately normally distributed with unit variance) is 1.645. The null hypothesis of no serial correlation is accepted if $|h| < 1.645$ or rejected if $|h| > 1.645$.

When the h-statistic is not defined (because Tvar(b) is greater than 1 and, consequently, we cannot take the square root of a negative number), another alternative test can be used.[20] This test involves the estimation of a new regres-

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[19] See Robert S. Pindyck and Daniel L. Rubinfeld, Econometric Models and Economic Forecasts, (McGraw-Hill, New York, 1981), pp. 194-195, and also P. Rao and Miller, Applied Econometrics, (Wadsworth, Belmont, California, 1971), pp. 123-124.

[20] See J. Johnston, Econometric Methods, (McGraw-Hill, New York, 1960), p. 313.

sion of the residuals obtained from the ordinary least squares regression, that is

$$e(t) = d + fe(t-1) + gY(t-1) + hX(t)$$

where the residuals (the e's) are regressed on themselves lagged one year and on all the explanatory variables of the original regression equation. We then do a t-test of the null hypothesis that the coefficient 'f' is not significantly different from zero. If 'f' is greater than the critical value, we reject the null hypothesis and conclude that first-order serial correlation is present.

These tests constitute the fundamental evaluation that is used in the ex-ante analysis of model-building. By using this process, we will be able to determine the validity of any given economic model.

1.3.2 Methods of Estimation

The linear regression model or linear simultaneous equations model is based on certain assumptions pertaining to the stochastic terms. Some of these assumptions refer to the distribution of the random variables and others to the relationship between these random variables and the explanatory variables, and finally other assumptions refer to the relationship between the explanatory variables themselves.[21]

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[21] Camilo Dagum and Estela Bee Dagum, *op. cit.*, pp. 102-105 and 165-166.

This set of assumptions is sufficient if the method of 'least squares' is to be used in the estimation of the parameters of a linear regression model. However, it is a well known fact that when the random disturbances of a stochastic economic relationship are correlated with the explanatory variable(s), the ordinary least squares (OLS) no longer provides unbiased and consistent parameter estimates.[22] Nevertheless, the OLS method has remained a popular econometric procedure to explore individual equations in order to determine their final specifications. Therefore, each equation of the model used in this study will be estimated by the single-equation technique, that is, the estimation of one equation of the system at a time, employing the traditional OLS method as an exploratory estimator. The ob-

[22] Many applied studies have demonstrated the presence of measurement error and serial correlation in the disturbance terms. In the present study, we notice that because of the massage process to which the data were submitted, both endogenous and exogenous variables contain systematic and random errors. Moreover, it is necessary to specify more carefully the nature of the independent variables (i.e., if they are truely exogenous) and, in particular, if they contain lagged dependent variables. A 'frequency domain' approach to derive spectral estimation methods for a dynamic model with lagged dependent variables and measurement error has been suggested by Professor Cheng Hsiao, 'Measurement Error in a Dynamic Simultaneous Equations Model with Stationary Disturbances', Econometrica, Vol. 47, No. 2, (March, 1979), pp. 475-494. The methods suggested are, however, hampered by their enormous computational complexity, which implies that Professor Hsiao is actually providing some basic information for the development of a new approach to future econometric work. See D.F. Nichols, A.R. Pagan and R.D. Terrell, 'The Estimation and Use of Models with Moving Average Disturbance Terms: A Survey', International Economic Review, Vol. 16, (1975), pp. 113-134. See also E.J. Hannan "The Identification Problem for Multiple Equation Systems with Moving

vious alternative to OLS as an exploratory estimator is the two stage least squares method (TSLS), because it provides both consistent coefficient estimates and legitimate estimates of the asymptotic standard errors. However, during the exploratory stage of model building, when a decision must be made as to what structure the final equation should take, the critical risk is to commit a type II error by applying TSLS (i.e., to accept the null hypothesis that the parameter is zero when it is not). It appears, then, that the traditional OLS method is preferable than the TSLS procedure.[23]

Another justification for the use of the OLS method is given by a Saudi Arabian experiment. This experiment was based on a poor quality data set and on a small sample of 11

Average Errors', Econometrica, Vol. 39, (1971), pp. 751-765.
A detailed exposition of the properties [linearity, unbiasedness, consistency and minimum variance (efficiency)] of the estimators of a linear regression model is given by Michael D. Intriligator, op. cit., Chapter 4. See also Camilo Dagum and Estela Bee Dagum, op.cit., pp. 95-102, and H. Theil, Principles of Econometrics, (John Wiley, New York, 1971), pp.119-124.

[23] R.A.L. Carter, 'Least Squares as an Exploratory Estimator', The Canadian Journal of Economics, Vol. VI, No.1, February, 1973. The author used two naive models of the Canadian economy, with a sample of 20 observations, whose parameters were estimated by full information maximum likelihood (FIML) and the random disturbance terms for each equation were normally distributed with zero means and a constant covariance matrix, which was close to that produced by the FIML estimation. Then the Monte Carlo experiments were carried out. The disturbance terms were applied to the reduced form to obtain values for the endogenous variables. With this procedure, 100 samples were used to produce 100 OLS estimates of each parameter and 100 values of the standard error of each parameter. Two

observations. The OLS procedure was applied and produced coefficients that were statistically significant and with the right signs, according to economic theory. The model was then re-estimated by using the TSLS technique and, again, the coefficients were found to be statistically significant and with the right signs, confirming the previous findings.

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hypothesis were tested using the two-tailed test. The first hypothesis was the usual one, that the parameter was zero against the alternative one that the parameter was not zero. The latter is the hypothesis usually tested when OLS is used as an exploratory estimator. The statistic used in these hypotheses was the computed t-ratio, which was compared with 10 and 1 percent points of a student t-distribution. Once the OLS method was carried out, the TSLS followed the same procedure as above and the final results (Monte Carlo results) were compared. It was found that the OLS method was superior to the TSLS method. The risk of committing a type II error was greater with TSLS than with the OLS, and, second, the OLS had a greater advantage than the TSLS for equations containing many exogenous variables and for the coefficients of endogenous first difference variables. With respect to the type I error, the TSLS method was found to be superior than the OLS method. In his case, the author recognized the superiority of the OLS procedure compared to the performance of the TSLS method. However, a pretest estimation is recommended in cases when the true sampling model is unknown, which implies that the statistical model used in econometric studies should be sometimes determined by a preliminary hypothesis test using the data at hand. A

1.4 ECONOMETRIC MODELING

Econometrics is certainly a relatively new technique for the quantification of economic models. It was precisely with the Keynesian revolution on national income analysis after 1936 and during the 1940's that the desire to quantify and test economic models produced the scientific basis for the stochastic and statistical approach to economics.[24] It was not until the late 1940's and during the 1950's that the first econometric works developed in the industrialized economies and in the 1960's for the developing economies.[25]

Some experiments at econometric modelling were developed for Peru in 1965 and two others for Saudi Arabia and Iraq in 1973. The first was an econometric approach to economic de-

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two-stage method is set up to provide a rule for choosing between the estimator based on the sample data and the estimator consistent with the hypothesis. To a large degree, the pretest estimator is a rejection of the concept of a true statistical model for which statistical theory provides a basis for estimation and inference. See G.G. Judge, R. Carter Hill, W.e. Griffiths, Helmut Lutkepohl and Tsoung-Chao Lee, Introduction to the Theory and Practice of Econometrics, (John Wiley & Sons, New York, 1982), Chapter 21.

The model was also re-estimated by using the TSLS method, the results of which appear in Appendix B. This was done purely as an intellectual exercise. It was found that the coefficients were statistically significant, with the right signs, and were fairly close to the OLS results. However, these results appear to be questionable as nearly all the explanatory variables of the model contain measurement error due to the massage process of the data in Chapter III. Although, the OLS and TSLS methods provided similar estimates statistics, the superiority, evenly asymptotically, of the TSLS method is not evident.

[24] This process at quantification of economic models, together with the induced power of the Keynesian doctrine

velopment problems for a developing country in Latin America.[26] It consists of three simple macroeconomic models, each attempting to quantify the growth of the Peruvian economy using a sample period of 15 years from 1950 to 1964. Projections were tried and checked for consistency with existing data. The best model, an extension of the other two models, explicitly includes the government sector, which allows one to measure the effects of the new policy variables on the levels of national income and on the balance of payments. This model is composed of 12 equations, of which 5 are behavioural and 7 identities with 12 endogenous and 10 exogenous variables.

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on governments' direct intervention in their economies through policy instruments at their disposal, makes econometric modelling a necessary tool for economic planning towards an accelerated economic growth and development, particularly for the less developed countries which desperately need to eradicate massive poverty within a reasonable period of time.

[25] Marc Nerlove, "A Tabular Survey of Macro-Econometric Models", International Economic Review, Vol. 7, No. 2, (May, 1966), pp. 127-175. This survey consists of 25 of the major econometric models constructed up to about the middle of the 1960's, of which 24 are for 8 developed economies and 1 for a developing country, India. All these models are basically Keynesian in nature and are estimated on time series data, spanning together over about one hundred years. Three of the models for the developed countries are summarized here: 1) J. Tinbergen, "Business Cycles in the United States of America, 1919-1932". This model contains 50 equations, of which 32 are behavioural equations and 18 are identities. This model and a previous one of 24 equations on the Netherlands' economy published by the same author in 1936 seem, in most accounts, to share the point of departure in time of macro-econo-

The Saudi Arabian model consists of 25 equations, of which 19 are behavioural equations and 6 identities, dealing with the structure of that economy from 1960 to 1970.[27] The model includes the income sector, the expenditure sector and the monetary sector. The government sector is given an endogenous behaviour in the system while the export sector is totally excluded as petroleum accounts for almost 100 percent of total exports. The main objective of this model is to quantify the real sectors of the economy.

The Iraqi econometric model is quite an aggregated model of 15 equations, of which 11 are behavioural equations, estimated for the sample period 1953-1969, and 4 are identities.[28] The primary aim of the model was to analyze the effects of the petroleum export sector on the economy of Iraq.

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metric model building (see Ronald G. Bodkin and L. R. Klein, "Macro-Econometric Modelling: A Schematic History and a View of its Possible Future", Research Paper No. 8109, University of Ottawa, May 1981). 2) R. E. Caves and R. H. Holton, "The Canadian Economy: Prospect and Retrospect, (Harvard University Press, Cambridge, 1959), pp. 129-140. It is a long-term growth model of 12 equations, 9 behavioural and 3 identities, with emphasis on population and labour relationships, and 3) J Tinbergen, "Business Cycle in the United Kingdom, 1870-1914", (North-Holland, Amsterdam, 1951). The model consists of 39 equations, 26 behavioural and 13 identities, treating trade with the monetary sector. It excludes the labour force. See also L. R. Klein, "What Kind of Macroeconometric Model For Developing Economies?" in <u>Readings in Economic Statistics and Econometrics</u>, (Little, Brown & Co., Boston, 1968), pp. 559-570. According to Professor Klein the first macroeconometric models constructed and applied took place in Holland, United States and Canada, expanding afterwards to the United Kingdom, Japan and later to other countries.

[26] E. Thorbecke and A. Condos, "Macroeconomic Growth and Development Models of Peruvian Economy", in <u>The Theory and</u>

Another exercise in econometric modelling and its application was carry out on the economy of Mexico in 1971.[29] A new version of this model, on the basis of longer and better data, with new aspects of the Mexican economy taken into account, was published in 1974.[30] This model contains 143 equations, of which 40 are behavioural and the rest are accounting and identities.

In the case of Venezuela, its first econometric study was developed in 1968.[31] The United Nations' Economic Commission For Latin America constructed an econometric model entitled "Trade Projections For Venezuela" consisting of 34 equations, of which 12 are behavioural and 22 are identities and accounting equations. It emphasized the foreign sector, taking 6 behavioural equations to explain imports for both

Design of Economic Development, I. Adelman and E. Thorbecke, eds., (Johns Hopkins Press, Baltimore, 1966), pp. 181-209.

[27] Faisal Safooq Al-Bashir, A Structural Econometric Model of Saudi Arabian Economy: 1960-1970, (John Wiley & Sons, New York, 1977). This is a new version of his Ph.D. dissertation: An Econometric Model of the Saudi Arabian Economy: 1960-1970, University of Arizona, 1973.

[28] Ahmad Abdul Kader, The Role of the Oil Export Sector in the Economic Development of Iraq, Ph.D. dissertation, West Virginia University, 1973.

[29] Abel Beltran del Rio, "Mexico: an Economy at the Crossroad," Wharton Quarterly, University of Pennsylvania, Fall 1971.

[30] Abel Beltran del Rio and L. R. Klein, "Macroeconometric Model Building in Latin America: The Mexican Case", in The Role of the Computer in Economic and Social Research in Latin America, Nancy D. Ruggles, ed., (National Bureau of Economic Research, New York, 1974), pp. 161-190.

the petroleum and non-petroleum sectors plus 3 imports identities. The export sector, composed of petroleum, iron ore, and other exports, is exogenously determined in the model by 9 identities and accounting equations. The consumption and investment sectors are endogenously determined.

In 1974, the International Monetary Fund and the Central Bank of Venezuela developed a highly aggregated econometric monetary model of the Venezuelan economy. The model is composed of 6 behavioural equations and 3 identities. The main objective was the short-term forecasting of key macroeconomic variables such as the effect that a change in money supply would have on gross domestic product, and this in turn on the balance of payments and foreign reserves.[32] This model was complemented by another small model of 5 equations (2 behavioural and 3 identities) in 1974, attempting to analyze the determinants of the money multipliers under a fixed exchange rate.[33]

The latest experiment was developed in 1976 at the University of Pennsylvania as a Ph.D. dissertation.[34] It is a

[31] United Nations Economic Commission For Latin America, "Trade Projections For Venezuela", in Trade Prospects and Capital Needs of Developing Countries, UNCTAD, (United Nation, New York, 1968), pp. 590-614.

[32] Mohsin S. Khan, "Experiments with a Monetary Model for the Venezuelan Economy", in International Monetary Fund: Staff Papers, Vol. 21, (July, 1974), pp. 389-413.

[33] D. R. Khatkhate, V. G. Galvis and D. P. Villanueva, "A Money Multiplier Model for a Developing Economy: The Venezuelan Case", Ibid., pp. 740-757

[34] Pedro A. Palma-Carrillo, A Macro-Econometric Model of

large and quite disaggregated macroeconometric model of aggregated demand and supply, consisting of 139 equations, 42 of which are behavioural equations and 97 accounting identities. While the consumption sector is quite disaggregated within the private sector, the government sector is introduced as an exogenous variable. Investment is explained by only one behavioural equation and government is exogenous. The foreign sector includes the traditional variables of the economy. Excluding petroleum, the export equations are disaggregated into iron ore and some agricultural products, mainly cocoa and coffee, and imports are explained by commodity, intermediate and capital goods. The supply side of the model is an important disaggregation of the real sectors of the economy.

The model also contains a labour and a monetary sector.

The main objective of this model is to explain the real sectors of the economy and to provide some information about monetary and financial behaviour of variables during a sample period of 20 years from 1950 to 1969.

<u>Venezuela with Oil Price Impact Applications</u>, Ph.D. dissertation, University of Pennsylvania, 1976.

1.5 THE MODEL

The present macroeconometric model draws from all the previous studies. It is formulated according to the Keynesian theory of aggregate demand and income determination, but is based on the type of model formulation suggested for developing economies.[35]

The model takes a sample period of 30 years, from 1950 to 1979, in an aggregated system composed of 18 equations of which 10 are behavioural, 1 is technological and 7 are identity equations. It also contains 24 exogenous variables, of which 16 are non-controllable and 8 are controllable.

The main characteristics of the model are:

a) The petroleum sector is the only real sector taken into account. It enters the model by means of four equations. Three of these equations are export relations and the other is a petroleum tax function. The export relations contain two behavioural equations, which are explained by the economic expansion of ~~the~~ North-American and Latin-American regions, as defined in this study, and by the domestic petroleum consumption of Venezuela as well as its petroleum production and world petroleum prices. The other petroleum relation is an identity, which expresses the summation of petroleum exports to the trading partners of Venezuela (petroleum exports to Western Europe and to other parts of the

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[35] L. R. Klein, "What Kind of Macroeconometric Model for Developing Economies?", op. cit.

world are data). The petroleum tax equation is specified by total petroleum exports, an expectational variable and the domestic petroleum production and consumption.

b) The tax sector has been conveniently structured into four equations, of which the petroleum tax function takes a leading role as required by this model. Two crucial instrumental petroleum variables for economic policy application are provided by this equation: the levels of production and domestic consumption; it is assumed that both are under the control of the policy-makers.

d) The consumption and investment sectors are disaggregated into private and public sectors, but no further, and only the private components are endogenous to the system.

e) Labour employment enters the model through the aggregate production function.

The main objectives of this study are:

1) to estimate and quantify the direct contribution of the Venezuelan petroleum sector to the other sectors of the domestic economy.

2) to estimate and analyze the major effects that the Venezuelan petroleum sector, in general, and the petroleum export sector, in particular, may have on the government tax revenues and on the rest of the domestic economy.

In addition to the present introduction, there will be six more chapters outlining the structure of this study:

Chapter II will be a theoretical and descriptive presentation of the model as it purports to show the workings of the economy of Venezuela, on the basis of its peculiarities and the time-series data collected for the sample period 1950-1979. The model is Keynesian, but other hypotheses are studied as we try to translate into econometrics the characteristic features of the economy.

Chapter III will discuss the nature and quality of the data gathered for the sample period of this study. A pitfall of econometric modelling for Venezuela, in particular, and for developing economies, in general, is the quality of the data.

Chapter IV will present the structural model and the parameter estimates with a thorough analysis of the specifications of each equation, according to theory and statistical results.

Chapter V will deal with the simulation results over the sample period, 1950-1979, and the forecasting power of the model within and beyond the sample period. The latter performance shall be carried out through the ex-post forecasting for the year 1980, which shall be followed, in Chapter VI, by the ex-ante forecasting for the period 1981-1982.

Chapter VI will contain the ex-ante analysis of the forecasts for the year 1981-1982. Three scenarios of alternative forecasts shall be conducted for the year 1982 and, by comparing these results, we shall be able to quantify and analyze the impact that changes in the key exogenous variables may have on the Venezuelan economy.

Chapter VII will contain the conclusions of this study.

Chapter II

THE MODEL AND CHARACTERISTICS OF THE ECONOMY

2.1 THE APPROACH

The present model follows a simple linear normal relation of the form:[36]

$$\text{(I)} \quad Y(t) = a + b\,X(1,t) + \ldots + k\,X(m,t) + u(t)$$

where all classical assumptions are assumed. The dependent variable Y is estimated along with parameters a, b, ... ,k within a sample period of thirty years, spanning 1950 to 1979.

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[36] Models of the form: $Y = f(X) + u$ frequently appear in econometric studies. Y is the dependent variable which we want to explain, f(X) is an unknown function (linear or non-linear specification) of the independent variable X, and u is a disturbance term with E(u)=0, E(u**2)= sigma squared and E(uX)=0. The econometrician's problem is to determine the properties of f(X) by some computationally convenient procedure. One common procedure is the OLS, but the fact that this method's estimates do not necessarily provide reliable information about the local properties (derivatives, elasticities) of unknown functions makes it difficult for the practicing econometrician to design his sample (orthogonally), whose regressors are typically correlated. Hence, it is useful to realize the limitations of these approximations given by the OLS method. As predictors they have desirable properties, that is, the parameters estimated converge to the least squares approximation and not to the 'true' parameters (except in cases of orthogonal regressors). See H. White, 'Using Least Squares to Approximate Unknown Regression Functions', International Economic Review, Vol. 21, No. 1, (February, 1980), pp. 149-170.

Each structural equation of the above form is stochastic and linear in parameters and variables. The variable Y is the dependent variable and the X(i) are the m (i = 1, 2,... , m) independent or explanatory variables. The dependent variable Y relates to X(i) in a functional relationship with the presence of the stochastic disturbance term 'u'.

The regression equations of this model comprise behavioural and technological relations. The theory behind them conforms to the Keynesian theory of effective aggregate demand and income determination.

Aggregate demand or aggregate expenditure is defined by the following universal statement:

(II) GDPR = CTR + ITGR + (XR− MR) + MFSR

This identity states that real aggregate demand or real gross domestic product (GDPR), measured by expenditures on final products in any year, is always equal to the sum of real aggregate consumption by both consumers and government (CTR), real gross fixed investment by the private and public sectors (ITGR), net real exports of goods and services, that is, real exports (XR) minus real imports (MR), and net real factor payment abroad from foreign investment or, in other words, real imports of factor services (MFSR).

In other words, the GDPR measures the flow of currently produced goods and services within the borders of the economy at constant market prices annually. Each term or component of GDPR in (II) is specified in this model in constant 1968 prices and as a functional relationship to relevant variables according to both the existing theory and to what seems to be the reality of the economic environment of a country such as Venezuela. The structure of the Venezuelan economy has been divided conveniently into two sectors: the petroleum sector and the non-petroleum sector. Besides the investment policies of the petroleum companies and the government, the growth of the petroleum sector depends upon the world demand and supply relationship of the petroleum market, specifically on the strength of the economies of Venezuela's major trade partners. The non-petroleum sector depends upon the investment policies of the private and public sectors for its economic growth. Both these sectors are treated endogenously (in this case) as the model formulated is concerned with their analyses for policy implications.

2.2 A GLOBAL VIEW

Venezuela is one of the most fortunate members of the LDC's in terms of wealth. It has been particularly fortunate over the past thirty years and will be for many years to come. Paradoxically, while the State is wealthy and politically stable, most of the population remains poor with a large proportion of illiteracy, bad housing conditions and high levels of unemployment.[37]

[37] This condition of living is a direct consequence of the

The country is rich in natural resources, ranging from mineral deposits to energy, sufficient agricultural and forest lands, and fresh and salt water fisheries. These resources can support a larger population than the currently estimated 13.62 million people with a better quality of life.

There has been an institutionalized and expanding petroleum industry since 1936,[36] leading both the external sector, with annual averages of about 93 percent of total exports, and the domestic sector, with about 30 percent of real gross domestic product (GDPR). The huge foreign exchange earnings of the petroleum industry provide the country with the high capacity to import in order to meet the rising demand for consumer goods as well as for capital and

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striking inequality of income distribution in Venezuela, where there exists a high and increasing concentration of the national income in the hands of the 5 percent of the households (HH) at the top, while the 80 percent of the HH at the bottom become poorer. To illustrate this case, we look at the statistics and, in order to provide a more meaningful context of the human suffering, we compare them with those corresponding to Canada. To this effect, we shall use first the Gini coefficient, one of the many indicators of income inequality, which ranges from 0 to 1, implying that the larger the coefficient, the greater the inequality of income distribution; afterwards, we show their respective income distributions, (years in brackets):

Gini Coefficients:

Venezuela: .5445 (1962) up .6223 (1971). Case worsened
Canada: .3333 (1965) down .3074 (1979). Case improved.

Bottom 80 Percent of the HH:

Venezuela: 41.0 (1962) down 34.6 (1971). Small middle class.
Canada: 60.0 (1965) up 63.2 (1979). Large middle class.

Top 5 Percent of the HH:

Venezuela: 27.2 (1962) up 40.5 (1971). Becomes richer.
Canada: 14.1 (1965) down 12.3 (1979). Smaller share.

intermediate goods to increase the productive capacity through a policy of import-substitution.[39]

With all the financial resources at hand, Venezuela seems to be powerless to provide efficient public services, entrepreneurship for its many deficit-run public corporations, and unable to control the rising social inequality generated by a continuous deterioration of education, health, housing and employment.

With these economic and social conditions in mind, we shall attempt to specify and analyze the consumption relationship in the country.

Venezuela shows an extreme case of increasing concentration of income (40.5 from 27.2 %) at the top, and at the expense of the 80 percent of the HH who became poorer (34.6 from 41.0 %). No doubt the Gini coefficient is very high at .6223 in 1971, more than double that of Canada eight years later (.3074). Canada is the reverse case: the 80 percent from the bottom not only received the highest share of income but improved it (63.2 from 60.0 %), which means that Canada has a large middle class of earners while the top 5 percent of the HH have a reduced but nevertheless large income share (12.3 from 14.1 %) in 1979. It would be of much interest to know the income distribution structure of Venezuela now, after 7 years of petroleum bonanza (1979). See Banco Central de Venezuela (B.C.V.), La Economia Venezolana en los Ultimos Treinta y Cinco Anos, (B.C.V., Caracas, 1978), pp. 9-24; M. Chossudovsky, La Miseria en Venezuela, (Vadell, Valencia, 1980), 4th. ed.. See also Shail Jain, Size Distribution of Income: A Compilation of Data, (World Bank, Washington, D. C., 1975), pp. xi-xiv, 21, 118-119; The Economic Commission for Latin America, Income Distribution in Latin America, (United Nations, New York, 1971), pp. 41-61, and International Labour Office, Household Income and Expenditure Statistics: 1968-1976, (I. L. O.,

2.3 SPECIFICATION OF THE CONSUMPTION FUNCTION

Because we are treating a developing economy exhibiting a high inequality of income distribution, aggravated by a high rate of illiteracy, unskilled labour and extensive bureaucratic corruption, we expect a high marginal propensity to consume (MPC) both in the short-run (MPCs) and in the long-run (MPCl), and a high average propensity to consume (APC) as well. A high income elasticity is also expected.

So, given a consumption function of the form:[40]

(2.1) $CPR(t) = a + b\ YNR(t) + c\ CPR(t-1) + u(t)$

Geneva, 1979), No. 3, pp. 74-81.

[38] Luis Vallenilla, Auge, Declinacion y Porvenir del Petroleo, (Tiempo Nuevo, Caracas, 1973). Chapters 1-5 provide a genesis of the petroleum business in the world in general and, in particular, a comprehensive historical analysis of the petroleum industry in Venezuela since 1917. See also the outstanding work by Edwin Lieuwen, Petroleum in Venezuela: A History, (University of California Press, Berkely, 1955), Second Edition, which covers the evolution of the petroleum exploitation in Venezuela until 1952, and Anibal R. Martinez, Our Gift, Our Oil, (Dordrecht, 1966) and Recursos de Hidrocarburos de Venezuela, (Caracas, 1972). For a comprehensive survey on petroleum refining, see Weine Karlsson, Manufacturing in Venezuela, (Institute of Latin American Studies, Stockholm, 1975), Chapter 3.

[39] The share of imports to GDPR remained at about 14 percent in the 1950's and 1960's, and increase rapidly in the 1970's as a consequence of petroleum price increases. From 15.37 percent GDPR in 1970, the share climbed to 48.30 percent in 1976 dropping to 23.20 in 1979, presumably due to the production cuts of petroleum during that

where real private consumption (CPR) is a functional relationship of real national income (YNR) and lagged real private consumption [CPR(t-1)]. The random term u(t) is another variable that comprises all unobservable events not explicitly explained by the function. And we suppose also that,

$$0 < b < 1 \quad \text{and} \quad 0 < c < 1$$

in any given year t(1, 2, ... , 30).

Now, we can define the MPC for the short (MPCs) and long-run (MPCl), as the measure that a unit change in income (in our case real national income -YNR-) may have on consumption, as explained by:

(2.1a) $MPCs = (\partial CPR/\partial YNR) = b$ and,

(2.1b) $MPCl = (\partial CPR/\partial YNR) = b/(1-c)$,

where lagged consumption [CPR(t-1)] is treated as a variable equal to the current value. And we expect, according to theory, that

(2.1c) $MPCs < MPCl$

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year.

*° The function we are referring to is the one produced by T. M. Brown, "Habit Persistence and Lags in Consumer Behaviour", Econometrica, Vol. 20, No. 3, (July, 1952), pp. 355-371.

and since the average propensity to consume (APC), which defines the average proportion of consumption out of income, in the long term, is

(2.1d) $APC = [a/(1-c)YNR] + [b/(1-c)]$ then,

(2.1e) $MPCs < MPCl < APC$

The income-elasticity defined as the percentage change in a dependent variable with respect to one percentage change in the independent variable, under the assumption that the price of the commodity remains constant, this gives us:

$$(2.1f) \qquad E(YNR) = \partial[(\ln CPR)/\partial(\ln YNR)]$$
$$= (\partial CPR/\partial YNR)/(CPR/YNR)$$
$$= MPC/APC$$

where E(YNR) is the income-elasticity at t.

In estimating the consumption function, we began the analysis with Keynes' Absolute Income Hypothesis and, afterwards, tested other hypotheses. We found that Brown's Habit Persistence Hypothesis, re-specified with the money stock as an explanatory variable, gave the best results.

Aggregate real consumption (CTR), in 1968 prices, was divided into two components: real private consumption (CPR) and real public consumption (CGR).

2.3.1 Real Private Consumption.

Private consumption in 1968 prices (CPR) has been the largest component of aggregate real consumption (CTR) throughout the sample period from 1950 to 1979, remaining relatively stable at about 80 percent during the 1950's and 1960's, except for the years 1957 and 1958 when it dropped to 74.96 and 78.35 percent respectively due, presumably, to the social and political unrest unleashed in the country by the downfall of the dictatorship. During the 1970's, the share of CPR out of CTR remained at a lower average level of about 78.67 percent as a direct consequence of greater government participation in consumption.

We have also observed that the simple annual average propensity to consume, has declined from an average of about 80 percent in the 1950's, to 68.90 percent in the 1960's and 63.62 percent in the first four years of the 1970's. A look at the data showed that CPR, after having grown at a high rate of 8.83 percent in the 1950's, grew at a much lower rate of 3.79 percent in the 1960's and at a rate of 4.90 percent during the 1970-1973 period. Of course, this behaviour of consumption is a normal response to the performance of the whole economy, specifically to the rate of change of real national income (YNR). Although the YNR growth rate decreased throughout these periods, its growth was over and above the growth of CPR for the same periods. In fact, YNR declined from a record high rate of growth of 9.35 percent in the 1950's to 5.49 percent in the 1960's and to 6.86 percent, an improved rate, during the 1970-1973 period. This relationship between consumption and income was reversed during the remaining six years of the sample period, 1974-1979, when an unexpected and extraordinary volume of petroleum revenues entered the country as a direct result of successive world petroleum price increases that took place since January 1974. Wages and salaries were raised substantially and more people were employed. Then, CPR climbed to a record high growth rate of 10.87 percent while YNR grew at an average yearly rate of 6.44 percent for that same 1974-1979 period, (which includes the depressed year of 1979 when the economy reached a growth rate of 0.73 percent, the lowest ever).

The expansion of petroleum exploration and development that took place during the 1950-1979 period, in particular during the first two decades, and the continuous increases in petroleum exports, created a strong migration from the rural areas to the petroleum fields and the cities.[*1] The economic expansion brought about by the petroleum sector on

[*1] Mostly the young people left the depressed agricultural fields and towns to move to more promising opportunities such as the big cities and the petroleum fields, searching for a better way of life during those years of petroleum boom. Just over half the population, 52 percent, was located in the rural areas by 1950. Twenty years later, this rural population had decreased to about 27 percent and by June 1980 it accounted for 24 percent of the total population of the country. See Banco Central de Venezuela (B.C.V.), La Economia Venezolana en los Ultimos Treinta y Cinco Anos, (B.C.V., Caracas, 1978), p. 11

the whole economy and, in particular, the stimulus given to the increasing activities of the public sector, explain the rather high growth rate of national income and consumption referred to above. A look at the data for the period 1950-1960 shows that while consumption for low-income-elasticity goods such as food, beverages and basic services (necessities) increased, the consumption of high-income-elasticity commodities such as non-basic services, durables and non-durables remained relatively stable.[42] This general behaviour of the structure of consumption conforms to theory and empirical evidence. The first claim on income is the satisfaction of the basic needs of life anywhere. This is more commonly revealed in the less developed countries (LDC's), particularly during periods of reduced economic activity. The consumption of commodities of higher income-elasticities tends to increase when the economy is buoyant, and this seems to be a strong characteristic of the more developed countries (MDC's). These two structures of the composition of consumption are strongly and simultaneously present, in broad terms, in Venezuela, implying two well defined socio-structures: the 'haves', which are the minority,

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[42] B.C.V., op. cit., pp. 149-158. Given the overall performance of the economy, we expect higher consumption of both the low and high-income-elasticity goods for the 1970's, for which published data are not available. However, this should not be interpreted as a direct consequence of a better income-distribution but rather as the result of a higher income concentration in the hands of the high-income classes whom we expect will account for most of the increases in the consumption of durables.

and the 'have-nots', the large majority, which creates the paradox of poverty in the midst of plenty. The irregularities that can be observed through the data in measuring consumption may be explained as the normal process that occurs when people at the lower end of the income scale (the unemployed and the under-employed) tend to meet their basic needs by some combination of borrowing, dissaving and dependence on their better-off families under the expectations of higher future incomes.[43]

The experimental work which is presented in Chapter IV gets into the task of probing for a form of the consumption function which may be in agreement with general theory on consumer behaviour and able to produce a close fit to the observed data.

2.4 SPECIFICATION OF THE INVESTMENT FUNCTION

As in the case of consumption, total gross fixed investment (ITGR) is also divided into two major components: public gross fixed investment (IGGR) and private gross fixed investment (IPGR). Each of these two sectors plays an important role in the process of capital formation, but it is the government that is absolutely engaged in heavy investment planning that embraces infrastructure construction (ports, roads, schools, hospitals, low-income housing and other so-

[43] G. M. Meier, Leading Issues In Economic Development: Studies In International Poverty, (Oxford Univ. Press, Oxford, 1970), pp. 430-439.

cial overhead projects) as well as an extensive investment policy on basic industries (from petroleum, natural gas, coal and hydroelectric power to the petrochemical, aluminum, iron and steel industries).** On the average, its share of the ITGR has increased since 1950. From a simple average of 28 percent in the 1950's, IGGR climbed to 33 percent during the 1960's and to 35,57 percent in the 1970's, reaching a high level of 41 percent during the second half of the latter decade. The increasing participation of the public sector in capital stock seems to indicate that the private sector is losing investment opportunities, in particular in the basic industries. However, the private sector holds a strong position in manufacturing, agriculture and housing.

The public and the private sectors have both heavily contributed to capital accumulation in Venezuela. For the first decade of this study, 1950-1959, total gross fixed investment reached an average of 38.80 percent of gross domestic product in constant 1968 prices (GDPR), which undoubtedly was very high; it decreased in the following decade, 1960-1969, to 21.51 percent, still relatively high, and rebounded in the 1970's to 30.56 percent, of which the government is accountable for a share of 11.22 percent of the GDPR. This composition of investment makes the construction of an investment function rather difficult for a less devel-

** J. Doutriaux and H. Osborne, "An Inter-industry Model for Corporate Planning in an Industrializing Country", (University of Ottawa, Institute for International Co-operation, March, 1981). Mimeo.

oped country (LDC), according to neo-classical and Keynesian theories.[45] Empirical studies of more developed countries specify that the rate of interest, mortgage rates, profits, sales, gross national product, capital stock, and so on, are relevant variables to determine the investment function.[46] While these variables may specify and explain reasonably well the investment function of developed economies, we cannot expect the same specification to work for a developing country such as Venezuela, where regardless of the level of interest rates, mortgage rates, profitability, etc., the country must increase its social overhead investments as well as accelerate the process of its industrialization to provide, as soon as possible, a better way of life for its fast growing population. For such a great task the Venezuelan government seems to be the natural investor as it is the recipient of the huge resources coming from the exports of petroleum, on the one hand, and because of the mounting po-

[45] Fisher's eligible options of investment are based on the theory of maximization of the present value of capital at the going market rate of interest at which the net annual returns are discounted. In other words, an investment project should be undertaken whenever the "rate of return over cost" is equal to or above the interest rate. See I. Fisher, The Theory of Interest, (Augustus Kelly, Clifton, New Jersey, 1974), Chapter VII, First edition, (Macmillan, New York, 1930). Similarly, J. M. Keynes' position on the subject depends on the positive spread between his "marginal efficiency of capital" (Fisher's rate of return over cost) and the market interest rate for an investment project to be undertaken See A. H. Hansen, A Guide To Keynes, (McGraw-Hill, New York, 1953). Chapter 5.

[46] Edwin Kuh, Capital Stock Growth: A Microeconometric Approach, (North-Holland, Amsterdam, 1971). Second edition, Chapter 2.

litical pressure arising from the social restlessness in the country, on the other hand. From this derives the need for switching from the petroleum-based economy to a balanced economic system. The capacity creation to counteract the supply deficiency of this developing economy comes from its ability to secure enough foreign reserves from its petroleum exports, and, therefore, its capacity to import capital goods from the MDC's in order to carry on a faster development process.[47] Therefore, the purchasing power of the economy, as measured by the GDPR, and levels of private investment of previous years (inertia or persistent behaviour) should be relevant variables to explain the private investment function of the country.

2.5 THE PETROLEUM SECTOR AND THE PETROLEUM SUB-MODEL

Petroleum is an important commodity in international trade.[48] Modern economies, in particular those of the indus-

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[47] For most of the LDC's, the lack of sufficient foreign reserves becomes the main constraint to import from the MDC's the plant and equipment necessary to industrialize. See E. E. Hagen, *op. cit.*, pp. 366-371. See also H. B. Chenery and A. M. Strout, "Foreign Assistance and Economic Development," *American Economic Review*, Vol. LVI, No. 4, Part I (Sept., 1966), pp. 680-733).

[48] The statistics reveal this fact, at least up to now. And, by all accounts, it seems that this will continue for years to come until energy technology makes deep inroads to bring about mass availability and utilization efficiency of other energy alternatives that may shift quite substantially the present energy consumption structure. Petroleum resources, then, can last for as long as possible and be re-directed as an industrial raw material, which has been a strong position of the Organization of

trialized countries, have been increasingly dependent on this exhaustible source of energy as the major component of their total energy consumption mix, since long before World War II. At present, they rely heavily on petroleum to fuel their agriculture, manufacturing industries, transportation systems, and military strenth; in summary, to provide so many of the amenities of life required by the high standard of living to which their societies have become accustomed.

Since World War II, the economies of Canada, Western Europe, Japan, the U.S.A. and the U.S.S.R., have come to depend increasingly on petroleum to satisfy their thirst for fuel. Table 1 illustrates this case for the regions of our concern.

Petroleum Exporting Countries (OPEC), which in turn seems to be closer to _The Limits to Growth_ concern on exhaustion of natural resources, waste and ecological damages. See Joel Darmstadter, P.D. Teitelbaum and J.G. Polach, _Energy in the World Economy: A Statistical Review of Trends in Output, Trade and Consumption Since 1927_ (Johns Hopkins University Press for Resources for the Future, Baltimore, 1971), pp. 32-40, and Profiles Nos.: 1-2, 3-5, 18-22, 23-34, and 35-38. Joel Darmstadter, J. Dunkerley, J. Alterman, _How Industrial Societies Use Energy: A Comparative Analysis_ (Johns Hopkins University Press for Resources for the Future, Baltimore, 1977), Parts I and II. See also United Nations, _Yearbook of World Energy Statistics 1979_ (U.N., New York, 1981), Table 4, pp. 48-55, and M. B. Stoff, _Oil, War, and America Security_ (Yale University Press, New Haven, 1980), pp. 209-216. To complete the picture of such a massive use of petroleum, consequences and alternatives, see Dr. Fahhil J. Al-Chalabi, Deputy Secretary General of OPEC, 'The Concept of Conservation in OPEC Members Countries' in _Middle East Economic Survey_, Vol. XXII, No. 52, (October, 1979), pp. 21-31, and Donnella H. Meadows, D. L. Meadows, J. Randers and W. W. Behrens, _The Limits to Growth_ (Universe Books, New York, 1972), Section: Natural Resources.

TABLE 1

Coal and Petroleum in Volumes (V) and Shares (%) of Total Energy Consumption: Selected Years (Mn.bbl/d petroleum-equivalent)

REGIONS	SOURCES OF ENERGY	1960 V	1960 %	1970 V	1970 %	1973 V	1973 %	1979 V	1979 %
NORTH AMERICA:	COAL:	5.2	24.4	6.9	20.6	6.8	18.6	7.3	19.3
	PETROLEUM:	9.0	42.4	14.3	42.5	16.8	45.6	17.8	47.3
WESTERN EUROPE:	COAL:	7.2	65.2	5.9	32.5	5.1	25.0	5.0	23.4
	PETROLEUM:	3.2	29.2	10.2	56.1	12.0	58.4	11.6	54.4
LATIN AMERICA:	COAL:	.1	8.1	.2	5.4	.2	4.7	.3	5.7
	PETROLEUM:	1.3	76.2	2.4	73.1	3.1	73.6	3.8	72.1

Source: Computed from The United Nations *Yearbook of World Energy Statistics 1979*, (U.N., New York, 1981), pp. 48-55. Japan has very little coal of its own and must import all the petroleum it consumes, about 6 Mn.bbl/d. See also footnote 40 above.

These economies, North America and Western Europe, together, as well as individually, more than doubled their gross domestic products during the past twenty years, growing from \$1056.5 Bn. in 1960 to \$2132.0 Bn. in 1979, in constant 1968 prices. Their respective populations were 244 and 316 Mn. people at the end of 1979. Meanwhile, Latin America with a higher population of about 359 Mn. people, in mid 1979, moved from about $100 Bn. to $280 Bn., within the same period.[49]

In summary, the industrial countries consumed an annual average of about 85 percent of world petroleum production and an approximately equal percentage of the exports of the Organization of Petroleum Exporting Countries (OPEC),[50] during the decade of the 1970's.

2.5.1 A Petroleum-Based Economy

Petroleum is the life-blood of the Venezuelan economy. It contributes directly about one-third of the gross domestic product of the country, about 76 percent of all the govern-

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[49] The Organization for Economic Co-operation and Development (O.E.C.D.), National Accounts 1981 (U.N., Paris, 1981), pp. 84-86, provided the gross domestic products and populations for North America and Western Europe. The Economic Commission for Latin America (E.C.L.A.), Statistical Yearbook for Latin America 1979 (U.N., New York, 1980), pp.124-125, provided the gross domestic product, at factor cost, while its population for mid-1979 was obtained from the United Nations, 1979 Demographic Yearbook (U.N., New York, 1980), pp. 157-159.

[50] Petroleum & Energy Intelligence Weekly Inc., Petroleum Intelligency Weekly, various issues, December 1979-March 1980, Middle East Petroleum and Economic Publications, Middle East Economic Survey (Cyprus, October 1979). See also M. Field, 100.000.000 Dollars A Day (Sidgwick & Jackson, London, 1975), Chapter 3.

As a matter of general information, we provide here a short note on OPEC: The Organization was founded in 1960 by Iran, Iraq, Kuwait, Saudi Arabia and Venezuela. Through the leadership of its Minister of Mines and Hydrocarbons, Dr. Pedro Pablo Perez Alfonzo (the 'father of OPEC'), Venezuela convinced the Arab countries to join in ment tax revenues, in constant 1968 prices, and almost all the foreign exchange received through its exports, which accounts for an annual average of 93 percent of total exports during the sample period 1950-1979 and an annual average of 95 percent for the last six years of the 1970's. Although the direct employment capacity of the petroleum sector is low[51] (about 1.3 percent of the labour force), its indirect contribution to overall employment must be relatively higher. The petroleum tax revenues are channelled back into the economy by the government expenditures on investment, according to the economic policy on development designed by the Central Planning Office (Cordiplan), in both the productive sector via the State corporations (which include the iron, steel and aluminum industries, other mines, hydropower, petrochemical industries, etc. The petroleum industry generates its own funds for investment expansion), and the social sector via investment on infrastructure and human

the efforts to create a kind of organization capable of confronting, with one voice, the economic power exercised by the 'petroleum majors' at home and abroad. The main concern of OPEC has always been to maximize profits of its exhaustible petroleum resources through higher economic and social development for its members, without jeopardizing the well-being of its trading partners. Qatar joined in 1961 and Libya and Indonesia joined in 1962. Much later Abu Dhabi, Algeria and Nigeria entered in 1967, 1969 and 1971, respectively. Ecuador and Gabon were the last two members to join in 1973.

[51] The employment capacity of a capital-intensive industry is always low. However, it must be borne in mind that the petroleum industry is a particular case of capital-intensiveness due to its intrinsic technical nature and not to any other preconceived economic or otherwise designed policy of man.

capital investment (education, training and health), housing and other social services; and, finally, government consumption in goods and services in general. Both government expenditure components have their expansionary economic effects on the economy. Simultaneously, the private sector will also exert its economic expansion via its own investment and consumption components.

In the case of Venezuela, the link between the economic development policy and the petroleum activity comes from the outside, not from within, which implies that petroleum affects the domestic economic development with the resources it brings in from abroad, in particular from the industrialized countries. Therefore, the heavy investment policy of the State for shifting the economy from the present natural resource base to a diversified economy is financed through these petrodollars.

2.5.2 The Specification of the Sub-model

Most energy studies dealing with consumption relate energy demand to variables that seem most susceptible to economic influence, such as production and prices, population and economic growth.[52]

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[52] Joel Darmstadter, J. Dunkerley and J. Alterman, *op. cit.*, pp. 1-3, and Robert S. Pindyck, *The Structure of World Energy Demand* (MIT Press, Cambridge, Massachussetts, 1979), Chapters 1,3, and 5-8.

We shall follow a close path with this hypothesis. However, we shall not be directly concerned with the energy demand of the main trading partners of Venezuela, but rather with the ability of Venezuela to export energy.

From all the above consideration, we attempt to specify a petroleum sub-model that takes into account the most relevant economic variables that may affect the export or supply of petroleum from Venezuela. The model rests on the following assumptions: 1) Venezuela is a reliable supplier of petroleum (about 2 Mn. Bbl/d since 1974; see XOQ in Appendix C), 2) There exists an excess demand for the domestic supply abroad, and 3) Energy alternatives are at a starting point of development. The ability of Venezuela to supply petroleum is affected by: a) An increasing economic growth of the importing region, b) The total energy consumption requirement of same region, c) The domestic Venezuelan price relative to Venezuelan international price of petroleum, d) The pressure from domestic energy consumption.

The equations of this sub-model follows the above specification and the form of (I), that is,

(2.2) $XTOR(j,t) = a + b\ Z(1,t) + \dots + k\ Z(m,t)$

where, (t) refers to the sample period: 1960-1979.

XTOR(j) refers to petroleum exports in constant 1968 bolivares for each region j (j = NA, WE, LA). The Z(i) refer to m (i = 1,...,m) explanatory variables of each equation and region concerned, according to the general hypotheses: (a)-(d) applied to (2.2).

As shown in Table 2, and as an illustration, we have allocated the Venezuelan petroleum exports, in constant 1968 bolivares, in three major regions, for the years 1960, 1970, 1973, 1975 and 1979:

TABLE 2

Venezuelan Petroleum Output and Export to North-America, Latin-America and Western Europe in Mn. bbl/d. Selected Years:

REGIONS	1960	1970	1973	1975	1979
VENEZUELA OUTPUT:	2.85	3.71	3.37	2.35	2.36
NORTH AMERICA:	1.42	2.10	2.12	1.36	1.33
LATIN AMERICA:	.56	.77	.67	.45	.37
WESTERN EUROPE:	.52	.52	.35	.27	.34

<u>Source</u>: Computed from Ministerio de Energia y Minas *Petroleo y Otros Datos Estadisticos*, (Caracas, 1979), p. 107.

North America (NA), is composed of the United States of America (USA) and Canada, the major trading countries. NA imported about 57 percent of Venezuelan production, in the

1970's; also in the 1970's, Latin America (LA), excluding Cuba, became the second important region with an import of 19 percent, and, finally, Western Europe (WE), here defined as the members of the European Economic Community plus Norway, Portugal, Sweden and Spain, imported about 13 percent, in the 1970's.

The rest of the World imported 1.2 percent, during the same period, and the balance of about 10 percent was consumed by Venezuela.

2.5.3 Export Analysis

The specification of this sub-model allows us to go one step further.

The increasing economic dependence that Venezuela holds on petroleum exports to its industrialized trading partners (the counterpart market for the imports of capital and intermediate goods) presents a high degree of vulnerability for the continuing economic development process to which the country has committed itself. While keeping in mind that political forces abroad are a real threat, in particular when there exists an excess petroleum supply and retaliatory measures may be taken for one reason or another, we consider here that economic market forces are the only determinants of world demand for Venezuelan petroleum. We should, then, look at the behaviour of these trading partners under economic growth fluctuations at home and changes of petroleum prices, production and consumption in Venezuela. Certainly, fluctuations in these variables must have some economic impact on Venezuela. Then, it is desirable to analyze the response that changes in gross domestic product and imported petroleum prices in the industrialized economies in particular may have on their petroleum imports, as well as to consider to what extent Venezuela may influence such imports through domestic energy policy.[53] This shall be done by a demand analysis via the concept of elasticity. Thus, having a function such as (2.2), the import elasticity with respect to Z(1) is defined as:

$$(2.3)\quad E(1) = (\partial XTOR/XTOR)/(\partial Z/Z)$$
$$= (\partial XTOR/\partial Z)(Z/XTOR) = n(Z/XTOR),$$

where 'n' is the estimated slope of (2.2) above.

[53] Clearly, fluctuations of key variables, in particular continuous GDPR growth and petroleum price increases, would have a strong effect on the industrial demand for energy. Such an effect, however, will depend not only on the substitutability of petroleum within the structure of the present energy mix, but also on the restructuring of the present fuel fed industrial systems. This implies two related energy technologies, one geared to alternative energy resource production, economically and environmentally acceptable to society, and the other directed to a new capital transformation of plants and equipments capable of utilizing the new energy sources. All these considerations are condensed in our assumption (3) above. Venezuela, being a reliable supplier, will always be able to find markets for its exports.

A more convenient elasticity is one which is always constant. In econometrics and in particular in the case of energy, the double-logarithmic form of (2.2), which refers here to natural logarithm, produces constant elasticities of easy estimation and interpretation and, furthermore, gives a better goodness of fit than any other form.[54]

In our specific case, we shall be dealing with income and price elasticities of the petroleum importing regions (NA, WE and LA) as responses to changes in their gross domestic products and Venezuelan petroleum prices. We shall also be considering the respective elasticities to Venezuela's petroleum production, consumption and domestic prices as a behavioural import response to Venezuelan energy policy.

2.6 THE IMPORT SECTOR

The import side of the foreign trade sector has been growing relatively faster, in real terms, than both the gross domestic product and the exports from the petroleum sector, during the past thirty years of the sample period of this study.

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[54] These findings are discussed by S.J. Prais and H.S. Houthakker, The Analysis of Family Budgets (Cambridge University Press, London, 1955), Second edition, 1971, pp. 87-103. Among the five Engel curve forms of the demand functions under their analysis, the double-logarithmic form produced the best results with respect to expenditures on fuel and lighting (p.99). See H.S. Houthakker, 'New Evidence on Demand Elasticities', Econometrica, Vol.33, No.2 (April, 1965), pp. 277-288. See also Michael D. Intriligator, op. cit., pp. 217-225 and 496-499.

Petroleum is by all accounts the only export commodity on which the country depends to finance its massive imports of both capital goods, as well as intermediate goods, required by its industrialization programs, and consumer goods to supplement the still low productive capacity of the domestic economy in order to meet the excess demand for consumer goods. Expressed in constant 1968 prices, these imports increased at an average annual rate of 8.8 percent in the 1950's, declining to 5.2 percent in the 1960's, but increasing quite rapidly in the following 1970's to a higher level of 9.3 percent. The overall average annual rate of increase of imports was 7.2 percent for the three decades, while petroleum exports and gross domestic product, both in real terms, also increased continuously but at lower rates of 5.7 percent and 6.0 percent, respectively, during the said period. Furthermore, the percentage shares of imports over petroleum exports increased from an average of 79.4 percent in the 1950's to an average of 92.5 percent in the 1970's. We can also observe in Table 3 that the share of imports over petroleum exports, after declining at an average annual rate of 12.5 percent until 1974, with respect to the 1971 level, (due mainly to the fast growing petroleum prices of those years), rose continuously at an extraordinary average annual rate of 28.2 percent until 1978, when it reached its highest share level of 159 percent then declined again in 1979, remaining nevertheless at a high level of 105.1 percent.

TABLE 3

Percentage Shares of Imports from Petroleum Exports and Gross Domestic Product: 1950-79

YEAR	MTR (1)	XTR (2)	XTOR (3)	GDPR (4)	SHARES (1)/(2) (%)	(1)/(3) (%)	(1)/(4) (%)
	(in billions Bs.)(*)						
1950	2.94	4.41	4.24	13.49	66.67	69.34	21.79
1951	3.18	4.73	4.53	15.06	67.23	70.20	21.12
1952	3.77	5.11	4.81	16.16	78.78	78.38	23.33
1953	4.05	5.34	5.01	17.16	75.84	80.84	23.60
1954	4.27	5.84	5.47	18.81	73.12	78.06	22.70
1955	4.49	6.61	6.19	20.48	67.93	72.54	21.92
1956	5.40	7.50	7.00	22.65	72.00	77.14	23.84
1957	7.11	8.83	8.15	25.28	80.52	87.24	28.12
1958	6.88	7.98	7.26	25.61	86.22	94.77	26.84
1959	6.86	8.46	7.59	27.63	81.09	90.38	24.83
(1950-59)	(8.8%)	(6.7%)	(6.0%)	(7.4%)	(74.4%)	(79.4%)	(23.8%)
1960	5.13	9.04	7.78	28.73	56.75	65.94	17.86
1961	5.52	9.91	9.06	30.18	55.70	60.93	18.29
1962	6.00	11.13	10.24	32.91	53.91	58.60	18.23
1963	5.76	11.68	10.74	35.17	43.32	53.63	16.38
1964	7.49	12.06	10.26	38.59	62.11	73.00	19.41
1965	8.44	12.29	11.42	40.86	68.67	73.90	20.66
1966	7.76	11.68	10.78	41.81	66.44	71.99	18.56
1967	8.20	12.25	11.19	43.49	66.94	73.28	18.85
1968	9.06	12.32	11.43	45.76	73.54	79.26	19.80
1969	9.33	12.47	11.39	47.47	74.82	81.94	19.65
(1960-69)	(5.2%)	(3.3%)	(3.9%)	(5.3%)	(62.8%)	(69.3%)	(18.8%)
1970	9.74	12.76	11.52	50.92	76.33	84.55	19.13
1971	10.16	14.25	13.15	52.46	71.30	77.26	19.36
1972	11.04	15.25	13.94	54.17	72.39	79.20	20.38
1973	11.26	19.77	17.52	57.47	57.00	64.27	19.59
1974	11.71	26.73	25.47	60.98	43.81	45.98	19.20
1975	16.19	21.20	20.05	64.59	76.37	80.75	25.07
1976	19.65	21.83	20.57	70.02	90.00	95.53	28.06
1977	27.28	21.51	20.52	74.80	126.80	133.00	36.47
1978	29.52	19.52	18.57	77.16	151.23	159.00	38.26
1979	23.64	23.91	22.49	77.73	99.00	105.11	30.41
(1970-79)	(9.3%)	(6.5%)	(6.9%)	(4.3%)	(86.4%)	(92.5%)	(25.6%)
(1950-79)	(7.2%)	(5.8%)	(5.7%)	(6.0%)	(74.5%)	(80.3%)	(22.7%)

<u>Source</u>: Banco Central de Venezuela, <u>Informe Economico</u> (Caracas, 1960, 1965, 1969, 1970); <u>Memoria</u> (Caracas, 1958).
(*) Total imports (MTR), total exports (XTR), total petroleum exports (XTOR) and gross domestic product (GDPR) are all deflated by the gross domestic product implicit deflator.

Similarly, the percentage share of imports over real gross domestic product increased from an average of 23.8 percent in the 1950's to an average of approximately 25.6 percent in the 1970's. The second half of the 1970's shows the highest percentage shares of imports over gross domestic product, climbing from an average share of about 19.5 percent in the first half of the decade to 31.6 percent in the second half, in which 1977 and 1978 show the highest levels of 36.5 percent and 38.3 percent, respectively.

We have said above that imports grew at a lower average annual rate of 5.2 percent in the 1960's than the 8.8 percent registered in the 1950's. In fact, imports did decrease in the period 1960-63 at an average yearly rate of 3.4 percent relative to the level of imports of 1959. This behaviour of imports appears to have been due to the following circumstances: (1) Because of the petroleum income tax rate increase from 28 percent to 47 percent on net profits in 1959,[55] the profitability of the petroleum business declined and thus, so did the inflow of foreign petroleum capital, (2) The decline of petroleum prices, since 1959, brought in less foreign exchange per barrel of petroleum exported,[56] (3) The new import-substitution policy imposed

[55] Mostafa F. Hassan, 'The Fiscal Obligations of the Oil Industry in the Middle East', '<u>Middle East Economic Report</u>,' NO. 2, (May, 1960). The 50-50 profit-sharing agreement was raised to 60-40 in favour of the State.

[56] This deterioration of the price of a natural resource of a developing economy seems to give support to Dr. Raul Prebisch's thesis. We can observe here that, while the

barriers which contributed to the reduction of imports, and (4) The political unrest and the lack of credibility of the newly elected democratic government created a climate of economic risk in the country.[57]

2.6.1 The Terms of Trade

The expression 'terms of trade' or its equivalent 'net terms of trade' refers to the ratio of export unit value indexes over the corresponding import unit value indexes. In Table 4,

we can find that Venezuelan export prices increased at an average annual rate of 3.14 percent during the period 1950-57. Expressed in 1968 bolivares, exports doubled dur-

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price of petroleum declined in the 1960's, the opposite happened to the prices of industrial imports, causing a depressing effect in the distribution of wealth from Venezuela to the industrialized countries, from where most of these imports come from, as Venezuela had to export more petroleum in order to import the same volume and quality of commodities as previously. This is equivalent to say that the terms of trade (the ratio of the unit value of export over the unit value of import) was not favourable to Venezuela, which had to transfer excess natural resources abroad for just nothing in exchange, retarding the process of the economic development of the country. See Raul Prebisch, 'Commercial Policy in the Underdeveloped Countries,' 'American Economic Review, Papers and Proceedings,' (May, 1959) and 'Towards a New Trade Policy for Development,' 'A Report by the Secretary General of the Conference,' (United Nations Conference on Trade and Development, New York, 1964) See also Hans Singer, 'The Distribution of Gains Between Investing and Borrowing Countries,' 'American Economic Review' (May, 1950)

[57] We refer here to Romulo Betancourt's government, founder and mentor of the social democratic party 'Accion Democ-

TABLE 4

The Terms of Trade of Venezuela, Gross Fixed Investment (ITGR) in Bn. Bs. and as a Share of Gross Domestic Product (GDPR): 1950-1979

YEAR	UNIT VALUE INDEXES X(%)	UNIT VALUE INDEXES M(%)	TERMS OF TRADE (%)	QUANTUM OF EXPORT	CAPACITY TO IMPORT	ITGR (Bn. Bs.)	ITGR/GDPR (%)
1950	109.5	61.1	179.2	35.8	64.1	5.05	37.6
1951	109.9	66.9	164.3	38.4	63.1	5.37	35.9
1952	114.9	69.8	164.6	41.5	68.3	6.74	42.0
1953	123.5	70.0	176.4	43.3	76.5	7.40	43.4
1954	125.2	72.4	172.9	47.4	82.0	8.46	45.2
1955	125.1	71.9	174.0	53.6	93.3	7.99	39.2
1956	126.2	77.1	163.7	60.9	99.6	8.66	38.4
1957	140.2	84.5	165.9	71.7	118.9	9.20	36.6
1958	134.3	84.4	159.1	64.8	103.1	9.12	35.8
1959	119.7	99.5	120.3	68.7	82.6	9.39	34.1
1950-59						(6.4%)	(38.8)
1960	115.0	101.5	113.3	73.4	83.1	7.31	25.6
1961	115.2	102.2	112.7	80.4	90.7	6.22	20.7
1962	111.9	107.1	104.5	90.3	94.4	6.49	19.8
1963	108.9	97.1	112.1	94.8	106.3	6.66	19.0
1964	104.4	93.2	112.0	97.9	109.7	8.01	20.9
1965	101.8	99.8	102.0	99.8	101.7	8.60	21.1
1966	100.3	95.4	105.1	94.8	99.7	8.78	21.1
1967	99.5	95.4	104.3	99.4	103.7	9.08	21.0
1968	100.0	100.0	100.0	100.0	100.0	10.38	22.8
1969	97.0	101.8	95.3	101.2	96.4	10.31	23.0
1960-69						(3.5%)	(21.5)
1970	102.0	113.0	90.3	103.6	93.5	10.95	21.5
1971	120.5	126.3	95.4	115.7	110.4	12.29	23.4
1972	123.3	145.0	85.0	123.8	105.2	14.14	26.1
1973	179.9	166.2	108.2	160.5	173.7	15.49	26.9
1974	424.5	243.8	174.1	217.0	377.8	15.13	24.8
1975	337.5	349.5	96.6	172.1	166.2	18.99	29.4
1976	357.0	445.8	80.1	177.2	141.9	24.37	34.8
1977	366.9	641.8	57.2	174.6	99.8	31.43	42.0
1978	352.9	696.6	50.7	158.4	80.3	32.28	41.8
1979	543.9	674.9	80.6	194.1	156.4	27.04	34.8
1970-79						(9.5%)	(30.6)

Source: Computed from Banco Central de Venezuela, La Economia Venezolana en los Ultimos Treinta Años, (Caracas, 1971), p. 303., and La Economia Venezolana en los Ultimos Treinta y Cinco Anos! (Caracas, 1978), p. 177; Informe Economico (Caracas, 1969), p. A-159, and *Informe Economico*, (Caracas, 1979), p. A-394 and pp. A-212-215. X% and M% refer to export and import unit value indexes, respectively.

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ing that period as the demand for petroleum rose in the industrialized North-America and Western Europe, which was also assisted by the Suez Canal crisis in 1956, when the petroleum supplies from the Middle East were reduced. The percentage unit value index of exports (X%) showed continuous price increases, moving from about 110 percent in 1950 to 140 percent in 1957; but because import prices were rising faster than those of exports, that is at an average annual rate of 4.14 percent compared to 3.14 percent for exports, the terms of trade deteriorated somewhat during that period. However, the 'income terms of trade' or, equivalently, the 'capacity to import', which we define here as the product of the value index of the terms of trade by the quantum of exports, increased at an average of 7.52 percent throughout the period. These, amongst other factors, explain how Venezuela was able to increase its import commodities at the average annual rate of 11.7 percent during that

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ratica', freely elected President of Venezuela for the five year term 1958-63. Mr. Betancourt became the first President to have completed his term and to have handed over the government to another elected President in 1964. Although his government tried on its own merits to bring about a policy of economic and social change within a comprehensive political policy of national unity, he was unable to placate the economic nationalism and social justice cries of the radical opposition which, afterwards, engaged the government in guerilla warfare, during the period 1960-63.

period. It must be added that although the capacity to import declined in the following years, there were foreign exchange surpluses,[58] which were used to supplement the budgets of 1958-1959 and, therefore, import growth still remained at a high rate of 8.3 percent per year with respect to the level of imports of 1956.

From 1958 up to 1970, export prices declined, relative to the high levels of 1957, and, consequently, the high capacity of the country to import was reduced. In fact, while export prices declined at an average annual rate of 2.0 percent, import prices climbed at a rate of 2.27 percent, indicating that the terms of trade deteriorated at an average annual rate of 4.27 percent in that period. Therefore, in the 1950's and in the 1960's, the continuous increases of import prices, relative to those of exports, had depressing effects on the terms of trade of Venezuela and, thus, in its capacity to import, forcing the country to expand its petroleum exports in order to meet its economic requirements. In fact, during those twenty years, the volume of petroleum exports increased substantially from 1.5 million bbl/d in 1950 to 2.8 millions bbl/d in 1957, then to 3.5 millions bbl/d in 1965 and 3.6 millions bbl/d in 1969.

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[58] These surpluses were accumulated because of the increases in petroleum prices in 1950-57 and the extensive sale of petroleum concessions in 1956 and 1957. See Mostafa F. Hassan, 'Capital Flight: Venezuela 1958-1960', Inter-America Economic Affairs, (Autumn, 1963), pp. 53-73. See also International Monetary Fund, International Financial Statistics, (Washington, 1961, 1970, 1979).

Venezuela was able, then, to almost double its capacity to import from 1950 to 1957 (see Table 4), but for the reasons expressed above this capacity to import was reduced in an irregular pattern from 1958 to 1970. This scenario changed drastically in the 1970's. The volume of exports, which since 1950 had risen continuously, began to decline in 1971 at a time when petroleum prices had already started to climb. The first increases were registered in 1970, but it was in 1973 and 1974 that petroleum prices jumped quite sharply, remaining relatively stable during the following four years to climb again in 1979. However, because import prices rose more rapidly than those of exports, that is at an average annual rate of 19.6 percent against 18.2 percent during the decade, the terms of trade did not improve as could have been expected, except in the 1973-74 period. Nevertheless, the capacity to import did improve beginning in 1971 and, after declining the following year, jumped to the highest level ever in 1973 and 1974, decreasing afterwards until 1978. The capacity to import improved again with the new petroleum price increases of the following year 1979.

Despite the fact that Venezuela has to pay out large amounts of foreign exchange resources to foreigners, the country has been able to maintain a high capacity to import in order to meet its import-substitution industrialization requirements, as well as to supplement via imports the equally high demand for consumer and intermediate goods, contributing to an increase in the productive capacity of the economy, relatively stable prices and a stable and strong Venezuelan currency during the past thirty years.

From the above, we may conclude that Venezuela, unlike other Latin-American or, for that matter, many other developing economies, has enjoyed a much better scenario with respect to its terms of trade position. As a petroleum export-oriented economy, Venezuela has enjoyed far more stable prices and volumes of exports than those countries exporting other primary products. However, we should keep in mind that, for the 1968-79 period, the behaviour of the terms of trade has been one of a declining trend, interrupted only by the sudden and large jump in petroleum prices in 1973-74 period, but declining even faster during the second half of the 1970's at a yearly compounded average rate of about 15 percent, excluding 1979. This general trend of deterioration of the terms of trade has affected the capacity to import of the country (or income terms of trade), during which period, although improved to high annual levels, has shown a deteriorating trend since 1973, excluding the 1974 and 1979 years when petroleum prices rose to abnormal levels. During this period, import commodity prices rose at an average annual rate of 18.8 percent against 1.2 percent for real petroleum exports.

The terms of trade, as defined above (i.e., the ratio of export to import unit value indexes), seems to give support to Dr. Raul Prebisch's argument, as we have already mentioned. First, developed economies control technology, the market commodities and the financial centers, and, therefore, are able to increase the prices of their capital and manufactured export goods to developing economies, almost regardless of their gain from efficiency through new technology and skills; and second, because of the monopoly power of the industrialized economies and the low elasticity of demand for the primary products of the developing economies, the former economies can affect effectively the export prices of the latter. This situation has forced Venezuela to pursue an import-substitution industrialization policy during the past twenty years while advocating a new world economic order.

2.6.2 The Balance of Payments

The previous sections dealt with the relationships associated with Venezuela's international trade, that is, values and quantities of exports and imports of commodities, their constant 1968 prices, the terms of trade and the corresponding income terms of trade or capacity to import of the country.

Here we are concerned with the contributions that the petroleum sector, and the non-petroleum sector as well, have made on the economic development of Venezuela through its balance of payments.

We observe that by engaging in world trade, the Venezuelan currency, the bolivar, must be exchanged at a given rate against foreign currencies, which for all intents and purposes refer to the United States' dollar.[59] Exports, as well as other transactions, bring in foreign exchange which is sold (and bought) against the bolivar in the foreign exchange market to cover the costs of imports and other international payments. These receipts and payments are the concern of the balance of payment accounts, which is nothing more than entries recorded in the national accounts, usually for yearly periods.

The balance of payments consists of the 'current account,' which measures the values of the commodity movements, and the 'capital account' and the 'official monetary transactions,' which measure the monetary movements.

Table 5 shows the balance of payments contributions of the petroleum sector and the non-petroleum sector, in terms of the accounts mentioned above and in millions of current US dollars.

Dividing our period of analysis in three decades, we observe in Table 5 that during the 1950's the current account reached its highest level in 1957, declining afterwards till

[59] The bolivar has behaved as a very stable and strong currency, but because of the capital flight and the lack of confidence in the political environment prevailing in the country during Romulo Betancourt's government, between the 1958 and 1968 term period, the bolivar was devalued to a fixed rate from US$.311 to US$.230 per bolivar since 1964, allowing, of course, for marginal fluctuations in market conditions.

TABLE 5

The Balance of Payments of Venezuela: 1950-59 (in millions of dollars of the USA)

ACCOUNTS (*)	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
CURRENT ACCOUNT:										
<u>Petroleum Sector</u>:										
a)Exports	1124	1297	1384	1445	1600	1841	2162	2688	2419	2257
b)Imports	-76	-126	-208	-179	-139	-141	-152	-416	-219	-143
c)Other	-416	-447	-448	-482	-539	-685	-932	-1155	-758	-605
d)Balance:	632	724	728	784	922	1015	1028	1117	1442	1509
<u>Non-Petroleum Sector</u>:										
a)Exports	41	50	68	69	73	63	49	63	53	60
b)Imports	-544	-580	-602	-686	-818	-846	-931	-1350	-1269	-1363
c)Other	-117	-140	-154	-191	-219	-222	-271	-413	-381	-392
d)Balance:	-620	-670	-688	-808	-964	-1005	-1153	-1700	-1597	-1695
BALANCE CURRENT ACCOUNT:	12	54	40	-24	-42	10	-125	-583	-155	-186
CAPITAL ACCOUNT										
a)Balance:	-92	-48	30	69	41	38	546	1084	-230	-181
MONETARY MOVEMENT:	80	-6	-70	-45	1	-48	-421	-501	385	367
MONETARY RESERVES:	315	321	391	436	435	483	904	1405	1020	653

<u>Source</u>: Computed from Banco Central de Venezuela, <u>Memoria</u> (Caracas, 1958) and <u>Informe Economico</u> (Caracas, 1960, 1969, 1979).

(*) refers to 1) The Petroleum Sector includes the iron sector and 'Other' refers to investment incomes and services, 2) The minus sign of the 'Monetary Sector' refers to additions to international monetary reserves, 3) 'Monetary Reserves' refers to international monetary reserves, and 4) The 'Capital Account' includes errors and omissions.

the end of the decade. During that period, the balance of the petroleum sector current account more than doubled, which implies that its surpluses increased at an average annual rate of 9.1 percent, while the rest of the economy (the non-petroleum sector) showed growing deficits at a faster average annual rate of 10.6 percent. These deficits were covered by the petroleum sector surpluses of both the current account and the capital accounts.[60] As petroleum prices decreased in the 1960's, the average annual rate of growth of the petroleum sector receipts, as shown in Table 6, reached its lowest level at .3 percent against 7.2 percent of the previous decade.

However, the balance of the petroleum trade account shows larger but declining surpluses of foreign exchange than in the 1950's, while the non-petroleum sector shows a similar erratic behaviour of its receipts, as previously, but a much slower average annual rate of 3.5 percent of growth for its imports than the 9.6 percent rate in the 1950's, due mainly to the import-substitution policy of that decade. Once again, the large amounts of foreign exchange accumulation by the petroleum sector more than offset the deficits of the non-petroleum sector for that period.

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[60] The net inflow of capital together with the increasing values of petroleum exports, during the period 1947-1957, allowed Venezuela to accumulate the largest surpluses of foreign exchange in Latin-America. See International Monetary Fund, _International Financial Statistics_ (Washington, 1952, 1961, 1980).

TABLE 6

The Balance of Payments of Venezuela: 1960-69 (in millions of dollars of the USA)

ACCOUNTS (*)	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
CURRENT ACCOUNT:										
<u>Petroleum Sector</u>:										
a)Exports	2333	2401	2482	2395	2427	2383	2282	2379	2397	2306
b)Imports	-90	-57	-110	-107	-73	-69	-54	-59	-97	-99
c)Other	-516	-586	-660	-633	-717	-746	-714	-725	-681	-638
d)Balance:	1727	1758	1712	1655	1634	1568	1514	1595	1619	1569
<u>Non-Petroleum Sector</u>:										
a)Exports	51	51	61	71	54	53	60	82	78	217
b)Imports	-1043	-1082	-1074	-959	-1151	-1264	-1235	-1269	-1477	-1530
c)Other	-337	-331	-338	-308	-329	-392	-391	-449	-445	-485
d)Balance:	-1329	-1362	-1351	-1196	-1426	-1603	-1566	-1636	-1844	-1798
BALANCE CURRENT ACCOUNT:	398	396	361	459	208	-35	-52	-41	-225	-229
CAPITAL ACCOUNT										
a)Balance:	-505	-416	-364	-301	-111	22	102	142	279	238
MONETARY MOVEMENT	107	20	3	-158	-97	13	-50	-101	-54	-9
MONETARY RESERVES:	546	526	523	681	778	765	815	916	970	979

<u>Source</u>: Computed from Banco Central de Venezuela, <u>Memoria</u> (Caracas, 1958) and <u>Informe Economico</u> (Caracas, 1960, 1969, 1979).

(*) refers to 1) The Petroleum Sector includes the iron sector and 'Other' refers to investment incomes and services, 2) The minus sign of the 'Monetary Sector' refers to additions to international monetary reserves, 3) 'Monetary Reserves' refers to international monetary reserves, and 4) The 'Capital Account' includes errors and omissions.

The petroleum sector contributed with an average annual share of about 97 percent of all the foreign exchange earnings received by the country and with all the surpluses of the balance of payments, during the past twenty years.

The new decade of the 1970's is characterized by structural changes.

A new energy conservation policy has been put into place, partly due to the widespread awareness of society and political pressure to 'sow-the-oil', to the diminishing of proven reserves of light and medium type crude petroleum and an increase of prices. Petroleum exports were reduced at an average annual rate of decrease of 5 percent from 3.5 millions bbl/d in 1970 to 2.1 millions bbl/d in 1979, while petroleum exploration and development took place on shore and off shore. The iron and the petroleum industries were nationalized and petroleum prices, in constant 1968 prices, more than tripled, giving the state an opportunity to emphasize its industrialization policy. A glance at Table 7 shows that the petroleum sector current account receipts began increasing again in 1970 at an average annual rate of 6.6 percent until 1972, but because of the Middle East war in 1973 and OPEC's decision to increase prices, these receipts were pushed upwards to a 51.6 percent and 60.6 percent in 1973 and 1974, respectively relative to the 1972 level.

The second half of the 1970's was characterized by a recessionary economic climate beginning in 1975 in the indus-

TABLE 7

The Balance of Payments of Venezuela: 1970-79 (in millions of dollars of the USA)

ACCOUNTS (*)	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
CURRENT ACCOUNT:										
<u>Petroleum Sector</u>:										
-Exports:	2527	3049	3060	4639	11035	8768	9058	9391	8842	13812
-Imports:	-88	-85	-61	-61	-152	-186	-139	-323	-527	-644
-Other:	-483	-668	-399	-637	-813	-563	-71	-250	-213	-475
-Balance:	1956	2296	2600	3941	10070	8019	8848	8818	8102	12693
<u>Non-Petroleum Sector</u>:										
-Exports:	113	103	142	164	255	214	284	270	332	387
-Imports:	1625	-1811	-2161	-2565	-3724	-5276	-7198	-9871	-10707	-10193
-Other:	-548	-599	-682	-663	-831	-786	-1680	-2396	-3462	-3274
-Balance:	-2060	-2315	-2701	-3064	-4300	-5848	-8594	-11997	-13837	-13080
BALANCE CURRENT ACCOUNT:	-104	-11	-101	877	5770	2171	254	-3179	-5735	-387
CAPITAL ACCOUNT a)Balance:	188	467	378	-221	-1601	491	-212	3023	4205	1607
MONETARY MOVEMENT:	-84	-456	-277	-656	-4169	-2662	-42	156	1530	-1220
MONETARY RESERVES:	1023	1479	1756	2412	6584	9243	9285	9129	7599	8819

<u>Source</u>: Computed from Banco Central de Venezuela, <u>Memoria</u> (Caracas, 1958) and <u>Informe Economico</u> (Caracas, 1960, 1969, 1979). (*) refers to 1) The Petroleum Sector includes the iron sector and 'Other' refers to investment incomes and services, 2) The minus sign of the 'Monetary Sector' refers to additions to international monetary reserves, 3) 'Monetary Reserves' refers to international monetary reserves, and 4) The 'Capital Account' includes errors and omissions.

trialized world and, in consequence, Venezuelan petroleum exports were reduced even further to 2.1 millions bbl/d in 1975 from the previous level of 2.8 millions bbl/d in 1974, reducing foreign exchange receipts by 20.5 percent from the peak level of 1974. The upward turn of economic recovery in 1976 improved these conditions and the trade account receipts started to increase, dropping somewhat in 1978, but increasing quite fast at an average annual rate of 9.5 percent for the whole second half of the 1970's, reaching its highest level in 1979.

The balance of payments shows that the petroleum sector current account surpluses increased at an average annual rate of 20.6 percent for the whole decade, which represents a quite large jump relative to the -1.0 percent rate of the 1960's and the 9.1 percent rate of the 1950's. These rises in the trade account of the petroleum sector were almost matched by the extraordinary increases in import payments from the non-petroleum sector which rose at an average annual rate of 20.2 percent in the 1970's, which, if compared to the 3.9 percent and 9.6 percent average annual rates corresponding to the 1960's and 1950's respectively, implies that there was an acceleration of imports of both capital and non-capital goods. Capital goods rose at an average annual rate of 11.7 percent and non-capital goods (intermediate and consumer goods) increased even higher at a rate of 12.5 percent during the decade. Most of these extraordinary increases took place since 1975, a year after the sharp petroleum world price rises and, consequently, the balance of payments trade account of Venezuela reached its highest deficit levels ever in 1977 and 1978. But because of the surpluses in the public sector capital account, due mainly to long-term government borrowing, although declining since 1979, the overall balance of payments of the country closed those years with surpluses.[61]

In summary, we may conclude that because of the jump in petroleum prices, at a time when Venezuela decided to reduce production and exports, the current account receipts and, therefore, the petroleum exports receipts, growing at an average annual rate of 18.5 percent in the 1970's (against .3 percent in the 1960's and 7.2 percent in the 1950's), registered the highest inflows of foreign exchange ever experienced by the country, in particular, after 1973. However, the shares of petroleum exports out of total foreign exchange remained at 97 percent, as in the previous two decades, which implies that the non-petroleum sector, by keeping its own share constant at 3 percent, must have improved its export receipts as fast as the petroleum sector, exclud-

[61] It must be emphasized that PDVSA has been increasing its holdings of foreign exchange in the international markets, which by the end of 1979 more than doubled the level of 1978. The Venezuelan Investment Fund (FIV) has also been placing its funds in interest earning assets abroad. One of the arguments given is that by doing so, Venezuela is preventing a dislocation of its domestic market and a weakening of its strong national currency. See Banco Central de Venezuela, <u>Informe Economico</u> (Caracas, 1979), pp. 348-352 and A-382-383.

ing the year 1979 when the Iranian revolution started and petroleum demand rose again with another round of price increases.

All the above favorable conditions gave Venezuela the means and the opportunity to expand its real gross domestic product (GDPR) at an average annual rate of 4.3 percent during the 1970's and 4.7 percent if 1979 were excluded, the year when the GDPR in constant 1968 bolivares grew at less than 1 percent with respect to 1978. As shown in Table 8, the balance of payments of the petroleum sector current account receipts alone, as a percentage of GDPR, grew from 21.5 percent in 1970 to 42 percent in 1974, but it started to decline in 1975 from 31.8 percent to 22.2 percent in 1978.

Because of the new round of petroleum price increases in 1979, this percentage climbed to 28.2 percent in 1979 and, thus, the overall share for the decade was pushed up to 27.2 percent of the GDPR, which was superior to the 25.8 percent of the 1960's but inferior to the 31.5 percent of the 1950's.

We can also observe in Table 7 that the international monetary reserves, in US dollars, continuously increased during the decade, reaching their highest levels ever, going from $ 1 billion in 1970 to $ 8.8 billions in 1979 after experiencing a shortfall in the previous two years. The average annual rate of growth of these reserves was 24 percent

TABLE 8

The Petroleum Sector Contribution to the Balance of Payments Current Account and as Percentage of Gross Domestic Product

YEARS	CURRENT ACCOUNT RECEIPTS (in Mn. US$)		GDPC (Mn.Bs.)	SHARES (**)	
	Petroleum (1)(*)	Non-Petroleum (2)(*)	(3)(*)	(Percentages) (1)/(3)	(2)/(3)
1950	1124	41	12100	30.0	1.0
1951	1297	50	13300	31.4	1.2
1952	1384	68	14300	31.2	1.5
1953	1445	69	15140	30.7	1.5
1954	1600	73	16760	30.7	1.4
1955	1841	63	18310	32.4	1.1
1956	2162	49	20870	33.4	1.7
1957	2688	63	24400	35.5	1.8
1958	2419	53	25140	31.0	.7
1959	2257	60	25460	28.5	.8
(1950-59)	(7.2%)	(3.9%)	(7.7%)	(31.5%)	(1.3%)
1960	2333	51	26260	28.6	.6
1961	2401	51	27620	28.0	.6
1962	2482	61	30180	26.5	.6
1963	2395	71	32890	23.4	.7
1964	2427	54	36420	29.7	.6
1965	2383	53	38720	27.4	.6
1966	2282	60	40390	25.1	.7
1967	2379	82	42520	24.9	.9
1968	2397	78	45720	23.3	.8
1969	2306	217	47920	21.4	2.0
(1960-69)	(-.1%)	(15.6%)	(6.2%)	(25.8%)	(0.8%)
1970	2527	113	52310	21.5	1.0
1971	3049	103	57420	23.1	.8
1972	3060	142	61800	21.5	1.0
1973	4639	164	73480	27.1	.9
1974	11035	255	112510	42.0	1.0
1975	8768	214	118280	31.8	.7
1976	9058	284	135320	28.7	.9
1977	9391	270	155880	25.9	.7
1978	8842	332	170960	22.2	.8
1979	13812	387	210220	28.2	.8
(1970-79)	(18.5%)	(13.1%)	(14.9%)	(27.2%)	(0.9)

Source: Banco Central de Venezuela, Memoria (Caracas, 1958) and Informe Economico (Caracas, 1960, 1965, 1969, 1975, 1979). (*) Brackets in Columns (1), (2) and (3) enclose averages annual rate of growth, in current terms. (**) Shares in percentages were obtained after converting columns (1) and (2) in bolivares (Bs.), according to the foreign exchange rate (FEIC).

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for the decade, which was four times larger than the 6 percent rate of the 1960's and just over three times the 7.7 percent rate of the 1950's. Thus, with an excessive accumulation of international reserves[62] and with an even greater capacity to import than ever before, the GDPR grew at an average annual rate of 4.3 percent and unemployment declined from 9 percent in 1970 to its lowest level of 6 percent during the second half of the decade. However, the inflation which had been in check during the two previous decades, demonstrating the ability of the country to maintain prices relatively constant, began to climb rapidly in the 1970's, particularly since 1974. As imports of consumer and intermediate commodities increased substantially along with their sharp world price increases and the new tariff reforms, Venezuela experienced its highest compounded yearly rate of inflation of 6.3 percent by the end of the 1970's, going from an average of about 1.3 percent for the previous two dec-

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[62] If we consider the poverty level of Venezuela, we may think that such a huge financial fund yielding low returns as international reserves is excessive indeed. However, we have mentioned somewhere else that the Venezuelan banking system and the economy as a whole are not large and sophisticated enough to absorb these financial resources without causing serious disruptions in the economy and in the monetary flows of the country. Of course, these holdings of foreign currencies can be invested abroad; see footnotes 4 and 61.

ades.

Another important contribution of the petroleum foreign exchange receipts is in the process of gross fixed capital formation, including human capital. Investment funds do not seem to be an important constraint compared to labour specialization in this petroleum-rich country. Gross fixed investment has always been high compared to gross domestic product (GDPR) as shown in Table 4 above. For the 1950's, investment represented an average annual rate of 38.8 percent of the GDPR while growing at an average yearly rate of 6.4 percent (see ITGR in Table 4). Both of these measures of investment declined in the 1960's to a share of 21.5 percent of the GDPR and to a respectable growth rate of 3.5 percent per annum (to .9 percent relative to the investment level of 1959), but in the 1970's gross fixed investment grew faster than before at a rate of 9.5 percent with an average annual share of 30.6 percent of the GDPR. These measures of investment are indeed quite high, relative to Latin-America and some developed economies.[63]

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[63] However, it is quite doubtful that all these levels of investment are entirely productive investments. It should be kept in mind that a large portion of investment goes into the form of depreciation (from an annual average of 77% in the 1950's, depreciation declined to 65% in the 1960's and to 28% in the 1970's), which is indeed a very strong inducement to invest, but idle equipment as well as unrepaired equipment, buildings and roads are not productive investments, and they seem to account for quite a large proportion of the gross fixed capital stock of the country.

The country is endowed with huge natural resources and a young population eager to learn and to facilitate development. However, and with the exception of the petroleum sector, the economy's absorptive capacity[64] of investment is somewhat limited now, due primarily to the scarcity of labour skills and technology. These constraining factors should not be taken as a paramount limitation. Venezuela does enjoy an existing stock of labour skills and technology that, if used efficiently and in combination with foreign resources, could possibly enable the country to push its production frontier outwards, in particular that of the non-petroleum sector, thus eliminating the backwardness of some of the economic sectors of the economy. And in so doing, the Venezuelan economy would then be able to absorb ad-

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[64] John H. Adler, Absorptive Capacity: The Concept and its Determinants (The Brookings Institution, Washington, D.C., 1965), p. 1. The author defines this concept as '...that amount of investment, or that rate of gross domestic investment expressed as a proportion on gross domestic product, that can be made at an acceptable rate of return, with the supply of co-operant factors considered given.' Of course, this concept is proper for a developed economy where the aggregate supply of skills of labour and diversified technology is relatively abundant and where the pattern of investment can render a much higher rate of return. However, from the point of view of the public sector of a developing economy, these conditions cannot be accepted. The main obstacle to enlarging the absorptive capacity of investment in a developing economy is the inelasticity of supply of those 'co-operant factors' of production, which translates as a lack of managerial skills (no politicians), labour skills in various fields and entrepreneurship. Therefore, investment in human capital must be a primary objective of the state. This objective can be pursued through schooling, training and training at work. The social rate of return is of prime concern here.

ditional productive capital investment at the same time that the standard of living would improve for most of the people.[65] Table 9 seems to indicate the importance that capital accumulation holds in economic development and, hence, its relationship to the economic growth of the country.

While capital accumulation grew fast in constant terms at an average annual rate of 2.8 percent in the 1960's and 7.7 percent in the 1970's, relative to the 1969 level, we observe that capital imports increased from an average share of 26.6 percent of total imports in the 1960's to 37.5 percent in the 1970's. The opposite was the case for imports of consumer goods and intermediate and primary goods, which decreased from 31.0 and 42.4 percent in the first decade to 24.7 and 37.8, respectively, in the last. This seems to imply that the petroleum sector financing of capital imports, in particular, has been a good contribution to economic growth throughout that period.

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65. Republica de Venezuela, '_V Plan de la Nacion_' (Gaceta Oficial No. 1860 Extraordinario, Caracas, Marzo 11, 1976). See Diagnosis and Strategy for Development.

TABLE 9

Percentage Composition of Imports in Venezuela: 1959-79

YEAR	CONSUMER GOODS	INTERMEDIATE AND PRIMARY GOODS	CAPITAL GOODS
1959	34.5	34.3	31.2
1960	35.4	38.3	26.3
1961	37.8	38.8	23.4
1962	34.1	42.9	23.0
1963	32.2	42.3	25.5
1964	31.3	43.3	25.5
1965	29.5	43.7	26.8
1966	27.9	42.3	29.8
1967	27.7	43.9	28.4
1968	28.4	43.0	28.6
1969	26.4	45.1	28.5
(1960-69)	(31.0)	(42.4)	(26.6)
1970	24.5	40.4	35.1
1971	23.1	37.2	39.7
1972	23.1	35.9	41.0
1973	21.5	37.5	41.0
1974	29.9	41.4	30.7
1975	26.4	39.1	34.5
1976	23.9	36.7	39.4
1977	25.7	32.7	41.6
1978	24.5	36.1	39.4
1979	25.1	41.2	33.7
(1970-79)	(24.7)	(37.8)	(37.5)

Source: Computed from Banco Central de Venezuela *La Economia Venezolana en los Ultimos Treinta Anos* (Caracas, 1971) and *Informe Economico* (Caracas, various years)

2.6.3 Import-Demand Analysis

As in the case of the export sector of Subsections 2.5.2 and 2.5.3 above, we are also concerned with those changes in the economic market affecting the quantities and prices of commodities imported into Venezuela. Then, in building an import model for the case at hand, we should, on a priority basis, take the following into account: 1) The high capacity to import which the country has been showing at least since 1950 has depended in its entirety on the ability of Venezuela to be a reliable supplier of petroleum to its major trade partners. 2) The import-substitution industrialization process undertaken by the country early in the 1960's has become a driving force for the expansion of imports of capital and intermediate goods (including some raw materials), in particular, to further improve the productive capacity of the domestic economy and, in so doing, to continue the process of import-substitution of consumer goods and basic capital goods. 3) The Venezuelan import market was dominated, during the decade of the 1970's, by North-America with a percentage share of 48 percent, of which the USA is accountable for the largest portion (44.5 percent), while Canada holds the balance of 3.5 percent. The second dominant region is Western Europe (WE) with 32.1 percent, followed by Japan with 9 percent and lastly Latin-America with 8 percent during the same period. And, lastly, 4) The rate of foreign exchange of the bolivar against the USA dollar is fixed, while the dollar is allowed to float against the major European and Japanese currencies, which have been appreciating against a declining dollar and, therefore, against the bolivar, in particular since 1971 and 1973, when the dollar was devalued,[66] thus affecting the composition of Venezuelan imports by country and/or region.[67]

Therefore, an import model for Venezuela should really take into account the above characteristics of its import market. Then, we consider that petroleum exports and/or gross domestic product, as income variables, must be important determinants of imports for they reveal the purchasing power ability of the domestic economy to absorb the expanding import streams, according to the strategy for industrialization of the state. However, we should keep in mind that an ingredient of the import-substitution industrialization policy is the ability of the economy to generate sufficient savings, whose rate depends on the acceleration of the strategy plan that may imply curtailment in the consumption

[66] This refers to the major currencies crisis in 1969-1970 which brought on the end of the Bretton Woods era. On the 15th. of August, 1971, President Richard Nixon suspended the convertibility of the dollar into gold or any other reserve assets. See Gordon F. Boreham, Eli Shapiro, Ezra Solomon and William White, Money and Banking: Analysis and Policy in a Canadian Context, (Holt, Rinehart and Winston, Inc., Toronto, 1979), Second Edition, pp. 830-833.

[67] While North-America held the largest annual share of Venezuelan imports (48%), followed by Western Europe (32.1%) in the 1970's, we observe that the USA share has been growing more slowly than that of Canada, 18.8% vs. 20.4%, while Western Europe has been trailing the USA with 17.6%. This appears to be an indication on the effects that value variations of the corresponding foreign currencies have had on Venezuelan imports. Western Europe has been losing ground since 1973, when the dollar was devalued for the second time after 1971, as the appreciation of their currencies made their exports less competitive. However, the opposite case has been experienced with respect to Japan whose currency, the yen, has also been in the upward movement and yet Japan has managed to

sector and, in this respect, consumption may have a role to play in defining the import function. It follows, then, that the import-substitution industrialization process further requires, in its first stages, an increasing capital and intermediate expansion of imports, which implies that the accumulation level of the capital stock becomes a relevant variable in determining the levels and composition of imports. Furthermore, and by the nature of this argument, it appears that imports of previous periods carry by necessity an inducement to enhance imports for the following period, that is an expectation variable which in this case is the dependent variable with a year lag.[68] Finally, we consider that the import price index is fundamental in determining imports for it takes care of price variations,

hold its ground on exports to Venezuela at an average annual rate of 20.6%, superior to that of Western Europe and about the same as Canada, which suggests that Japan may be providing tangible incentives to Venezuelan trade. On its part, Canada seems to be benefiting substantially from its lower value dollar vs. the USA dollar and, hence, against the bolivar, making Canadian goods more competitive. Although Latin-America holds only a 8% share of total Venezuelan ~~imports~~, it must be said that it is the region which has been showing the highest rate of growth of exports to Venezuela: an average annual rate of 28.3% during the 1970's. Lower value currencies in the region and Venezuela's deliberate policy of trade diversification and participation in the regional markets have contributed immensely to this fast growing share of imports from Latin-America. See Banco Central de Venezuela, Informe Economico (Caracas, 1979), p. A-396.

[68] Most of these arguments may be considered effects of the nature and structure of factor proportions in a developing economy. As it is well known, Venezuela faces an employment problem, that is, skilled labour is scarce in both contexts of technical knowledge and of managerial ability and experience, whether we think in terms of the

value variations of foreign currencies and, quite possibly, transfers of some of the gains from technological progress in the industrialized economies where most of the Venezuelan imports come from. Along with this point, the rate of foreign exchange should also play an important role as an explanatory variable in the model, but because the bolivar has always been pegged to the USA dollar and the rate of foreign exchange has also been defined in terms of it, we expect that this variable may become quite irrelevant.

2.6.4 The Specification of the Import Function

From all the above considerations, we shall test, then, those variables that seem to carry some economic relevance in defining our import function.

As in the case of exports, the equations of the import model shall follow the specification and form of (I) above, that is:

$$MTR(t) = a + b\,Z(1,t) + \dots + k\,Z(m,t) \tag{2.4}$$

where, (t) refers to the sample period 1950-1979,

MTR(t) refers to imports of commodities in constant 1968 prices,

Z(i) refers to m (i=1, ... ,m) explanatory variables

modern industrial sector or the agricultural sector. See Albert Hirschman, The Strategy of Economic Development (Yale University Press, New Haven, 1958), pp. 143-155. See also U. HLa Myint, The Economics of the Developing Countries (Praeger, New York, 1965), pp. 136-142.

considered in each equation of the test, according to the a priori reasoning given above.

The model (2.4) shall refer to two import functions: one dealing with imported capital goods, meaning here those commodities produced abroad and which are used by the domestic economy to produce other goods, including capital goods; the other import function shall deal with non-capital goods, that is, consumer goods plus semi-finished goods whose added value after processing remains quite low.

As shown in Table 8 above, these two groups of imports, capital and non-capital, show an inverse relationship due to the industrialization policy of the country, that is, while the average share of capital imports increased from about 34 percent in the first half of the 1960's to about 49 percent in the second half of the 1970's, the other group decreaseg from about 66 percent to about 51 percent for the same periods.

2.7 THE CENTRAL GOVERNMENT TAX REVENUES

The Venezuelan public sector finance may be disaggregated into (a) Central Government, (b) Regional Governments (States, District and Municipalities), and (c) Autonomous Institutions (public enterprises, finance and service institutions). Regional governments depend heavily on the Central Government revenues for the finance of their operations, and non-petroleum public enterprises are still at the stage of being a financial burden to the central government too, due to their continuous deficits.[69] This seems to be the behavioural pattern of other autonomous institutions. Therefore, we consider here that only the Central Government is the relevant receiver of sufficient tax revenues from the petroleum and non-petroleum sectors of the economy to lead the economic development and to carry on with the administration of the country. These revenues are classified by the central bank in its annual reports, Informe Economico, as ordinary and extraordinary revenues depending upon the sources of such revenues. The former being tax levies and the latter mainly public debt. Because of their large relative magnitudes, ordinary revenues shall be our concern here.

Ordinary revenues constitute almost all the government income, accounting for about 98 percent of total receipts, which we have disaggregated into 'direct taxes', 'indirect taxes' and 'petroleum taxes'. Direct taxes are defined here as those revenues coming from personal and corporate income from the non-petroleum sector, while indirect taxes are those receipts from import duties, consular fees, taxes on cigarettes and liquor, foreign exchange gains and others, and finally, petroleum tax revenues are those receipts com-

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69. The commercial account deficits of public non-petroleum corporations grew, in real terms, from 470 Mn. Bs. in 1979 to 1151 Mn. Bs. in 1980, which were financed by the government. See BCV, Informe Economico 1980, (Caracas, 1981), p. 325.

ing from all taxes imposed on the petroleum industry. As seen in Table 10, the composition of taxation by sources has changed considerably during the thirty years of the sample period of this study, showing the heavily increasing dependence of the public sector on the petroleum sector to finance the administration of the government and the massive undertakings to develop the economy.

The tax receipts from the petroleum sector increased from an average share of 63 percent of total tax revenues (TXTR) in the 1950's to 68 percent in the 1960's and to 76 percent in the 1970's, growing from an average annual growth rate of 7.2 percent in the 1950's to about 12.4 percent in the 1970's (mainly due to petroleum price increases in contrast to the quite often decreasing prices of the 1960's when the growth rate declined by 1 percentage point. A glance at Table 10 shows that indirect taxes (TXIR) also increased from an average annual rate of about 4 percent in the 1950's and the 1960's to 6 percent in the 1970's, which may be explained by the spillover effect of the petroleum boom. This occurred mainly in imports on non-capital goods during the study period and in particular in the 1970's. However, this growth rate was not large enough to stop these tax shares from decreasing from about 29 percent of total tax revenues in the first decade to 17 percent in the 1960's and, finally, to about 10 percent in the 1970's. Direct taxes (TXDR) show an opposite behaviour. The growth rate of these taxes

TABLE 10

The Central Government Revenues from Direct Taxes (TXDR), Indirect Taxes (TXIR) and Petroleum Taxes (TXOR) and as Percentage Shares from Total Revenues (TXTR): 1950-79

YEARS	TXTR	TXOR	TXDR	TXIR	PERCENTAGE SHARES		
	(In Billions of 1968 Bolivares)						
	(1)	(2)	(3)	(4)	(2)/(1)	(3)/(1)	(4)/(1)
1950-59	6.85%	7.21%	16.54%	3.51%	63.1%	8.0%	28.9%
1960	4.62	3.07	.59	.96	66.4	12.8	20.8
1961	5.17	3.42	.78	.97	66.1	15.1	18.8
1962	5.09	3.36	.76	.97	66.0	14.9	19.1
1963	5.49	3.72	.80	.97	67.8	14.6	17.6
1964	6.84	4.88	.87	1.09	71.3	12.7	16.0
1965	7.08	4.87	1.09	1.12	68.8	15.4	15.8
1966	7.41	4.98	1.21	1.22	67.2	16.3	16.5
1967	7.80	5.28	1.28	1.24	67.8	16.4	15.8
1968	8.16	5.54	1.32	1.30	67.9	16.2	15.9
1969	8.46	5.69	1.43	1.34	67.3	16.9	15.8
1960-69	6.24%	6.36%	9.26%	3.85%	67.8%	15.3%	16.9%
1970	9.04	5.91	1.77	1.36	65.4	19.6	15.0
1971	10.74	7.59	1.80	1.35	70.7	16.7	12.6
1972	10.93	7.64	1.89	1.40	69.9	17.3	12.8
1973	13.83	10.29	2.16	1.38	74.4	15.6	10.0
1974	33.86	30.02	2.16	1.68	88.7	6.4	4.9
1975	29.50	24.44	2.87	2.19	82.8	9.7	7.5
1976	25.56	20.51	3.03	2.02	80.2	11.8	8.0
1977	25.13	19.86	3.18	2.09	79.0	12.7	8.3
1978	23.32	16.68	4.10	2.54	71.5	17.6	10.9
1979	25.04	19.06	3.55	2.43	76.1	14.2	9.7
1970-79	10.73%	12.42%	7.21%	6.0%	76.0%	14.1%	9.9%

Source: Computed from Banco Central de Venezuela *La Economia Venezolana en los Ultimos Treinta y Cinco Anos* (Caracas, 1978), pp. 263-274; *Informe Economico*, (Caracas, 1979), pp. A-335-338, and Ministerio de Energia y Minas, *Petroleo y Otros Datos Estadisticos*, (various).

declined during the three decades, falling from 16.5 percent in the 1950's to 7.2 percent in the 1970's. In spite of this, they almost doubled their shares at the end of the period when they reached an average annual share of 14 percent in the 1970's, a rise from 8 percent in the 1950's. This indicates that the non-petroleum sector of the economy is growing or, for that matter, that the import-substitution industrialization policy is working.

2.7.1 The Behavioural Relationship of the Tax Functions

From the above analysis and according to the linear relationship (I), we shall test the three government tax revenue functions described above taking into account those economic variables that seem to have the most economic relevance in defining the behavioural relationship of these tax functions.

The application of the linear model (I) to the tax function states that,

$$(2.5)\quad TXTR(j,t) = a + b\ Z(1,t) + \dots + k\ Z(m,t) + u(t)$$

where, (t) refers to the 1960-1979 period and TXTR(j) are the tax revenues in constant 1968 prices from each category of taxes j [j = Indirect Taxes (TXIR), Direct Taxes (TXDR) and Petroleum Taxes (TXOR)]. The variable Z(i) refers to m (i = 1, ... , m) explanatory variables that may enter into the specification of j, and 'u' is the stochastic disturbance term that relates functionally TXTR(j) to the Z(i).

Following the definitions given above to the three sources of taxations, we assume that the most relevant variable to explain Indirect Taxes should be the imports of non-capital goods (MNKR) from which most of these taxes come (see Table 9). Similarly, Direct Taxes should be well explained by the non-petroleum sector of the economy on which personal as well as corporate income taxes are levied. Each of these two explanatory variables should be able to provide some indications about the effectiveness of the import-substitution policy of the State (see Table 10). Furthermore, we expect also that government officials rely on previous tax behaviour to determine present tax allocation. Hence, an expectational tax variable such as the dependent variable lagged one year should be considered in the specification of each of the tax functions.

2.7.2 The Petroleum Tax Function

The Venezuelan petroleum sector has been discussed extensively in Sections (2.5) and (2.6). Subsections (2.5.1), (2.5.2) and (2.6.2), in particular, assign significant importance to the petroleum export sector as the activity that makes possible the transfer of a large amount of financial resources from abroad, which has enabled Venezuela to enter into the present processes of economic development taking place for the past thirty years. According to the analysis and the definition given in Section (2.7) on what is meant by Petroleum Taxes, we expect that variables such as petroleum production (QOVER), domestic petroleum consumption (COVER) and petroleum exports (XTOR) should be very important explanatory variables in determining the petroleum tax function of Venezuela. Furthermore, given the conditions of the international petroleum market and the favourable position of Venezuela with its trading partners during the 1950-1979 period, and in particular in the 1970's when petroleum world prices started to climb substantially from the low and fluctuating prices of the 1960's, we expect that the petroleum taxes from previous years should also have a determining effect on present petroleum tax behaviour.

2.8 THE SUPPLY SIDE OF THE MODEL

We have presented the aggregate demand side of the Venezuelan economy above; now we turn to the supply side of this economy which is represented by the gross domestic product, also in constant 1968 prices.

The total output of commodities of an economy is produced according to complex processes of a technical nature relating diverse factors of production, amongst which labour and capital are usually singled out in the economic literature as the dominant factors. We shall follow the same reasoning in estimating the Venezuelan production function.

2.8.1 The Production Function

Empirical research has been concerned with existing neoclassical economic theory on the aggregate nature of the Cobb-Douglas production function.[70] The basic argument arises from the underlying technologies and aggregation problems encountered in the homogeneity approach to the factors of production, labour and capital, which have been selected from a more complex production function of the real world, as the most relevant variables representing the technological relationship between these factor inputs and output.[71]

We shall apply this same theoretical and empirical construct to the aggregate, economy-wide, production relationships that may exist between labour, capital and total out-

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[70] In an early study on the American manufacturing industry, 'A Theory of Production,' American Economic Review (Mar., 1928), Vol. XVIII, No.1, pp. 139-165, Professor Paul H. Douglas computed annual indexes of workers and fixed capital from 1899 to 1922 and related them to the corresponding annual index of output. He observed that the relationship of these factors of production were approximately constant proportions of total output. The mathematician, Professor Charles W. Cobb, translated these properties into the well known explicit mathematical form of the production function that takes after their names. See also Paul H. Douglas, 'Are There Laws of Production?,' American Economic Review, Vol. XXXVIII, No.1, (March, 1948), pp.1-41.
The original production function was:

P = b L(**k)C(**1-k), (note: '**' means 'to the power')

where P is the value added output from labour (L is the number of workers per year) and the stock of capital (C). The parameter b is the efficiency technical coefficient that relates output to L and C while the k and 1-k coefficients represent the proportions of output going to L put in the Venezuelan economy, mainly that

(III) GDPR = A L(**a)K(**b),

which assumes to satisfy the following properties:

(IIIa) GDPR = f(0,K) = f(L,0) = 0 (K, L are indispensable)

(IIIb) MPK = $(\partial f/\partial K) > 0$

MPL = $(\partial f/\partial L) > 0$ (MPK, MPL are nonnegative)

(IIIc) ∂(**2)f/∂L(**2) < 0

∂(**2)f/∂K(**2) < 0 (increasing returns to K, L)

and,

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and C respectively. This original Cobb-Douglas function exhibits constant returns to scale to both factor inputs and an unitary elasticity of substitution amongst them. But, it should be noted at this point that in his *Lectures on Political Economy*, (Routledge & Kegan Paul Ltd., London, 1934), Vol. 1, Parts II and Part III, pp. 116 and 286, Johan Gustaf Knut Wicksell (1851-1926) analyzes this same form of the production function used by Cobb-Douglas in 1928.

A more general Cobb-Douglas function suggested by David Durand in his article 'Some Thoughts on Marginal Productivity with Special Reference to Professor Douglas' Analysis,' *Journal of Political Economy*, Vol. XLV (Dec., 1937), pp. 747-758, is

Y = A (L**a)(K**b),

where the new letters Y,K,A have the same meaning as P,C,b, but where a and b are no longer constrained to unity, implying the possibilities of a production function exhibiting increasing returns to scale (a+b>1), decreasing returns (a+b<1) or constant returns (a+b=1).

(IIIb) $$\frac{\partial^2 f}{\partial L^2} \cdot \frac{\partial^2 f}{\partial K^2} - \left[\frac{\partial^2 f}{\partial L \partial K}\right] \cdot \left[\frac{\partial^2 f}{\partial L \partial K}\right] \gtreqless 0$$

(decreasing, increasing or constant returns to K, L),

which shall be applied to the sample period.

GDPR is the real gross domestic product (1968 = 100) and A represents the technology parameter that may be embodied in the GDPR through the relations of labour (L) and the capital stock (K). The sum (a + b) is the returns to scale parameter, which describes the GDPR response to a proportionate increase of the input factors; accordingly, we may have:

a) If (a + b) < 1, decreasing returns to scale are present.

b) If (a + b) = 1, then constant returns exist, and finally

c) If (a + b) > 1, there are increasing returns.

It is assumed that the production function (III) satisfies the properties in (IIIa) to (IIIb) per unit of time. Property (IIIa) implies that L and K are necessary factors of production and their respective marginal products (MPL and MPK) obey property (IIIb), while the proper curvature of

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[71] The technical nature given to factor inputs has always been a profound concern in economic theory and econometric testing. On the one hand, labour (as well as land) is usually measured in number of men (units of land) per period of time; capital, on the other hand, is given an exchange value, which seems to be an extraneous measurement to itself. Johan Gustaf Knut Wicksell, Ibid., p. 149, wrote: "However good the practical reasons for this may be, it is a theoretical anomaly which disturbs the correspondence which would otherwise exist between all the factors of production." See also Derek L. Bosworth, Production Functions: A Theoretical and Empirical Study (Saxon House Ltd., Westmead, Farnborough, Hants., England, 1976), Chapters 3, 7-9.

the isoquants are convex to the origin as shown in property (IIIb).

In estimating the production function, we shall also work with disembodied technological progress in the Hicks-neutral sense,[72] which should be revealed through the unchanged marginal rate of technical substitution (MRTS) of labour and capital, that is, the ratio of the marginal products of labour (MPL) and the marginal products of capital (MPK) over the sample period. Finally, a stochastic disturbance term u(t) is included. Then, the Cobb-Douglas function may be written as:

(IV) GDPR(t) = A e([**rt + u(t))] L(t)(**a) K(t)(**b)

where the parameters A, r, a and b shall be estimated by ordinary least squares (OLSQ) if the function is linearised by taking natural logarithms:

(V) Log GDPR(t) = k + rt + a log L(t) + b Log K(t) + u(t)

(Va) MPL(t) = (a/L)*GDPR(t) and MPK(t) = (b/K)*GDPR(t)

(Vb) MRTS-KL(t) = [MPK(t)/MPL(t)] = (b/a)(L/K)

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[72] There are three particular forms of disembodied technical progress corresponding to the neutral concept in Harrod-neutral, Hicks-neutral and Solow-neutral. Regardless of what is meant by neutrality in these cases, it makes no difference what case is taken into the application of the Cobb-Douglas function since all forms are algebraically equivalent and empirically indistinguishable from one another. See David F. Heathfield, Production Functions (Macmillan Press Ltd., London, 1971), pp. 40-43.

This form of the production function is linear in the unknown parameters k (i.e., log A), r, a and b. The coefficients a and b are the elasticities of output with respect to labour and capital, respectively, and r is the rate of tecnological progress. Total output is the gross domestic product in constant 1968 prices (GDPR), labour (L) is the number of workers per year and the stock of capital (K) is taken to be the gross value of fixed capital in constant 1968 prices for the sample period of this study, 1950-1979. The marginal rate of technical substitution of capital for labour (MRTS-KL) will show the substitutability of these factor inputs to one another. Thus, we can see, through (Vb), whether or not labour-using and/or capital-using techniques were in use during the sample period. We would expect that the import-substitution industrialization policy undertaken by the government since the early 1960's (Section 2.6.3) would be revealed by a shift from labour-using techniques in the 1950's to capital-using techniques in the 1960's and the 1970's. As seen, the stock concept is applied to the factor inputs, but we may also apply here the flow concept in terms of payments accrued to the factors from total GDPR. This may be the case when constant returns to scale are assumed, and in which case function (V) becomes:

(VI) $\text{Log}\,(GDPR/L)(t) = k + rt + (1-a)\,\text{Log}(K/L)(t) + u(t)$

which is the intensive form of the production function relating output per worker per year to the annual capital-labour ratio. Furthermore, the problems of multicollinearity and heteroskedasticity, which are the usual econometric problems encountered in the previous forms, are reduced in this form.[73]

Another technique[74] that may be tried in dealing with the multicollinearity problem is reconsidering equation (V) in the following two-step procedure:

$$\text{(V')}\quad \text{Log(GDPR)}(t) = k + rt + a[\text{Log}(L) + (b/a)\text{Log}(K)](t) + u(t)$$

by computing (b/a) first as the average of the income shares of the K/L ratio for each year t of the sample period, based on the fact that a and b are, respectively, labour and capital deflated income shares of the product distribution shown in equation (3.41) below, we can afterwards compute:

$$\text{(a)}\quad [\text{Log}(L) + (b/a)\text{Log}(K)](t) = F(t)$$

for each year t of the sample period, and plugging then F(t) in (V') and running the equation, we shall get an estimate of a, which will allow us to estimate the coefficient b:

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[73] Michael D. Intriligator, op. cit., pp. 267-269.

[74] Ronald G. Bodkin and Lawrence Klein, 'Nonlinear Estimation of Aggregate Production Function,' Review of Economics and Statistics, Vol. XLIX, No.1, (Feb., 1967), pp. 28-44.

(b) $b = a(b/a)$,

which if substituted in (V') reproduces equation (V).

2.8.2 A Re-specification and Estimation of the Production Function

As already discussed in Section 2.6.2, Venezuela enjoys a relative abundance of capital resources, in both capital stock and investment resources, but not in the co-operant factor of production, such as managerial and entrepreneurial skills and a diversified supply of skilled labour so badly needed for this capital-intensive economy. This scarcity of skilled labour becomes the main obstacle for the expansion of the absorptive capacity of investment in the country, which further retards economic development. If we consider that labour is the limiting factor of production and that capital accumulation is the abundant variable, we may, then, specify the aggregate production function of this economy as a straight linear function of labour employment (LABOUR) and the variable TIME measured in time periods from the first given year onwards:

(VI) $GDPR(t) = k + a\ LABOUR(t) + b\ TIME$,

the variables of which have been discussed above.

Chapter III

THE DATA SET

3.1 GENERALITIES

One of the major problems in building econometric models for the LDC's is the data. Most LDC's, and Venezuela is not any exception, suffer from a lack of good data in terms of length, quality, degree of disaggregation and accessibility if it exists. The reasons are many and of no interest to us to discuss. We can only remark that the nature of our data has contributed to the rather aggregative character of this study.

In our specific case, we managed to collect the relevant raw yearly data for the sample period of this study: 1950-1979. One of the most distressing problems encountered, at first, was the discontinuity and inconsistencies in the series. However, in order to make it usable it was necessary to 'massage' it, using splicing and other techniques.[75] All time-series data were converted into constant 1968 prices, from either 1957 prices or current prices, and presented in billions of bolivares (Bn. Bs.), the legal

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[75] Michael D. Intriligator, Econometric Models, Techniques, and Applications, (Prentice-Hall., Englewood Cliffs, New Jersey, 1978), pp. 62-74.

tender currency in Venezuela. The conversion to constant prices is made to avoid the well known phenomenon of 'money illusion', whereby people occasionally deceived themselves in so far as being unable to measure a priori the true purchasing power of their nominal income, which we do not believe is usually the case.

The latest publications by the Venezuelan Central Bank: La Economia Venezolana en los Ultimos Treinta y Cinco Anos, (Caracas, 1978) and Informe Economico 1979, (Caracas, 1980), provided us with most of the time-series data used here. The first publication provided the data for 1950-1976, which comprises two time-series, each one based on its own base year and on a different national accounts system. The first period of the data, 1950-1969, is given in 1957 prices and was assembled according to the old system of national accounts of the United Nations. The data corresponding to the second period, 1970-1976, is given in 1968 prices and follows the new system of national accounts of the United Nations, which Venezuela adopted in 1970. This last period includes observations for 1968 and 1969, two overlapping years with respect to the first period and of some importance for the splicing techniques used below. It should be mentioned here that the two systems of social accounts of the United Nations already referred to are not compatible in terms of concepts and methodology applied. The second publication mentioned above provided the revision of the national accounts for the whole of the 1970's in current prices and constant 1968 prices under the new national accounts system of the United Nations.

All the massaged data used in the model (See Appendix C) and the variables that identify the data shall always refer in this study to constant 1968 prices in million bolivars, unless otherwise specified. Therefore, the variables of the model will carry an 'R' at the end of their acronyms as an identification referring to constant 1968 prices.

3.2 THE GROSS DOMESTIC PRODUCT SECTORS

Our first task was to produce annual time-series consisting of thirty observations each for the real gross domestic product (GDPR), for the petroleum real gross domestic product (GDPOR), for the non-petroleum real gross domestic product (GDPNOR) in constant 1968 prices, and for the GDPR implicit deflator during the sample period of 1950-1979. A look at the data based on 1968 prices of both of the above publications shows that the two series differ in magnitude. We recall from above that one set of data, 1970-1979, is the latest revised data published so far while the 1968-1976 data is not. Therefore, we assume that the difference in magnitude of these two series was caused by the methodology applied in collecting and assembling the data. To make these time-series compatible we proceeded as follows:

(a) We regressed six overlapping years of the series, 1970-1975, of the same base year 1968, and obtained the following results:

(3) $GDPR = -.343 + 1.02(GDPR)$

$r2 = .9998 \quad SEE = 214.419,$

where GDPR is gross domestic product at revised 1968 prices, (GDPR) is gross domestic product at unrevised 1968 prices, r2 is the correlation coefficient and SEE is the regression standard error of estimate.

We assumed that the parameters of (3) being common to the six overlapping years under treatment must also be common to the other two years, 1968-69, of the unrevised data. Hence, the respective estimations were carried out:

(3.1) $GDPR(1969) = -.343 + 1.02(46.798)$

$= 47.391$ Bn. Bs.

and,

(3.2) $GDPR(1968) = -.343 + 1.02(44.855)$

$= 45.409$ Bn. Bs.

where the year in brackets indicates the corresponding new revised GDPR for that year. However, the two GDPRs generated by this method were smoothed to conform better with the new time-series as we converted the 1950-1969 series based in constant 1957 prices to 1968 prices.

(b) Finding a common factor (cf) for the years 1968 and 1969, we obtained:

(3.3) A(1968) = GDPR(68)/GDPR(57)
= 45.409/43.167
= 1.0520

and,

(3.4) A(1969) = GDPR(68)/GDPR(57)
= 47.391/44.782
= 1.0583

where, A(1968) is the ratio obtained by dividing 1968 GDPR in 1968 prices by 1968 GDPR in 1957 prices and A(1969) refers to the ratio with respect to 1969. These two ratios are very close to each other, in fact equal to 1.06 to two decimal points, which is the average.

Therefore,

(3.5) cf(1968-1969) = 1.06

which means that the new revised GDPR series based on 1968 prices contains the old series (based on 1957 prices) 1.06 times, so that we have assumed that the 6 percent difference must be due to methodological changes.

(c) Generating a new revised GDPR series:

We proceeded, then, to multiply the 1950-1969 series by this common factor (1.06), and in so doing we generated a new revised GDPR series in constant 1968 prices.

The implicit deflator (GDPID) of the gross domestic product, based on constant 1968 prices, was generated using a different technique. We converted the 1950-1969 GDPR series based on 1957 prices to current prices series by multiplying it by its implicit deflator,[76] which was subsequently adjusted to the new revised data by multiplying it by the common factor 1.023 obtained from the ratio of 1968 GDPR in constant 1968 prices (45.757) over its current prices (44.721), both generated above. This conversion, together with the GDP in current prices for the 1970's published in Informe Economico 1979, provided us with the whole 30 observations required for the gross domestic product in current prices. By dividing this series by the new revised GDPR in constant 1968 prices generated above, we obtained the implicit deflator of the gross domestic product.

The petroleum gross domestic product in 1968 prices (GDPO) was our next undertaking. First, since part of the petroleum activities, including natural gas, goes into the manufacturing sector because of the refining process, according to published data, we considered that these values should be transfered to the petroleum sector in order to show the overall strength of the sector. This part of the data is published in 1957 prices and it was necessary to convert it to current prices by using the petroleum gross

[76] The gross domestic product implicit deflator based on 1957 prices was taken from Jorge Salazar-Carrillo, Oil in the Economic Development of Venezuela, (Praeger, New York, 1976), p. 204.

domestic product implicit deflator based on 1957 prices.[77] Secondly, the 1970-1979 data for the gross domestic product dealing with the petroleum sector, also in current terms, does not distribute by sectors the import duties levied on imports. We decided to do this by applying weights to the sectors, which we considered to be more reasonable than to distribute it otherwise without sufficient information. We used the following formula:

(3.6) GDPOC = YOC[1 + TMC/(GDPC-TMC)]

where, GDPOC is the petroleum gross domestic product in current prices, YOC is total current revenues from crude petroleum, natural gas and refined products, TMC is taxes on imports and GDPC is gross domestic product in current prices.

The conversion of this new data to constant 1968 prices was carried out by deflating GDPOC:

(3.7) GDPOR = GDPOC/GDPID

where, GDPID is the implicit deflator of the gross domestic product generated above and which we have considered to be the most appropriate price deflator in the present case since the world petroleum price increases have not directly affected Venezuela.[78]

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[77] The petroleum gross domestic product implicit deflator, in 1957 prices, was also taken from Jorge Salazar-Carrillo, *ibid.*, p. 208.

[78] The sharp and sudden world petroleum price increases of the 1970's have not reached the Venezuelan domestic pe-

The non-petroleum gross domestic product in constant 1968 prices (GDPNOR) was obtained from the identity:

(3.8) $\quad GDPNOR = GDPR - GDPOR$

for the sample period 1950-1979.

The following task was to generate real national income (YNR) in 1968 prices, that is, the annual income distributed between human capital and physical capital. This process was similar to the one used for GDPR above, except that the original data used here are published in current prices. We regressed six overlapping years, 1970-1975:

(3.9) $\quad YNC = .620 + .995(YNC)$

$\qquad r2 = .9997 \quad SEE = 301.933$

where, YNC is the revised nominal national income data and (YNC) the non-revised data. SEE is the standard error of estimate of the equation and the fact that the slope is so close to 1 tells us that the YNC and (YNC) follow the same trend, and, so being the case, we proceeded to smooth the 1968 and 1969 non-revised observations:

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troleum price consumption as yet. According to pronouncements made by the State petroleum corporation, Petroleos de Venezuela S.A. (PDVSA), the petroleum price paid by the public in general is about USA 4.50 to 5.00 \$/bbl., while its world price was above 35 \$/bbl during 1979, which means that the petroleum consumption is under a heavy subsidy by the State. Attempts have been made to modify this price structure but the issue has become so thorny, in terms of its political and economic implications, that the issue is still in the air. <u>El Nacional</u> (December 17, 1979), p. D1.

$$(3.10) \quad YNC(1969) = .620 + .995(36.532)$$
$$= 36.970 \text{ Bn. Bs.}$$

and,

$$(3.11) \quad YNC(1968) = .620 + .995(35.334)$$
$$= 35.778 \text{ Bn. Bs.}$$

These two figures are important as they become the two YNC revised data for 1968 and 1969, under the new national accounts system, and the two overlapping years with respect to 1950-1969 YNC series, under the old national accounts system. These two overlapping years allow us to make the splicing of the two YNC series, 1950-1969 and 1970-1979. For this, we proceed as in (3.3) and (3.4) above. The common factor (cf) required is:

$$(3.12) \quad cf(1968\text{-}1969) = 1.017$$

which means that the new revised YNC series is estimated to equal the old one times 1.017 which in turn seems to indicate that the difference of 1.7 percent is due to conceptual and methodological changes. By multiplying the old series, 1950-1969, by this common factor, we splice the whole series, 1950-1979, but in current prices. To convert it to constant 1968 prices (YNR) it was deflated by the implicit deflator (GDPID) of the gross domestic product:

$$(3.13) \quad YNR = YNC/GDPID$$

for the period 1950-1979.

3.3 THE MONETARY DATA

The Venezuelan banking and financial structure is still far behind the degree of sophistication reached by a comparable institution in a developed economy. Financial instruments such as government bonds do not exist and private bonds are relatively limited.[79] The interest rate, therefore, does not appear to play any important role, during the sample period of this study. We will try to find this out empirically. However, considering that Venezuela is an open economy, with strong commercial links with the United States, the prime lending rate in the New York money market may be the leading indicator pointing to the opportunity cost in holding any financial domestic asset vis-a-vis foreign assets. This will also be verified empirically. For this purpose, we have available the corresponding interest rate time-series, for Venezuela (RVEN) and the USA (RUSA), and the complete time-series for the two concepts of the money supply which we use in this model. One is the supply of money narrowly defined (SMC), which comprises currency in the hands of the public plus chequeable accounts (current accounts), and the other one is a broader concept that takes the previous definition plus savings and time deposit accounts (SLMC). Both of these series are published in nominal terms, but they were deflated by the consumer price index (CPI) based on 1968 prices:

[79] Deena R. Khatkhate et al., Ibid., p. 741

(3.14) SMR = SMC/CPI

(3.15) SLMR = SLMC/CPI

3.4 AGGREGATE DEMAND DATA

We are treating here the components of aggregate demand defined in (II), chapter 2, that is,

(II') GDPR = CTR + ITGR + (XR − MR) + MFSR

where consumption and investment are disaggregated for both the private and public sectors. The other three sectors, exports (XR), imports (MR) and service payments abroad (MFSR) shall be dealt with as the foreign sector of the model.

3.4.1 Consumption

The Venezuelan Central Bank publishes in its annual economic reports the data concerning private and public consumption. In the supply and aggregate demand accounts and in the national accounts, the Informe Economico 1969, and the Informe Economico 1979, there is a review of the data for the two decades of the 1960's and the 1970's, respectively, with the former in constant 1957 prices and in current prices and the latter in current prices . The latest long time-series review on the economy, already mentioned above, La Economia Venezolana en los Ultimos Treinta y Cinco Anos, also produces a complete review of private consumption, showing its structural composition from 1950 to 1976.[60] The period 1950-1969 is given in 1957 prices while 1968-1976 is given in current prices. Public consumption is absent in this publication, which means that public consumption for the period 1950-1959 is missing. These data seem to have been generated through budgetary analyses.[61] From 1950 to 1969 both time-series are in constant 1957 prices and from 1970-1979, they are both on current prices. To splice these two series was a rather easy task. Having on hand the new consumer price index (CPI), based on 1968 prices, we found that, as an annual average, this index contains 1.21 times the old consumer price index, based on 1957 prices. Then both consumption series, public and private, under the old index must be multiplied by the common factor 1.21 to generate the corresponding series in 1968 prices. This was done. The remaining part of the series, 1970-1979, being given in current terms, was deflated by the 1968 CPI. Through this method, both private and public consumption were generated for the whole sample period. The sum of them produced the

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[60] The structure of composition of consumption in reference is the customary one that consists of four groups: food, beverage and tobacco; durable goods and non-durables; and services. The proportion and combination of them depends on the level of real disposable income of the consumer, other things being equal.

[61] Pedro A. Palma-Carrillo, Ibid., p. 441. No information is given as to the origin of the missing data, which we failed to find in Informe Economico 1969, to which reference is made.

total consumption (CT):

(3.16) $CTR = CPR + CGR$

3.4.2 Investment

Total gross fixed investment in 1957 prices is also available for part of the sample period from both the main publications mentioned above. However, its disaggregation into private and public investment is made in the two economic reports mentioned above but only since 1964, which means that the corresponding data for the period 1950-1963 is missing. To generate this data we took the following steps:

(a) We analyzed the shares of investment of the public sector as reported in Informe Economico 1969 during the period 1964-1969. We observed that some sectors increased throughout this period while others remained relatively constant. For example, the share of government investment out of total investment increased in economic activities such as agriculture, petroleum and mining, transportation and communication, and services and housing. Its shares of investment in manufacturing, electricity and public administration showed very little change throughout the period.

(b) We took the combined government shares of investment, 33,34 percent out of total investment, corresponding to 1964 and applied them to 1960-1963, under the assumption that this total share of the composition of government investment was the maximum possible level of investment.

(c) To complete the data, 1950-1959, we took the investment share of the first group of activities corresponding to 1964, which was the smaller, and added to the average share of the second group of activities during 1964-1969. This share was 27.96 percent.

(d) To splice the data, we proceeded as in the previous cases. We generated the data for investment in 1968 prices first and, afterwards, in 1957 prices for the 1950-1979 sample period:

(d1) In the first case, we regressed total investment in 1968 revised prices, ITGR, in 1968 non-revised prices, (ITGR), for the six overlapping years, 1970-1975. The results were:

(3.17) ITGR = .360 + .9789(ITGR)

$r2$ = .9999 SEE = 49.835

As in the previous cases, we computed the ITGR values for 1968 and 1969:

(3.18) ITGR(1969) = .360 + .9789(10.762)

= 10.895 Bn. Bs.

(3.19) ITGR(1968) = .360 + .9789(10.234)

= 10.378 Bn. Bs.

(d1.a) Next, we found a common factor. Having computed total investment for 1968 and 1969, revised estimates, we tried to find the relationship (R) between them and the corresponding values based on 1957 prices (ITR); that is,

(3.20) R(1969) = ITGR/(ITR)

= (10.895/6.660) = 1.6358

(3.21) R(1968) = (10.378/6.707) = 1.5473

(d1.b) We decided to take the ratio given by (3.21) as the common factor (the other seemed too high to be realistic) to multiply each year of the total investment series, 1950-1969. By doing this, the series 1950-1969 was converted to 1968 prices and, therefore, spliced with the 1970-1979 series.

(d2) The above generated investment data in 1968 prices, ITGR, were latter converted into 1957 prices (ITR). This was done by regressing the twenty overlapping observations of (ITR) on the ITGR data for the 1950-1969 period to obtain the following:

(3.21.1) (ITR) = .00004 + .6463 ITGR

r2 = .9999 SEE = .0002

which allowed us to convert the 1970-1979 ITGR data into 1957 prices.

6

3.5 THE CAPITAL STOCK

We do not have a comprehensive time-series data on capital accumulation. As far as we are concerned, the only time-series published is the one provided by Informe Economico 1969 in 1957 prices for the 1960's. Missing are the corresponding data for the 1950's and the 1970's. However, these missing sections of the data were calculated according to the following relationships:

(3.22) $K(t) = K(t-1) + ITN(t)$

where, $ITN(t) = ITG(t) - DEP(t)$

and, $t = 1950, \ldots, 1979.$

that is, that capital stock (K) at any year t is always equal to the previous year's capital stock, K(t-1), plus current net investment (ITN) or plus gross investment (ITG) minus depreciation (DEP) during the same year t.

Then, expressing the relationship in constant bolivares, we have:

(3.23) $KGR(t) = KGR(t-1) + ITGR(t) - DEPR(t)$

We need to know depreciation in real terms (DEPR), which can be determined from (3.23):

(3.24) $DEPR(t) = ITGR(t) - [KGR(t) - KGR(t-1)]$

Having on hand the data for the right-hand-side of (3.24) in 1957 prices and for the period mentioned above (1960-1969), we proceeded to estimate the depreciation for that same period. For instance,

$$DEPR(1961) = 4.019 - (55.800 - 55.162)$$
$$= 3.381 \text{ Bn. Bs.}$$

that is, depreciation in constant 1957 prices was 3.381 billion bolivares in 1961, and so on for the 1962-1969 years. The depreciation rate, d*,(with respect to KGR in 1957 prices), was also estimated for the period 1960-1963:

(3.25) $d^* = DEPR/KGR(t-1)$

It was observed that d* declined from an average annual rate of 6.1 percent in the 1960-1963 period to 5.1 percent in 1964-1969. This decline of the rate of depreciation during that last period of the 1960's appears reasonable. Private capital investment, and foreign investment in particular, requires an appropiate environment of political and social stability. A well established democratic system of government, as understood in the market economies, seems to provide the most secure institutional arrangements allowing a long horizon for private investment planning. The conditions leading to the desirable rate of return and depreciation allowances are usually dictated by a myriad of transitory political elements, together with market forces, as the political process develops in less developed economies. In the case of Venezuela, a petroleum economy, there was a rather artificial political stability, but nevertheless a stable and expedient environment for investment, imposed by military rule from 1948 to 1957. Private investment increased substantially from 3.64 billion bolivares in 1950 to 6.63 billion in 1957 in constant 1968 bolivares, decreasing considerably from 6.60 billion in 1958 to 4.80 billion in 1963 during the first term in Office of a new elected government. This was a sort of transitional government, so to speak, from 'dictatorship' to 'democracy', which exacerbated the political restlessness of the people at a period of high economic and political expectations.[62] However, at the end of this violent period, 1963, the country began an era of peaceful political climate. The economy was rising and private investment started to increase, reaching a level of 6.64 and 16.10 billions bolivares at the end of 1969 and 1979, respectively. In consequence, the depreciation rate dropped continuously and considerably from 6.1 percent in 1963, as already mentioned above, to 3.0 percent in 1978 and to 2.8 percent in 1979. For these reasons, we have assumed that, during the artificial political tranquility of the 1950's, depreciation charges had to be rather high as a

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[62] James D. Cockroft, 'Venezuela, Estratificacion de Clases y Revolucion', Economia Politica del Subdesarrollo en America Latina, (Ediciones Signos, Buenos Aires, 1970), Andr{ Gunder Frank, James D. Cockroft and Dale L. Johnson (eds.), pp.331-341.

trade-off for the high risk investment ventures taken during that period of military rule, but not as high as those charges allowed during the subsequent transitional government. Therefore, we took the average annual rate of depreciation during the 1960-1963 period, which was 6.1 percent, to generate the capital stock by applying (3.23) and (3.25) above in a descending process from 1959 to 1950; that is,

(3.23a) $KGR(t-1) = [KGR(t) - ITGR(t)]/(1-d^*)$

where,

$$(1-d^*) = (1-.061) = .939$$

for t(1950,...,1959).

For example:

$$KGR(1959) = (55.162 - 4.725)/.939$$
$$= 53.714 \text{ Bn. Bs.}$$

which says that the capital stock in 1959 is equal to the capital stock less the net investment of the following year 1960, after correction for depreciation. In general, 1959 and 1960 may be replaced by 'previous year' and 'current year', respectively.

By using the above method, we generated the 1950-1969 series for capital stock and depreciation in 1957 prices.

The remaining time-series for the 1970-1979 period were also calculated. Informe Economico 1979 provided us with the 1970-1979 data for ITGR and DEPR in 1968 prices, but capital stock, KGR, was not available. To generate KGR, we proceeded as follows: first, the ITGR and DEPR data were converted to 1957 prices by multiplying them by the common factor .6463 given by the reciprocal of (3.21), and, second, the rate of depreciation (d*) was calculated according to (3.25) and KGR according to a variation of (3.23a); that is,

(3.23b) $KGR(t) = (1-d^*)KGR(t-1) + ITGR(t)$

For instance, the capital stock (KGR) for 1970 was:

(3.27) $$KGR(1970) = (1-.045)(74.042) + 7.077$$
$$= 77.787 \text{ Bn. Bs.}$$

and so on for the remainder of the period, 1971-1979.

With this procedure, we generated the data for total gross fixed investment (ITGR), for depreciation (DEPR), the rate of depreciation (d*) and for the capital stock (KGR) for the whole sample period, 1950-1979, but in 1957 prices. To convert them to 1968 prices, they were multiplied by the common factor 1.5473 given by (3.21) above.

3.6 THE FOREIGN SECTOR

This sector is composed of a) Petroleum exports and other exports, and b) Imports and Service Payments Abroad.

Petroleum exports account for an average of over 93 percent of total exports during the last three decades of this study. With the price increases that begun in 1974, this share rose to about 95 percent in the last six years of the

1970's, which implies that other exports, mostly agricultural and mineral products, were reduced from a share of about 7 percent to 5 percent during these periods. Petroleum exports are embedded in a Petroleum sub-model, which takes into account the peculiarities of the petroleum sector of Venezuela.

Imports of goods and services constitute, together with service payments abroad (net factor payments), the other side of the foreign trade sector. Imports alone consumed about 75 percent of all foreign exchange earnings. Alarmingly, this share went out of control during the petroleum price increases in the 1970's jumping to 90 percent in 1976 and to 127 and 151 percent in 1977 and 1978, respectively, dropping to 99 percent in 1979.

Finally, net factor payments or service payments abroad for foreign investment and labour services in Venezuela is the closing element of the import sector and, of course, of the foreign trade sector. Its financing as a share of total foreign exchange has slowly declined from a high level of 32 percent in the 1950's to 28 percent in the 1960's and 26 percent in 1970-1973; however, its deep decline took place in the remaining six years of the 1970's, dropping to about 5 percent in 1974 and to .33 percent in 1979. (It should be noted that these payments became positive, that is, they brought in 1 and 2 percent of the foreign exchange received in the country in 1976 and in 1977, respectively).

3.6.1 The Export Sector And The Petroleum Sub-model

In order to conform to the available sources of data regarding the major regions engaged in petroleum imports from Venezuela, this sub-model shall span only twenty years from 1960 to 1979.

The major petroleum importing countries are the USA and Canada, which together are identified here as developed North America (NA).[63] Latin America (LA) is the second region in importance, followed by Western Europe (WE), which is composed here of the members of the European Economic Community (EEC), Norway, Portugal, Sweden and Spain.[64] Finally, we consider the rest of the world XORESTR for the purpose of closing the model, which means that total petroleum exports shall always be equal to the sum of exports to each region.

3.6.2 The Sub-model Data

To generate the corresponding data for each of the above regions, the following steps were taken: first, the petroleum[65] export time-series, in barrels per year, to each of the

[63] Mexico is part of Latin America (LA) and, therefore, excluded from North America where it geographically belongs.

[64] The EEC members are Belgium, Denmark, France, Greece, West Germany, Italy, Ireland, Luxemberg, The Netherlands and The United Kingdom.

[65] We remind the reader that 'petroleum', as defined here, refers not only to crude petroleum but also to its varia-

regions were gathered from the Venezuelan Ministry of Energy and Mines' publications known as Petroleo y Otros Datos Estadisticos, here-in-after referred to as PODE. These data were available from 1950 to 1968 in PODE 1970, p. 107, under the implicit concept of 'exports to final users', implying that the importer is at the same time the final consumer.[86] This concept seems to have been changed to 'direct exports' since 1969. The direct implication of this new concept means that petroleum movements from Venezuela to Aruba and Curacao, for processing, are now being taken as exports, which, if in turn were to be taken as final consumption of the islands, it would make the Latin American region, of which the islands are considered to be a part, a major consumer of petroleum relative to its gross domestic product. Therefore, it was necesary to find out the petroleum export distribution from the Antilles to the other regions, from 1969 to 1979. For this , we took the two overlapping years 1969 and 1970 from PODE 1970, p. 107, and PODE 1979, p. 85, concluding that 80.72 percent was re-routed to North America, 8.85 percent to Western Europe and 8.42 percent to Latin America. These percentages were applied to the data from

ty of products and liquified petroleum gases. In fact, about 50 percent of exports is in the form of products refined beyond the crude petroleum stage.

[86] PODE does not consider crude petroleum movements from Venezuela to The Netherlands Antilles (Aruba and Curacao) as exports, but further movements from these Antilles to other regions are considered as such, at least up to 1970. In fact, these exports were substantial, from about .700 Mn. bbl/d in 1950 to .800 Mn. bbl/d in 1970.

1970 to 1979 and, in so doing, the whole time-series were completed since 1960, as required by the sub-model. They were, afterwards, converted from barrels to constant 1968 bolivares. To do this, it was necessary at first to generate the realized world composite price, in real terms, of the Venezuelan petroleum barrel (POVWR), which was done simply by dividing total petroleum export revenues in real terms (i.e., revenues deflated by the country's gross domestic product implicit deflator based on 1968 prices) by the quantity exported during the period 1960-1979. Then, by multiplying these time-series by the yearly quantities of petroleum exports to each of our regions, we generated the corresponding value time-series to North America (XONAR), to Western Europe (XOWER), to Latin America (XOLAR) and to the rest of the world (XORESTR), in billion bolivares (Bn. Bs.) in 1968 prices. The sum of these exports provides us with total petroleum exports (XTOR).

The corresponding petroleum consumption time-series, also in 1968 prices, in North America (CONAR), in Western Europe (COWER) and in Latin America (COLAR), were computed from the <u>Yearbook of World Energy Statistics 1979</u>, (United Nations, New York, 1981), pp. 49, 51 and 55. They were converted from metric tons (mt) to barrels (bbl) and finally to constant bolivares by multiplying them by the USA conversion factor of 7.418 bbl/mt obtained from <u>PODE 1979</u>, p. viii, as the standard for all the regions and, afterwards, by POVWR generated above. The Venezuelan petroleum consumption in constant 1968 bolivares (COVER) was generated from PODE 1970, p. 141, PODE 1974, p. 127 and PODE 1979, p. 114. They provided us with the data for total petroleum revenues and total petroleum exports in current bolivares for 1960 and 1965-1979. The difference between these two series provided us with the quantities of petroleum consumption in the country. Since the data for 1961-1964 were missing, we took the average growth of consumption for 1960-1970 (8.0 percent) and applied it to the data to generate those missing numbers.[87] Then, we deflated the 1960-1979 series by the implicit deflator and converted the Venezuelan petroleum consumption from current to constant 1968 bolivares (COVER), which in turn was divided by the quantity of petroleum consumption (COVEQ) to generate the time-series of domestic price[88] in constant bolivares (POVER) for the same period 1960-1979.

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[87] The data show that the growth of petroleum consumption was relatively stable in 1965-1968, increasing somewhat in 1969-1970. We took, then, the average growth of the whole period, at 8.0 percent, to be acceptable and applied it to the series. At present, the growth rate of petroleum consumption in Venezuela is about 10 percent annually.

[88] Petroleum consumption in Venezuela has enjoyed a far too low price since 1973. According to the President of Petroleos de Venezuela S. A. (PDVSA), Gen. Rafael Alfonzo Ravard, the domestic price was somewhere between 4.50 and 5.00 $/bbl., which, if compared with the international price of 35.00 $/bbl., suggests that Venezuela was heavily subsidizing the domestic consumption. See El Nacional, (December 17, 1979), p. D2.

Our last step was to produce the gross domestic products time-series for each of the three regions, also in 1968 prices.

The Organization for Economic Co-operation and Development (OECD), Paris, publishes the National Account Statistics of its members. So, the publications National Account 1975, p. 132, and National Accounts 1981, pp. 84 and 86, provided us with the gross domestic product in both the current prices and constant 1975 prices for the members of North America and Western Europe during our sample period 1960-1979, except that the gross domestic product in constant prices is missing for 1960.

In the case of the USA, we found that the 1962 and 1963 percentage difference of the gross domestic product in both current and constant prices kept a close growth rate spread of 1.57 percent for each year. We thought it quite reasonable to maintain that same growth rate with regard to the current and constant gross domestic product for 1961. Since the growth rate of 1961, in current prices, was 3.35 percent, it follows that 1.78 percent (3.35 - 1.57) should be its approximate growth rate, in constant 1975 prices. Assuming this, we generated the missing 1960 gross domestic product, also in 1975 prices. Once having the 20-year time-series for the gross domestic product in both current and constant 1975 prices, we proceeded to compute its implicit deflator, for which the 1975 base was moved to 1968, in order to generate a new gross domestic product time-series in constant 1968 prices, as required. Similar steps were taken in the case of Canada, except that due to the irregularity of the percentage difference referred to above for those same years, we took instead the growth rate of gross domestic product, in current prices, for the years 1962 and 1963 (1.21 percent) and applied it to generate the missing gross domestic product, in constant 1968 prices for 1960. Next, the sum of the USA and Canada gross domestic products gave us our required gross domestic product corresponding to North America, converted afterwards into billions constant 1968 bolivares (GDPNAR), according to the market exchange rate obtained from the International Monetary Fund's publication <u>International Financial Statistics Yearbook 1981</u>, pp. 448-449. With respect to Western Europe, we added all the corresponding gross domestic products of all the members of the region as defined above. The missing 1960 gross domestic product of the group was generated by applying the average growth of the two following years, 1962-1963, which individually had an almost equal rate (4.5 percent). The base year 1975 was changed to 1968 and a new series for the gross domestic product, in constant 1968 prices, was generated for the region (GDPWER).

Finally, the Latin America gross domestic products, in 1968 prices, (GDPLAR) were generated. The Economic Commission for Latin America's publication <u>Statistical Yearbook</u>

For Latin America 1979, pp. 124-125, provided the data for 1960, 1965 and 1970-1978. The missing data for 1962-1964 and 1966-1969 were provided by the Statistical Yearbook for Latin America 1975, pp. 4-5. This publication also provided the data for 1960, 1965 and 1970-1974, which differ from the data of the previous 1979 publication. We then adjusted these two series by finding a common factor (1.0102) with respect to the base year 1970 and proceeded to multiply it by the data for 1960-1969 from the 1975 publication. This operation reproduced the gross domestic products of the years 1960 and 1965 given by the 1979 publication, which allowed us to confirm that the adjustment was a correct one. The 1979 gross domestic product, which remained missing, was generated by extrapolation, taking the average growth rate of 1976, 1977, and 1978 (4.47 percent) and applying it to obtain the missing data.

We faced two problems with our new generated gross domestic product for Latin America, which appear in constant 1970 prices (GDPLAR), instead of 1968 prices. First, the data refer to factor cost, which is less than in terms of market prices; the difference being net indirect taxes (i.e., taxes - subsidies). Since this last piece of information was not available in the above said publication, and since it may be assumed that net indirect taxes are relatively low, between 2 and 5 percent (this has been the case in Venezuela for the past ten years, but in the case of the OECD these taxes reached 12 percent in 1955-1965), we decided to accept this class of gross domestic product as a close approximation to its value at the market price. Second, we have mentioned above that our GDPLAR is in 1970 prices. This remains since we were not able to find a way to convert it to 1968 prices. More information was needed to do so. However, a two year gap should not create much of a difference. In conclusion, we accepted the new GDPLAR as a close approximation to the desired gross domestic product in 1968 prices, hoping a rather acceptable performance within the submodel. Again, the time-series were converted to billions of constant bolivares.

3.6.3 Non-Petroleum Exports

The non-petroleum export data (XNOR) were computed by a simple subtraction of total petroleum exports (XTOR) from total exports (XTR), which have not yet been described. This was done by taking total exports in current bolivares from *International Financial Statistics*, pp. 450-451, and deflating them by the Venezuelan implicit deflator, based on 1968 prices, and thus we have:

(3.28) $XNOR = XTR - XTOR,$

which is simply an identity, meaning that non-petroleum exports (XNOR) are always equal to the difference between total exports (XTR) and petroleum exports (XTOR). Most of these exports comprise iron ore, agricultural and manufacturing products, which represent a relatively small proportion of total exports (about 5 percent from 1975).

3.7 THE IMPORT DATA

The time-series data for the import sector have been collected and processed from various annual reports and publications of the Banco Central de Venezuela (The Central Bank of Venezuela) and other sources for the 1950-1979 period.

The data consist of three groups of empirical information: (1) The import c.i.f. per se, (i.e., cost, insurance and freight included in the valuation of imports for the national accounts), which we disaggregated into two major components: (i) Capital imports, and (ii) Non-Capital imports, (2) The Terms of Trade, and (3) The Balance of Payments. The terms of trade and the balance of payments bring together the export and the import sectors and provide us with information about the performance and behaviour of the foreign sector and the rest of the economy.

The import data were available in nominal terms. The corresponding data for the period 1950-1959 were taken from A Macro-econometric Model of Venezuela[69] and the remainder of the data for the 1960-1979 period was obtained from Informe Economico 1969, p. A-VII-11, and Informe Economico

[69] See Pedro A. Palma-Carrillo, op. cit., Appendix C.

1979, pp. A-202-203. The whole time-series, 1950-1979, was then deflated by the general GDP deflator based on 1968 prices.[90]

The same above sources provided the data for capital imports (MKR), and by subtracting these series from total imports series (MTR) we obtained the non-capital imports (MNKR), that is, given that:

$$(3.29) \quad MTR(t) = MKR(t) + MNKR(t)$$

then,

$$(3.30) \quad MNKR(t) = MTR(t) - MKR(t)$$

The capital import series were obtained by summing up machinery, equipment and other tools, construction materials and transport equipment. The corresponding capital import wholesale price index (MWKI) was obtained from *A Macro-econometric Model of Venezuela*, for which the 1957 base year was moved to 1968 for the 1950-1969 period. The data corresponding to the 1970-1979 period were obtained from *Informe Economico 1979*, p. A-193. The non-capital import wholesale price index (MWPI) and the domestic wholesale price index (DWPI) were obtained from *La Economia Venezolana en los Ultimos Treinta y Cinco Anos*, pp. 289-291 and *Informe Economi-*

[90] The Banco Central de Venezuela in *La Economia Venezolana en los Ultimos Treinta y Cinco Anos* provides revised import data in current terms for the period 1950-1976, but because its valuation is made on the f.o.b. (free on board) concept it is improper to make use of such data.

co 1979, Table A-III-8.

3.7.1 The Terms of Trade

We have dealt with this term in Subsection 2.6.1., Chapter II, at some length. There, this concept was defined as the ratio of export unit value indexes over import unit value indexes and its product by the quantum index of exports was denominated as the 'purchasing power index of exports' or more formally the 'income terms of trade' or, equivalently, the 'capacity to import.'

The export and import unit value indexes, for the 1950-1969 period, were obtained from La Economia Venezolana en los Ultimos Treinta Anos, (Caracas, 1971), p. 303, which 1959 base was moved to 1968, and the remaining data for the period 1970-1979 were obtained from Informe Economico 1979, p. A-394.

The quantum index (Qi) of exports follows Laspeyres' formula:

(3.31) $Qi = SUM(PoQn)/SUM(PoQo)$

where SUM implies summation over the sample period t(1,2,...,T years) and Po is the price of each category of goods exported Qo in the base year (i.e., the unit value of the goods exported in 1968) and Qn is the quantity of each category of goods for each year of the sample period.

The quantum index of exports for the period 1950-1969 was obtained from the first publication mentioned above, p. 303, and its base year moved to 1968; but the 1970-1979 data were computed from Informe Economico 1979, p. A-394.

3.7.2 The Balance of Payments

Subsection 2.6.2., Chapter II, above, covered at length the balance of payments of Venezuela. The structure given there of these payments, in particular the current account, reflects our intention of showing the contribution that the petroleum sector and the non-petroleum sector may have had in the economic development of Venezuela, during at least the 1950-1979 period. The capital account provides us with the balance of the account, which we considered sufficient since the petroleum sector has dominated most of the sample period, except for 1976-1979 when the non-petroleum sector received a net inflow of capital. We should recall, at this point, that the petroleum industry passed under government ownership in January 1, 1976.

The Banco Central de Venezuela publishes quite extensively the balance of payments of the country, and from which we have computed the data in use in this study for the 1950-1979 period. The corresponding data for the imports of factor services (MFSR), or net factor payments abroad, were obtained from the International Financial Statistics 1981, pp. 450-451. Venezuela is a net importer of these services.

3.8 TAX REVENUES DATA

Three kinds of taxes have been defined in Section (2.7) according to the needs and objectives of this study: Indirect Taxes, Direct Taxes and Petroleum Taxes. Indirect and direct taxes are those revenues taken by the government from the non-petroleum sector of the economy while petroleum taxes are those revenues collected entirely from all the activities of the petroleum sector. In order to produce these kinds of tax time-series, it was necessary to perform some disaggregations on the aggregated tax series obtained from the Central Bank of Venezuela. In its Informe Economico 1979, pp. A-335-338 and in La Economia Venezolana en los Ultimos Treinta Y Cinco Anos (Caracas, 1978), pp. 263-274, it is shown that indirect taxes contain excise taxes on petroleum products refined in the country and direct taxes are levied on personal income, corporate income and on other activities of the petroleum sector, all values in current bolivares. Since we are concerned here with the fiscal contribution of the petroleum sector to total government tax revenues, it was necessary to add up all these different taxes levied on the petroleum activities plus the royalty taxes and foreign exchange gains to form the new category already defined as 'petroleum taxes'. Other taxes derived from changes of the tax structure were distributed amongst the above categories according to weights, from 1960 to 1979.

Finally, the above nominal tax time-series were deflated by the consumer price index in order to generate the respective tax time-series in constant 1968 prices.

3.8.1 Miscellaneous Data

An adjustment was introduced in (II) above as a residual term generated by the difference between supply and aggregate demand, that is,

(3.32) $ADJT = GDPR - [CTR + ITGR + (XR - MR) + MFSR]$

which term takes care of the errors and omissions that quite likely occurred in the process of generating the data of this study.

3.9 THE PRODUCTION FUNCTION DATA

In order to conform with the specifications of the production functions of Section 2.8, Chapter II, labour input is measured as the number of employees per year while capital input is measured by its yearly gross fixed value in 1968 prices, during the sample period. But we also measure the factor inputs in terms of their deflated income receipts of the real gross domestic product per year, which is a flow concept that may be taken as an alternative measurement to the previous stock concept.

The time-series corresponding to gross domestic product is available according to Section 3.2 and the one for capital is also on hand and discussed in Section 3.5 above. But the labour time-series data is incomplete, which makes the completion of it our first task.

The official publication by the Central Bank of Venezuela _La Economia Venezolana en los Ultimos Treinta Anos_, (Caracas, 1971), p. 76, provided the number of working people from 1950 to 1969. Missing are the number of workers from 1970 to 1979, but other publications, _La Economia Venezolana en los Ultimos Treinta y Cinco Anos_, (Caracas, 1978), p. 35 and _Informe Economico 1979_, (Caracas, 1979), pp. A-202-203, provided us with the annual national wage bill in three segments of data: one covers the period 1950-1969 with unrevised data, the next is from revised data 1968 to 1976 and the last covers the 1970-1979 period with a new revision of data. The task here then is first to generate a new revised national wage bill time-series for the period 1950-1979 and, afterwards, to regress the number of working persons per year during the period 1950-1969 against the previously estimated wage bill data in order to extrapolate the missing number of workers for the new period 1970-1979.

Therefore, in order to make the above three time-series sets compatible and, consequently, produce one single time-series set of newly revised wage bill, we proceeded as follows:

a) We regressed seven overlapping years of the series 1968-1976 and 1970-1979 and obtained the following regression equation:

(3.32) LWBRC(T) = .23088 + .99878 LWBNRC

$r2 = .9999 \quad SEE = .077$

where LWBRC and LWBNRC stand for the new revised and non-revised nominal wage data for each year t, respectively.

b) This equation (3.32) allowed us to extrapolate the new revised wage bill corresponding to 1968 and 1969:

(3.33) LWBRC(1968) = .23088 + .99878(17.612 Bn. Bs.)
= 17.821 Bn. Bs.

(3.34) LWBRC(1969) = .23088 + .99878(18.670 Bn. Bs.)
= 18.878 Bn. Bs.

c) With the above results, we now have a 1968-1979 revised wage bill data offering two overlapping years with the old 1950-1969 wage bill. To make these two time-series compatible, we find first the common factor that relates them through the two overlapping years:

(3.35) f1(1968) = (LWBRC/LWBNRC)(1968)
= (17.821/20.099) = .8867

(3.36) f2(1969) = (18.878/21.244) = .8886

Since the above two ratios, f1 and f2, are almost the same, we decided to take the average as a common factor (cf):

(3.37) cf(1968-1969) = .888

d) By multiplying the old 1950-1969 time-series by the common factor .888, we generated the whole new revised wage bill time-series for the sample period.

The second task now is to generate the number of working people for the same sample period. To do this, we proceeded with another regression equation:

(3.38) LABOUR = 1.1635 + .0859(LWBRC)

$r2$ = .998 SEE = .176

By plugging in the brackets of the equation the annual wage bill for 1970-1979, the number of workers corresponding to this period is extrapolated:

(3.39) LABOUR(1970) = 1.1635 + .0859(20.104)

= 2.890 workers,

......(....) = ...,

......(....) = ...,

......(....) = ...,

(3.40) LABOUR(1979) = 1.1635 + .0859(44.416)

= 4.979 workers.

With the above procedure, the labour time-series was completed.

An observation should be made at this point. The working population of Venezuela in 1979 seems to be too high at the estimated level of almost 5 million workers if we relate it to the level and the structure of the population as discussed in footnote 29 (13.6 million), Chapter II, which is an estimation based on the 1971 census.[91] According to unofficial accounts, based in the latest 1981 census, the population of Venezuela was approximately 15 million for 1979, in which case our estimate, although still high, seems to be not too far fetched considering the presumably high level of underemployment and the actual deterioration of income distribution in the country.

As previously indicated, we shall also assume in the estimation of the production function that real gross domestic product (GDPR) is exhausted by the deflated income payments to the labour input (LWBR) and to the capital input (KAPR). LWBR was deflated by the consumer price index and it can be written:

(3.41) $GDPR(t) = LWBR(t) + KAPR(t)$

and so we have:

(3.42) $KAPR(t) = GDPR(t) - LWBR(t)$

which was generated in real terms, based on 1968 prices.

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[91] It should be noted that the population censuses taken in Venezuela since 1936 appear to be highly inaccurate within a 6 to 10 percent range of omissions made. See Jose Eliseo Lopez, La Expansion Demografica de Venezuela, (Merida, 1963), pp. 9-12, and J. Chi-yi Chen, Estrategia del Desarrollo Regional: Caso de Venezuela, (Caracas, 1967), pp.35-36. See also Julio Paez Celis, 'Evaluacion de las Omisiones de los Censos de los Anos 1936, 1941 y 1950', Revista de Fomento, No.97, (March, 1962), p.97.

Chapter IV

THE MODEL AND THE PARAMETER ESTIMATES

4.1 THE MODEL

The model consists of 18 endogenous variables equaling, of course, the same number of model equations, of which 10 are behavioural, 1 is technological and 7 are identity equations. The model counts also on 35 predetermined variables, of which 11 are lagged endogenous and 24 exogenous variables. The latter type of variable contains 16 non-controllable and 8 controllable variables or instruments.

4.1.1 Glossary of Variables

All variables of this model are expressed in constant 1968 prices to which the R at the end of their acronyms refers.

(A) Endogenous Variables:

GDPR	Gross Domestic Product
YNR	National Income
CPR	Consumption (C) of the Private Sector (P)
CTR	Total Consumption (CT)
IPGR	Investment of the Private Sector (IP) in Gross Terms (G)
ITGR	Total Investment in Gross Terms

XONAR	Exports of Petroleum (XO) to North-America (NA)
XOLAR	Exports of Petroleum to Latin-America (LA)
XTOR	Total Petroleum Exports (Excludes Cuba: Venezuela broke diplomatic and trade relations with Cuba, early in the 1960's).
XTR	Total Exports (XT)
MKR	Imports (M) of Capital Goods (K)
MNKR	Imports of Non-Capital Goods (NK)
MTR	Total Import (MT)
TXIR	Tax (TX) Indirect Receipts (I)
TXDR	Tax Direct Receipts (D)
TXOR	Tax Petroleum Receipts (O)
TXTR	Total Tax Receipts (TXT)
LABOUR	Employment in Millions of Workers

(B) Predetermined Variables:

(b.1) Lagged Endogenous:

CPR(-1)	CPR lagged one year
CTR(-1)	CTR lagged one year
IPGR(-1)	IPGR lagged one year
YNR(-1)	YNR lagged one year
TXIR(-1)	TXIR lagged one year
TXDR(-1)	TXDR lagged one year
TXOR(-1)	TXOR lagged one year
MKR(-1)	MKR lagged one year

MNKR(-1)	MNKR lagged one year
GDPR(-1)	GDPR lagged one year
LABOUR(-1)	LABOUR lagged one year.

(b.2) Exogenous Variables

(b.2.1) Non-Controllable:

ADJT	Adjustment Term for Aggregate Expenditures
COVER	Consumption of Petroleum in Venezuela
COVER/QOVER	Consumption of Petroleum in Venezuela as a share of total petroleum production
KGR(-2)	Capital-Stock (K) in Gross Terms lagged two years
MWPI/DWPI	Non-capital Import Wholesale Price Index Relative to Domestic Wholesale Price Index
MWKI/DWPI	Capital Import Wholesale Price Index Relative to Domestic Wholesale Price Index
MWKI/DWPI(-1)	MWKI/DWPI lagged one year
MWPI/DWPI(-1)	MWPI/DWPI lagged one year
GDPLAR	GDPR of Latin-America
GDPNAR	GDPR of North-America
GDPNOR	GDPR of the Non-Petroleum Sector[92]
POVWR	Realized Price of Venezuelan Petroleum in the World
TIME	Time Trend

[92] The inclusion of an endogenous GDPNOR, as shown in Eq.(19) below, in the simulation model would reduce the multipliers of the model. (See Eq.(19), p. 141).

XOWER	Exports of Petroleum to Western Europe
XORESTR	Exports of Petroleum to the Rest of the World
XNOR	Exports of the Non-Petroleum Sector.

(b.2.2) Controllable:

CGR	Consumption of the Public Sector
IGGR	Investment of the Public Sector
SMR	Stock of Money (Money Supply)
SLMR	SMR plus savings and time-deposits
QOVER	Quantity of Petroleum Production in Venezuela
POVER	Petroleum Price in Venezuela
POVER/POVWR	Petroleum Price in Venezuela Relative to Venezuelan Petroleum World Price
MFSR	Imports of Factor Services in Net Terms.

4.1.2 The Structure Of The Model

The general specification of this model has been discussed in Chapter II, but further analysis will appear in this chapter.[93] Note also that the coefficient of determina-

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[93] It has also been suggested by Professor R.A.L. Carter that the most appropiate methodology for specifying a stochastic equation model is to begin with a very general specification and then 'test down' until a more specific model is obtained. See A.C. Harvey, The Econometric Analysis of Time Series, (John Wiley & Sons, New York, 1981), Chapters 5 and 8.

tion (R2) reported in this model is not adjusted by degrees of freedom.

Eq. (1) CPR = 1.830 + .479 CPR(-1) + .209 YNR + .598 SMR
(t's) (5.55) (8.53) (7.69) (9.36)

R2=.999 F(3/25)=5739.8 D-W=2.301 h=-.851 SEE=.546

Eq. (2) CTR = 1.000 CPR + 1.000 CGR

Eq. (3) IPGR = 4.517 + .644 IPGR(-1) - .129 KGR(-2)
(t's) (5.47) (4.50) (-5.17)

+ .179 GDPR + .309 SLMR
(3.95) (5.58)

R2=.973 F(4/23)=208.3 D-W=1.993 h=.0283 SEE=.741

Eq. (4) ITGR = 1.000 IPGR + 1.000 IGGR

Eq. (5) YNR = -1.526 + .490 YNR(-1) + .430 GDPR + .185 TXTR
(t's) (-2.24) (5.05) (5.12) (4.50)

R2=.998 F(3/25)=4004.2 D-W=2.051 h=-.158 SEE=.890

Eq. (6) TXIR = .321 + .429 TXIR(-1) + .070 MNKR (t's) (2.5) (2.37) (3.41)

R2=.933 F(2/16)=113.3 D-W=1.574 h=1.541 SEE=.136

Eq. (7) TXDR = -1.045 + .394 TXDR(-1) + .057 GDPNOR

(t's) (-3.27) (2.49) (4.00)

R2=.958 F(2/16)=179.9 D-W=1.611 h=1.140 SEE=.222

Eq. (8) TXOR = -2.686 + .206 TXOR(-1) + 1.179 XTOR -

(t's) (-.53) (2.41) (6.74)

-1.021 COVER*100/QOVER

(-1.79)

R2=.957 F(3/15)=111.4 D-W=1.867 h=.312 SEE=1.875

Eq. (9) TXTR = 1.000 TXIR + 1.000 TXDR + 1.000 TXOR

Eq.(10) XONAR= 13.357 + .002 GDPNAR - 7.713 POVER/POVWR -

(t's) (7.11) (3.97) (-9.74)

-6.690 COVER

(-2.64)

R2=.950 F(3/16)=92.2 D-W=2.202 SEE=1.016

Eq.(11) XOLAR= .922 + .003 GDPLAR + .089 QOVER - 2.089 COVER (t's) (4.09) (5.55) (4.56) (-4.29)

R2=.980 F(3/16)=220.6 D-W=2.121 SEE=.171

Eq.(12) XTOR = 1.000 XONAR + 1.000 XOLAR + 1.000 XOWER

+ 1.000 XORESTR

Eq.(13) XTR = 1.000 XTOR + 1.000 XNOR

Eq.(14) MKR = -2.251 + .546 ITGR + .022 MWKI*100/DWPI -

(t's) (-5.5) (14.68) (3.32)

- .091 CTR

(-4.72)

RHO=.460 R2=.974 F(3/26)=306.5 D-W=1.778 SEE=.305

Eq.(15) MNKR = 6.773 + .400 MNKR(-1) + .185 YNR -

(t's) (3.30) (3.00) (4.80)

-.010 MWPI*100/DWPI

(3.50)

R2=.975 F(3/25)=219.1 D-W=1.616 h=1.085 SEE=.865

Eq.(16) MTR = 1.000 MKR + 1.000 MNKR

Eq.(17) GDPR = 1.000 CTR + 1.000 ITGR + 1.000 XTP -

-1.000 MTR + 1.000 MFSR + 1.000 ADJT

Eq.(18) GDPP = -1.650 + 7.315 LABOUR + 1.460 TIME

(t's) (-1.95) (10.88) (17.67)

RHO = .420 R2 = .998 F(2/27) = 2845.6

D-W = 1.713 SEE = .803

NOTE: Although the gross domestic product of the non-petroleum sector (GDPNOR) appears in this model as an exogenous variable, it is an endogenous variable to the Venezuelan economy and, hence, it should be treated as such. This was done:

Eq.(19) GDPNOR = 1.012 + .586 GDPR + .384 TIME - 10.029 DUM

(t's) (1.48) (7.73) (2.26) (-7.85)

R2 = .994 F = 1376.3 D-W = 1.637 SEE = 1.227

The regression equation explains relatively well the GDPNOR, although the equation appears to show a slight auto-correlation of the error terms. A dummy variable (DUM) was included to take account of the petroleum price increase in 1974. However, the inclusion of Eq.(19) in the simulation model would definitely reduce the multipliers of the model. This suggests that further experiments to explain the GDPNOR should be carried out in further research.

We also tried the demand for money and obtained the following results:

Eq.(20) $SMR = -5.058 + .248\ GDPR + .537\ RVEN$

(t's) (-4.18) (3.98) (.92)

$R2 = .831 \quad F = 66.6 \quad D\text{-}W = .1962 \quad SEE = 2.762$

Eq.(20a) $SMR = -4.806 + .266\ GDPR + .312\ RUSA$

(t's) (-4.05) (4.59) (.66)

$R2 = .829 \quad F = 65.4 \quad D\text{-}W = .1853 \quad SEE = 2.783$

Eq.(21) $SLMR = -10.958 + .517\ GDPR + .611\ RUSA$

(t's) (-5.17) (5.01) (.73)

$R2 = .853 \quad F = 78.0 \quad D\text{-}W = .1209 \quad SEE = 4.965$

Eq.(21a) $SLMR = -11.474 + .477\ GDPR + 1.100\ RVEN$

(t's) (-5.33) (4.32) (1.06)

$R2 = .856 \quad F = 80.0 \quad D\text{-}W = .1079 \quad SEE = 4.91$

As can be seen, the demand for money does not respond to the Venezuelan interest rate (RVEN), as we assumed a priori, neither does it the USA prime rate (RUSA). The addition of a dummy variable, taking care of petroleum sharp price increase in 1974, or the inclusion of a time variable did nothing to improve the relationship.

4.2 THE CONSUMPTION FUNCTION

Venezuela is paradoxically a rich and poor country. Rich because nature has endowed its soil with a huge wealth; poor, because most of its people do not share the wealth under exploitation and they live in poverty.[94]

Keeping this scenerio in mind, we should consider that this wealth, which is mostly derived from petroleum resources,[95] must be taken into account in any formulation of the consumption function to reflect the wealth of the public sector and the poverty of the people, at least during the sample period of this study, 1950-1979. This wealth is embodied in the official national accounts, tax and monetary statistics, which have been converted to constant 1968 prices in order to avoid the phenomenon of monetary illusion. Some words of warning should be given at this point. The introduction of real national income as an explanatory variable instead of disposable income will generate a lower short-run marginal propensity to consume (MPCs) than otherwise expected.[96]

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[94] See Section (2.2), Chapter II above.

[95] Natural resources belong to the Venezuelan state, regardless of the ownership of the land. The means of exploitation of the resources may belong to the private sector. This was the case in the petroleum industry until recently. In January 1976 this industry was nationalized.

[96] Although the consumer price index is considered in most econometric studies to be the correct deflator to deflate both consumption and income variables. We have decided in this study, for reasons of common sense as well as because of the fact that this study is so aggregated, to

In estimating the consumption function, we started from the simple Keynesian Absolute Income Hypothesis and gradually built more acceptable relationships from which to select the best functions in terms of goodness of fit and information.

Aggregate consumption in constant 1968 prices (CTR) is composed of private consumption (CPR) and public consumption (CGR); that is:

(4.2) CTR = CPR + CGR.

4.2.1 Private Consumption Function

The Absolute Income Hypothesis relates consumption to national income,[97] which seems to be the relevant variable for the case on hand according to the above reasoning. National income comprises labour and capital incomes before taxes. Such a consumption function may reflect the dichotomy of a wealthy state and the poverty condition prevailing in the country.

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deflate national income by the gross domestic product deflator. In his annual and aggregated models of the USA economy (1929-1962), Professor L. R. Klein deflated disposable income by the gross national product deflator with the implication of a lower MPCs=.56. Using the same data deflated by the consumption deflator, Professor M. K. Evans estimated a higher MPCs=.66. See M. K. Evans, op. cit., p. 57. See also H. O. A. Wold (ed.), Model Building in the Human Sciences, (Union Europeene d'Editions, Monaco, 1967)

[97] Alvin H. Hansen, A Guide to Keynes, (McGraw-Hill, New York, 1953), p. 73.

The hypothesis was tested by using the ordinary least squares (OLS) method of estimation and the results were:

(4.2.1) $CPR = -.0002 + .718\ YNR$
(t's) (-.00) (29.18)

$R2 = .968$ $F = 851.6$ $D\text{-}W = .2555$ $SEE = 2.475$
$MPC = .718$

The sign of the regression coefficient is positive, as expected a priori, and its t-ratio (.718/.0246) is very high at 5 percent significance level and 28 degrees of freedom, indicating that its own standard error is very low. Note that the constant term is not statistically different from zero, contrary to expectation. (As indicated in the above regression equation, we have chosen to present in parentheses the t-statistics from here on, rather than the estimated standard errors, for each regression equation of this model). The coefficient of determination and the F-ratio [R2=.968 and F(1/28)=851.6 which at 5 percent level of significance has a theoretical F-value of 4.20] are also high. Then, the independent variable explains relatively well the variance and, hence, the private consumption function (CPR); however, the Durbin-Watson statistic was very low (D-W =.2555) clearly pointing to the existence of first order serial correlation of the disturbance terms.[98] In terms of

[98] J. Johnston, Econometric Methods, (McGraw-Hill, New York, 1960), pp.243-244.

goodness of fit, the regression equation (4.2.1) is poor as most of the residuals are above the 5 percent error,[99] but, in terms of information, the equation behaves relatively well as it tells us that the MPC, in both the short and long-run, is about 72 percent. This is a low measure of the MPC for Venezuela compared to the simple average annual change of 82 percent (excluding 1960) and also confirmed by other studies.[100] We do expect a higher MPC due to the extremely unequal income distribution whereby the majority of the population must spend its low income on food, clothing, health and other services, leaving no capacity for saving. Furthermore, the demonstration effect clouds any possibility of saving. The small upper income class emulates the high standard of living of the developed countries (MDC) and, consequently, creates the socio-economic environment for the upper middle class to do likewise, eroding any possible capacity to save. Therefore, we shall continue our quest for a better consumption equation, if possible.

Keeping this line of thought, we estimated the same equation with the introduction of a dummy variable (DUMMY) presuming to capture both the temporal and qualitative effects

[99] The residuals are presented in percentages, that is, the residuals are divided by the corresponding actual values of the endogenous variable. This is a relative measure of the unexplained variation.

[100] Pedro A. Palma-Carrillo, <u>ibid</u>., p. 95. He used disposable income instead as the explanatory variable in testing Keynes'hypothesis for the period 1950-1960, for which there is available disposable income data. The estimated MPC was 90 percent.

in consumption caused by an upward shift of national income from the unexpected increase in petroleum prices in the 1970's, which subsequently generated a demand inflation (due to supply deficiency) without precedent where stable prices previously prevailed, and Venezuela's adoption of the United Nations new national account system.

The resulting equation was:

$$(4.2.2) \quad CPR = -1.040 + .775\, YNR - 2.581\, DUM$$
$$(t's) \quad (-.88) \quad (16.22) \quad (-1.39)$$

$R2 = .97$ $F = 440.8$ $D\text{-}W = .2431$ $SEE = 2.435$

$MPC = .775$

The equation gives no improvement in terms of goodness of fit, but it does generate better information about the consumption behaviour of the country. The marginal propensity to consume (MPC) increased to about 77 percent, an improvement of 8 percent on the previous equation, but the coefficient still remains too low.

We tested Professor Friedman's Permanent Income Hypothesis[101] making use of the 'permanent income' concept as mean-

[101] M. Friedman, A Theory of the Consumption Function, (Princeton Univ. Press, Princeton, 1957). This hypothesis is rather difficult to test as we do not have data on 'transitory' consumption and income. The whole hypothesis has created much confusion and arguments against it. Professor Ronald Bodkin in his "Windfall Income and Consumption", A. E. R., Vol. 49, (Sep. 1959), pp. 602-614, puts in doubt Friedman's postulate that 'transitory income' is not correlated to 'transitory consumption' as he found out that 'unexpected income'

ing regular income that could be spent in consumption of goods and services. We did not see fit to use Koyck's transformation technique.[102] We merely used regular income and the previous year regular income as explanatory variables. The results were extremely poor for fitness and information. In fact, the sign of the regression coefficient of the income variable was negative, but previous income showed to be an important explanatory variable of consumption. Of course, this equation was rejected.

We introduced, then, one lagged dependent variable to test Brown's Habit Persistence Hypothesis.[103] The results were the following:

$$(4.2.3) \quad CPR = -.500 + .163\ YNR + .851\ CPR(-1)$$
$$(t's) \quad (-1.11) \quad (2.93) \quad (10.28)$$

$$R2 = .993 \quad F = 1977 \quad D\text{-}W = 1.3049$$

$$\text{Durbin } h = 2.0912$$

$$SEE = 1.136 \quad MPCs = .163 \quad MPCl = 1.094$$

(windfall income) which may be construed as 'transitory income' because of its nature was indeed correlated with consumption.

102 Balvir Singh and Aman Ullah, "The Consumption Function: the Permanent Income versus the Habit Persistence Hypothesis", R. E. S., Vol. LVIII, No. 1, (Feb. 1976), pp. 96-103. According to the authors, the application of Koyck's distributed lag model violates some of the basic postulates of Friedman's hypothesis, invalidating, therefore, the coefficients of the resulting regression equation.

103 T. M. Brown, "Habit Persistence and Lags in Consumer Behaviour", Econometrica, Vol. 20, No. 3, (July, 1952), pp. 355-371.

For a 95 percent confidence level the critical value of the Durbin h statistic equals 1.645 and the computed h-statistic does exceed that value, meaning that the disturbance terms are not serially independent. In fact, a look at the residual errors showed that 7 years have residuals between 5 and 9.4 percent, with the highest at 11.7 percent corresponding to 1953. We also observed that the standard error of the coefficient of the income variable is low, making the coefficient statistically significant by the t-test at 5 percent significance level with 26 degrees of freedom. The coefficient of determination is close to 1. In spite of these significant results, the equation leads to the underestimation of the aggregate MPCs (.163) and to the overestimation of the MPCl (1.09). The inclusion of the population effect through per capita values confirmed the previous results and the introduction of a dummy variable, reflecting the exceptional consumer behaviour of the 1970's, did not improve the informative power of the equation. One thing was clear from these equations, the lagged dependent variable, CPR(-1), is a very powerful explanatory variable of consumption and should be taken into account in any further specification of the consumption function. In effect, we added the stock of cash money in constant 1968 prices (SMR) to equation (4.2.3) as an explanatory variable in testing the wealth effect on consumption behaviour.[104] Of course,

[104] A. Ando and F. Modigliani, "The Life Cycle Hypothesis of Saving: Aggregate Implications and Tests", A. E. R.,

the stock of money (SMR) is not the proper variable for wealth as understood in theory, but for the case at hand it seems to be the best proxy available.[105] The new specification of the function produced better information and a better fit:

(4.2.4) CPR = 1.830 + .209 YNR + .598 SMR + .479 CPR(-1)

(t's) (5.55) (7.69) (9.36) (8.53)

R2 = .999 F = 5739.8 D-W = 2.3012 h = -.8509

SEE = .546

MPC1(YNR) = .437 MPC1(SMR) = 1.251

From a statistical analysis, we conclude that this equation generates an almost perfect goodness of fit. The coefficient of determination is almost 1 and since the h-statistic is smaller than the critical value at 5 percent significance level we do not reject the null hypothesis, concluding that the error terms are independent. A look at the residuals shows that 26 of them have a measure under a level of 3 percent error and only 3 residuals above it but under 6.8 percent. And furthermore, the magnitude of the F-ratio (5739.8) makes the regression significant at 5 per-

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Vol. 53, (March, 1963), pp. 55-84.

[105] M. K. Evans, "The Importance of Wealth in the Consumption Function", J. P. E., Vol. 75, No. 4 (August, 1967), pp. 335-351. According to the author, the liquid-assets part of wealth seems to be of a great importance in determining consumption.

cent significance level, that is, the set of explanatory variables explains very well the variation in the CPR. However, while looking at the size of the MPCs (.209) of the income variable, we see that although it improved, it did not reach a a satisfactory level. The sign of the coefficient of SMR is positive as expected and its size is reasonable at a value of 0.6.

By dropping the dependent lagged variable, we obtained:

(4.2.5) $CPR = 3.2673 + .403\ YNR + .968\ SMR$
(t's) (6.64) (13.52) (11.29)

$R2 = .994$ $F = 2412.4$ $D\text{-}W = .5536$ $SEE = 1.054$
$MPC(YNR) = .403$ $MPC(SMR) = .968$

The size of the Durbin-Watson statistic (.5536) shows that the residual errors are autocorrelated and, therefore, the regression equation cannot be accepted. We observed that in both of the two previous equations the MPC is higher out of the wealth variable than out of regular income, which seems to be at odds with theory and empirical findings.[106]

[106] In his Ph.D. dissertation, Pedro A. Palma-Carrillo showed that the MPC out of monetary liquidity (SLMR), which is a broad definition of money supply, and which he takes as a proxy for wealth, was much too low in comparison with the MPC out of disposable income (.368 vs. .838). We also tried this relationship with disposable income in real terms (YDR). (We took Palma's current disposable income data for 1950-1969, converted them to constant 1968 prices and projected them into the 1970's by letting them grow at the same rate as the GDPR, except for 1974-1976 when, because of a higher expectation on petroleum prices, disposable income was assumed to

Finally, we tried to incorporate population in equation (4.2.4) in terms of real per capita values to bring about the effects of the extreme unequal income distribution in the country. This equation gave the following results:

$$(4.2.6) \quad CPPR = .052 + .034\,YNPR + .092\,MSPR + .875\,CPPR(-1)$$

(t's) (.77) (1.33) (1.14) (12.24)

$R2 = .997$ $F = 3055.8$ $D\text{-}W = 2.5701$ $h = -1.6033$

$SEE = .039$ $MPC(YNPR) = .034$ $MPC(MSPR) = .092$

where CPPR, YNPR and MSPR are the per capita variables, in constant 1968 bolivares, for private consumption, national income and money supply, respectively. CPPR(-1) is the lagged dependent private consumption variable. The results of this regression equation are not satisfactory. Although the

increase just a little faster. It should be said here that YDR followed fairly closely the growth rate of the GDPR in the 1950's and the 1960's. Such a tendency kept YDR rather stable (59 percent of GDPR) with a slight increase at the end of the period (60 percent in 1968-1969). We applied these findings in estimating YDR for the 1970's]. A dummy variable was also included with values of 0 for the period 1970-1973 and 1 for 1974-1979, when petroleum prices increased. The resulting equation was:

$$CPR = 2747.070 + .574YDR + .578SLMR - 1805.636DUM$$

(t's) (4.99) (14.64) (15.76) (-2.98)

$R2 = .997$ $D\text{-}W = 1.2692$ $SEE = 821.455$

where $.578 > .574$ as expected. The D-W statistic test appears to be inconclusive; however, 28 residuals showed errors under the 4.4 percent level relative to the actual values of the CPR and only 2 residuals were between 7 and 10 percent.

coefficient of determination is almost equal to 1 and the Durbin h-statistic is smaller than the critical value +- 1.645, the parameter estimates, excepting the one corresponding to the lagged variable, are not statistically significantly different from zero at a 5 percent level of significance for 25 degrees of freedom, at which the corresponding t-critical value is 1.708. Behaviourally, these estimates do not seem to explain well the consumption function of the country as their magnitudes are too small; in fact, they are much smaller than those already discussed in the previous regression equation (4.2.4). But we have also noticed that the coefficient estimate of CPPR(-1) almost doubled when reaching the level of 88 percent from the previous level of 48 percent of total private consumption as a response to the reduction of the estimates of the other coefficients. Is this consumption absorbtion by CPPR(-1) an indication of the deterioration of the already high unequal income distribution problem in the country ?[107] We know that a great proportion of the population depends on government transfer of payments to meet their needs, in rural and in urban areas as well. These people are in need of urgent economic relief in terms of food, health, water, electricity and schools, at least. These are basic requirements that may keep in existence the sort of tenuous social peace existing in the country at present.

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[107] See Section (2.2), Chapter II.

4.2.2 The Total Consumption Function

Given the nature of this study, it was decided to test a more aggregated consumption function, leaving the public consumption sector exogenously determined. Therefore, the total consumption function in constant 1968 prices (CTR) was estimated according to the Absolute Income Hypothesis. The estimated MPC was 93 percent of real national income (YNR), acceptable for a country like Venezuela, and the r2 was also acceptable at a level of .969. However, the low D-W statistic (.2077) indicated the presence of first order serial correlation.

Gross domestic product in constant 1968 prices (GDPR) was introduced as the only explanatory variable of consumption. The results of this equation were statistically similar to those of the previous equation with a MPC lower but still acceptable at 87 percent of GDPR. Afterwards, we tested the wealth effect by adding the money supply (SMR), a proxy for wealth, to this equation, and the results were:

$$(4.2.7) \quad CTR = 1.803 + .410\ GDPR + 1.533\ SMR$$

$$(t's) \quad (3.48) \quad (18.86) \quad (23.27)$$

$$R2 = .997 \quad F = 4876.4 \quad D\text{-}W = 1.5024 \quad SEE = .960$$

From the statistic analysis, this equation has an excellent goodness of fit as indicated by the coefficient of determination, the F-ratio, the t-ratios and the D-W statistic. From the point of view of information, the MPC out of GDPR is 41 percent, which may be acceptable under the considerations stated at the end of the private consumption section, and the MPC out of SMR is too high at 153.3 percent.

We tried another specification:

$$(4.2.8) \quad CTR = 1.231 + .191\ GDPR + .792\ SMR + .098\ TXTR + .503\ CTR(-1)$$
$$(t's) \quad (4.12) \quad (6.53) \quad (7.90) \quad (3.22) \quad (8.53)$$

$R2 = .999$ $F = 8827$ $D\text{-}W = 2.5400$ $h = -1.533$
$SEE = .493$

From the point of view of the statistical analysis, this equation has a good fit. The h-statistic does not exceed the critical value, meaning that the error terms are serially independent, the R2 is almost equal to 1 and the F-ratio is very high. However, from the point of view of information, we observed that this new relationship did not improve the previous one; in fact, the coefficient for GDPR dropped to 19 percent from 41 percent in the previous regression equation and the coefficient for SMR dropped to 79.2 percent from the high level of 153.3 percent previously. We notice also that the coefficient of government revenues from total taxes (TXTR), although significant by the t-test, is small.

The following equation excludes government revenues, but includes the dependent variable with a lag of one year in an effort to capture the adjustment of movements of the consumption function:

$$(4.2.9) \quad CTR = 1.631 + .252\ GDPR + 1.018\ SMR + .391\ CTR(-1)$$
$$(t's) \quad (3.33) \quad (9.68) \qquad (12.07) \qquad (7.01)$$

$$R2 = .999 \quad F = 8560.3 \quad D\text{-}W = 2.7301 \quad h = -2.061$$
$$SEE = .578 \quad MPC(GDPR) = .252 \quad MPC(SMR) = 1.018$$

Statistically, this equation is similar to equation (4.2.8), except that the Durbin h-statistic indicates the presence of serial correlation of the disturbance terms. From the information point of view, the equation propensities to consume are better; however, the MPC out of GDPR still remains very low.

From all this analysis, we conclude that equation (4.2.4) seems to be the most acceptable one as money supply and the effects of previous consumption are included. Also, it is thought that government spending should be exogenous.

4.3 THE INVESTMENT FUNCTION

The basic Keynesian investment hypothesis maintains that, given the state of expectation towards the future, investment is inversely related to the current interest rate.[108]

[108] H. Hansen, *Ibid.*, Chapter 5.

This hypothesis is easily applicable to developed economies where money and financial markets are well organized and have been developed for a long time. In the present case, it is not quite the same. The market rate of interest seems to be ineffective, at least it has been up till now, as a decision instrument to invest due to its rigidity and to a high degree of market imperfection. The cost of capital does not reflect the relative abundance or scarcity of the factor of production, and the government intervention in selective investment reinforces these imperfections. For these reasons, we shall not include the interest rate in any of our specifications of the investment function of Venezuela. We find that other variables are more effective in explaining investment decisions, such as gross domestic product in real terms (GDPR) or disaggregated into petroleum (GDPOR) and non-petroleum (GDPNOR), real gross capital stock (KGR), real stock of money (SMR) or real monetary liquidity (SLMR).

4.3.1 Private Real Gross Fixed Investment

Different hypotheses based on the acceleration principle were tested. The Harrod-Domar model known as the 'naive' accelerator was the first one to be tried.[109] This hypothe-

[109] E. D. Domar, "Capital Expansion, Rate of Growth, and Employment", Econometrica, Vol. 14, No. 2, (April, 1946), pp.137-147. R. F. Harrod, "An Essay on Dynamic Theory", Economic Journal, Vol. 49, (March, 1939), pp.14-33. See also H.R. Williams and J.D. Huffnagle (eds.), Macroeconomic Theory: Selected Readings, (Appleton-Century-Crofts., New York, 1969), pp. 407-450.

sis relates net investment to the change of output. As a matter of convenience, we decided to use a variant of this theory that takes into account gross investment instead of net investment.[110] The results of this first test by means of the ordinary least squares were poor in terms of information and fitness:

(4.3.10) IPGR = 4.415 + 1.649 [GDPR(t) - GDPR(t-1)]
(t's) (2.97) (2.78)

$r2$ = .222 F = 7.7 D-W = .3050 SEE = 3.751

The magnitude of the capital-coefficient estimate, although statistically significant, was too low at 1.649 compared to the yearly average gross capital-output ratio of 3.22 for the three decades of this study or 2.84 for the 1970's. However, it is interesting to note that this capital-coefficient is quite high and holds a closer relationship to the capital-output ratio in this study than the respective findings of other studies in developed countries.[111] A look at the low coefficient of determination

[110] The 'naive' accelerator: In(t)=b[Y(t) - Y(t-1)], is a relationship of net investment (In) over and above depreciation and the change of aggregate output (Y) of two periods (t) and (t-1). A variant of this theory is: I(t)=a + b[Y(t) - Y(t-1)], where I is gross investment, i.e. the change of gross capital stock, and b is the marginal capital-coefficient. See M. K. Evans, Macroeconomic Activity: Theory, Forecasting and Control, (Harper & Row, New York, 1969), pp. 81-82.

[111] M. K. Evans, Ibid., pp. 81-82. According to Evans the capital- coefficient was less than unity for the postwar

($r2=.222$) seems to indicate that the equation as a whole contributes very little to explain the investment function of the country, which is also shown by the low F statistic, and the low Durbin-Watson statistic (D-W=.3050) and clearly points to the presence of serial correlation for the disturbance terms. Of course, this equation was rejected. A word of caution should be said here. The relationship specified in equation (4.3.10) does not take into account government gross fixed investment and, therefore, the capital-coefficient is underestimated. A variant of this theory was then used by taking real depreciation (DEPR) as another explanatory variable.[112] The estimated equation gave the following results:

$$(4.3.11)\quad IPGR = \underset{(2.42)}{1.358}\,[GDPR - GDPR(-1)] + \underset{(3.71)}{1.104}\,DEPR \qquad (t's)$$

$$R2 = .318 \quad F = 12.9 \quad D\text{-}W = .2552 \quad SEE = 3.513$$

As can be seen, these results are not any better than those produced in the regression equation (4.3.10). Therefore, equation (4.3.11) cannot be accepted.

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years while S. Kuznets found that the gross capital-output ratio reached a level of 6.8 during the same period 1939-48. See S. Kuznets, _Capital in the American Economy_, (Princeton University Press, Princeton, 1961), pp. 78-79.

[112] A previous test was done with the inclusion of the constant term, but the results were poorer than those provided in equation (4.3.10).

A modified form of the acceleration principle is the capital stock-adjustment model: $IN(t) = aY(t) - bK(t-1)$, which was suggested by Goodwin and Chenery.[113] This model says that net investment is positively related to the level of income (Y) while negatively related to existing capital stock [K(t-1)]. In other words, the higher the level of income, the higher the level of investment to be added to the existing capital stock, and with a given level of income the higher the stock of capital the lower investment would be as capital accumulation approaches the desired level.

Since we are interested in gross fixed investment, the model was modified to take this conversion into account. The estimated equation produced these results:

$$(4.3.12)\quad IPGR = -.049 - .084\ GDPR + .109\ KGR(-1)$$
$$(t's)\quad (-.06)\quad (-1.20)\quad (3.99)$$

$$R2 = .847 \quad F = 72.2 \quad D\text{-}W = .8280 \quad SEE = 1.693$$

The signs of the coefficients of the explanatory variables were wrong, according to theory. The magnitude of the coefficient of income is not significantly different from zero as its t-value contains 1.20 times its own standard error, and the low level of the D-W statistic shows that the disturbance terms are not serially independent.

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[113] R. M. Goodwin, "The Non-linear Accelerator and the Persistence of Business Cycles", Econometrica, Vol. 19, No. 1 (January, 1951), pp. 1-17. and H. B. Chenery, "Overcapacity and the Acceleration Principle", Econometrica, Vol. 20, No. 1 (January, 1952), pp. 1-28.

Being unsatisfied by the above, we proceeded then to improve the specification of the model by testing longer lags for capital stock, including other explanatory variables. After many trials and errors, the final model selected allowed a lag of two years for KGR, the inclusion of the dependent variable lagged one year and the supply of money, in the narrow and broad concepts (SMR and SLMR), as independent variables. The resulting equations are:

(4.3.13) IPGR = 3.188 + .192 GDPR - .121 KGR(-2)
(t's) (4.15) (3.75) (-4.27)

+ .711 IPGR(-1) + .465 SMR
(3.76) (4.35)

$R2 = .965$ $F = 159.8$ $D\text{-}W = 2.1221$ $SEE = .842$

The Durbin h-statistic was not defined.

(4.3.14) IPGR = 4.517 + .179 GDPR - .129 KGR(-2)
(t's) (5.47) (3.95) (-5.17)

+ .644 IPGR(-1) + .309 SLMR
(4.50) (5.58)

$R2 = .973$ $F = 208.3$ $D\text{-}W = 1.9930$ $SEE = .741$

$h = .0283$

Equation (4.3.13) exhibits the right signs for the coefficients once the lagged dependent variable and the money supply (cash plus chequing accounts on hand -SMR-) were included. The t-values are good, meaning that the coefficients are statistically significant. Furthermore, the magnitudes of these coefficients are acceptable, in particular the coefficient of GDPR, according to empirical evidence. However, we expect that the overall effect on investment shall be improved by the sizes of the coefficients of the money stock and previous year investment. The equation explains relatively well the investment behaviour in the country ($R2=.965$ and $F=159.8$); however, the Durbin h-statistic was not defined and further testing was necessary to check the problem of serial autocorrelation amongst the error terms. This test produced quite a large and statistically significant coefficient (.487) for the lagged residual vector and a high t-value (2.77), revealing that the disturbance terms of the original equation (4.3.13) are serially correlated. That equation, of course, was rejected.

Equation (4.3.14) contains a broader concept of money supply, real monetary liquidity (SLMR = SMR plus savings and time deposits), than the previous equation (SMR). The magnitudes of the coefficients remained acceptable and with much higher t-values, higher coefficient of determination and F-ratio ($R2=.973$ and $F=208.3$) and with a smaller computed h-statistic (.0283) than the critical value (1.645) at 95 percent level of confidence. We, therefore, do not reject the null hypothesis that the error terms are serially independent. The equation seems to explain relatively well the investment behaviour of the country and, hence, is accepted.

4.3.2 Total Real Gross Fixed Investment

Total real gross fixed investment (ITGR) is given by the following identity:

(4.3.15) ITGR = IPGR + IGGR

Total real gross fixed investment (ITGR) is always equal to real gross private investment (IPGR) plus real gross public investment, which is exogenous here, (IGGR).

4.4 NATIONAL INCOME

National income (YNR) has been defined in Chapter III as gross income per year distributed between the labour and capital factor inputs. Several functional relationships of this income variable were tried with respect to gross domestic product (GDPR), total tax revenues (TXTR), time (TIME) and a dummy variable that takes 1 for each year of the 1970's and 0 for the previous two decades. The first try gave the following results:

(4.4.16) YNR = -5.384 + .945 GDPR

(t's) (-7.37) (58.51)

$R2$ = .992 F = 3423.4 D-W = .263 SEE = 1.71

The positive sign of the regression coefficient and its high t-ratio (58.51) at 5 percent significance level and 28 degrees of freedom conform to a priori expectations. Although the magnitude of this coefficient is quite high at 94.5 percent of the GDPR compared to the average actual share of 78.5 percent according to the data, the negative sign and the size of the constant term (-5.384) make the estimation of YNR much closer to reality, its good fit being shown by the high levels of its R2 and F statistics. However, the presence of strong serial correlation amongst the disturbance terms as indicated by the low Durbin-Watson statistic (.263) led us to improve this equation. The inclussion of either TIME or a DUMMY (the 1970's = 1 and the 1950's = 1960's = 0) as explanatory variables did not improve the relationship. In both cases the problem of serial correlation persisted, compounded in the first case by a negative time coefficient contrary to expectation. An attempt was then made to correct this problem by applying the Hildreth-Lu procedure[114] to the original equation. The results are as follows:

(4.4.17) $YNR = -9.653 + 1.020\ GDPR$

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[114] G. Hildreth and J.Y. Lu, 'Demand Relations with Autocorrelated Disturbances' <u>Technical Bulletin</u>, No. 276 (Michigan State University Agricultural Experiment Station, 1960). This procedure selects from a grid of values restricted to the interval -1 to 1 that value for the correlation coefficient RHO which will generate the best regression equation with the lowest sum of squared residual errors.

(t's) (-3.76) (23.42)

RHO = .840 R2 = .998 F = 548.6 D-W = 2.381

SEE = .827

For an optimal RHO = .840, which is quite high, the Durbin-Watson statistic improved significantly from .263 to 2.381, quite above the critical value of 1.54 in the one-tailed test. However, the regression coefficient increased to a higher level (1.020) than previously (.945), and although the constant term helped to reduce its effect on YNR it also underestimated the function.

At this point, we decided to try other specifications by including in (4.4.16) the expectational variable YNR(-1) and/or total tax revenues (TXTR). We obtained the following results:

(4.4.18) YNR = -1.890 + .643 YNR(-1) + .368 GDPR

(t's) (-2.12) (5.37) (3.37)

R2 = .996 F = 3444.3 D-W =1.550 h = 1.585

SEE = 1.175

(4.4.19) YNR = -9.040 + .977 GDPR + .109 TXTR

(t's) (-3.72) (22.65) (2.94)

RHO = .850 R2 = 998 F = 328.3 D-W = 2.331

SEE = 727

(4.4.20) YNR = -1.526 + .490 YNR(-1) + .430 GDPR + .185 TXTR (t's) (-2.24) (5.05) (5.12) (4.50)

$R2 = .998$ $F = 4004.2$ $D-W = 2.051$ $h = .158$

$SEE = .890$

The first regression equation (4.4.18) of the above set seems to be relatively good in terms of behaviour and statistic information. It explains relatively well YNR and the Durbin h-statistic at 1.585 is smaller than the critical value 1.645 at 95 percent confidence level; in fact 28 residuals are under 5.5 percent error with the exception of the residual for 1951 which is close to 10 percent error. However, due to the still high SEE (standard of error of estimate) at 1.175, we ran another regression which included TXTR and whose results revealed the presence of serial correlation problems. Equation (4.4.19) was then tried under the Hildreth-Lu technique obtaining an optimal RHO=.850 and D-W=2.331 with a low SEE=.727. The residual vector shows that 21 disturbance terms were under 3.0 percent error and 7 under 6.1 percent. Finally, the last try, equation (4.4.20) is also a good functional relationship with respect to both behavioural and statistical information. The low level of the h-statistic at .158 indicates the absence of serial correlation and the vector of the residuals shows that 20 residuals were under 3.0 percent error, 8 under 4.7 percent and 1 under 7.2 percent. Similar to the previous regression equation, this last equation also has an excellent goodness of fit as can be seen by its high $R2=.998$, $F(3/25)=4004.2$ and the low SEE=.890. Note that as the government increases its total tax revenues, the national income also increases as an effect of government income redistribution via its transfer payments to the needy. Either one of these two last equations should be considered in the model, depending on their simulation performance.

4.5 THE PETROLEUM EXPORT SECTOR

According to the hypothesis that there exists a direct relationship between energy consumption and some relevant economic variables as defined in the specification of the submodel, Chapter II, we attempt to relate here the petroleum supply from Venezuela to her major trading regions, North America (XONAR), Western Europe (XOWER) and Latin America (XOLAR), with a mix of domestic controllable variables and some exogenous variables. In the first group, we have: relative prices (POVER/POVWR), which are defined as the ratio of domestic prices (POVER) and the Venezuelan realized world petroleum prices (POVWR), production (QOVER) and consumption (COVER). The second group of variables are outside the power of Venezuela, and are: the economic growth measured in gross domestic products and the energy consumptions, in constant 1968 prices, of each of the regions defined above.

4.5.1 The Sub-model Parameter Estimates

North America

The above hypothesis was first tested with North America and the resulting equations were:

$$(4.5.21)\ XONAR = \underset{(-6.37)}{-2.189} + \underset{(2.10)}{.0005}\ GDPNAR + \underset{(28.73)}{.767}\ QOVER - \underset{(-3.20)}{2.927}\ COVER$$

(t's)

$R2 = .993 \quad F = 734.4 \quad D\text{-}W = .6582 \quad SEE = .369$

The signs of the regression coefficients are right; however, the magnitudes of the coefficients of the gross domestic product of the area (GDPNAR) and the Venezuelan petroleum consumption (COVER) are not quite as expected. The first coefficient is too low at .0005 when it should be somewhere in between .002 and .003 and the second at least 8, according to a priori analysis of the data. In this respect, the negative sign of the constant term helps somewhat, but not enough because of the small size of its absolute value. The coefficient of Venezuelan petroleum production (QOVER) seems reasonable.

The statistics give a somewhat reassuring result. The t-ratios are high, which means that the standard errors of the coefficients are very low. The coefficient of determination at almost 1 ($R2 = .993$) is a good indication that the independent variables explain very well the dependent variable, which is also confirmed by the high F value (734.4); however, the Durbin-Watson statistic at .6582 is not reassuring at all, as the test rejects the null hypothesis that the residuals of the errors are serially independent. No corrections were tried at this point, as we proceeded with other regression trials:

(4.5.22) XONAR = 23.815 + .003 GDPNAR - 2.262 POVER

(t's) (3.99) (7.50) (-4.64)

R2 = .830 F = 41.1 D-W = 1.980 SEE = 1.745

From the supply side, petroleum exports to North America (XONAR) are negatively related to Venezuelan domestic petroleum prices (POVER), which assumes that the higher the POVER, the lower the domestic consumption (COVER) would be, and, hence, a higher petroleum surplus for exports would result. From the demand side, however, we note that XONAR declines as POVER increases, with the implication that petroleum may be diverted from exports to the Venezuelan domestic market, contrary to economic policy. Although the regression equation provides an excellent goodness of fit, the information side of the analysis is not satisfactory due to the negative sign of POVER and the large size of the constant term.

Our next regression seems to satisfy both the information and the statistical analysis:

(4.5.23) XONAR = 12.177 + .001 GDPNAR - 7.481 POVER/POVWR

(t's) (5.75) (2.78) (-8.18)

$R2 = .921$ $F = 99.8$ $D\text{-}W = 1.970$ $SEE = 1.181$

First, we observe that the signs of the coefficients are all right and their magnitudes seem to be acceptable; however, we do have some reservations about the large size of the constant term and the low size of GDPNAR, even considering a trade-off between them. The sign and magnitude of POVER/POVWR are as expected from the analysis of the domestic market, as explained in the preceding paragraph. Note also that XONAR is in the nature of total expenditure variable, which could indeed increase with a rise in its own price, if demand is price-inelastic. From the statistical analysis, we notice an excellent goodness of fit: a high coefficient of determination (R2 = .921) and F value (99.8), all the coefficients are statistically significant by the t-test, and the Durbin-Watson test accept the null hypothesis of no serial correlations amongst the residual error terms.

Although the results of (4.5.23) are considered excellent, we incorporated in that equation the domestic consumption of Venezuela (COVER) to pursue the relationship even further with this non-controllable variable. The results are:

(4.5.24) XONAR = 13.357 + .002 GDPNAR − 7.713 POVER/POVWR
(t's) (7.12) (3.97) (−9.74)

− 6.690 COVER
(−2.64)

R2 = .945 F = 92.2 D-W = 2.2016 SEE = 1.016

The coefficients have the expected signs: positive relationship with economic expansion and negative with respect to the domestic consumption of Venezuela, keeping in mind that relative prices in Venezuela are a bridge between XONAR and COVER, as already explained above.

In terms of the statistical analysis, this regression equation provides an excellent goodness of fit.

Finally, we tried to incorporate in these relationships the petroleum consumption of the importing region. The results are:

(4.5.25) XONAR = 3.95 + .003GDPNAR + .00006CONAR(−1)
(t's) (1.60) (3.30) (4.36)

− 14.084COVER
(−2.77)

R2 = .820 F = 20.1 D-W = 1.530 SEE = 1.825

(4.5.26) XONAR = 5.267 + .002GDPNAR + .00005CONAR(−1)

$$\begin{array}{lllll}(t's) & (2.16) & (2.12) & & (3.58)\end{array}$$

$$- 11.375COVER + 2.311DUM$$
$$(-2.37) \qquad (1.74)$$

$$R2 = .850 \quad F = 17.6 \quad D\text{-}W = 1.820 \quad SEE = 1.713$$

Regression (4.5.25) can be rejected on both grounds, on information and statistical tests. The absolute size of the coefficient of COVER is too high at 14.084 and the constant term is statistically not different from zero, and the Durbin-Watson statistic at 1.53 indicates that the respective test is inconclusive. The following equation (4.5.26), which incorporates a dummy variable that takes the value of 1 from 1974 to 1979 when petroleum prices increased sharply and 0 for the other years, provides better and more acceptable information about the behaviour of the relation as well as a good fit.

The above analysis provides us with excellent results about the relationship that exists between energy consumption and economic growth, prices, production and supply of energy. These results are better expressed by the regression equations (4.5.23), (4.5.24) and (4.5.26), of which the regression equation (4.5.24) seems to be the best of the set.

Latin America

The exercise for the previous region was useful in carrying out the experiment on Latin America.

The following are some of the best regressions tried:

(4.5.27) XOLAR = .922 + .003 GDPLAR + .089 QOVER −
(t's) (4.09) (5.55) (4.56)

− 2.089 COVER
(−4.29)

R2 = .976 F = 220.6 D-W = 2.1208 SEE = .171

(4.5.28) XOLAR = 1.552 + .006 GDPLAR − 3.235 COVER
(t's) (5.93) (11.65) (−5.28)

R2 = .946 F = 148.2 D-W = 1.6870 SEE = .251

(4.5.29) XOLAR = 2.475 + .0045 GDPLAR − .608 POVER/POVWR
(t's) (5.55) (6.89) (−2.42)

− 2.605 COVER
(−4.34)

R2 = .960 F = 128.9 D-W = 1.9124 SEE = .222

The first regression equation of this group is excellent in terms of information and statistical tests. All the coefficients have the right signs and their magnitudes are good, according to the t-test and a priori analysis of the data. The independent variables explain very well the dependent variable with high summary statistics ($R2 = .98$ and $F = 220.6$) and, finally, the Durbin-Watson test indicates that the residual errors are not autocorrelated.

The following equation (4.5.28) shows that while the coefficient of COVER has the right sign and size, the coefficient of the gross domestic product (GDPLAR) was almost 100 percent too high; but overall, the equation is good with regards to our concerned information and goodness of fit.

Our last equation in this group (4.5.29) is excellent, although the coefficient of GDPLAR still remains high. All the coefficients are statistically different from zero, due to their low standard of errors, and the dependent variable is very well explained by the independent variables, according to the high summary statistics ($R2 = .96$ and $F = 128.9$), and, finally, the high Durbin-Watson statistic at 1.9124 suggests to us that the disturbance terms are serially independent.

Western Europe

All the regression equations tried for this region failed, which behaviour may be due to the rather rapid decrease of imports from Venezuela, with a somewhat irregular pattern since 1970. Therefore, we decided to consider the consumption of this region as an exogenous variable.

The residual of petroleum exports, which we have already identified as exports to other parts of the world (XORESTR), is also taken as exogenous.

In conclusion, the total petroleum exports from Venezuela to the world are given by

(4.5.30) XTOR = XONAR + XOLAR + XOWER + XORESTR,

which means that total petroleum exports will always be equal to the sum of the individual exports to each of the defined regions.

Total exports (XTR), then, are defined as the sum of petroleum exports (XTOR) and non-petroleum exports (XNOR), that is:

(4.5.31) XTR = XTOR + XNOR

4.5.2 Export-Demand Elasticities

As already discussed in Chapter II, the double-logarithmic form of equation (2.4) is, by all accounts, the most extensively linear model used in empirical testing of the demand function. This type of regression equation has also been applied here to each one of the trading partners of Venezuela: In the case of North-American import-demand for petroleum from Venezuela (that is, Venezuelan petroleum export to the region: XONAR), we obtained the following estimated equations:

(4.5.32) logXONAR = −2.754 + .163 logGDPNAR + 1.296 logQOVER

(t's) (−2.94) (1.39) (20.96)

− .200 logCOVER

(-1.53)

R2 = .990 F = 431.3 D-W = .6160 SEE = .052

(4.5.33) logXONAR = -2.213 + .510 logGDPNAR

(t's) (-2.93) (5.54)

- .5821 logPOVER/POVWR

(-10.67)

R2 = .955 F = 179.6 D-W = .9831 SEE = .097

(4.5.34) logXONAR = -5.567 + .905 logGDPNAR

(t's) (-3.72) (5.10)

- .609 logPOVER/POVWR - .546 logCOVER

(-12.45) (-2.50)

R2 = .967 F = 158.8 D-W = 1.2014 SEE = .085

The first regression equation (4.5.32) can be rejected on several grounds. Its income-elasticity (.163) and the elasticity with respect to petroleum consumption in Venezuela (-.200) are statistically not different from zero, and the Durbin-Watson statistic (.616) indicates the presence of autocorrelation of the residual errors. The second equation (4.5.33) is somewhat better. The signs of the elasticity estimates are right and their high t-values reveal small standard errors, meaning that the magnitudes of these coefficients are statistically significant; however, the income-elasticity (.510) for North-America seems to be somewhat small according to other findings, which points to the fact that petroleum demand and petroleum imports are both income-elastic and price-inelastic.[115] In any event, the regression equation cannot be accepted on the ground that the Durbin-Watson test rejects the null hypothesis of no serial correlation of the residual terms. The last equation (4.5.34) produced much better results in terms of behavioural and statistical information. The income-elasticity is almost 1 and the other coefficients show that the demand for Venezuelan petroleum is price-inelastic (-.609) and consumption-inelastic (-.546) as expected. Like in the two previous equations, the correlation coefficient is high (.967), but the estimated Durbin-Watson statistic (1.2014) is not less than the lower critical value (.89) and not larger than the upper critical value (1.55), so the test becomes inconclusive.

We decided, then, to introduce a lag on total petroleum consumption to capture cyclical movements of demand due to changes of the GDPNAR and/or petroleum price. The first try, although good in terms of behavioural information and statistically significant elasticity estimates with a high summary coefficient, was rejected as the Durbin-Watson test was inconclusive. This situation was overcome by introducing a dummy variable for the 1970's to capture structural

[115] Faisal Safooq Al-Bashir, op. cit., pp. 29-31, and Robert S. Pindyck, op. cit., Chapter 7.

changes which may have been caused by the sudden and sharp petroleum price increases during that period. The results are as follow:

(4.5.35) logXONAR =-9.453 + .700logGDPNAR + .501logCONAR(-1)
(t's) (-3.86) (2.73) (5.78)

- .997logCOVER + .218DUM
(-3.01) (2.38)

$R2 = .940 \quad F = 46.2 \quad D\text{-}W = 1.8280 \quad SEE = .115$

From the statistics, this relation is an excellent regression equation of North-America petroleum imports from Venezuela. From the behavioural side, we are also inclined to accept it as a good one, although the income-elasticity appears to be somewhat low (.700) and the consumption-elasticity high (.997). At this point, we should emphasize that Venezuelan petroleum exports are comprised of a variety of energy products which have a variety of final uses, of which residual fuel and crude petroleum are the major components having elasticities less than 1 for the former and more than 1 for the latter.[116] On these accounts, equation (4.5.35)

[116] In the case of Saudi Arabia, Faisal Safooq Al-Bashir, op. cit., p. 30, estimated an income-elasticity of 1.172 and a price-elasticity of -.570 for crude petroleum demand in North-America. S.J. Prais and H.S. Houthakker, op. cit., p. 99, estimated a demand income-elasticity of .740 for residential fuel in U.K., and Robert S. Pindyck, op. cit., Section 5.1, found that the industrial sector demand price-elasticity for liquid fuel (mostly residual fuel oil) was about -.81 for Canada and -1.10 for USA.

seems to be reasonable.

In the case of Latin-America, the estimated regression equations give the following results:

$$(4.5.36)\quad \log XOLAR = \underset{(-7.18)}{-4.754} + \underset{(5.44)}{.664} \log GDPLAR + \underset{(5.70)}{.513} \log QOVER - \underset{(-3.14)}{.452} \log COVER \quad (t's)$$

$R2 = .978 \quad F = 217.4 \quad D\text{-}W = 1.8990 \quad SEE = .055$

$$(4.5.37)\quad \log XOLAR = \underset{(-6.96)}{-4.805} + \underset{(8.51)}{.875} \log GDPLAR - \underset{(-5.35)}{.211} \log POVER/POVWR - \underset{(-3.73)}{.542} \log COVER \quad (t's)$$

$R2 = .973 \quad F = 221.7 \quad D\text{-}W = 2.0182 \quad SEE = .057$

Statistically, these two regression equations conform very well with their respective tests, indicating an excellent goodness of fit. With respect to the behavioural information, the size of the income-elasticity (.664) of (4.5.36) is smaller than the income-elasticity (.700) of (4.5.35) for North-America, which seems to contradict some evidence that in the developing economies the income-elasticities for petroleum demand are larger than in the developed economies.[117] The elasticities with respect to petroleum production (QOVER) and consumption (COVER) appear to be of reasonable size. But equation (4.5.37) presents better estimates. It confirms previous findings that in developing countries the income-elasticity (.875) is larger than in developed countries (.700) and the reverse case for the price-elasticity (.211 versus higher coefficient in developed economies). This last equation counts also on a high correlation coefficient (R2 = .973) and F statistic (221.7) together with a very small standard error of estimate (SEE = .057), high t-values and high D-W statistic (2.0182), which test indicates the absence of serial correlation.

4.6 THE IMPORT SECTOR

We follow the specification of the import function discussed in Subsection 2.6.2., Chapter II above, mainly that,

$$(2.7') \quad MTR(t) = a + b\ Z(1,t) + \ldots + k\ Z(m,t)$$

where, MTR(t) is total imports at t (t=1,2,...,30 years), and Z(j) refers to m (j=1,2,...,m) explanatory variables in defining the import function at period t.

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[117] Robert S. Pindyck, op. cit., Chapter 7. The author points out that due to the structural changes taking place in developing countries, the structure of energy consumption is forced to change. The changes involve industrial modernization, urban migration and, in consequence, higher consumption of energy resources.

It was further stated, then, that total imports were disaggregated into two major components: imports of capital goods (MKR) and imports of non-capital goods (MNKR), in constant 1968 prices, that is:

(4.6.38) MTR(t) = MKR(t) + MNKR(t)

where each component shall follow the form and specification of (2.7') above.

Therefore, the first task was to test each one of these components and to express them in a functional relationship, according to the four economic conditions discussed in Subsection 2.6.1. of Chapter II.

4.6.1 The Capital Import Function

The first tries dealt with the hypothesis that petroleum exports (XTOR), or gross domestic product (GDPR) or national income (YNR), all in constant 1968 prices, were important income variables in determining the capital import function of Venezuela. The results of these tests rejected that hypothesis, mainly on statistical grounds where serious serial correlation problems appeared (D-W=.28), very low coefficients of determination (R2=.54) and high standard of errors of estimates (2.123). The worst results were related to XTOR, even after including the expectation variable MKR(-1) in the model, at which point we decided to drop XTOR as an explanatory variable and to employ, instead, the realized composite price of the petroleum barrel exported (POVWR), in constant 1968 prices, but the results were not satisfactory either. The inclusion of the import wholesale price index (MWKI) as an additional explanatory variable improved the capital-import regression equation with the following results:

$$\text{(4.6.39)}\quad MKR = -1.165 + .768\ MKR(-1) + .125\ GDPR$$
$$\text{(t's)}\quad (-1.60)\qquad (6.6)\qquad (1.70)$$

$$+ .226\ POVWR - .061\ MWKI$$
$$(2.80)\qquad (-1.80)$$

$R2 = .920\quad F = 61.1\quad D\text{-}W = 1.213\quad h = 2.719$

$SEE = 1.060$

We observe again the persistent behaviour of the insensitiveness of the GDPR in explaining MKR, which is quite similar to the results produced when testing YNR as an explanatory variable; that is, its coefficient does not quite make its t-test (the t-value 1.70 is just under the borderline of the t-critical value) at 5 percent significance level. Furthermore, the problem of serial correlation amongst the disturbance terms still remains, as the Durbin-h statistic exceeds the critical value (i.e., 2.719 > 1.645) at 95 percent confidence level.

One conclusion can be drawn from this test: income variables[118] such as XTOR, GDPR or YNR are not sensitive enough variables (directly) to explain the capital import requirements of Venezuela. This conclusion, however, should not be taken as implying that the above income variables are not driving economic forces to capital imports for a developing economy such as that of Venezuela; the opposite is the case. The strong economic conditions of the country are shown by its relative fast drive to industrialization, which indicates that because of a relative high level of savings, the country has been able to count on a high level of capital formation. Once the country is on the way to industrialization by means of imports of capital goods, facing simultaneously a temporary bottleneck in the scarce skilled labour market (with the development of the human capital continuing at home and abroad), and enjoying a strong capital import purchasing power, further expansion of the abundant capital factor of production is required in Venezuela if industrialization is to continue unabated.[119] Hence, the driving eco-

[118] This conclusion seems to follow other experiences. The USA import of raw material and semi-manufactured goods, during the 1948-65 period, was not a straight forward relationship with respect to the GDPR but rather with inventory investment. However, the import of consumer goods was better explained by the income variable. See Michael K. Evans, op. cit., pp. 221-226.

[119] The expansion of the economic capacity of the country continues according to a given strategy of industrialization whereby more capital-intensive techniques are employed for new industries as well as for the old ones. These techniques are, of course, labour-saving, but Venezuela has been simultaneously engaged in upgrading the

nomic force of the income variable is there through savings, that is, the difference between national income and consumption, which enabled Venezuela to engage in such a high capital investment as shown in Table 4, Chapter II above.

Taking into account the above argument, we tried a regression equation with gross fixed investment (ITGR) and the relative price of capital import wholesale price index with respect to the domestic wholesale price index (MWKI*100/DWPI) as explanatory variables. In a second regression equation, and because of the failure of the income variable to perform well, we took total consumption (CTR) and private consumption (CPR), in constant 1968 prices, as other explanatory variables. The results are as follows:

(4.6.40) $MKR = -1.326 + .373\ ITGR + .002\ MWKI*100/DWPI$

(t's) (-5.05) (29.59) (.64)

$R2 = .980 \quad F = 656.6 \quad D\text{-}W = 1.337 \quad SEE = .418$

(4.6.41) $MKR = -2.100 + .521\ ITGR + .020\ MWKI*100/DWPI$

(t's) (-7.09) (12.91) (3.59)

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skills of its labour force which in turn pushes upwards the employment of more capital-intensive techniques. As we are aware, the short-run effect of this policy translates into a very small employment level, since the skilled labour force is very limited; however, it is expected that, as the economy develops and the production capabilities improve, this effect would be much greater in the long-run. See Ronald I. McKinnon, 'Foreign Exchange Constraints in Economic Development and Efficient Aid Allocation', The Economic Journal, Vol. 74, (June, 1964), pp. 388-409.

-0.080 CTR
(-3.80)

$R2 = .987 \quad F = 660.0 \quad D\text{-}W = 1.096 \quad SEE = .342$

AE(ITGR) = 1.87 AE(MWKI*100/DWPI) = .48

where AE refers to average elasticity[120] with respect to the variable in brackets.

(4.6.42) $MKR = -1.996 + .512\ ITGR + .019\ MWKI*100/DWPI$
(t's) $(-7.01)\quad(12.98)\qquad(3.45)$

$-.098$ CPR
(-3.65)

$R2 = .987 \quad F = 642.0 \quad D\text{-}W = 1.057 \quad SEE = .347$

From the behavioural side of the regression equation (4.6.40), we observe that ITGR is positively related to MKR, as it should be, and the magnitude of its coefficient is about right, according to the data. But, the sign of the relative price variable (MWKI*100/DWPI) is also positive, contrary to economic theory, while its coefficient was statistically not significant, making that variable irrelevant, so far. From the statistical information, the t-value of

[120] The average elasticities were computed according to E(j)=n[Z(j)/Y], where 'n' is the OLSQ coefficient of the explanatory variable Z(j) (j=1,...,m variables) and Y is the dependent variable. The ratio (Z(j)/Y) is the ratio of the means of the variables. See (2.3) in Chapter II.

the coefficient of ITGR is quite high, implying that such a variable is very relevant in explaining the capital import function, while the t-value of the relative price of capital import is under the t-critical value, and the Durbin-Watson statistic at 1.337 places the respective test in the inconclusive interval. However, the F-statistic being so high at 656.6 indicates that the set of explanatory variables has an influence in determining the capital import function, which together with the high coefficient of determination R2=.98 and the low standard error of estimate (SEE=.418) seems to indicate that equation (4.6.40) could be improved. Therefore, we incorporated in that function an additional explanatory variable already mentioned above, the total consumption in real terms (CTR), giving interesting results as expressed by equation (4.6.41) above. In this new relationship, the relative price variable again exhibits a positive coefficient and, on this occasion, a statistically significant one. We found that the average price-elasticity [AE(MWKI*100/DWPI)] of the function is quite low (.48). Given this level of inelasticity plus the positive sign of the coefficient and the need for industrialization, as discussed in Chapter II, it seems that no price increases in the observed range would discourage Venezuela to pursue its commitment to industrialization and, therefore, capital import would keep increasing instead of declining, which so far emphasizes the high expenditure capacity of the economy for these imports. These findings may well imply that we are treating here an expenditure elasticity, which by defination is equal to 1 plus the average price-elasticity. Thus the true quantity elasticity could be negative.

The sign and magnitude of the coefficient of CTR seem to be in agreement with economic theory and the data on hand. Increases in consumption expenditures can only be made at the expenses of lower national savings, which in turn imply less capital expenditures on investment projects. With respect to gross fixed capital investment (ITGR), we find that its coefficient is quite high.

The inclusion of private consumption (CPR) in equation (4.6.42) only confirms the findings of the previous equation (4.6.41).

In spite of the above favourable considerations, both equations show the presence of first-order serial correlation problems. An attempt was made to correct them by using the standard econometric technique known as the Hildreth-Lu. We obtained the following results:

(4.6.43) MKR = -2.251 + .546 ITGR + .022 MWKI*100/DWPI

(t's) (-5.50) (14.68) (3.32)

-.091 CTR

(-4.72)

RHO = .460 R2 = .974 F = 306.5 D-W = 1.778

SEE = .305, and, AE(MWKI*100/DWPI) = .50

AE(ITGR) = 1.93 AE(CTR) = .81

(4.6.44) MKR = -2.292 + .545 ITGR + .023 MWKI*100/DWPI

(t's) (-5.18) (14.86) (3.34)

-.117 CPR

(-4.76)

RHO = .480 R2 = .973 F = .284.0 D-W = 1.661

SEE = .306.

Each one of the above two transformed regression equations now shows good statistical results. Equation (4.6.43) reveals that for an optimal RHO=.460, relatively low, the Durbin-Watson statistic improved significantly from 1.096 to 1.778, which is quite above the critical upper value 1.65. Furthermore, the goodness of fit remains excellent, although slightly reduced, and all the other statistics discussed for equation (4.6.41) pass the respective statistical tests. Thus, we prefer this regression equation to equation (4.6.44). The most important argument in favouring equation (4.6.43), and the reason for its construction, is that the public consumption sector must be incorporated in the determination of the national saving level, that is, the magnitude of the residual (or gap) between national income and total consumption. Assuming normal increases in private consumption, that is without any undue fiscal intervention, the lower the growth rate of goverment consumption the higher the level and rate of growtn of savings would be, which in turn implies higher levels of capital investment through time. We conclude, therefore, that equation (4.6.43) should be taken as a good representation of the capital import function of Venezuela.

4.6.2 The Non-Capital Import Function

Similar to the previous analysis in determining the capital import function, we shall also hypothesize here that either gross national product (GDPR) or the national income (YNR), in constant 1968 prices, could be an important income variable determining the non-capital function (MNKR) of Venezuela. The relative price measured by the ratio of the import wholesale price index (MWPI) over the domestic wholesale price index (DWPI) shall also be taken as an explanatory variable.

The first tries gave the following results:

(4.6.45) MNKR = 11.523 + .292 GDPR - .189 MWPI*100/DWPI

(t's) (6.24) (17.57) (-7.21)

$R2 = .947$ $F = 243.4$ $D-W = .964$ $SEE = .977$

(4.6.46) MNKR = 10.557 + .287 YNR - .152 MWPI*100/DWPI

(t's) (5.89) (17.74) (-6.26)

$R2 = .948$ $F = 248.0$ $D-W = 1.187$ $SEE = .968$

AE(YNR) = 1.49 AE(MWPI*100/DWPI) = 2.14

A glance at the two equations reveals that both relations conform to the same general behaviour and statistical information. However, a closer analysis reveals that MNKR cannot contribute with a 29.2 percent share in GDPR, according to the data on hand. In 1950, this share was 14.4 percent and reached its highest level of 23.2 percent in 1978, dropping to 20.2 percent the following year. Similarly, the relative price coefficient is also quite high, as it should never be higher than 16 percent. In this respect, equation (4.6.46) is closer to reality. A 28.7 percent share of MNKR to YNR is a more reasonable level to accept since the corresponding share increased from 20 percent in 1950 to 22 percent in 1979 and, moreover, the price coefficient is acceptable and all the other statistics are slightly better than in (4.6.45). Therefore, we shall take the national income (YNR) as a better explanatory variable of the non-capital import function of Venezuela rather than the gross domestic product (GDPR), and, thus, we shall proceed to improve such a functional relationship.

At this point, we decided to apply the Hildreth-Lu procedure directly to equation (4.6.46) and the results are as follows:

(4.6.47) MNKR = 9.595 + .280 YNR - .139 MWPI*100/DWPI

(t's) (3.89) (13.03) (-4.29)

RHO = .420 R2 = .958 F = 113.1

D-W = 1.775 SEE = .866

AE(YNR) = 1.45 AE(MWPI*100/DWPI) = 1.84

With an optimal RHO=.420, the signs and magnitudes of the coefficients of equation (4.6.47) are generally the same as in (4.6.46), but the Durbin-Watson statistic improved significantly, exceeding the critical value for this kind of test accepting the null hypothesis. We also observe in (4.6.47) that the non-capital import income-elasticity, at the mean, [AE(YNR)] dropped from 1.49 to 1.45 and so was the case for the price-elasticity [AE(MWPI*100/DWPI)], which declined from 2.14 to 1.84. These high elasticities appear to indicate the extent to which the domestic Venezuelan market depends on foreign supply.

Finally, we re-estimated equation (4.6.46) with the inclusion of the expectational variable, that is, the dependent variable lagged one year [MNKR(-1)], as an additional explanatory variable in the model. The results are the following:

(4.6.48) MNKR = 6.773 + .400 MNKR(-1) + .185 YNR
(t's) (3.28) (2.95) (4.85)

- .010 MWPI*100/DWPI
(-3.50)

R2 = .975 F = 219.1 D-W = 1.616 h = 1.085
SEE = .865

The Durbin-test was applied to this equation and since its h-statistic at 1.085 is smaller than the critical value 1.645 at 95 percent confidence level, the null hypothesis of no serial correlation amongst the disturbance terms was accepted. Although the inclusion of MNKR(-1) seems to weaken the equation since its t-value is relatively low (2.95) for this kind of variable, which may have a depressing effect on the other variables. This equation, nevertheless, is a good one that may be included in the model.

4.6.3 Import-Demand Elasticities

We have already touched on elasticities affecting the demand for foreign commodities. Those import-demand elasticities are averages since they were evaluated by means of the variables in reference. Now, we shall employ a more convenient concept of elasticity, the one which is constant along the function at any point or period and for which the double-logarithmic form (2.8) shall again be applied.

Capital Import-Demand Elasticity:

The best capital-import function obtained above (4.6.43) was treated in double-logarithmic form together with the Hildreth-Lu procedure to correct for serial correlation. The results are:

$$(4.6.49)\quad \text{Log}(MKR) = \underset{(-5.29)}{-3.196} + \underset{(7.80)}{1.345} \log(ITGR) - \underset{(-.63)}{.146} \log(CTR)$$

(t's)

$$+ .337 \log(MWPI*100/DWPI)$$
$$(1.57)$$

RHO = .530 R2 = .931 F = 113.0 D-W = 1.442

SEE = .097

An optimal RHO=.530 was found, but the Durbin-Watson statistic dropped substantially from 1.693 to 1.442, leading to an inconclusive test for serial correlation, and the coefficient of determination (R2) as well as the t-statistics have also fallen. However, since the purpose of this exercise is to aid in drawing some conclusions concerning the results so far revealed by the average import-demand elasticities evaluated above, the approximate constant elasticities given here by equation (4.6.49) may suffice in drawing these conclusions. We find, then, that equation (4.6.49) provides us with an average price-elasticity of about .34, which is quite low according to its t-value (1.57), but definitely no higher than the average elasticity of .50 given by (4.6.43). This means that capital imports into Venezuela are positively expenditure elastic, which implies that no price would be high enough to discourage further capital imports (in value terms) and, thus, reduce speed of the undergoing industrialization process of the country. These observations seem to be reinforced also by the high capital import-elasticity with respect to total gross fixed investment (ITGR) as it may be drawn from the average elasticity of 1.93 from equation (4.6.43). Furthermore, a glance at equation (4.6.43) shows that the marginal propensity to import capital goods with respect to ITGR is quite high at 54.6 percent of capital needs, showing, therefore, the high dependence the country has on the industrialized economies.

It appears by all accounts, then, that Venezuelan demand for foreign capital would keep increasing, according to the strategy of the import-substitution industrialization process in the country and as long as the national rate of savings remains high.

Non-Capital Import-Demand Elasticities:

The regression equation (4.6.47) gives a marginal propensity to import non-capital goods of about 28 percent of national income (YNR), in constant 1968 prices, considered above high, but nevertheless acceptable, and the marginal propensity with respect to price is about 13 percent.

There, we computed the average income-elasticity [AE(YNR)] to be 1.45 high again, of course, and also the price-elasticity [AE(MWPI*100/DWPI)] was found to be 1.84. These high elasticities reflect, respectively, the high degree of dependence and the high degree of responsiveness that Venezuela has on foreign suppliers of non-capital goods. Unlike the capital equation (4.6.43), the non-capital equation (4.6.47) shows a negative sign for the price variable and a high elasticity, as expected, implying the negative and high response that any undue price increases may have on total non-capital imports into the country.

We shall try to find out the levels of these elasticities within the double-logarithmic form:

$$(4.6.50)\quad \text{Log(MNKR)} = \underset{(2.09)}{3.566} + \underset{(10.57)}{1.206}\ \text{log(YNR)} - \underset{(-2.99)}{1.314}\ \text{log(MWPI*100/DWPI)}$$

(t's)

RHO = .510 R2 = .870 F = 86.9 D-W = 1.760
SEE = .107

By all accounts, the equation is still a good one, obtaining a constant income-elasticity of about 1.21 and a price-elasticity of about 1.31, which are somewhat lower than their respective average elasticities of 1.45 and 1.84 given by equation (4.6.47), as expected.

With the above findings, we confirm the high elasticities of the variables concerned. The import of consumer and semifinished goods (some raw materials included) into Venezuela is very elastic with respect to both national income and relative prices. This reflects the also high dependence that Venezuela has on its foreign supplier of non-capital goods to supplement the still low, but growing, productive capacity of its economy, while the high relative price-elasticity seems to show the high response in Venezuela reducing imports in case of an excessive increase in import prices.

4.7 THE CENTRAL GOVERNMENT TAX REVENUES

From the analysis made in Section (2.7) and Subsection (2.7.1) of Chapter II, we shall test the three tax revenue functions specified above.

Total tax revenues (TXTR) may be given by the following identity:

(4.7.51) TXTR = TXIR + TXDR + TXOR

4.7.1 The Indirect and Direct Tax Functions

The first regression analysis test was applied to the indirect tax relationship (TXIR) taking non-capital imports (MNKR) and the expectation variable [TXIR(-1)] as explanatory variables. The results are as follows:

(4.7.52) TXIR = .557 + .115 MNKR

(t's) (7.45) (13.84)

$R2 = .914$ $F = 191.7$ $D\text{-}W = 1.1062$ $SEE = .151$

(4.7.53) TXIR = .321 + .070 MNKR + .429 TXIR(-1)

(t's) (2.46) (3.45) (2.32)

$R2 = .934$ $F = 113.3$ $D\text{-}W = 1.5738$ $h = 1.565$

$SEE = .136$

The regression equation (4.7.53) shows that the inclusion of TXIR(-1) provides a solution to the inconclusive character to the Durbin-Watson statistical test in (4.7.52). The Durbin-h statistic at 1.565 is smaller than the critical value 1.645 at 95 percent confidence level and, hence, the problem of serial correlation amongst the disturbance terms seems to be solved. The equation is a good one in terms of both the behavioural and statistical information.

We proceeded with the estimation of the direct tax function. These are the results:

(4.7.54) TXDR = -1.583 + .089 GDPNOR
(t's) (-7.75) (17.37)

R2 = .944 F = 302 D-W = .8981 SEE = .251

(4.7.55) TXDR = -1.045 + .057 GDPNOR + .394 TXDR(-1)
(t's) (-3.27) (4.00) (2.46)

R2 = .957 F = 179.9 D-W = 1.6113 h = 1.182
SEE = .222

As expected, non-petroleum gross domestic product in constant 1968 prices (GDPNOR) explains well the direct tax function and the sign and size of its coefficient agrees with theory and the data on hand. But the low level of the Durbin-Watson statistic (.898) seems to indicate the presence of a serial correlation problem which was corrected by including TXDR(-1) in (4.7.55). This last equation produced a Durbin h-statistic smaller than the critical value at 95 percent confidence level (i.e.: 1.182 < 1.645), which enabled us to accept the null hypothesis that the disturbance terms are not serially correlated. We accepted the regression equation (4.7.55) as a good function of direct taxes.

4.7.2 The Petroleum Tax Function

In testing the petroleum tax function of Venezuela, we begin from the a priori reasoning of Sections (2.5) and (2.7) of Chapter II. Petroleum production (QOVER), domestic petroleum consumption (COVER) and petroleum export (XTOR) should be important explanatory variables in determining the petroleum tax function of the country. Previous petroleum tax revenues, TXOR(-1), should also be taken into account.

The first trial produced the following results:

(4.7.56) $TXOR = -12.071 + 1.550\ XTOR$

(t's) (-7.80) (15.32)

$R2 = .929 \quad F = 234.7 \quad D\text{-}W = 1.2888 \quad SEE = 2.253$

This equation was rejected because of the large magnitude of the export coefficient and of the standard error of the estimate of the equation and, finally, because of the inconclusive Durbin-Watson test. The inclusion of the domestic petroleum consumption (COVER) or the TXOR(-1) corrected this test, but the sizes of the coefficient still high remain. The results of these tries are:

(4.7.57) $TXOR = -9.272 + 1.748\ XTOR - 6.439\ COVER$

(t's) (-4.92) (13.69) (-2.22)

$R2 = .945 \quad F = 145.5 \quad D\text{-}W = 1.5804 \quad SEE = 2.041$

$$\text{(4.7.58)} \quad TXOR = -11.371 + 1.371\ XTOR + .181\ TXOR(-1)$$
$$\text{(t's)} \quad (-6.83) \qquad (9.33) \qquad (2.02)$$

$R2 = .948 \quad F = 145.4 \quad D\text{-}W = 1.6202 \quad h = .900$

$SEE = 2.000$

Despite the good exhibits of these two equations, we find that the coefficient of XTOR and the SEE still remain high and an improvement seems to be necessary. To this effect we included in (4.7.58) a new variable, the percentage share of COVER from QOVER and the results are as follows:

$$\text{(4.7.59)} \quad TXOR = -2.686 + 1.179\ XTOR + .206\ TXOR(-1)$$
$$\text{(t's)} \quad (-.53) \qquad (6.74) \qquad (2.41)$$

$$-1.021\ COVER*100/QOVER$$
$$(-1.79)$$

$R2 = .957 \quad F = 111.4 \quad D\text{-}W = 1.8672 \quad h = .3117$

$SEE = 1.875$

As in all the cases of previous petroleum tax equations, this last relation presents the right signs and the magnitudes of the coefficients appear to be more reasonable according to the available data and, furthermore, the somewhat smaller SEE and higher coefficient of determination lead us to accept this last equation as a better tax function for the petroleum sector.

4.8 THE ESTIMATION OF THE PRODUCTION FUNCTION

The technological relationship between output and the factor inputs, as theorized by the Cobb-Douglas hypothesis, seems to embody basic problems conceptually and empirically in the estimation of the aggregate, economy-wide, production function. However, we shall follow the Cobb-Douglas function in an attempt to estimate the production function of our concern, relating directly gross national product to only two factor inputs, labour and capital, which are assumed to be homogeneous.

Therefore, we shall apply here the loglinear equation (V) referred to in Section 2.8, Chapter II, above, and the results of the first test are as follows:

$$(4.8.60)\ \text{Log GDPR} = \underset{(4.51)}{1.267} - \underset{(-5.26)}{.598}\ \text{Log(LABOUR)} - \underset{(-2.74)}{.300}\ \text{Log(KGR)} + \underset{(13.99)}{.065}\ \text{TIME} \quad (t's)$$

$$R2 = .995 \quad F = 1630.9 \quad D\text{-}W = .7112 \quad SEE = .037$$

This regression equation cannot be accepted either on theoretical or on statistical grounds. The sign of the coefficient of LABOUR (the number of workers) cannot be negative.

These results may be accounted for by the low quality of the labour data on hand, including the capital stock data (see Chapter III). However, be this as it may be, we must proceed using these data in this exercise. We decided, then, to substitute the variable LABOUR with LWBR, which is a measure of labour in terms of payments to the labour input as produced in the national accounts. The results are:

$$(4.8.61)\quad \text{Log(GDPR)} = \underset{(5.19)}{2.883} - \underset{(-.10)}{.029}\ \text{Log(LWBR)} - \underset{(-.16)}{.037}\ \text{Log(KGR)} + \underset{(5.25)}{.062}\ \text{TIME} \qquad \text{(t's)}$$

$$R2 = .989 \quad F = 770.5 \quad D\text{-}W = .2695 \quad SEE = .054$$

As can be seen, equation (4.8.61) provides worse results than the previous equation (4.8.60). Both inputs coefficients are negative and statistically are not different from zero.

At this point, we thought it convenient to assume a Cobb-Douglas function with a capital input measured in terms of its share value (KAPR) from total output (GDPR), according to equation (3.42), Section 3.9, Chapter III, above, but measuring labour in terms of the number of workers as previously (i.e., LABOUR). The resulting regression equation is:

$$(4.8.62)\quad \text{Log(GDPR)} = \underset{(6.15)}{1.146} + \underset{(3.79)}{.410}\ \text{Log(LABOUR)} \qquad \text{(t's)}$$

$$+ .608 \text{ Log(KAPR)} + .013 \text{ TIME}$$
$$(9.15) \qquad\qquad (1.90)$$

$R2 = .998 \quad F = 5031.4 \quad D\text{-}W = 1.682 \quad SEE = .023$

The signs of the coefficients of this equation are positive as expected, the t-values are high and the set of explanatory variables seems to explain well the production function as shown by the high F-statistic (5031.4). The coefficient of determination R2 is almost equal to 1 (i.e., .998, the Durbin-Watson statistic at 1.682 is above the critical value (1.65) and the standard error of the estimate of the equation SEE is very low (.023). As far as the magnitudes of the coefficients for LABOUR (.410) and KAPR (.608) are concerned, they seem to agree with a priori information according to the data obtained.

An economy which is as highly monopolistic as the Venezuelan economy is, with capital abundance relative to the limited skilled labour supply, which has experienced an average annual rate of growth of 6 percent in real terms over the sample period (see Table 3 and Section 2.6.2), cannot exhibit a production function with decreasing returns to scale. This diagnosis leaves us with the other two possible returns-to-scale phenomena to consider, that is, constant and increasing returns to scale.

Considering these cases, we find that equation (4.8.62) is homogeneous of degree (a + b), so that if (a + b) = 1, then the economy-wide production function exhibits constant returns to scale. Since the sum of the coefficients of equation (4.8.62) is close to unity (.410 + .608 = 1.018), this seems to suggest that over the sample period the Venezuelan economy experienced constant returns to scale. Since the sum of the coefficients (.410 + .608 = 1.018) seems to suggest that over the sample period the Venezuelan economy experienced constant returns to scale, we want to test the reliability of this result. We apply a t-test to the hypothesis that

H1:(.410 + .608) = 1, against the alternative hypothesis
H2:(.410 + .608) > 1

The computed t-value (t*) in a right-tail test at 5 percent level of significance and with 26 degree of freedom is .206 and the critical or tabular t-value is: t = 1.71.

Since t* < t (i.e., .206 < 1.71), the hypothesis H1 is accepted, meaning that 1.018 is not statistically different from 1. This result indicates that the Venezuelan economy did experience constant returns to scale over the sample period. This result, on the other hand, seems to contradict the findings in Table 11 and Figure 1 that during the first period, 1950-1965, the economy exhibited labour-using technological change (i.e., relatively less capital-intensive techniques), while during the remaider of the period, 1966-1979, the economy shifted markedly to more capital-using techniques, which is an indication of the presence of increasing returns to scale.

FIGURE 1

THE MARGINAL RATE OF TECHNICAL SUBSTITUTION OF CAPITAL FOR LABOUR (MRTS-KL): 1950-1979.

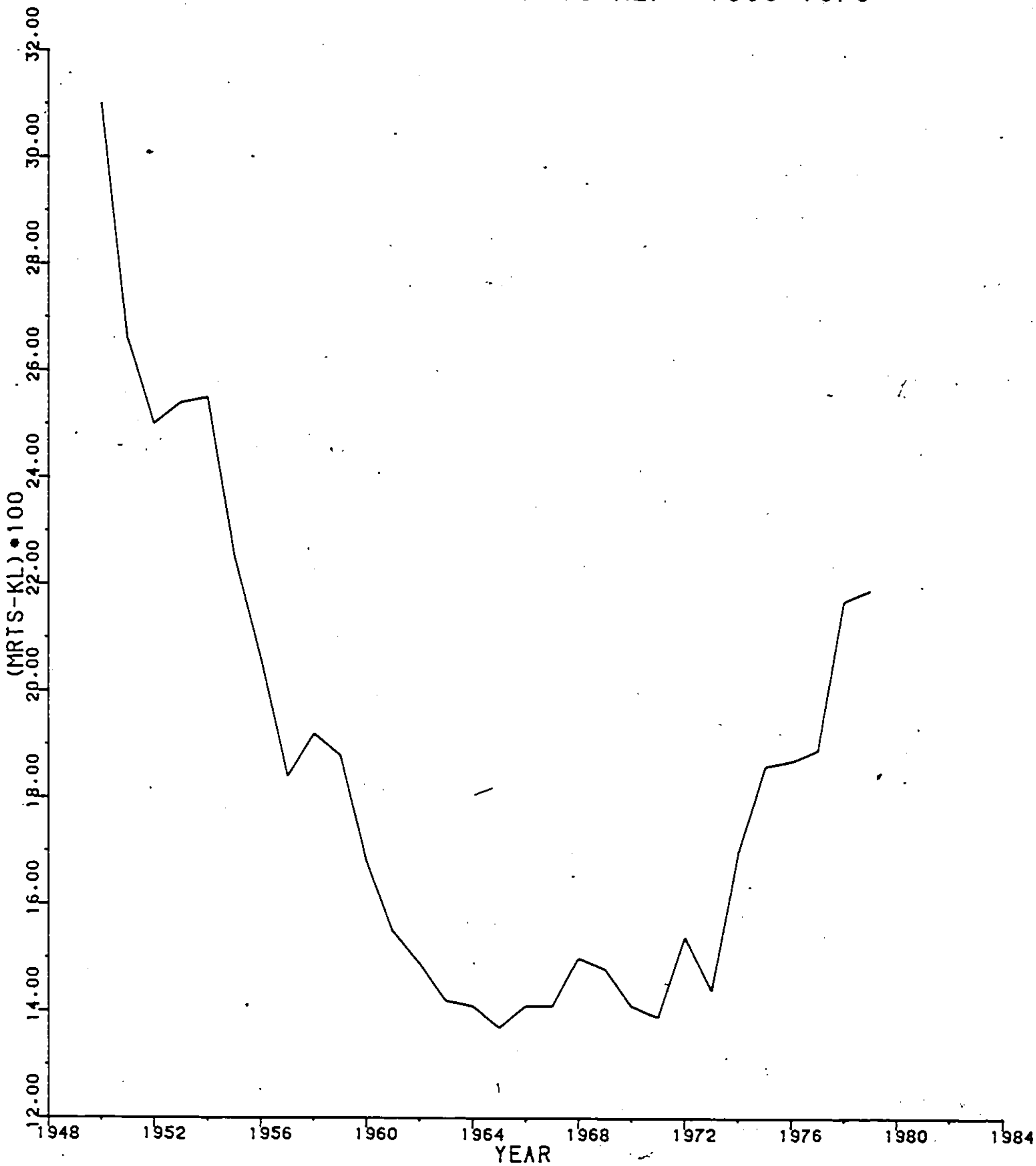

TABLE 11

The Marginal Products of Capital (MPK) and of Labour (MPL) and The Marginal Rate of Technical Substitution of Capital for Labour (MRTS-KL): 1950-1979

YEAR	LABOUR (Million Workers)	CAPITAL (Billion Bolivares)	MPL	MPK	MRTS-KL
1950	1.61	7.66	3.440	1.065	.310
1951	1.65	9.25	3.735	.994	.266
1952	1.73	10.24	3.830	.953	.250
1953	1.80	10.48	3.912	.995	.254
1954	1.87	10.91	4.120	1.053	.255
1955	1.92	12.75	4.362	.983	.225
1956	1.96	14.10	4.733	.974	.206
1957	1.99	15.83	5.208	.961	.184
1958	2.02	15.39	5.199	1.000	.192
1959	2.03	16.48	5.581	1.050	.188
1960	2.03	17.74	5.803	.977	.168
1961	2.05	19.39	6.036	.935	.155
1962	2.10	20.91	6.417	.954	.149
1963	2.16	22.07	6.682	.950	.142
1964	2.32	24.33	6.830	.965	.141
1965	2.44	25.95	6.864	.940	.137
1950-65	(2.6%)	(7.9%)	(4.4%)	(-.01%)	(-5.0%)
1966	2.52	26.11	6.815	.962	.141
1967	2.61	26.55	6.828	.962	.141
1968	2.79	27.91	6.727	1.007	.150
1969	2.88	29.05	6.741	.997	.148
1970	2.89	30.82	7.231	1.018	.141
1971	3.00	31.08	7.187	.997	.139
1972	3.16	30.91	7.042	1.083	.154
1973	3.29	32.73	7.184	1.034	.144
1974	3.66	31.93	6.830	1.159	.170
1975	4.00	31.55	6.588	1.227	.186
1976	4.27	33.82	6.722	1.260	.187
1977	4.56	35.22	6.732	1.272	.189
1978	4.93	33.30	6.404	1.389	.217
1979	4.98	33.31	6.374	1.399	.219
(1965-79))	(4.9%)	(1.7%)	(-.005%)	(2.7%)	(3.2%)

From 1950 to 1965 we can see that capital service payments grew at an average annual rate of 7.9 percent, triple that of labour (2.6%) in order to maintain an almost constant marginal product (MPK) at an average annual rate of -.01 percent, while the marginal product of labour (MPL) increased at a rate of 4.4 percent over that period. The marginal rate of technical substitution of capital for labour (MRTS-KL) declined at an average annual rate of 5.0 percent during the said period. This structure is reversed for the second part of the sample period. While labour increased at an average annual rate of 4.9 percent and capital climbed more slowly than before (at 1.7%), the MPL remained almost constant (at .005%) while MPK increased at a faster annual rate of 2.7 percent on the average, which is revealed in the increased MRTS-KL over the second part of sample period. These findings corroborate the implementation of the import-substitution industrialization policy of the state early in the 1960's.

Finally, we tried our last test:[121]

$$(4.8.63)\quad \text{Log(GDPR)} = 2.032 + .360\ \text{Log(F)} + .055\ \text{TIME}$$
$$(t's)\quad (23.65)\quad (7.57)\quad (65.51)$$

$$R2 = .996 \quad F = 3517.0 \quad D\text{-}W = .5307 \quad SEE = .033$$

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[121] See Ronald G. Bodkin and Lawrence R. Klein, <u>op. cit.</u>, p. 31.

As a whole, this regression equation seems to be a good one, except that the magnitude of the coefficient of the composite log(F) variable, which is at the same time the coefficient of the labour input variable, seems to be too low at .360 and the Durbin-Watson statistic is also too low indicating the presence of serial correlation amongst the error terms. The equation was then rerun using the Hildreth-Lu technique. The results are:

(4.8.64) $\text{Log(GDPR)} = 2.419 + .190\ \text{Log(F)} + .053\ \text{TIME}$

(t's) (12.24) (2.13) (22.43)

RHO = .790 R2 = .998 F = 259.9 D-W = 1.640

SEE = .022

Given that the estimate of the coefficient of labour is .190, which is even lower than previously, and 1.445 as the average annual ratio of the labour and capital real income from the product distribution, we get that:

$$.190(F) = .190[\text{Log(LWBR)} + 1.445\ \text{Log(KAPR)}]$$

$$= .190\ \text{Log(LWBR)} + .275\ \text{Log(KAPR)},$$

then the regression equation (4.8.64) becomes:

(4.8.64a) $\text{Log(GDPR)} = 2.419 + .190\ \text{Log(LWBR)} + .275\ \text{Log(KAPR)}$

$+ .053\ \text{TIME}$

It can be seen that this equation exhibits decreasing returns to scale and, therefore, cannot be accepted.

The above results seem to lead us to the conclusion that only the regression equation (4.8.62), which exhibits increasing returns to scale, is the most attractive functional relationship so far; however, because we hold strong reservations about the economic insight on the nature of KAPR, we feel that further experiments are required in the specification and estimation of the production function of our concern.

4.8.1 Re-estimation of the Aggregate Production Function

Capital formation was assumed to be in a relative abundant supply during the sample period, while labour was considered as the critical factor of the aggregate production function of the Venezuelan economy (see Section 2.6.2 and Subsection 2.8.2). We have, then, re-specified the production function[122] of this economy as a straight linear relationship of the GDPR and the number of employees and workers (LABOUR) and the disembodied technological progress achieved through the mere passing of time (TIME). The estimated equations are as follows:[123]

[122] Another attempt was made to estimate the production function as a logarithmic linear Cobb-Douglas relationship, but again, and as in the case of KGR above, the coefficient for LABOUR appeared with a negative sign, which, of course, was also rejected.

[123] We also tried to estimate here a production function in-

(4.8.65) GDPR = -1.865 + 7.863 LABOUR + 1.387 TIME

(t's) (-3.07) (16.99) (26.59)

R2 = .998 F = 6740.0 D-W = 1.118 SEE = .912

This regression produced good results; however, the presance of serial correlation allows us to re-estimate the equation through the Hildreth-Lu technique:

(4.8.66) GDPR = -1.650 + 7.315 LABOUR + 1.460 TIME

(t's) (-1.95) (10.88) (17.67)

RHO = .420 R2 = .998 F = 2845.6 D-W = 1.713

SEE = .803

the results of which indicate that with an optimal RHO at a level of .420 no serial correlation amongst the disturbance terms is present. The coefficients have the right signs as expected and their magnitudes are at reasonable levels, and the equation as a whole exhibits a good goodness of fit. This equation, ~~then~~, can be re-arranged to give:

(4.8.67) LABOUR =-.580 + .420 LABOUR(-1) + .137 GDPR - -.057 GDPR(-1) - .116TIME

which explains the employment level of the economy.

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cluding KGR, but the resulting equation produced a negative coefficient significantly not different from zero for this variable at a probability of 5 percent and 27 degree of freedom.

Chapter V

THE FORECASTING ACCURACY OF THE MODEL

Economic forecasting is closely linked to policy application and, most important, to policy evaluation. These objectives are precisely the reasons for the construction and estimation of this model under examination now. As seen in Chapter IV, the present macroeconometric model is a simple and highly aggregated 18-equation system representing the Venezuelan economy based mainly on the Keynesian effective demand doctrine.[124]

Regardless of their simplicity or complexity, econometric models, by their origin and nature, are just simplified structural instruments designed and estimated according to the perception and understanding that the research economist

[124] It has already been pointed out in Chapter I that most macroeconometric models of developed economies have been built on the Keynesian effective demand side of their highly productive and adaptable industrial economic systems. The concurrent recessions (stagflations), such as the present one, in the industrialized free world, precisely point to the inherent problem of demand deficiency of the system rather than to a supply limitation. Obviously, this is not the case in developing economies. As it is well known, developing countries are characterized by long term structural problems that limit the productivity and efficiency of their simple economies. Then, these economies, unlike the developed ones, face a limiting supply deficiency rather than a demand. Therefore, it seems to be more reasonable to construct a disaggregated supply side model for developing economies. Of course, this objective would be related to the availability of such disaggregated data.

may have on the real world of his/her concern and to the policy application intended. This is the final objective of such constructs based on the evaluation of their ex-ante forecasts.

5.1 THE SIMULATION PROCESS

The normative objective referred to above can only be pursued further after the full model has been examined for its accuracy to predict future economic phenomena. To this purpose, the model is submitted to a 'tracking' procedure or, just simply, to simulation exercises over the sample period to which the model has already been fitted. It is precisely through this process that each equation of the model is finally selected.[125] The process that takes place is generally as follows: by starting with the initial values of the endogenous variables (say 1960) and using the complete time

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[125] See Ronald G. Bodkin, K.S.R. Murthy and Tom Siedule, The Tracking Properties of the CANDIDE Model 1.0, (The Economic Council of Canada, Ottawa, 1975). Project Paper No. 17 (March, 1975). The CANDIDE MODEL (CANadian DIsaggregated InterDepartmental Econometric Model) is a large-scale, medium-term econometric system of the whole Canadian economy. It consists of two input-output submodels, one for production and the other for prices, which together with the rest of the model contain over 2000 endogenous variables and about 450 exogenous ones. See Ronald G. Bodkin and Tanny, Stephen M. (Eds.), CANDIDE MODEL 1.1, (The Economic Council of Canada, Ottawa, 1975). The latest version of this model, CANDIDE MODEL 2.0, unlike the previous versions, is based on the 1977 revision associated with the National Accounts, Industry Product Division and Input-Output Division Data bases. See R.S.Preston et al. (Eds.), CANDIDE MODEL 2.0, (The Economic Council of Canada, Ottawa, 1979).

paths of the exogenous variables (say 1960-79), the model is then solved through a procedure of successive iterations (the Gauss-Siedel procedure) over a desired range of time (say 1962-79) yielding solutions for each of the 18 endogenous variables. At this point, it remains to be known how well each estimated endogenous variable 'tracks' its corresponding already observed value. This is done through some well known measures of precision,[126] which are defined below.

The single variable measures of precision most often used in simulation analysis are:

(1) The Root-Mean-Square Simulation Error (RMSE), defined as:

(5.1) RMSE = [(1/T)SUM(Ys - Ya)(**2)](**1/2)

Where SUM indicates summation over T years.

(2) The RMSE percentage error (RMSE%):

(5.2) RMSE% = [[(1/T)SUM((Ys - Ya)/Ya)(**2)](**1/2)]*100

(3) The Average Absolute Error (AAE), defined as:[127]

[126] Ronald G. Bodking et al., The Tracking Properties, p. 2, and P.J. Dhrymes, E.P.Howrey, Saul H. Hymans, J. Kmenta, E.Edward, R.E.Quandt, J.B.Ramsey, H.T.Shapiro and V.Zarnowitz, "Criteria for Evaluation of Econometric Models." Annals of Economic and Social Measurement, Vol.1, (1972), pp. 291-324. See also H. Theil, Applied Economic Forecasting, (North-Holland, Amsterdam, 1966), pp. 26-36.

[127] The AAE is considered to be a better measure of deviation than the Mean Error or Bias because it avoids the

(5.3) AAE = (1/T)SUM(ABS)(Ys - Ya)

Where SUM(ABS) implies summation of absolute values.

(4) The AAE percentage error (AAE%):

(5.4) AAE% = [(1/T)SUM(ABS)[(Ys - Ya)/Ya]]*100

(5) Theil's Inequality Coefficient (U),[126] defined as:

(5.5) U = RMSE/[(1/T)SUM(Ya*Ya)](**1/2)

where RMSE has already been defined and the values of U lie between zero and infinity.

(6) The Bias or Mean Error:

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problem of positive error canceling out large negative error. For this reason the RMSE is more often used. See Robert S.Pindyck and Daniel L. Rubinfeld, Econometric Models and Economic Forecasts, (McGraw-Hill Book Co., New York, 1981), pp.362-367.

[126] This is a systematic measure of the predictive performance of an econometric model suggested by H. Theil, op. cit., pp. 28-30. If the inequality coefficient (U) takes a value equal to 0 [i.e.: Ys=Ya for all t(1,...,T years)], then the variable simulation has a perfect goodness of fit, which is almost impossible to attain, but if U takes 1 or larger values then it is said that the simulation goodness of fit is worse than it could possibly be with a least square method. Therefore, the closer U is to 0 (say U < .3), the better the goodness of fit is.

A variation of this definition limiting the upper bound to 1, is given by the same author in an earlier work, Economic Forecasts and Policy (North-Holland, Amsterdam, 1965), p. 32, where:

U=RMSE/[(1/T)SUM(Ya*Ya)(**1/2)
+ (1/T)SUM(Ys*Ys)(**1/2)],

(5.6) BIAS = (1/T)SUM(Ys - Ya)

(7) The square of the relative BIAS (UB):[129]

(5.7) UB = BIAS(**2)/RMSE(**2)

(8) Tracking Measures:

(a) Number of turning points rightly forecasted

(b) Number of turning points falsely forecasted

(c) Number of turning points missed.

(9) Comparative Measures:

(a) Comparison with 'naive' forecasts.

As it can be seen, measures from (5.1) to (5.7) refer to deviation of the simulated variable from its actual time-path, where T is the sample period, Ys is the simulation value or solution of the endogenous variable under analysis during period T and Ya is its corresponding observed value

and U will always fall within 0 and 1 inclusive. If U=1, then Ys=0, which could be interpreted as zero-change prediction.

[129] The decomposition of the variation of the numerator of U leads us to the sources of the simulation (forecast) errors: 1)the Bias proportion (i.e., the relative bias (UB), above defined), 2)the variance proportion and 3)the covariance proportion. Errors leading to the above categories are called, respectively, errors in 'central tendency' (i.e., Ys is different from Ya), errors from 'unequal variation' (i.e., the standard deviation of Ys is different from the standard deviation of Ya), and, finally, errors due to 'incomplete covariation' (i.e., the correlation coefficient R is not equal to 1). See H. Theil, Applied Economic Forecasting, pp. 29-32.

for the same period T. All the above measures together are very important criteria for determining the accuracy of the model with regard to the forecast. On the one hand, low simulation errors are indeed desirable measures of simulation goodness of fit, but on the other hand, it is also highly desirable that each endogenous variable under analysis track well the 'turning points' of the historical data.

5.2 ANALYSIS OF SIMULATION RESULTS

The period under simulation covers the 20 years from 1960 to 1979 when all the behavioural equations were estimated. This is done because, while some equations were estimated from 1950, the petroleum submodel equations were estimated from 1960. Furthermore, the years 1960 and 1961 were taken by lagged explanatory variables implying that the solution of the endogenous variables only covers 18 years starting in 1962 and up to the end of the sample period. Therefore, we should expect that the simulation solution for each endogenous variable, with the exception of the petroleum export equations, is not to be exactly the same as the estimated value of the single equation carried out in Chapter IV. It remains to be seen, however, what would be the response of all behavioural equations as a group and their aggregate identities equations. We shall examine such behaviour through a detailed analysis of simulation errors as discussed above, taking the equations one by one as they appear in the previous chapter, Subsection 4.1.2.

5.2.1 Consumption and Investment

Given that the magnitudes of the inequality coefficient (U) for each simulated (forecasted) value of the endogenous private consumption (CPR) and the total aggregate consumption (CTR) are very low (and the same .01), it follows then that the forecasting performance of these two endogenous variables should be very good. However, and before making any final conclusion, it is necessary to pursue this inquiry further. As seen in Table 12, CPR and CTR show zero relative bias (UB), implying that the errors of central tendency are very low and, therefore, the forecasting accuracy of the model is good.[130]

The above analysis can be confirmed by the low measures of deviation errors as indicated by the very low RMSE% at 2 and 1 percent for CPR and CTR, respectively, by the AAE% at 1 for each variable and, finally, by the relative high number and proportion of the turning points rightly forecasted for each of these variables, which appear tabulated in Table 13

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[130] Pindyck, Robert and Daniel L. Robenfeld, Econometric Models and Economic Forecasts, (McGraw-Hill, New York, 1981), p. 365. They argue that, regardless of the value of the inequality coefficient U, the value of the relative bias UB should be close to zero. A value of UB larger than .2 is an indication of systematic error, which requires a revision of the model.

TABLE 12

Dynamic Simulation: 1962-1979

VARIABLE	U*	UB	BIAS	RMSE	AAE	RMSE%	AAE%
CPR	.01	.00	.03	.50	.37	.02	.01
CTR	.01	.00	.03	.50	.37	.01	.01
IPGR	.05	.13	.32	.90	.69	.11	.08
ITGR	.03	.13	.32	.90	.69	.07	.05
YNR	.01	.12	.42	1.23	1.07	.03	.03
TXIR	.04	.00	.00	.13	.09	.08	.06
TXDR	.05	.01	.02	.23	.18	.11	.09
TXOR	.06	.00	.08	2.46	2.04	.30	.25
TXTR	.05	.00	.10	2.58	2.11	.21	.18
XONAR	.05	.00	.03	.95	.72	.08	.07
XOLAR	.02	.00	.00	.16	.13	.05	.05
XTOR	.03	.00	.03	.95	.72	.05	.04
XTR	.03	.00	.03	.95	.72	.05	.04
MKR	.04	.09	-.18	.60	.49	.19	.15
MNKR	.05	.02	.12	.85	.64	.09	.07
MTR	.04	.00	-.06	1.01	.78	.06	.05
GDPR	.03	.12	.68	1.93	1.45	.03	.02
LABOUR	.05	.00	-.00	.32	.21	.08	.06

To complement even further the present analysis, we present a visual illustration in Figures 2 and 3, depicting the simulated estimates and the actual values of each of these two endogenous variables over the period 1962-1979 and showing how close these two values are to each other within the sample period.

TABLE 13

The Tracking of the Turning Points: 1962-1979

VARIABLE	SIMULATED				
	RIGHT	WRONG	(YEAR)	MISSED	(YEAR)
CPR	5	0		1	(1970)
CTR	5	0		1	(1970)
IPGR	4	1	(1977)	2	(1967,72)
ITGR	6	1	(1969)	0	
YNR	5	1	(1978)	2	(1970,74)
TXIR	5	0		3	(73,75,78)
TXDR	7	1	(1973)	0	
TXOR	6	1	(1966)	0	
TXTR	6	1	(1966)	0	
XONAR	4	3	(1964,68,78)	0	
XOLAR	5	3	(1965,70,75)	1	(1967)
XTOR	7	1	(1964)	1	(1968)
XTR	7	1	(1964)	1	(1968)
MKR	5	1	(1970)	0	
MNKR	4	0		2	(70-71,78)
MTR	5	1	(1969)	0	
GDPR	7	2	(1974,78)	0	
LABOUR	4	4	(1966,69,74,79)	0	

The simulation results for gross fixed investment of the private sector (IPGR) as well as the much more aggregated total gross fixed investment (ITGR) are not as tight as those results given by the previous simulation of the consumption variables. From Table 12 we can observe that the goodness of fit of each of the investment simulated variables is acceptable with an inequality coefficient equal to .05 for IPGR and .03 for ITGR and, furthermore, the relative measure of deviation as given by the relative bias at .13 for each variable is also low. This level of fitness is also corroborated by the relative deviation measures given, accordingly, by the RMSE% (11 and 7 percent) and AAE% (8 and 5 percent) and illustrated by the Figures 4 and 5. The simulated estimates of IPGR track the trend reasonably well, showing a marked positive bias, during the sample period; however, it failed to predict two important turning points during the recession years 1967 and 1972. In both cases, the prediction was optimistic. From 1973 on, the tracking of the trend is quite reasonable, with the exception of the overshooting in 1978.

A look at Figure 5 produces a more rewarding sense of appraisal. The estimated values of total gross fixed investment (ITGR) track quite well its actual values and the main turning points, with the exception of the 1970 falsely predicted slowdown of ITGR (of course, ITGR is dominated by IPGR), perhaps influenced by the sudden drop of public investment in 1970-1971, a sector which has always been characterized by increasing and high government expenditures (see Table 4, Column 6, and Appendix). It seems that the deviation errors in IPGR are quite reduced (or some errors cancel out) when assembled together with the exogenous government gross fixed investment (IGGR) to produce a better goodness of fit for the much more aggregated ITGR.

We should note in the above analysis that both the total variables, CTR and ITGR, reproduce the same variation statistics as their corresponding and only endogenous components, private consumption (CPR) and private investment (IPGR), since the government consumption and investment (CGR and IGGR) enter the model as exogenous variables (see Table 12).

5.2.2 National Income

In the full-system simulation process and according to the criteria set forth in Section 5.1, the national income endogenous variable (YNR), as specified in equation (4.4.20), performed much better than equation (4.4.19) and, therefore, it has been included in the model. As shown in Figure 6, the simulated estimates track quite well the historical trend, with the exception of two minor turning points missed, one in 1970 and another in 1974 just prior to the minor recession of 1975, and a mild overshooting pick falsely predicted in 1978 (see also Table 13). Table 12 shows that the inequality coefficient is low at .01 and, while the relative bias is somewhat on the high side, but still acceptable, we expect good accuracy for the forecasts beyond the sample period, that is, the forthcoming ex-post analysis for

1980, due to the fact that the calculated root-mean square percentage error (RMSE%) and the average absolute percentage error (AAE%) are low at 3 percent each.

5.2.3 The Tax Revenue Variables

As shown in Table 12 and depicted in Figures 9 and 10, total tax revenues (TXTR) follow almost the same variation and time-path as petroleum tax revenues (TXOR). This comes as no surprise. Petroleum tax revenues dominate the tax structure of the country in an ever increasing trend that goes from an average share of about 63 percent of total ordinary taxes collected in the 1950's to 68 percent in the 1960's and to 76.0 percent in the 1970's (see Section 2.7) and, consequently, the deviation of its simulated values from its measured data is almost reproduced by the aggregate TXTR. In fact, each corresponding main turning point rightly forecasted for TXOR is replicated for TXTR, including the false drop predicted in 1966 (see also Table 13). Individually, each variable shows that its respective simulation results are reasonably close to the historical values, with very low inequality coefficient (.06 and .05) and zero relative bias, although their relative deviations as expressed by the RMSE% (30 and 21 percent) and the AAE% (25 and 18 percent) seem to be high.

The simulation results for indirect tax revenues (TXIR) capture very well the general trend of the historical data as can be seen in Figure 7, and with an apparent absence of relative bias together with low dispersion statistics, the forecasts over the sample period seem to be very reasonable. However, these estimates failed to capture the peak values of 1975 and 1978, which may be interpreted as a need to improve the specification of the respective behavioural equation.

Direct taxes (TXDR) also show low dispersion statistics, with a low .05 inequality coefficient, indicative of the high level of goodness of fit of the estimated values with respect to the actual ones, as can be seen in Table 12 and Figure 8. With a very low relative bias at .01 (interpreted as relatively low central tendency errors between estimated and actual values), and acceptable RMSE% and AAE% at 11 and 9 percent points, respectively, we expect that the specification of the corresponding behavioural equation may well do a reasonable performance in the ex-post forthcoming analysis.

5.2.4 The Export Sector

The dispersion statistics corresponding to each one of the four endogenous components of the export sector, that is, petroleum exports to North-America (XONAR), to Latin-America (XOLAR), the aggregate total petroleum exports (XTOR) and total exports of all commodities (XTR), are very low, and with zero relative bias, as indicated in Table 12. These low level statistics, together with Figures 5-10, 5-11 and 5-12, point to the reasonable level of accuracy of the simulated estimates over the sample period.

A look at Figure 11 immediately indicates that the estimates of XONAR track reasonably well the historical trend, with the exception of the somewhat erratical behaviour shown during the period 1962-1968, and capture well the main turning points from 1969 on, signaling relatively well the sudden increase in petroleum world prices of 1974 and missing only the upward movement of petroleum export prices during 1979. The overall simulation performance of this variable seems to be reasonably good, as judged from its graph and low relative deviation of 8 and 7 percent.

Figure 12 depicts the close relationship that exists between the estimated and actual values of petroleum exports to Latin-America (XOLAR). The forecasted values track quite well the historical trend over the sample period and, although they wrongly predicted a slowdown in exports in 1966, they kept continuously increasing going upward even through the downturn of 1970, but tracking closely all the other important turning points. Another good feature of XOLAR is the apparent absence of bias, which combined with the low variation percentage errors of 5 percent, is indicative of the high simulation performance of this variable.

Finally, we have now total exports of petroleum and non-petroleum commodities and, as expected, the variation and general trend of this identity correspond to the only endogenous and dominant components of the petroleum export sector, that is, XONAR and XOLAR, of which the former is indeed the very powerful variable. (Petroleum exports to other parts of the world as well as non-petroleum exports enter the model as exogenous variables). In fact, we can observe that Figure 13 (XTOR or equivalently XTR) is almost a replica of Figure 11 (XONAR) but with some improvements in terms of lower relative dispersion statistics (U, RMSE% and AAE%) and a better tracking record, which includes the upward movement in 1979, due to the influence of XOLAR.

5.2.5 The Import Sector

This sector is composed only of three endogenous variables, which are total imports (MTR) and its components, imports of capital (MKR) and non-capital (MNKR).

The variation statistics on Table 12 reveal that this set of variables performed reasonably well in the simulation exercises. In fact, a look at Figure 15 shows that the estimates of MKR track well the historical trend and capture the most important turning points, in particular those from 1971 on; but the relative dispersion statistics at 19 and 15 percent points are high. The simulation of MNKR, although it depicts a smooth graph of the estimated values tracking well the overall trend of the actual measures (see Figure 16), missed important downturns such as those of 1970-71 and, in particular, the one which ocurred in 1978, an indication that the functional relationship of MNKR needs further improvement.

As expected, MTR presents the best overall dispersion statistics of the simulated values of the import sector, the closest time-path and tracking record of all main turning points, as can be seen in Tables 12 and 13 and the respective figures.

5.2.6 The Gross Domestic Product

Turning now to gross domestic product (GDPR), we can observe in Figure 18 that the full-system simulation estimates for this important variable produces a reasonably good tracking performance of its relatively smooth historical trend. However, this simulation wrongly predicted a downturn in economic activities in 1974, when the opposite was the case as the Venezuelan realized petroleum export prices (POWVR) suddenly jumped over 166.0 percent, in real terms, over the prices of 1973 (see Appendix C), and overestimated the GDPR in 1978 dropping, afterwards, quite rapidly in 1979. Nevertheless, this variable has a good goodness of fit, positive bias and, as in the previous cases, very low relative variation percentage errors as shown either by RMSE% at 3 or AAE% at 2 percentage points in Table 12. Therefore, the simulation performance of this variable is reasonable.

5.2.7 The Employment Variable

The dispersion statistics of labour (LABOUR) seem to indicate a reasonable simulation performance for this important variable. A low inequality coefficient (U) at .05 with a moderate relative deviation measure of 8.0 percent (RMSE%) and 6.0 percent (AAE%) imply that the simulation of LABOUR has an acceptable goodness of fit. Another favourable feature exhibited by the simulated variable is the apparent absence of central tendency errors over the sample period simulation as shown by its zero bias proportion (see Table 12). However, the simulated estimates of this variable, although they track the general trend reasonably well (see Figure 19), wrongly predicted the 1974 and 1979 major turning points, just like in the case of the simulation of the GDPR. This is no surprise, as LABOUR is explained by GDPR. It seems, therefore, that the specification of LABOUR requires further improvement.

FIGURE 2

CONSUMPTION OF THE PRIVATE SECTOR (CPR)

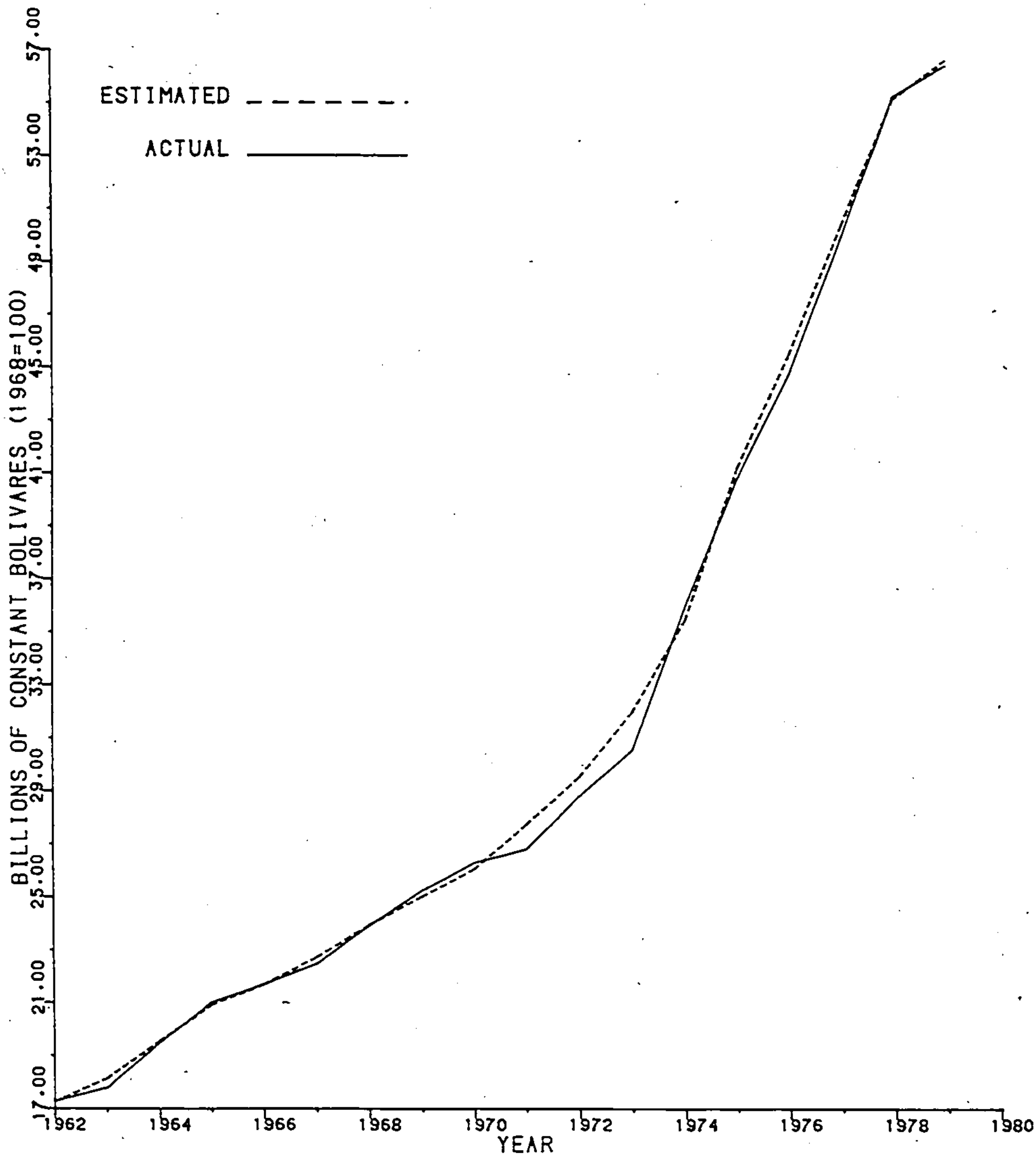


FIGURE 3

TOTAL CONSUMPTION (CTR)

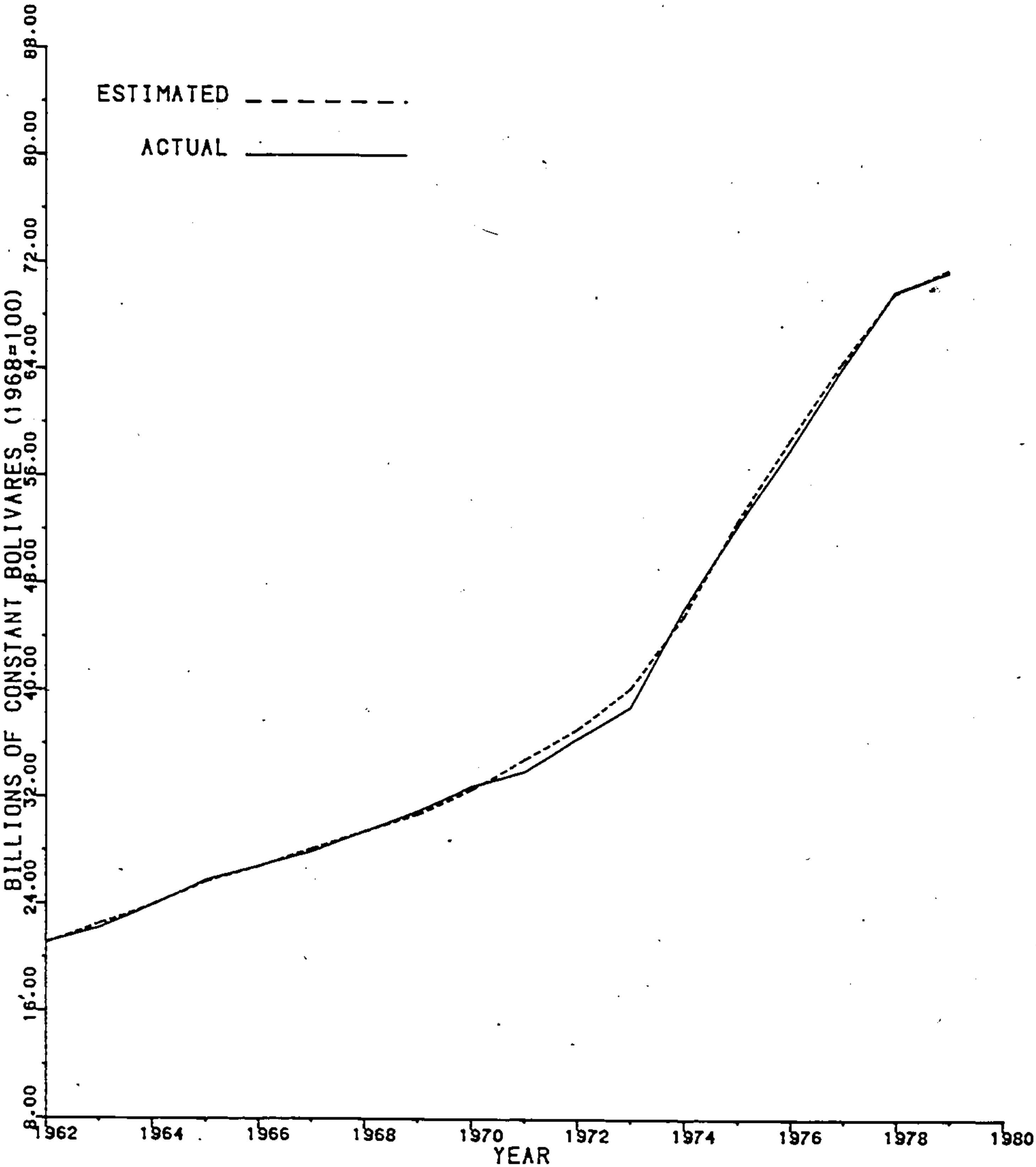


FIGURE 4

GROSS FIXED INVESTMENT OF THE PRIVATE SECTOR (IPGR)

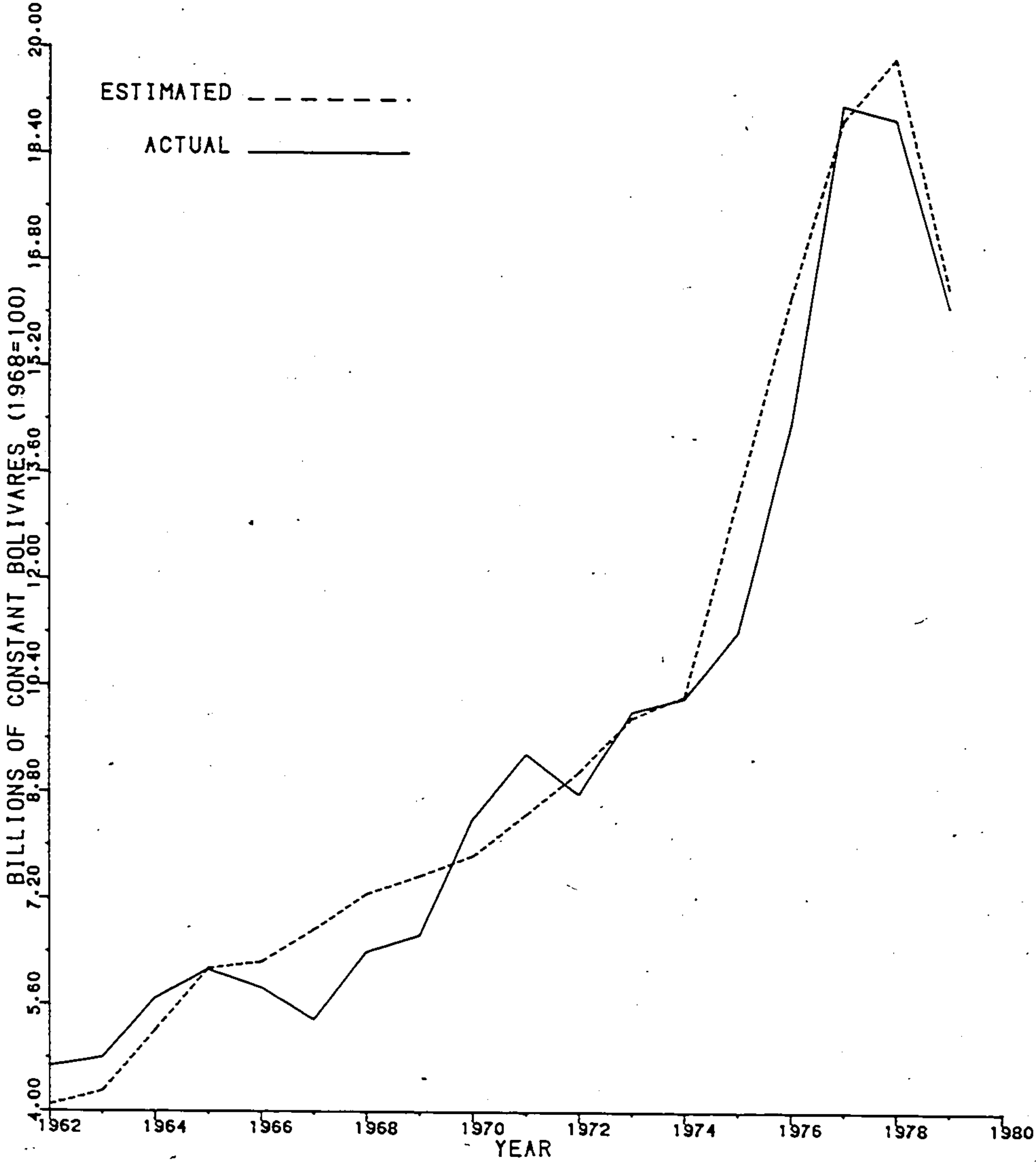


FIGURE 5

TOTAL GROSS FIXED INVESTMENT (ITGR)

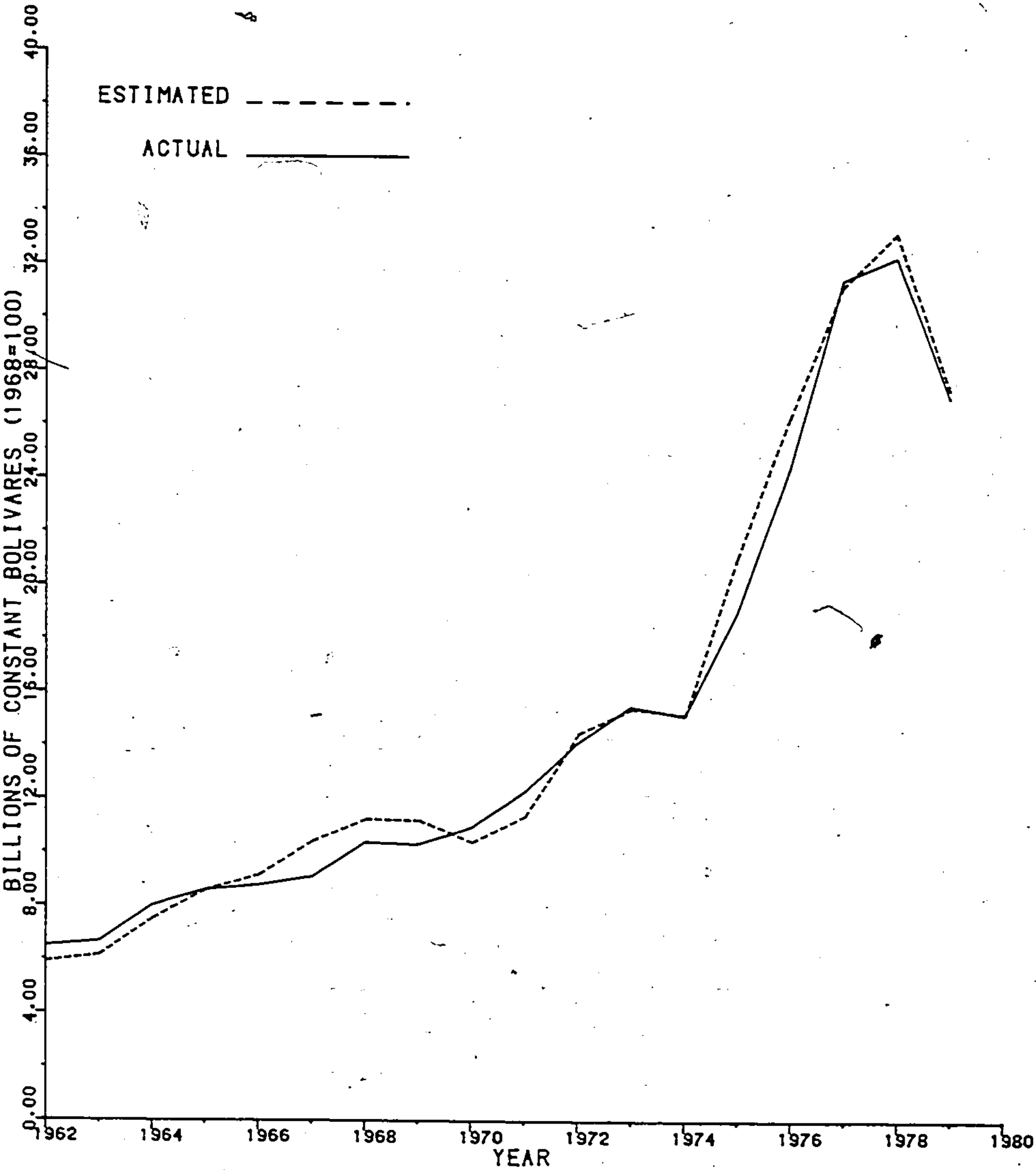


FIGURE 6

NATIONAL INCOME (YNR)

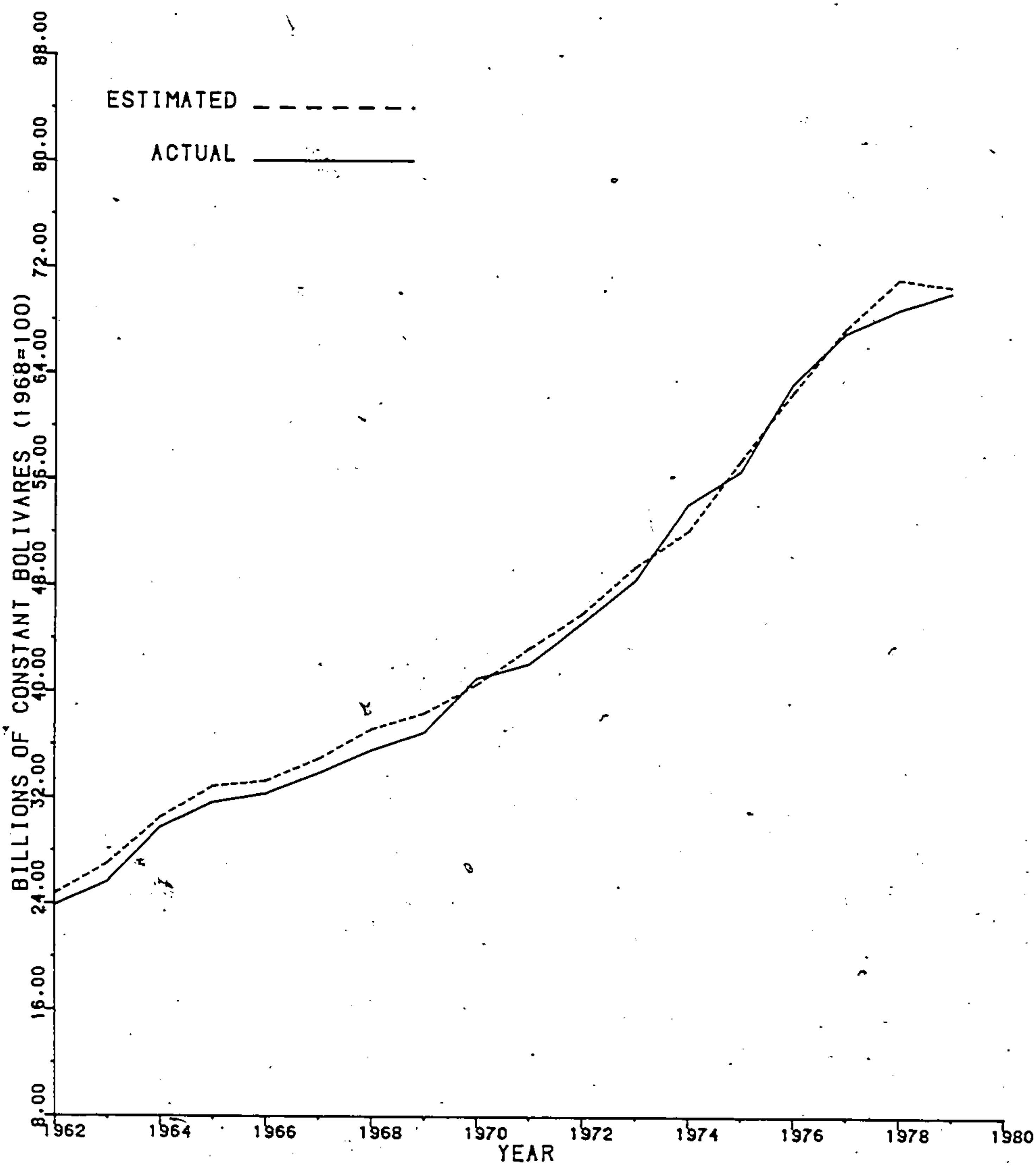


FIGURE 7

INDIRECT TAXES (TXIR)

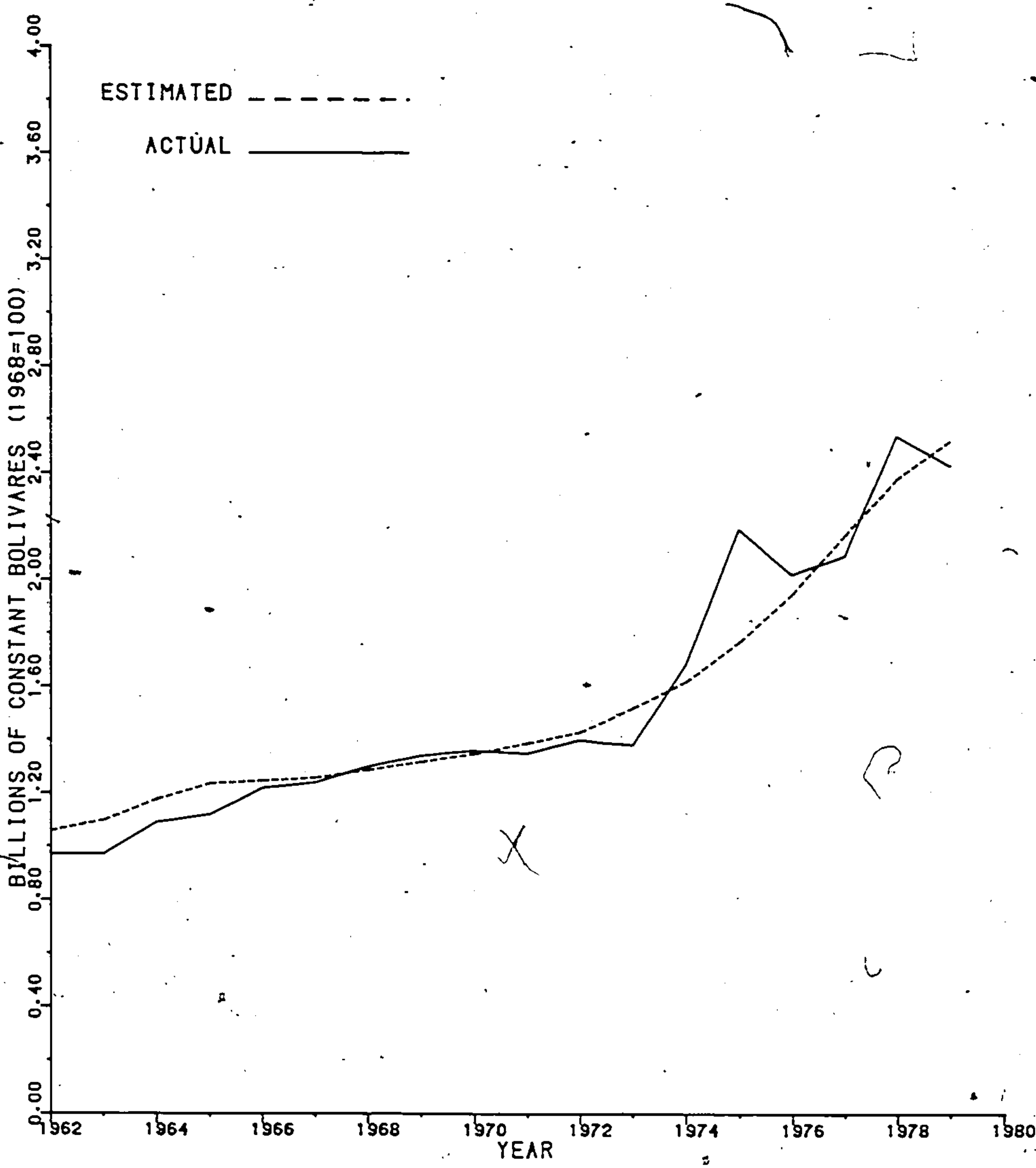


FIGURE 8

DIRECT TAXES (TXDR)

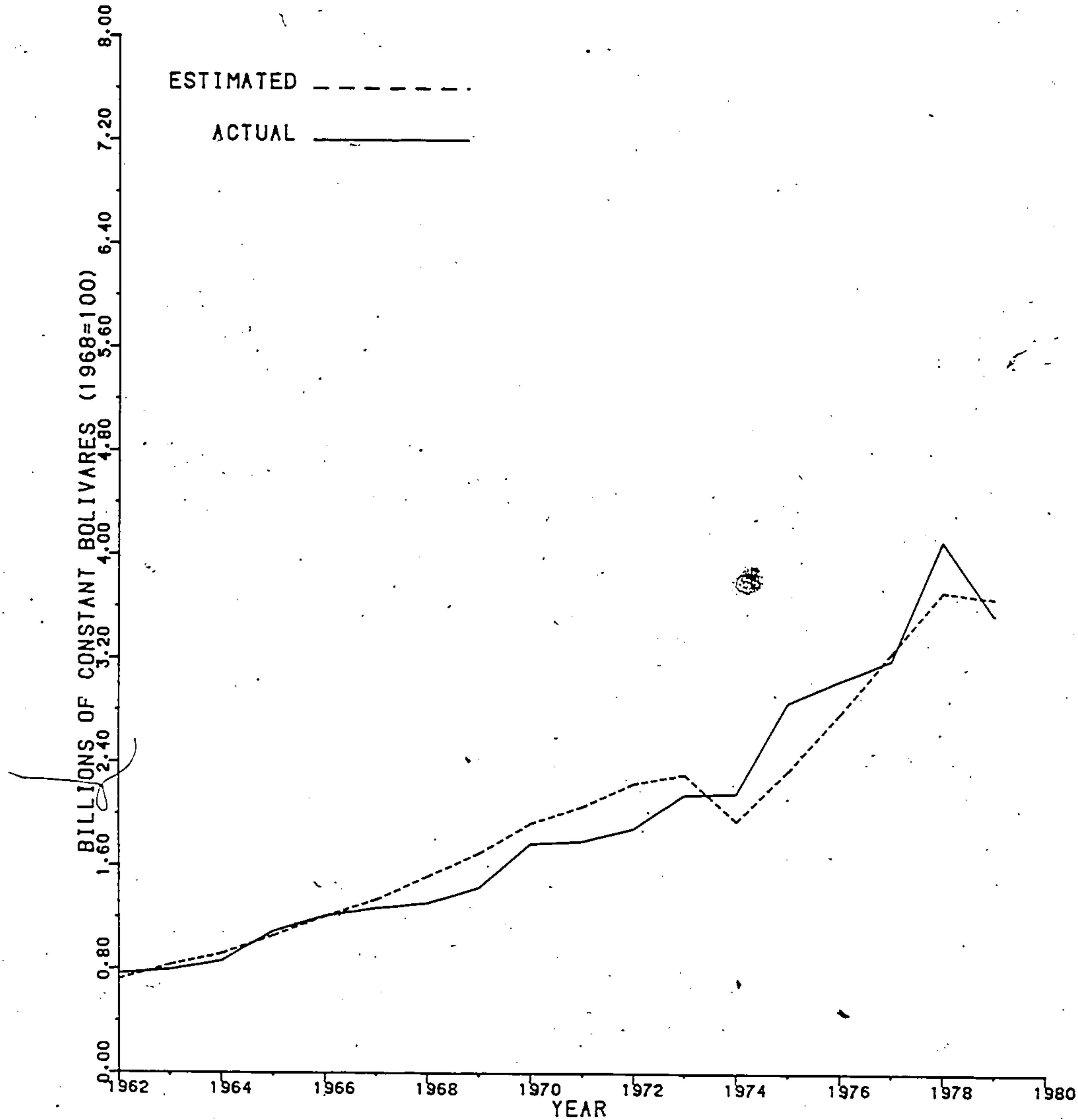


FIGURE 9

PETROLEUM TAXES (TXOR)

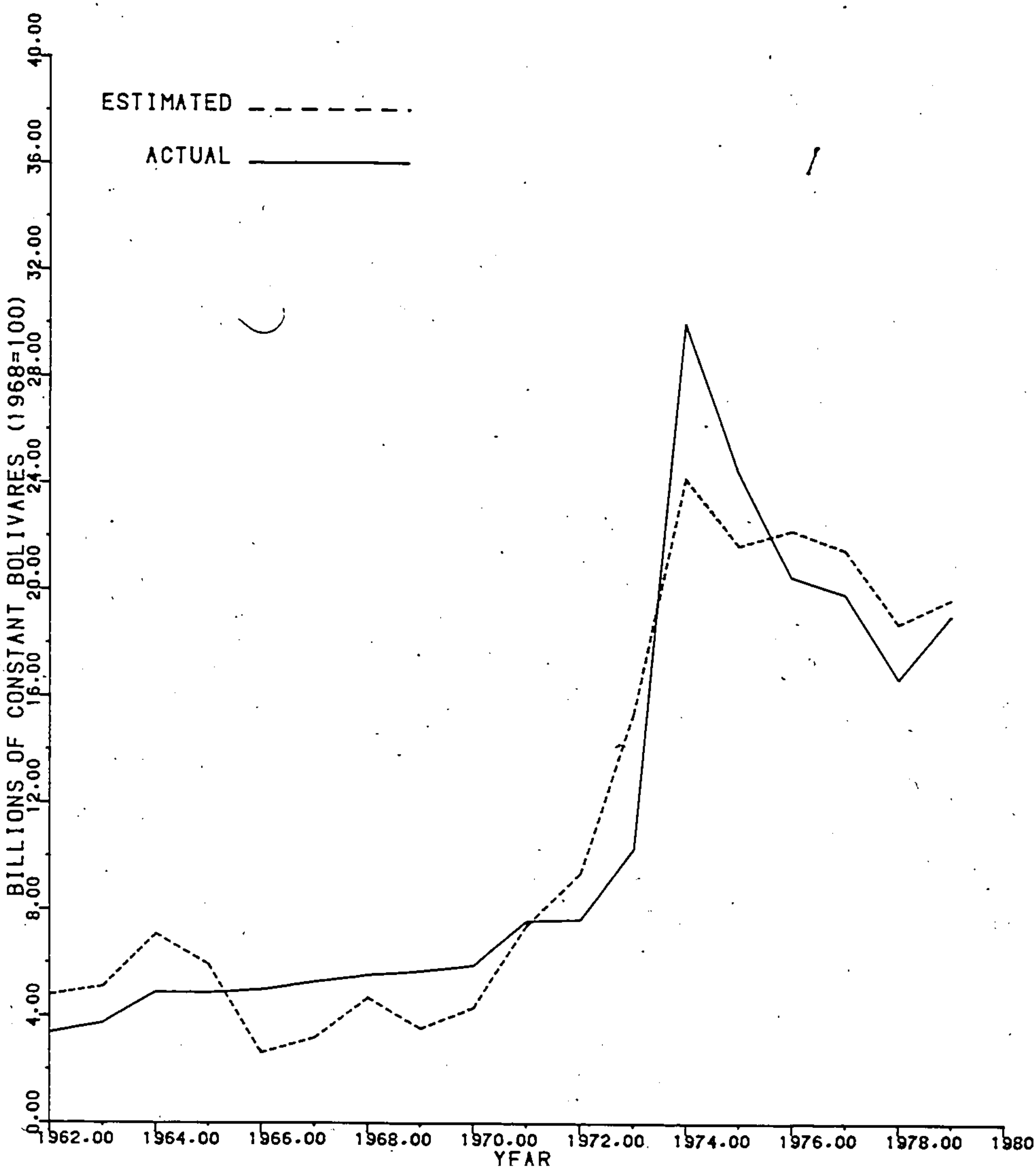


FIGURE 10

TOTAL TAXES (TXTR)

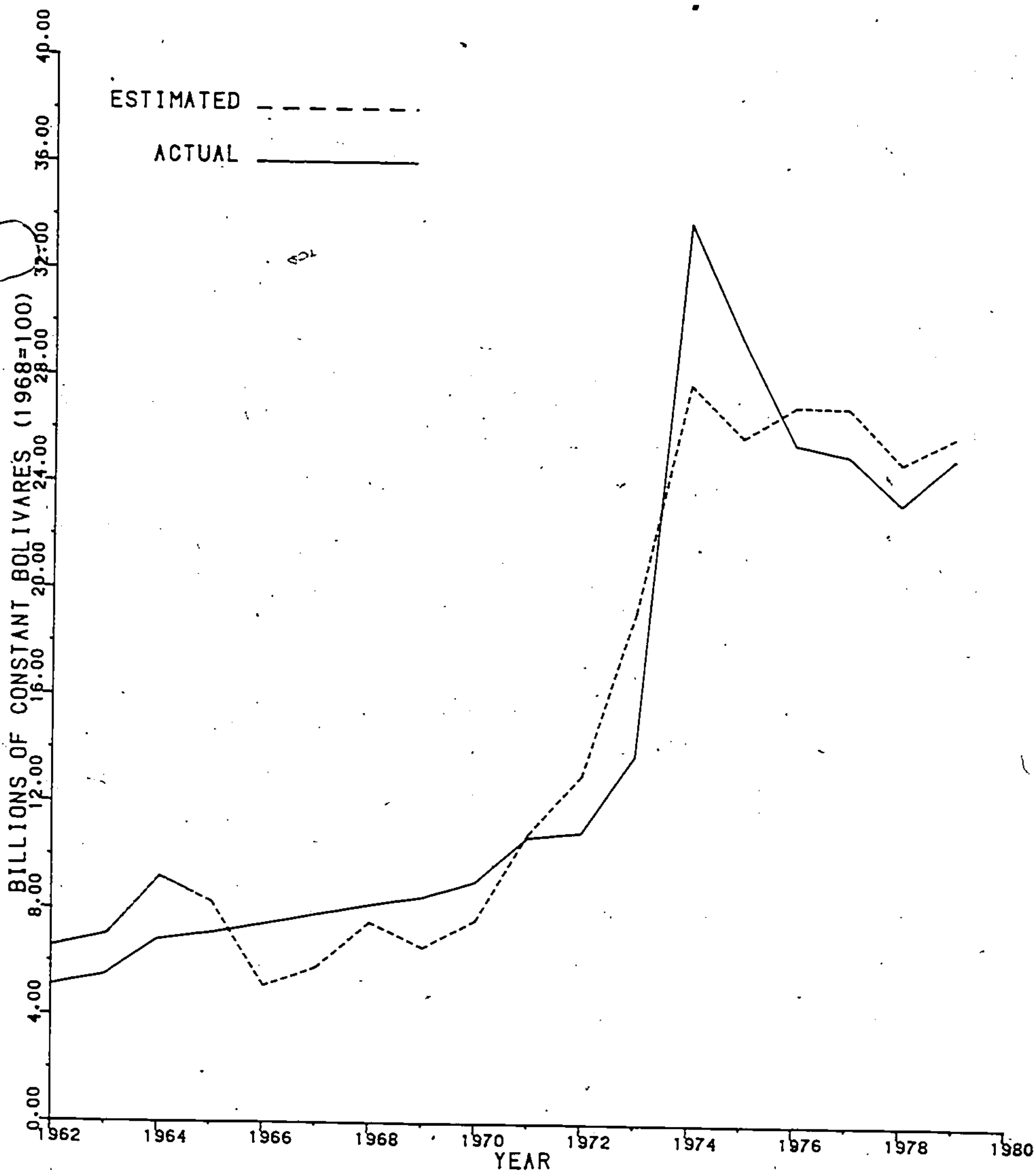


FIGURE 11

EXPORTS OF PETROLEUM TO NORTH-AMERICA (XONAR)

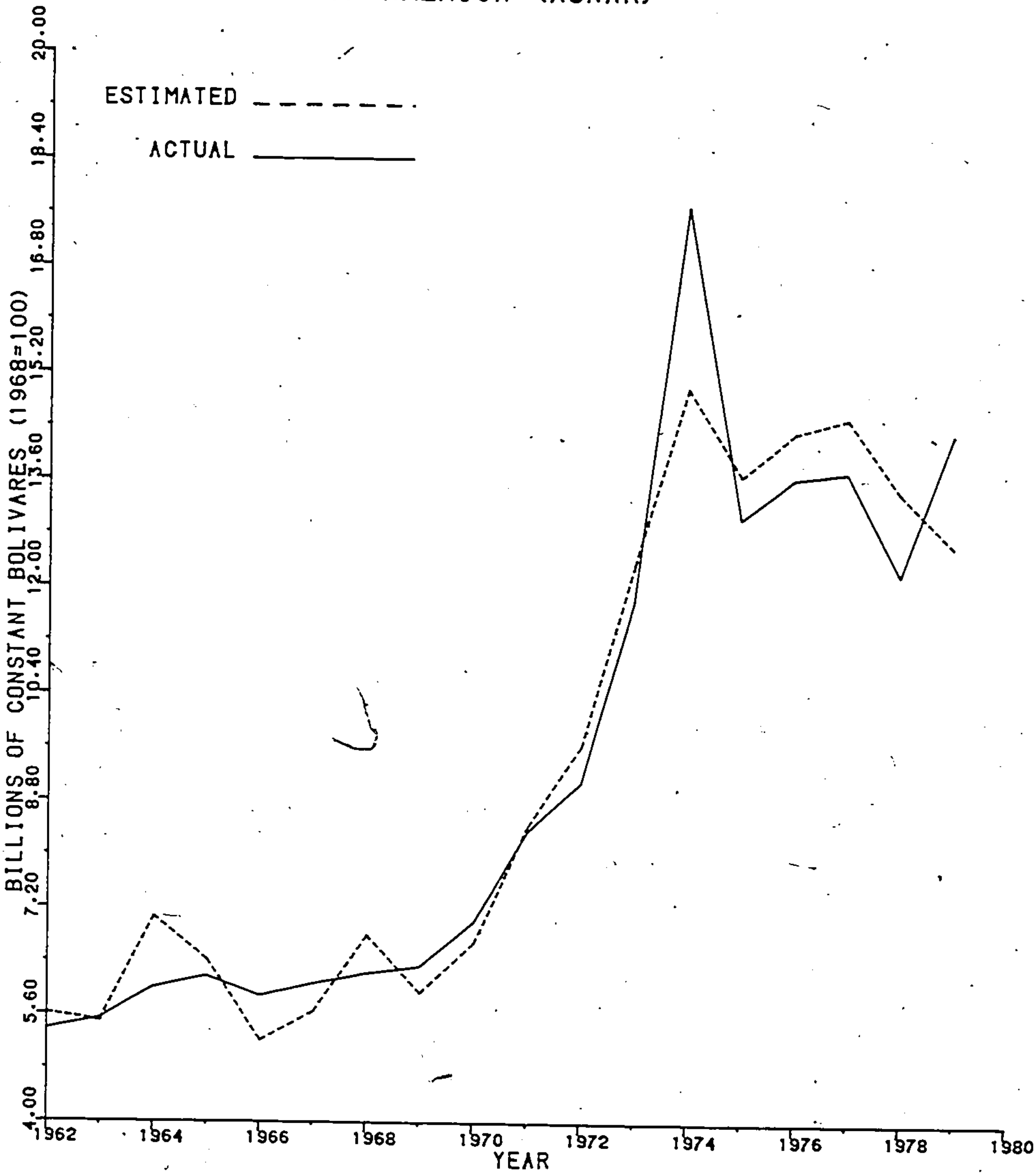


FIGURE 12

EXPORTS OF PETROLEUM TO LATIN-AMERICA (XOLAR)

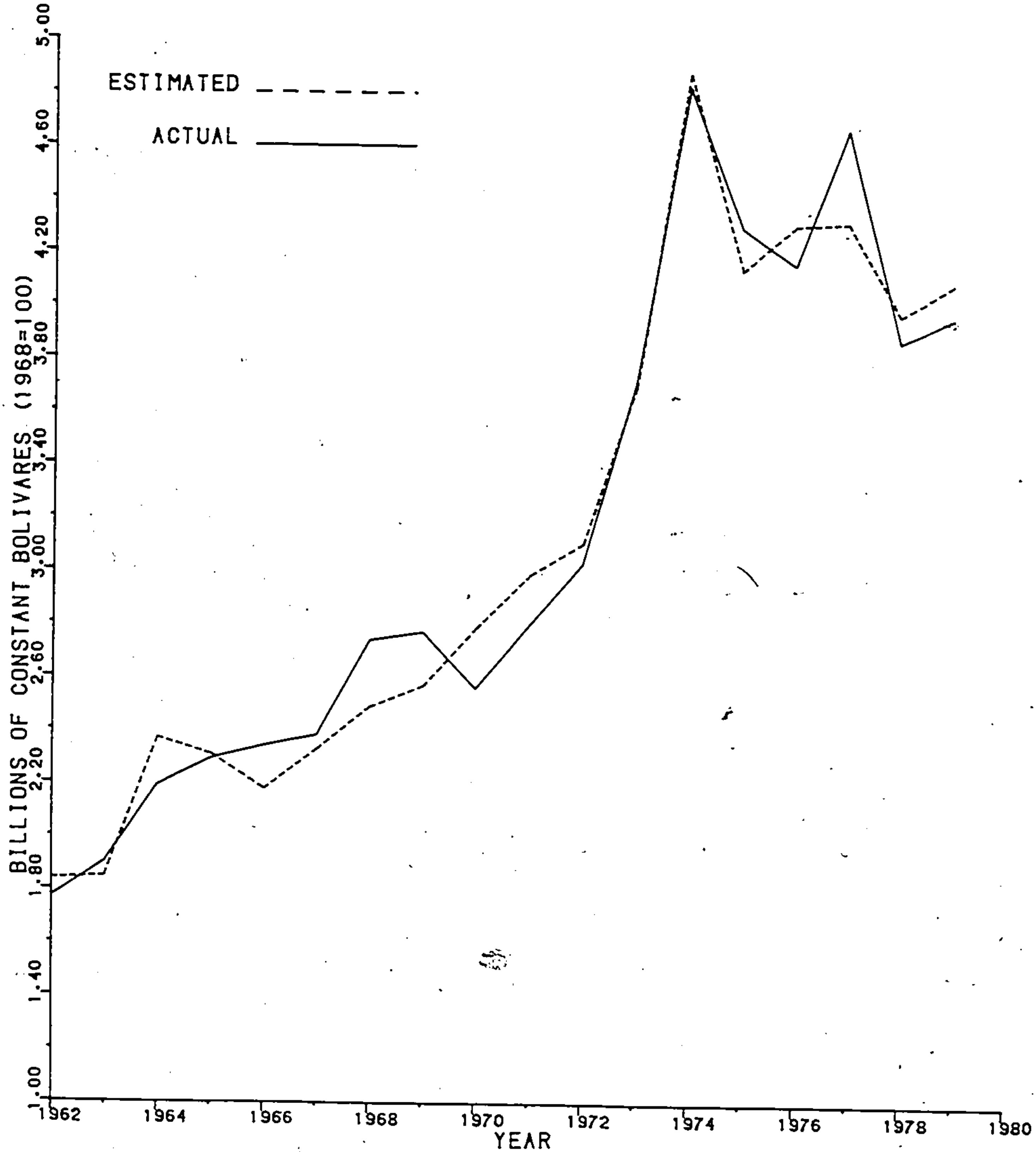


FIGURE 13

TOTAL EXPORTS OF PETROLEUM (XTOR)

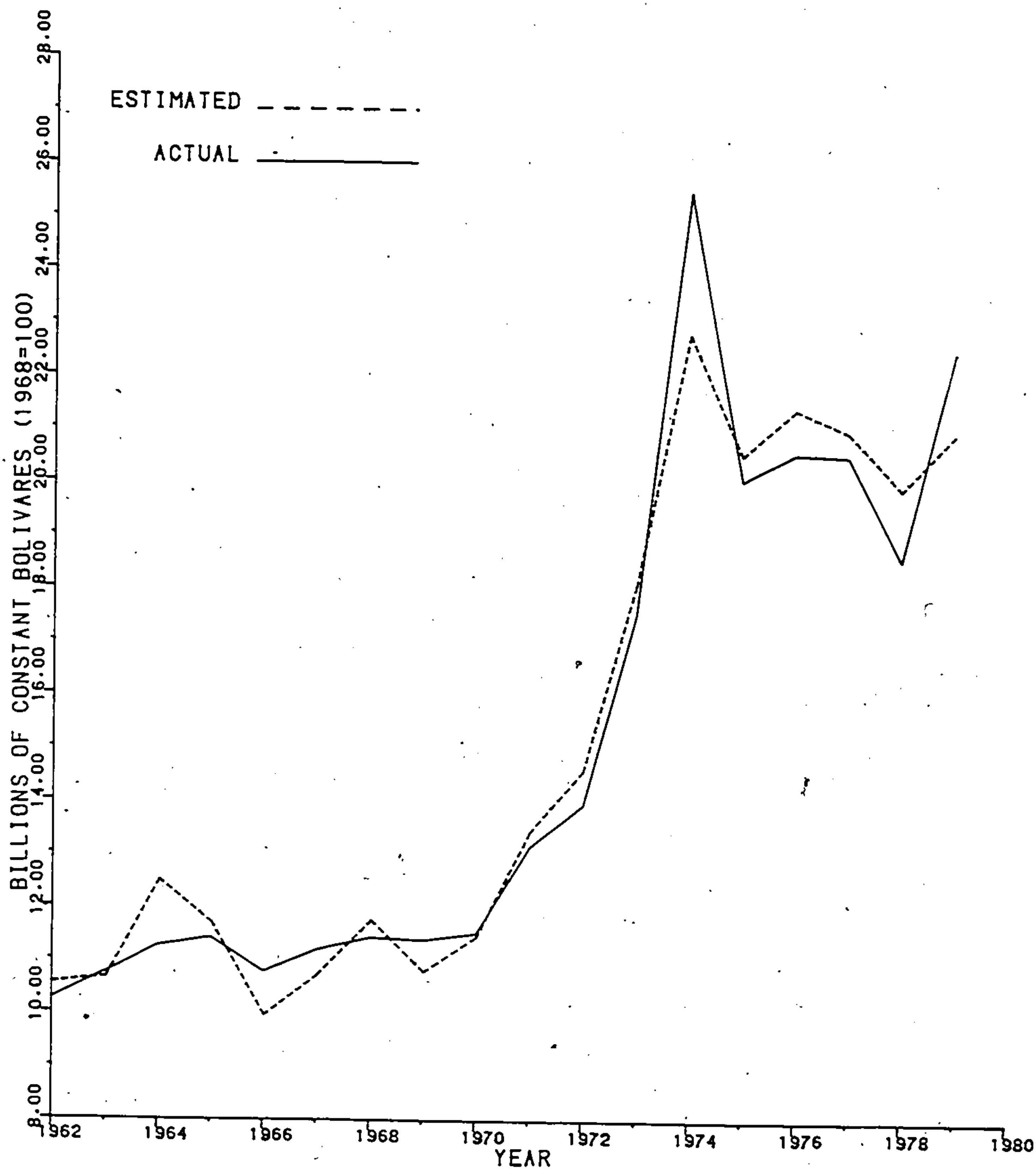


FIGURE 14

TOTAL EXPORTS (XTR)

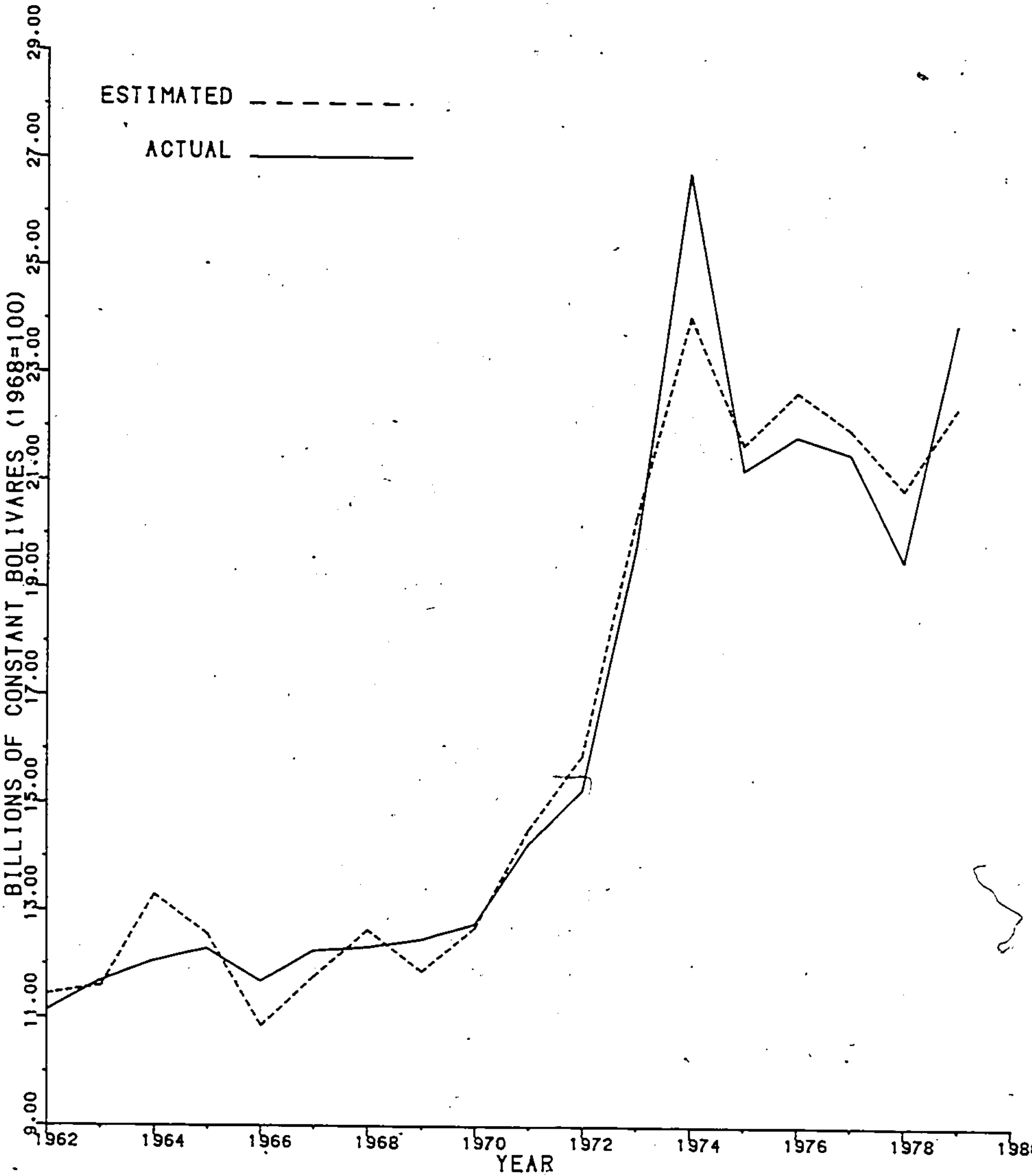


FIGURE 15

IMPORTS OF CAPITAL GOODS (MKR)

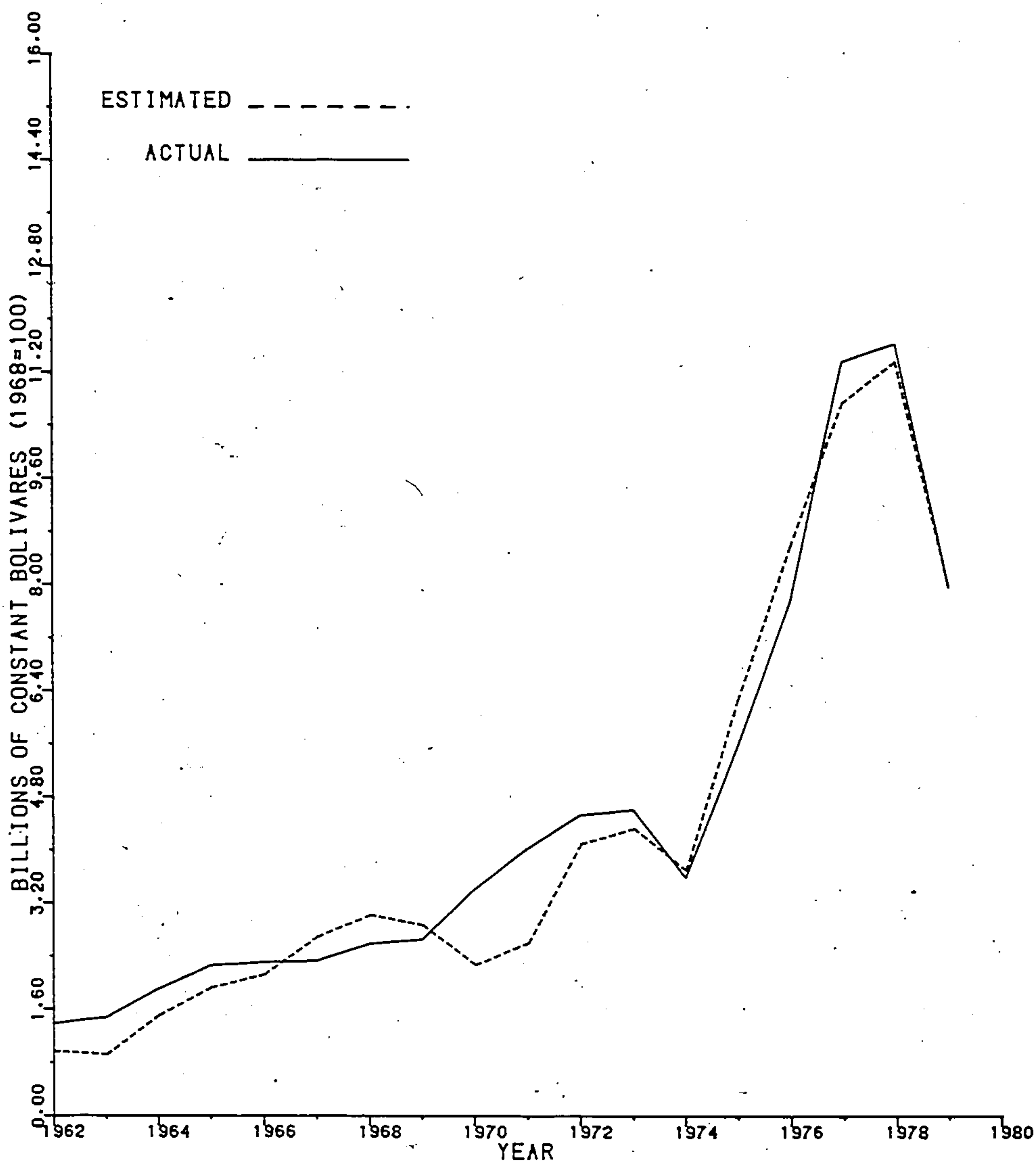


FIGURE 16

IMPORTS OF NON-CAPITAL GOODS (MNKR)

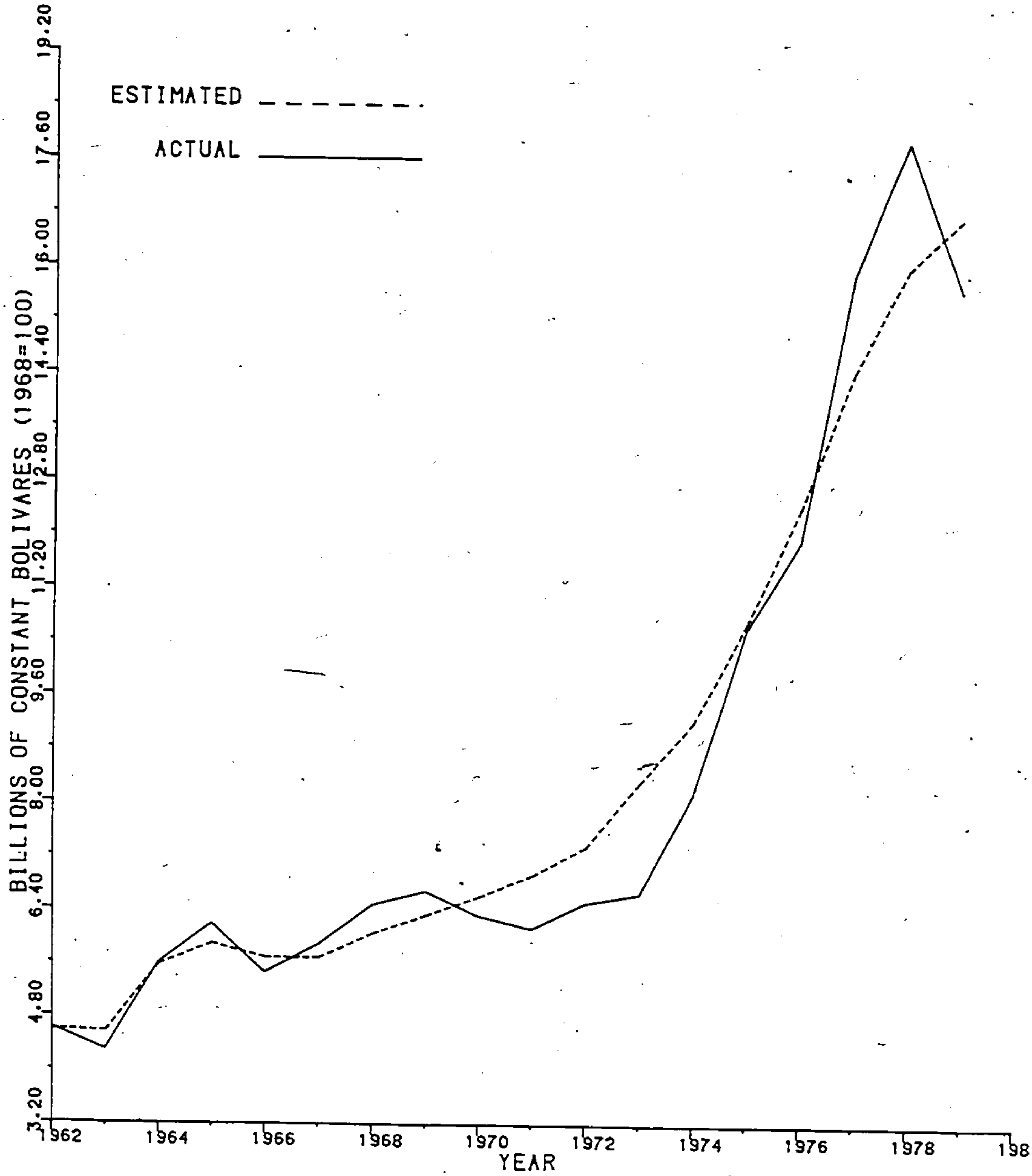


FIGURE 17

TOTAL IMPORTS (MTR)

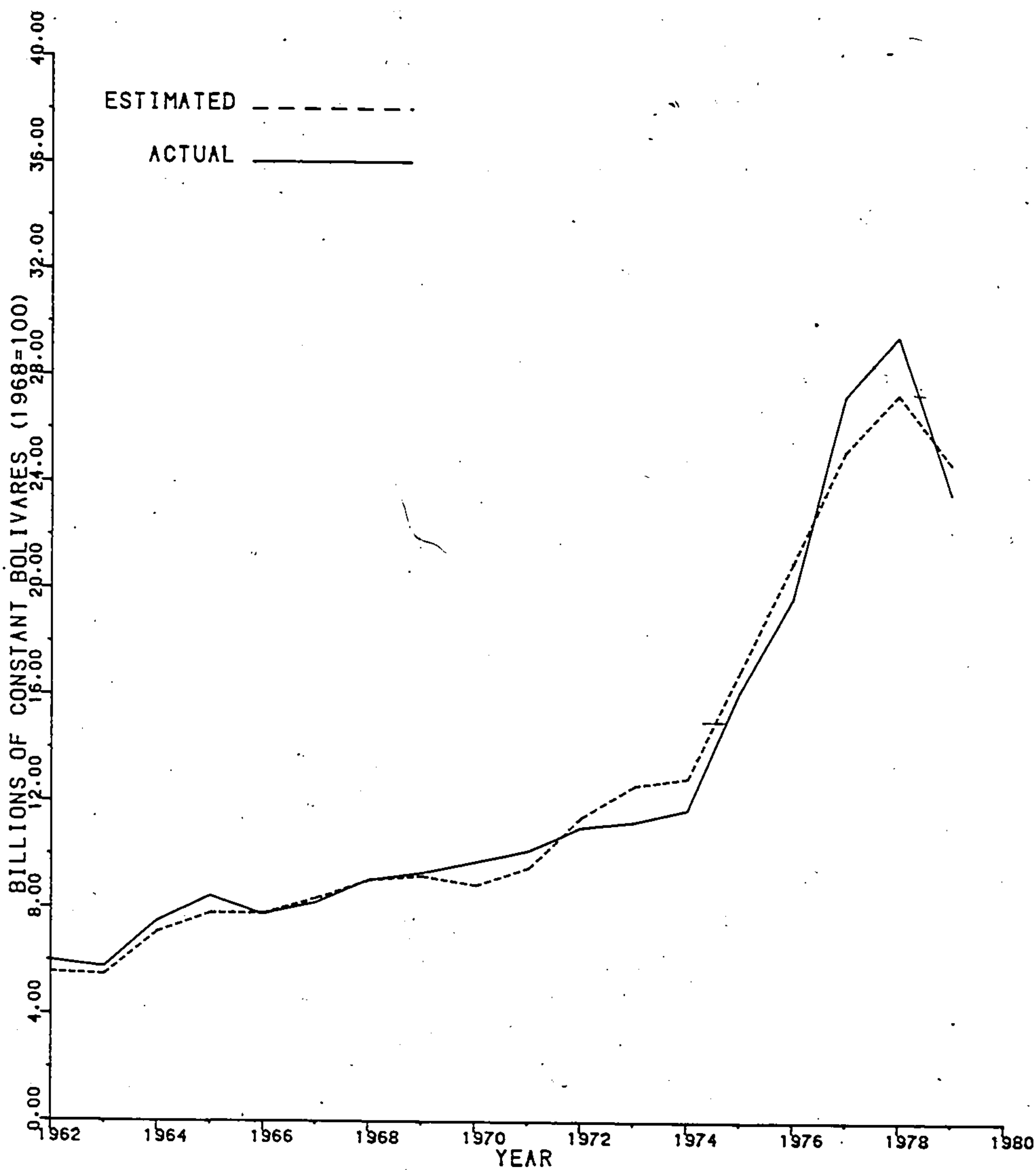


FIGURE 18

GROSS DOMESTIC PRODUCT (GDPR)

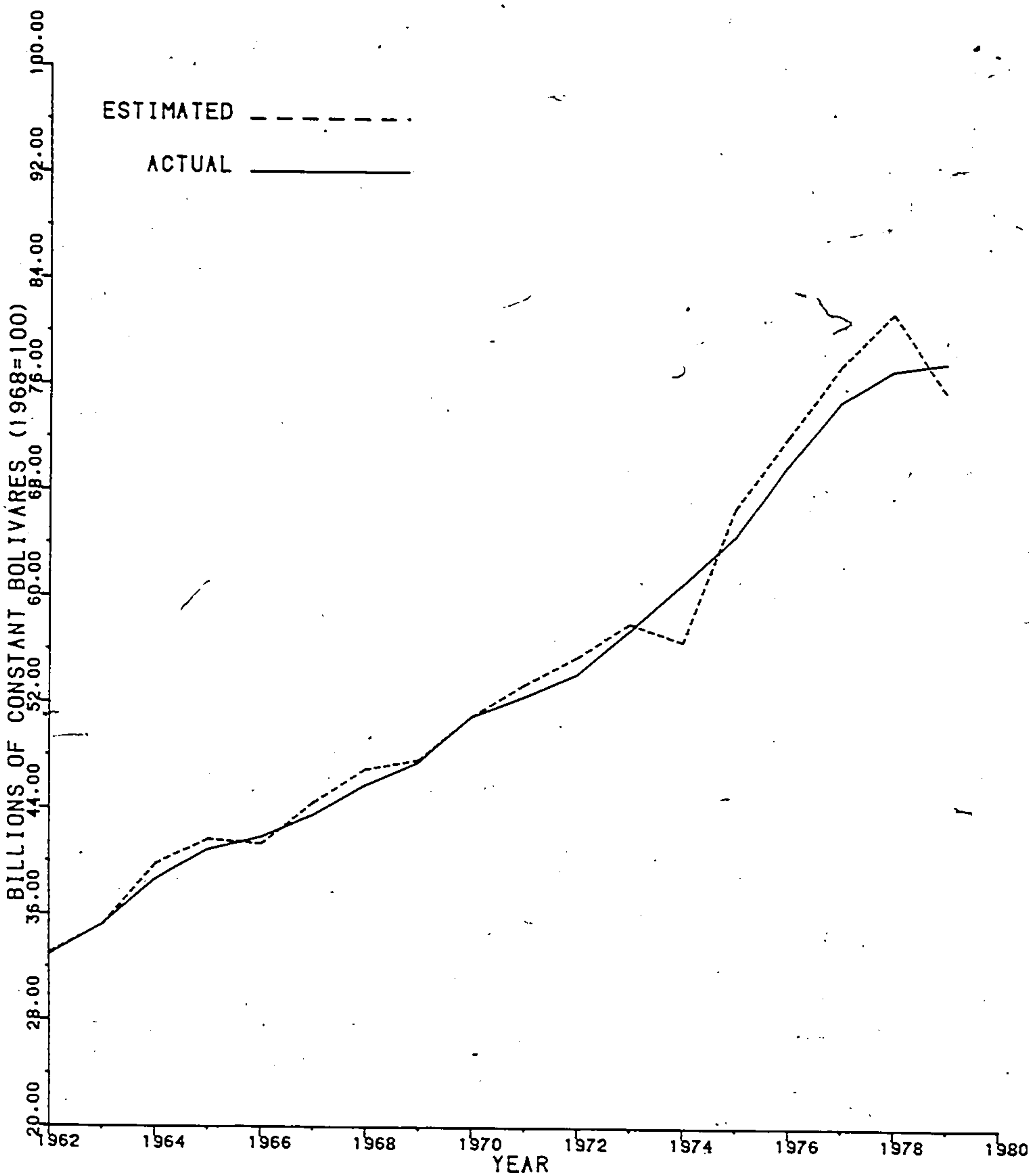
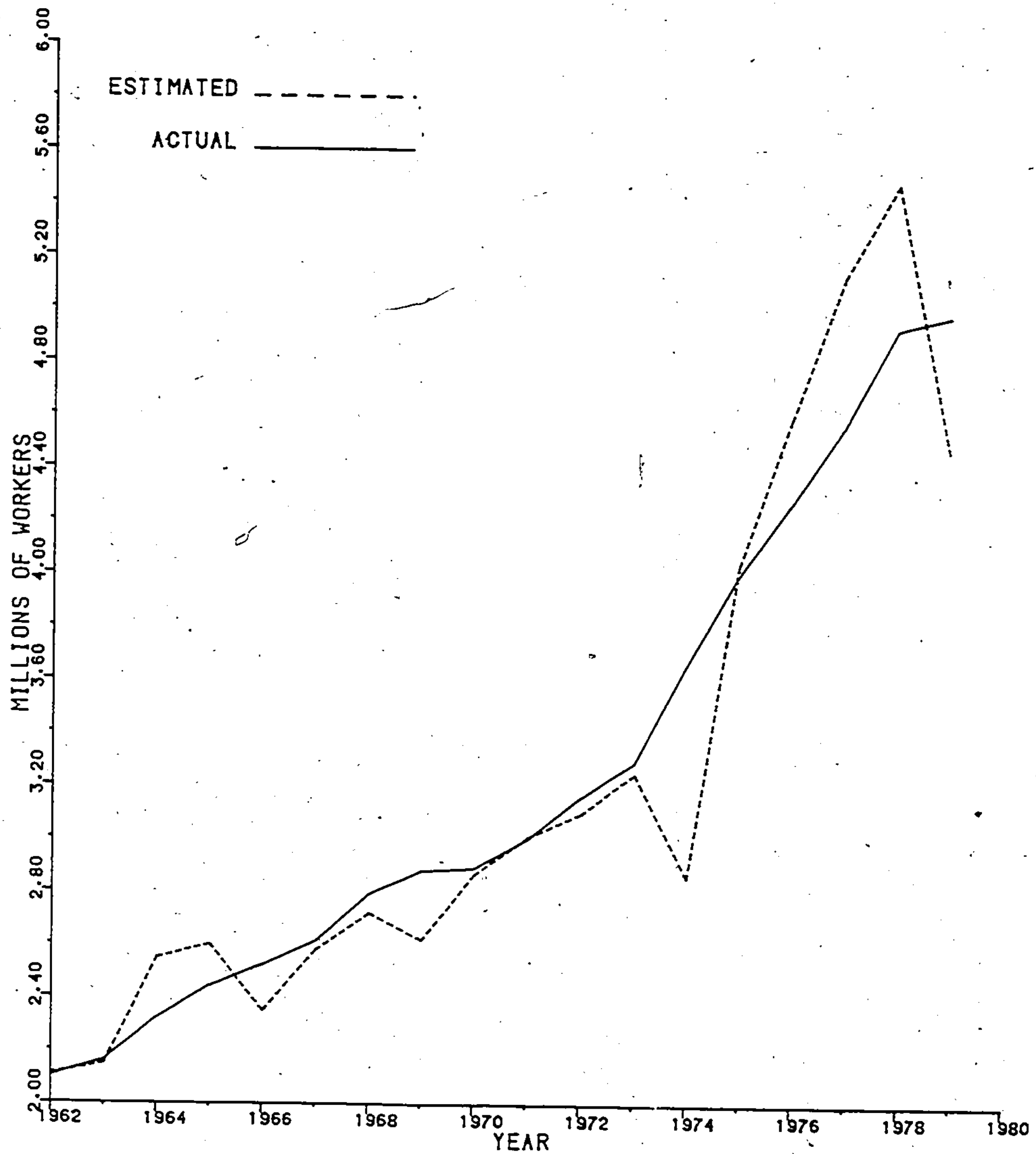


FIGURE 19

EMPLOYMENT (LABOUR)



5.3 AN EX-POST PREDICTIVE PERFORMANCE: 1980

We begin with the following question: How well did the Venezuelan economy perform in the years 1979-1980? The answer may be given as follows: The year 1979 is the beginning of an era of economic contraction, largely generated by domestic economic policy and to a lesser degree to foreign forces. The price liberalization policy together with welfare cuts adopted in 1979 by the new government[131] as a new strategy for development was based on the assumption that market price (i.e., competitive prices) is the right mechanism leading to economic efficiency in the allocation of resources, in production and in distribution with the final outcome of the maximum welfare of society.[132] Forgotten in such a strategy was the recognition of the highly monopolistic structure of the economy in the private sector as well

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[131] The Social Christian Party (COPEY) under the leadership of Dr. Luis Herrera Campins was democratically elected to govern the country for a period of five years, beginning in March 1979. The basic program of the government was against poverty.

[132] Economic efficiency takes prices and technical efficiency as given and proceeds to optimize output or minimize cost under these conditions. This process is known as optimization under constraint, and the underlying reasoning of it is the neoclassical theory, according to which when a regime of compatition is at full work then all workers tend to receive their respective marginal productivity (i. e., their corresponding contribution to the production process). According to Raul Prebisch, this reasoning is quite far from being true in real life. See Raul Prebisch, 'Dialogue on Friedman and Hayek From the Standpoint of the Periphery' in <u>CEPAL REVIEW</u>, (U.N., Economic Commission for Latin America, Santiago de Chile, December, 1981), pp. 153-174.

as the corruption in the management of public corporations. This economic structure did not respond to that strategy.[133] Contrary to the economic expansion which characterized the Venezuelan economy in the past, when the economy grew at an average annual rate of 6.2 percent in real terms during the years 1950-1978, economic growth slipped to .7 percent in 1979 and to a negative growth of 1.1 in 1980 (see Section 2.6 and Table 3), unemployment reached 6.6 percent of the labour force in 1980 from 5.4 percent in 1979, according to new official statistics.[134] These results were mainly caused by two years of continuous decline in production in the domestic productive sector of the economy: 1.6 percent in 1979 and .2 percent in 1980. Consequently, private investment (IPGR) dropped and so did the imports of capital goods (MKR). However, the public components of investment increased (IGGR), presumably due to past contractual agreements, as well as the imports of foodstuff to supplement the declining production of the agricultural sector, which slipped from a 3.7 percent growth rate in 1979 to 2.9 in 1980.

[133] The Central Bank of Venezuela (BCV) recognized in its Informe Economico 1980, (Caracas, 1981), p. 206, that price liberalization and the inflow of financial resources are not enough to make this economic structure competitive and, hence, more efficient.

[134] It should be noted here that for reasons quite well explained in Section 3.9 above, we generated the labour employment levels for the 1970's and, therefore, the discrepancies that may exist between the relevant data of the just received Informe Economico 1980 and the generated increasing time-series for labour (and the apparent full employment) must be taken into account in this context.

Only public consumption (CGR) decreased 4.0 percent in 1980 from the level of 1979.

The final outcome of the above economic policy was a larger level of unemployment (6.6 percent) and a higher inflation rate of 20.7 percent in 1980 from 13.6 percent in 1979.

Only the petroleum sector kept its dynamic expansion; however, this was rather a case of higher international prices administered by OPEC than a case of market forces through higher production and external demand. As is well known, North-America and Western Europe have increased their energy efficiency, increased consumption of other energy substitutes (12.8 percent) and reduced by 9.2 percent their consumption of petroleum in 1980. Furthermore, as the economic recession accentuated in these regions, so did the decline for petroleum imports from Venezuela.[135]

[135] In constant 1968 US dollars, the economic growth of the USA was -.17 percent in 1980, while that of Canada reached a .13 percent level with respect to 1979. North-America, as a whole, declined from a GDPR of US$ 1321.21 billion in 1979 to US$ 1319.23 billion in 1980, equivalently to a negative growth of -.15 percent in 1980, relative to the 1979 level. Western Europe and Latin-America have also been affected by the economic recession, in particular the latter region with a growth of about -.18 percent.

5.3.1 The Ex-post Forecast for 1980

The present ex-post forecast for 1980, in which the model is simulated one year beyond its sample period (1950-1979), was made possible as the relevant historical data[136] is now available at this stage of the study, according to the publications from the Central Bank of Venezuela, Informe Economico 1980, (Caracas, 1981), the Ministry of Energy and Mines, PODE 1980, The International Monetary Fund, International Financial Statistics 1981, and Annual Report 1981, (Washington, 1981).

As shown in Table 14, the first results of the ex-post forecast for 1980 generated reasonable estimates for gross domestic product (GDPR) and national income (YNR) under a 3 percent error.

Most of the components of the GDPR also did reasonably well. The estimates for private consumption (CPR) and total consumption (CTR) were underestimated with an error under 7 percent, while private investment (IPGR) and total investment (ITGR) produced better estimates with a higher accuracy of forecast of under a .5 percent error. However, the foreign sector variables did not perform as well, accounting for errors of estimates ranging from 15 to 31 percent. In particular, the export petroleum variables did not capture at all the shifts in the economic market conditions of the

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[136] This new data has been also processed according to the procedures established in Chapter III.

TABLE 14

First Ex-post Forecast Results In Billions of 1968 Bolivares and Labour in Million of Workers: 1980

VARIABLE	ACTUAL	FORECAST	ERROR	%ERROR
CPR	60.22	56.28	-3.94	-6.5
CTR	74.60	70.66	-3.94	-5.3
IPGR	10.44	10.42	-.02	-.2
ITGR	22.70	22.68	-.02	-.1
YNR	69.87	70.35	.48	.7
TXIR	2.47	2.63	.16	6.5
TXDR	3.25	3.55	.30	9.1
TXOR	20.95	21.71	.76	3.6
TXTR	26.67	27.88	1.21	4.6
XOMAR	12.90	8.94	-3.96	-30.7
XOLAR	4.66	3.34	-1.32	-28.4
XTOR	23.38	16.20	-7.18	-30.7
XTR	25.52	20.24	-5.28	-20.7
MKR	5.62	5.53	-.09	-1.5
MNKR	14.44	17.54	3.10	21.5
MTR	20.06	23.07	3.01	15.0
GDPR	76.91	74.94	-1.97	-2.6
LABOUR	4.98	4.18	-.80	-16.1

Source: The actual data has been collected from BCV, *Informe Economico 1980*, (Caracas, 1981), and processed according to requirements set in Chapter III.

major trading partners of Venezuela (see footnote 135 and 124) nor the new round of world petroleum price increases,[137] followed by a 21.5 percent overestimation of imports of non-capital goods (MNKR). Besides this overestimation of the forecasts of the foreign sector, the model showed the tendency to underestimate most of the other endogenous variables, with the exception of the tax variables, which did reasonably well in the forecast with less than 7 percent error, although direct taxes, TXDR, was accountable with about 9 percent error.

To correct the above forecasting deficiency of the model; that is, to tune the model, we introduced an adjustment term (ADJTX)[138] to each endogenous affected variable in equations (3), (10), (11) and (15) of the model in Chapter IV, Subsection 4.1.2, (see also Appendix A). This procedure is the only valid operation in the MATOP program.[139] Table 15 shows

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[137] The new realized petroleum composite price of \$8.06/bbl of 1980 represented for Venezuela an increase of 17.5%, in constant 1968 US dollars, with respect to the \$6.86/bbl of 1979. It should be added here that since the 66.4% price increase, in real terms, of 1974, the average composite price per barrel remained relatively constant at \$6.20/bbl until the end of 1978, climbing afterwards to \$6.86/bbl and \$8.06/bbl in 1979 and 1980, respectively, (see POVWR in Appendix C).

[138] The adjustments usually take the form of additions or subtractions from the constant term of the equations, so-called constant adjustments, sufficient to bring the estimated value of the dependent variable closer to the observed values. See F. Gerard Adams and David M. Rowe, *Forecasts and Simulations from the Wharton Econometric Model* (University of Pennsylvania, Morristown, N.J., 1973-1974), p.13. See also Robert S. Pindyck and Daniel L. Rubinfeld, *Econometric Models and Economic Forecasts*, McGraw-Hill, New York, 1981), pp. 401-405.

[139] Because the MATOP program estimates the parameters of the equation model at the same time it makes the forecasts (i.e., as a package with the same instruction), it

these variables and the adjustment terms.

TABLE 15

Adjustment Terms to Private Gross Fixed Investment (ADJT1, IPGR), Petroleum Exports to North-America (ADJT2, XONAR) and Latin-America (ADJT3, XOLAR), and Imports of Non-capital (ADJT5, MNKR): 1980

ADJTX	VARIABLES				
	IPGR	XONAR	XOLAR	MKR	MNKR
ADJT1	-1.14				
ADJT2		4.00			
ADJT3			1.35		
ADJT4(*)				0.0	
ADJT5					-3.00

(*) The ADJT4 corresponding to MKR appears here only as an indication of its existence, which shall be revealed in Chapter VI with values different from zero.

The above said adjustment procedure led to the ex-post forecast for 1980, the results of which are shown in Table 16.

is impossible to make any adjustment to the constant terms. In fact, this is a convenient feature of this program as it provides the required flexibility when several adjustments must be made to the same equation during the simulation process, as in the present case (note that the adjustment terms used here take different values for 1980-1982). See John Kuiper, 'MATOP80: A Generalized Program for Matrix Operations and Economet-ric Applications', Research Paper No. 8006, University of Ottawa, (October, 1982).

TABLE 16

Second Ex-post Forecast Results in Billions of 1968 Bolivares and Labour in Millions of Workers: 1980

VARIABLE	ACTUAL	FORECAST	ERROR	%ERROR
CPR	60.22	56.58	-3.64	-6.0
CTR	74.60	70.96	-3.64	-4.9
IPGR	10.44	10.84	.40	3.8
ITGR	22.70	23.10	.40	1.8
YNR	69.87	71.46	1.59	2.3
TXIR	2.47	2.44	-.03	-1.2
TXDR	3.25	3.55	.30	9.1
TXOR	20.95	21.50	.55	2.6
TXTR	26.67	27.49	1.02	3.1
XONAR	12.90	12.94	.04	.3
XOLAR	4.66	4.69	.03	.6
XTOR	23.38	23.45	.07	.3
XTR	25.52	25.59	.07	.3
MKR	5.62	5.74	.12	2.1
MNKR	14.44	14.78	.34	2.4
MTR	20.06	20.52	.46	2.3
GDPR	76.91	77.56	.65	.8
LABOUR	4.98	4.50	-.48	-9.6

Source: The actual data has been collected from BCV, *Informe Economico 1980*, (Caracas, 1981), and processed according to requirements set in Chapter III.

A comparison of the dispersion statistics of Table 16 with the corresponding information of Tables 12 and 14 reveals that most of the relative errors of the second ex-post forecast for 1980 are for the most part under those of the simulation results over the sample period and, of course, under those of the first ex-post forecast for the same year 1980, with the exception of the errors of the investment variables, which were overcorrected. With respect to Table 12 these smaller errors are not usually expected in ex-post forecasting, since the model has been extrapolated beyond the fitted sample period; that is, the coefficients of each equation of the model being fixed are now expected to perform into the future and, therefore, the percentage errors (%ERROR) are expected to be larger than those of the simulated historical values. With respect to Table 14, the errors are much smaller as they were closely adjusted to the results of Table 12 by applying to the model the tuning procedure indicated above. It should be kept in mind, however, that the study of the accuracy of econometric forecasts requires that some other and important source of errors be taken into account, such as the embodiment of human behaviour in the econometric model, the quality of the data and the method of estimation used together with the goodness of the 'educated guesses' of the exogenous variables.[140]

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[140] Michael D. Intriligator, Econometric Models, Techniques, and Applications, (Prentice-Hall, Englewood Cliffs, New Jersey, 1978). See also C.F. Christ, 'Judging the Performance of Econometric Models of the U.S. Economy', International Economic Review, (1975), Vol. 16, pp. 54-74.

Without any doubt, the present model presents deficiencies on these grounds, which are compounded by its highly aggregated structure. Yet, the results of the second ex-post forecast reproduced reasonably well the endogenous variables corresponding to the actual economic performance of the Venezuelan economy for the year 1980. We can observe in Table 16 that the ex-post forecasts for all the variables of the model are quite close to the actual values and, therefore, under an acceptable 10 percent level of error tolerance. Thirteen variables generated errors under or equal to 3 percent level, three variables were under 6 percent error and two others produced errors just above 9 percent. These estimates seem to be surprisingly reasonable. The smooth consumption variables (CPR and CTR) produced errors with just about 6 percent underestimation, which appears to be an indication that the short-run increase in the propensity to consume was not properly captured in 1980. Also the income variables (GDPR and YNR) produced estimates with about 2 percent error, which is quite close to the corresponding simulation results of Table 12.

The key variables in the tax and petroleum sectors did reasonably well also. Petroleum taxes (TXOR) did quite well at 2.6 percent error of estimate, since it is much lower than the error generated in the sample period simulation, while direct taxes (TXDR) remained about the same at the level of 9 percent error. Over all, these results seem to indicate that the changes in the short-run marginal propensities were closely detected. The tuning made to the model through the adjustment to XONAR and to XOLAR highly improved the forecasting accuracy of these variables, narrowing the errors to .3 and .6 percent, respectively, which in turn induced a good improvement for the forecast of the non-capital import variable (MNKR), in particular, and for the import sector, in general, to errors no greater than 2.4 percent, which seems to indicate that the model with its constant coefficients was able to capture the actual decline in the short-run propensity to import, which began in 1979 as the government tried to counteract the inflationary pressure brought about by its price liberalization and cuts of the subsidies on basic foodstuff. Notice that if GDPNOR had been endogenous, which would have been desirable, the forecasts might have shown slightly less growth, as direct tax collections would have been projected to be slightly higher than was the case.

We wish to stress again that, given the aggregate structure of this model, the relative low quality of the data and the numerous splicing operations made to generate acceptable time-series for the sample period chosen, the results of this model seem to be reasonable.

Chapter VI

EX-ANTE FORECASTS AND THEIR IMPLICATIONS ON THE VENEZUELAN ECONOMY

We shall extend the forecast process already established in Chapter V one step further and use the model to generate two ex-ante forecasts for the years 1981 and 1982. But before these simulations can be carried out, some assumptions must be made with regard to the exogenous variables of the model. At this stage, the forecaster must use his acquired knowledge of the economy under his study as well as his experience in dealing with forecasting problems. The main problem that arises is that as soon as the forecaster steps outside the sample period, he faces the uncertainty of not being sure about the right values that the exogenous variables will take. Extrapolation of time-series and 'educated guesses' on what the economy will be are the most frequently applied approaches to the assumptions surrounding the reasonableness of the values that should be given to the exogenous variables in question.[141]

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[141] Ronald G. Bodkin et al., The Tracking Properties of the CANDIDE MODEL 1.0, Chapter 4, and Robert S. Pindyck and Daniel L. Rubenfeld, Econometric Models and Economic Forecasts, Chapter 12.

6.1 TWO EX-ANTE FORECASTS: 1981-1982

Venezuela is an open economy heavily dependent on international trade as analyzed in Section 2.5, Chapter II. We explained there that the cause of growth of the petroleum sector and its linkage with the economic development of the country originates from abroad and not from the domestic market.[142] About two million barrels of petroleum a day are exported, mostly to the industrialized trading partners of Venezuela, bringing in the resources needed to push forward more economic development. In a recessionary period, such as the present one, petroleum consumption in the industrialized countries declines and so do petroleum exports and production from Venezuela, which in turn reduces the economic growth of the country. These characteristics of the Venezuelan economy are embodied in the specifications of the petroleum sub-model of Subsection 2.5.2, to which we refer in reaching reasonable values for some of the exogenous vari-

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[142] Although we do not have available data on the purchases made by the petroleum sector from the rest of the domestic economy to measure the 'backward linkages' of interdependence, we can agree that these purchases must be growing as the economy develops, but their proportions to the petroleum gross domestic product seem to be relatively low. Most of the industry purchases come from abroad in the form of capital equipment and technology. With respect to the less important 'forward linkages', the petroleum sector supplies all the petroleum requirements of the domestic market; but again, we should remember that such a market is quite small relative to the industry output and/or exports. On the subject of industrial interdependence, see Albert O. Hirschman, The Strategy of Economic Development, (Yale University Press, New Haven, 1958), Chapter 6.

ables beyond any control from Venezuela.

On the one hand, the economic growth in North-America (-.15 percent)[a] and in Latin-America (-.18 percent) declined in 1980, and being somewhat optimistic, we cannot expect these economies to grow faster than perhaps 1.0 and 2.0 percent, respectively, for 1981 and 1982. Some comfort leading to this optimistic view is the fact that petroleum prices declined in real terms in 1981 and so far in 1982; furthermore, petroleum prices in nominal terms are to remain about the same until 1985, according to some pronouncements from OPEC, which implies that real petroleum prices will continue to decline until then. The economic performance of Western Europe has been somewhat better than that of the other regions, and we expect that petroleum exports to that region (XOWER) will increase, although at a slower rate of 6.0 percent from the previous higher average annual rate of 8.0 percent during the 1974-1980 period, while the residual exports to the rest of the world (XORESTR) seem to continue at about 5.0 percent per year.

The depressed world market conditions in 1981 and 1982 also allow us to assume a moderate increase in the wholesale price index of imports of capital goods (MWKI), say 20.0 percent annually from the 32.0 percent increase in 1980, and a 12.0 percent increase for the wholesale price index of imports of non-capital goods (MWPI).

On the other hand, the Venezuelan domestic productive sector has not been performing any better since 1979, as explained in Section 5.3. Although the economic recession of North-America and Western Europe has been affecting the domestic economic growth of Venezuela, most of its negative effects are due to domestic economic policies. Therefore, we assume that the gross domestic product of the non-petroleum sector (GDPNOR), after declining 7.0 percent in 1979 and 3.0 percent in 1980, can be expected to have no growth in 1981 and probably 1.5 percent growth in 1982, as monetary policy is becoming more flexible and the public sector becomes more active in consumption and investment, as shown in 1980. We expect, for instance, that investment may grow at about the same rate of 8.4 percent as for the 1974-1980 period, which is two percentage points above the growth rate of investment in 1968-1973; but consumption may not grow as fast as previously. Furthermore, ~~while~~ the inflationary pressure continues, if even at a lower rate, the domestic wholesale price index is allowed to increase about 15.0 percent per year from the 23.0 percent of 1980.

In the domestic petroleum sector, we expect that prices, in real terms, should be increased gradually from the Bs. 11.91/bbl in 1979 (40.0 percent of the realized world prices. See COVER, POVER and POVWR in Appendix C) by 12.5 percent in 1981 and 1982, while the growth rate of petroleum consumption declines from the historical pattern of 5.0 percent average annual rate during the 1960-1980 period to about 1.0 percent for the period 1980-1982.

According to the above, we have calculated the values of the exogenous values, which are shown in Table 17.

It should be noted in Table 17 that we have also used here the same tuning technique applied in the ex-post analysis above; that is, the use of the adjustment terms (ADJ1, ADJ2, ADJ3, ADJ4 and ADJ5) to tune the model to generate what the forecaster may consider to be reasonable levels for the endogenous variables. One more adjustment term (ADJ4) is used here and applied to the endogenous imports of capital goods (MKR), which tended to overestimate its values in the 1981 forecast.

Table 18 shows the forecast results for the years 1981 and 1982.

A look at Table 18 will show that the 1981-1982 forecast results of the endogenous variables can be judged as quite reasonable. For example, the forecast levels for the income variables, GDPR (78.18 and 78.33 Bn. Bs., 1981 and 1982, respectively) and YNR (72.17 and 72.62 Bn. Bs., 1981 and 1982, respectively) seem to conform to the kind of results that can be expected during a period of economic recession. Furthermore, the behaviour shown by each endogenous variable of the model throughout the period 1970-1979 seems to confirm this view as shown in Tables 19, 20 and 21 below. (The endogenous variables of the real sector and the labour demand sector are shown in Table 19).

TABLE 17

Values Given to the Exogenous Variables in Billions of 1968 Bolivares: 1981-1982

EXOG. VARIABLES	1981	1982
ADJ1	2.75	-30.75
ADJ2	6.00	10.00
ADJ3	3.00	4.00
ADJ4	.25	0.00
ADJ5	-3.00	-2.00
ADJT	-24.00	-26.00
COVER	2.22	2.58
CGR	15.21	16.09
DWPI(%)	312.00	358.80
GDPLAR	1252.55	1283.86
GDPNAR	5589.34	5659.08
GDPNOR(*)	54.95	55.77
IGGR	13.74	15.40
KGR	306.45	325.64
MFSR	0.57	0.25
MWKI(%)	338.72	404.54
MWPI(%)	273.30	306.10
POVER	16.75	18.85
POVWR	34.22	31.62
QOVER	24.35	23.79
SLMR	47.07	50.36
SMR	20.19	21.60
XNOR	2.14	2.14
XORESTR	1.10	1.15
XOWER	5.07	5.39

Had Eq.(19), Chapter IV, which takes GDPNOR as an endogenous variable, been included in the model, it would have underestimated the values of the forecast.

As can be seen in these Tables, each endogenous variable shows the corresponding expected behaviour during the periods of economic expansion or contraction. We continue with these results in Table 20.

TABLE 18

Ex-ante Forecast Results in Billions of 1968 Bolivares and Labour in Millions of Workers: 1981-1982

VARIABLES	ESTIMATE(1981)	ESTIMATES(1982)
CPR	56.09	56.80
CTR	71.30	72.89
IPGR	9.45	9.39
ITGR	23.19	24.79
YNR	72.17	72.62
TXIR	2.38	2.43
TXDR	3.50	3.53
TXOR	21.66	21.81
TXTR	27.54	27.77
XONAR	12.94	13.86
XOLAR	5.68	5.99
XTOR	24.79	26.39
XTR	26.93	28.53
MKR	6.01	6.60
MNKR	14.37	15.52
MTR	20.38	22.12
GDPR	78.18	78.47
LABOUR	4.39	4.21

For instance, the GDPR grew at an average annual rate of 4.3 percent during the prosperous decade of the 1970's (including the 1975 world recession), dropping in 1980 to a negative growth of 1.1, which was expected as the world recession began, and the quantity of petroleum exports declined by 12.4 percent, although the value of petroleum exports (XTOR) rose by 4.0 percent (due to the 17.5 percent price increases in 1980), but inflation rose much faster at 20.7 percent. The Foreign Sector appears in Table 21.

TABLE 19

Actual Values and Rate of Growth of the Real Sector and the Labour Sector: 1970-1980, and Forecast Values With Adjusted Values (in brackets) : 1981-1982 (Values in Billions of 1968 Bolivares)

YEAR	GDPR	YNR	LABOUR
1970	50.92	40.99	2.89
1971	52.46	42.09	3.00
1972	74.17	45.20	3.16
1973	57.47	48.40	3.29
1974	60.98	54.15	3.66
1975	64.79	56.62	4.00
1976	70.02	63.26	4.27
1977	74.80	67.06	4.56
1978	77.16	68.82	4.93
1979	77.73	70.10	4.98
1970-79	4.3%	5.5%	5.6%
1980	76.91	69.87	4.98
1980/79	-1.1%	.3%	.0%
1981	78.18	72.17	4.39
(1981)	(77.55)	(70.51)	(4.81)
(*)/80	.8%	.9%	-3.4%
1982	78.33	72.62	4.21
(1982)	(77.70)	(70.95)	(4.68)
(**)/81	.2%	.6%	-2.7%

Note: For lack of space in the Table, the following symbols were introduced: (*) = adjusted 1981 forecast values (1981) and (**) = adjusted 1982 forecast values (1982).

TABLE 20

Actual Values and Rate of Growth of the Domestic Sector: 1970-1980, and Forecast Values with Adjusted Values (in brackets): 1981-1982 (Values in Billions of 1968 Bolívares)

YEAR	CPR	CTR	IPGR	ITGR	TXIR	TXDR	TXOR	TXTR
1970	26.27	32.83	8.40	10.95	1.36	1.77	5.91	9.04
1971	26.78	33.94	9.38	12.29	1.35	1.79	7.59	10.73
1972	28.79	36.41	8.78	14.14	1.40	1.89	7.64	10.93
1973	30.52	38.78	10.01	15.49	1.38	2.15	10.29	13.82
1974	35.94	46.10	10.22	15.13	1.68	2.16	30.02	33.86
1975	40.78	52.28	11.21	18.39	2.19	2.86	24.44	29.49
1976	44.71	57.98	14.34	24.37	2.02	3.03	20.51	25.56
1977	49.90	64.16	19.14	31.43	2.09	3.19	19.86	25.14
1978	55.20	69.90	18.93	32.28	2.54	4.11	16.68	23.33
1979	56.38	71.36	16.10	27.04	2.43	3.54	19.06	25.03
1970-79	7.9%	8.1%	6.7%	9.5%	6.0%	7.2%	12.4%	10.7%
1980	60.22	74.60	10.44	22.70	2.47	3.25	20.95	26.67
1980/79	6.8%	4.5%	-35.2%	-16.1%	1.6%	-8.2%	9.9%	6.6%
1981	56.09	71.30	9.45	23.19	2.38	3.50	21.66	27.54
(1981)	(59.46)	(74.79)	(9.10)	(22.77)	(2.41)	(3.18)	(21.10)	(27.51)
(*)/80	-1.3%	.3%	-12.9%	.3%	-2.5%	-2.2%	.7%	3.2%
1982	56.80	72.89	9.39	24.79	2.43	3.53	21.81	27.77
(1982)	(60.21)	(76.46)	(9.03)	(24.34)	(2.46)	(3.21)	(21.24)	(27.74)
(**)/81	1.3%	2.2%	-1.0%	6.9%	2.0%	.9%	.7%	.8%

<u>Note</u>: For lack of space in the Table, the following symbols were introduced: (*) = adjusted 1981 forecast values (1981) and (**) = adjusted 1982 forecast values (1982).

TABLE 21

Actual Values and Rate of Growth of the Foreign Sector: 1970-1980, and Forecast Values with Adjusted Values (in brackets): 1981-1982 (Values in Billions of 1968 Bolivares)

YEAR	XONAR	XOLAR	XTOR	XTR	MKR	MNKR	MTR
1970	7.00	2.56	11.52	12.76	3.42	6.32	9.74
1971	8.36	2.80	13.15	14.25	4.03	6.13	10.16
1972	9.08	3.03	13.94	15.25	4.53	6.51	11.04
1973	11.79	3.71	17.53	19.77	4.61	6.65	11.26
1974	17.72	4.83	25.48	26.73	3.59	8.13	11.71
1975	13.04	4.30	20.05	21.20	5.58	10.61	16.19
1976	13.64	4.16	20.56	21.83	7.74	11.91	19.65
1977	13.74	4.67	20.52	21.51	11.36	15.92	27.28
1978	12.21	3.87	18.57	19.52	11.63	17.89	29.52
1979	14.32	3.96	22.49	23.91	7.97	15.67	23.64
1970-79	7.4%	4.5%	6.9%	6.5%	8.8%	9.5%	9.3%
1980	12.90	4.66	23.38	25.52	5.62	14.40	20.06
1981	12.94	5.68	24.79	26.93	6.01	14.37	20.38
(1981)	(12.90)	(5.66)	(24.72)	(26.85)	(5.88)	(14.03)	(20.32)
(*)/80	.0%	21.2%	5.7%	5.2%	4.7%	-2.6%	1.3%
1982	13.86	5.99	26.39	28.53	6.60	15.52	22.12
(1982)	(13.82)	(5.95)	(26.30)	(28.43)	(6.46)	(14.15)	(22.05)
(**)/81	7.1%	5.2%	6.4%	5.9%	7.3%	8.0%	8.5%

Note: For lack of space in the Table, the following symbols were introduced: (*) = adjusted 1981 forecast values (1981) and (**) = adjusted 1982 forecast values (1982).

If we adjust the 1981-1982 forecasts of the GDPR (78.18 and

76.33 Bn. Bs., respectively), shown on Tables 18 and 19, by the .7 percent overestimation of 1980 forecast (Table 16), then we can arrive at even more reasonable forecasts (77.55 and 77.70 Bn. Bs., respectively), which then will show approximate rates of growth of .8 percent for 1981 and .2 percent for 1982. These levels and rates of growth are quite reasonable forecasts for Venezuela under its present economic conditions and the prolonged economic recession of its major trading and industrialized partners.

With respect to the government tax sector, we expect an erosion of revenues, as the world recession becomes severe and the Venezuelan productive sector contracts. Table 20 shows these results. We expect that the government will become somewhat more active in its expenditures from 1982 onward, particularly in the investment sector, while the industrialized countries (the major trading partners of Venezuela) are also expected to improve their economic performance. However, the growth rate of each tax structure will be below its corresponding historical rate. This situation may prove to be difficult for the country. First, if petroleum tax revenues continue to decrease, Venezuela may find itself unable to repay its huge foreign debt, which in turn will retard the economic development of the country. Second, the pace of the industrialization process will suffer and, most importantly, the human capital formation would be seriously interrupted.

The same reasoning could be extended to the other endogenous variables in order to judge the reasonableness of their corresponding forecasts for 1981 and 1982.

6.2 THE VENEZUELAN ECONOMY AND ITS PETROLEUM SECTOR

Since the major objective of this study is to analyze the major impact that the main industrial trading partners may have on the Venezuelan economy through its petroleum sector, the petroleum export sector was then endogenized following the specifications of the petroleum sub-model of Subsection 2.5.2. There, we assumed that the ability of Venezuela to supply petroleum for export depended on some major economic exogenous variables beyond Venezuelan control, although some others of lesser strength were under its direct control. Amongst these variables, we identified the following variables in constant 1968 bolivares: (1) The economic growth and energy consumption of the importing regions, (2) The world petroleum prices and the Venezuelan domestic petroleum prices, and (3) The Venezuelan petroleum production and consumption.

Therefore, this petroleum sub-model attempts to show the major effects that the industrialized regions of the free world may have on the Venezuelan economy when the economic conditions of these regions change.

6.2.1 Implications of Foreign Economic Growth and Petroleum Price Changes

We analyze here the impacts that changes in the magnitudes of the key variables of the petroleum sub-model may have on the Venezuelan economy through the macro-econometric model developed in Chapter IV. At this point it should become clearer why the petroleum sector has been endogenized in the structural form selected in Subsection 2.5.2:

Eq.(10) XONAR = 13.357 + .002 GDPNAR − 7.713 POVER/POVWR −
(t's) (7.1) (4.0) (−9.7)

−6.690 COVER
(−2.6)

$R2 = .95 \quad F(3/16) = 92.2 \quad D\text{-}W = 2.202$

Eq.(11) XOLAR = .922 + .003 GDPLAR + .089 QOVER −
(t's) (4.1) (5.6) (4.6)

−2.089 COVER
(−4.3)

$R2 = .98 \quad F(3/16) = 220.6 \quad D\text{-}W = 2.121$

Eq.(12) XTOR = XONAR + XOLAR + XOWER + XORESTR

Eq.(13) XTR = XTOR + XNOR

Moreover, the petroleum sector contributes directly with about one-third of the gross domestic product (GDPR) and with over 76 percent of all the government tax revenues. This general profile of the Venezuelan petroleum economy points to the high degree of vulnerability of its economic development due to the nature of its international trade.

Therefore, we wish to measure the impacts that, for instance, changes in gross domestic product in North-America (GDPNAR) and/or changes in world petroleum prices, determined by OPEC, may have on the Venezuelan economy. This attempt has been carried out through comparison of three alternatives scenarios. First of all, we have selected North-America (USA and Canada) as the region for these experiments, since it is the most important trading partner for Venezuela. It imported an average annual share of about 66.2 percent of total petroleum exports from Venezuela in the 1970's, and is the major supplier of capital and non-capital goods. Western Europe (XOWER) imported an average annual share of 12.3 percent of total Venezuelan petroleum exports and it is also a supplier of capital and non-capital goods; however, it enters the sub-model as an exogenous variable, after many attempts to endogenize it failed. The other important region to ~~Venezuela~~ is Latin-America (XOLAR), which is accountable for an average annual share of 21.0 percent; but the interdependence for industrialization, although growing, is relatively small compared to the relationship with North-America.

As can be seen in Eq. (10) of the sub-model, GDPNAR and POVWR are taken as exogenous variables. The former is the gross domestic product of Canada and the USA together and the latter is the realized world petroleum prices applied to the Venezuelan petroleum market conditions. These two variables are the key ones in the three scenarios to be considered. The other exogenous variables (COVER, POVER AND QOVER) are limited in strength due to the relative small size of the Venezuelan domestic market and, hence, kept constant.

The first scenario considers a change in GDPNAR, while keeping POVWR constant. The second scenario keeps GDPNAR constant, while it lets POVWR change. The third and last scenario allows changes in both variables. In each case, all the other exogenous variables of the model will also be kept constant.

6.2.2 Three Scenarios Based on Changes in GDPNAR and/or POVWR

We take as a point of departure the forecasts made for 1982, which from now on become the '1982 reference forecasts' (RF) for the three scenarios or experiments.

First, we want to know what would be the effects on the petroleum sector on the government tax revenues and on the economy, in general, if a higher rate of growth were to happen in North-America in 1982, over and above the one arrived at in the reference forecasts. Let us assume that such a growth rate will be 1.75 percentage points higher. POVWR is kept at Bs. 31.62/bbl. and all the other exogenous variables remain fixed.

The response of the model to the said change appears in Table 22.

We can observe in Table 22 that an increase of 1.75 percentage points in GDPNAR, holding POVWR constant at Bs. 31.62/bbl, would create an expansion of 1.52 percent in XONAR, which is in agreement with the export income-elasticity studied in Subsection 4.5.2. In turn, the expansion in XONAR would generate a considerable increase in government tax revenues. A look at the tax structure shows a strong impact on petroleum taxes (TXOR) with a response of 1.15 percent increase over RF (the 1982 reference forecast), followed by a negligable response from indirect tax revenues (TXIR), due to the small increase in non-capital imports (MNKR) on which these taxes depend. Of course, since non-petroleum gross domestic product (GDPNOR) has been kept fixed throughout the experiment, no changes in direct taxes (TXDR) can be expected. (It should be noted, however, that an endogenized GDPNOR would have affected the values of the projections by reducing the multipliers of the model).

The responses of the tax sector become stronger with the price effect; that is, in scenario (2), POVWR is allowed to increase from Bs. 31.62/bbl. to Bs. 40.00/bbl. (i.e., 27.0

TABLE 22

Three Alternative Scenarios in Billions of 1968 Bolivares and the Responses of the Model to Changes in GDPNAR and/or POVWR: 1982

VARIABLES	1982 RF	SCENARIO (1) GDPNAR(POVWR*) (1)	(1)/RF (%)	SCENARIO (2) POVWR(GDPNAR*) (2)	(2)/RF (%)	SCENARIO (3) GDPNAR POVWR (3)	(3)/RF (%)
CPR	56.80	56.83	.05	56.94	.25	56.97	.30
CTR	72.89	72.92	.04	73.03	.19	73.06	.23
IPGR	9.39	9.43	.43	9.58	2.02	9.62	2.45
ITGR	24.79	24.83	.16	24.98	.77	25.02	.93
YNR	72.62	72.77	.21	73.30	.94	73.45	1.14
TXIR	2.43	2.43	.00	2.44	.41	2.44	.41
TXDR	3.53	3.53	.00	3.53	.00	3.53	.00
TXOR	21.81	22.06	1.15	22.95	5.23	23.20	6.37
TXTR	27.77	28.02	1.00	28.91	4.11	29.17	5.04
XONAR	13.86	14.07	1.52	14.82	6.93	15.04	8.51
XOLAR	5.99	5.99	.00	5.99	.00	5.99	.00
XTOR	26.39	26.60	.80	27.35	3.63	27.56	4.43
XTR	28.53	28.74	.74	29.49	3.36	29.70	4.10
MKR	6.60	6.62	.30	6.69	1.36	6.71	1.67
MNKR	15.52	15.55	.20	15.64	.77	15.67	.97
MTR	22.12	22.16	.18	22.33	.95	22.38	1.18
GDPR	78.47	78.57	.13	79.41	1.20	79.65	1.50
LABOUR**	4.21	4.24	.71	4.36	3.56	4.39	4.28

(*) POVWR = Bs. 31.62/bbl, GDPNAR = 5659.08 Bn. Bs.
(**) LABOUR in million workers.

percent), while keeping GDPNAR at the RF level (i.e., Bs

5659.08 billions). From Subsection 4.5.2 we know that XONAR is price inelastic. Therefore, an increase of 27.0 percent of POVWR would generate a much smaller increase of 6.93 percent in XONAR, which in turn would force petroleum taxes to increase by 5.23 percent, more than quadrupling the previous 1.15 percent increase.

The third scenario (scenario (3)) is a combination of the two previous cases. The combined impact (which is virtually the addition of the two previous effects) of the changes in the real sector and in prices would be greatly marked here. We can observe that the value of petroleum exports to North-America would climb from 13.86 to 15.04 Bn. Bs, which is a 8.5 percent increase, and TXOR would rise from 21.81 to 23.20 Bn. Bs.; which represents an increase of 6.37 percent.

Similarly, we can see that the impacts of these changes would be felt in the rest of the economy. For instance, GDPR would increase from .13 percent in scenario (1) to 1.20 percent in scenario (2) and to 1.50 in scenario (3) and the other income variable, YNR, would follow the same trend, moving from .21 percent to .94 percent and to 1.14 percent, respectively. The impact on private consumption (CPR) is, as expected, small; but private investment (IPGR) increases much faster, from .43 percent in scenario (1), it climbed to 2.02 and 2.45 percent in scenarios (2) and (3), respectively. We can see also that these impacts are quite strong in the labour market. Employment would grow from .71 percent in scenario (1), to 3.56 percent in scenario (2) and to 4.28 percent in scenario (3); that is, relative to the previous level of employment.

Chapter VII

CONCLUSIONS

This dissertation is concerned with the Venezuelan petroleum sector and its economic relationship with the rest of the domestic economy and with the major trading partners of Venezuela. The analysis covers two major objectives which are based on the economic performance of Venezuela during the chosen sample period, 1950-1979, and on the forecasts made for the years 1980-1982. These objectives are:

(1) to examine the direct contributions of the petroleum sector to the domestic economy, and

(2) to analyze the effects that changes in the variables of the petroleum export sector may have on the government revenues and also on the rest of the domestic economy.

The first objective was examined at length in Chapter II, by means of theoretical and empirical analysis. There, we discussed thorougly the nature and strength of these contributions as an effect of export-led growth; that is, the economic expansion of the petroleum sector and its linkage with the economic development of the country is from abroad rather than from within. This explained the increasing economic dependence that Venezuela has shown on the petroleum sector during the sample period, 1950-1979, of this study. Petroleum is, by all accounts, the only major export commodity of Venezuela, accounting for most of total exports of the country, as discussed in Section 2.6. It was found that the the petroleum sector, in general, or the petroleum export sector, in particular, contribute directly to the economy with the following:

(a) About one-third of gross domestic product, in real terms,

(b) About 93 percent of total exports,

(c) Over 97 percent of all foreign exchange earnings,

(d) Over 76 percent of government revenues,

(e) Large and increasing surpluses to the trade account of the balance of payments, which allowed the high import capacity of the country during the sample period of this study (Tables 4-8). It was found that these surpluses grew at an average annual rate of 20.6 percent in the 1970's from -1.0 and 9.1 percent in the 1960's and 1950's, respectively. The surpluses stood at US $12,693 millions in 1979, in current terms.

The non-petroleum sector, on the other hand, had large and increasing deficits throughout the three decades, with the exception of the years 1973 and 1974. Imports of capital and non-capital goods kept accelerating at a rate of 20.2 percent in the 1970's, as compared to the 3.9 percent of the previous decade. Capital imports rose at 11.7 percent in the 1970's, while non-capital imports increased at 12.5 percent, in particular after the sharp climb of petroleum prices in 1974. By 1979, the current account deficit of the non-petroleum sector reached the level of US $13,080 million, also in current terms.

The terms of trade deteriorated throughout the sample period, with the relative exception of the 1973-1974 period, as import prices rose at an average annual rate of 4.1 percent compared with the 3.1 percent of export prices.

(f) Large additions to the international monetary reserves, which increased from US $1.0 billion in 1970 to US $8.8 billions in 1979; that is, an average annual growth rate of over 24 percent during the decade, four times larger than the 6 percent of the 1960's and three times larger than in the 1950's.

(g) Large investment funds. In the 1950's, gross investment represented an average share of 38.8 percent with respect to the GDPR. The share declined to 21.5 percent annual average in the 1960's, but rose to 30.6 percent in the 1970's. These are sizable investments, and it appears that investment funds are not a limiting factor for economic development. But skilled labour is. It was explained that, with the exception of the petroleum sector, the absorptive capacity of the economy for more investment was limited by the scarcity of specialized labour. The opposite seems to be the case for the industrialized countries. Labour, therefore, has become the limiting factor of production in Venezuela, associated with a relatively abundant co-operand capital input (Subsection 4.8.1, Chapter IV).

(h) The direct contribution of the petroleum industry to employment is known to be low and about 1.3 percent of the labour force; however, the indirect contribution to overall employment should be quite high. Some light on this matter comes from the increasing share of direct taxes from total ordinary taxes received by the government.

Unfortunately, we did not make an analysis of the interdependence of the petroleum industry with the industrial sector of the economy, due to the unavailability of an input-output table for the country. We believe, however, that such interdependence, although growing as the country develops, is still at a low relative measure. Here, the government has an important role to play. The huge tax revenues from the petroleum sector are channelled back to the economy through government expenditures, in particular via the industrialization program of the public sector.

In this study, we have disaggregated all the ordinary tax receipts into 'indirect taxes', 'direct taxes' and 'petroleum taxes'. This was a very convenient approach, since now we can see how dependent the government has become on the petroleum sector in order to finance its expenditures. For instance, it was found that from a 63 percent share of total tax receipts in the 1950's, the petroleum tax sector provided a 68 percent share in the 1960's and a 76 percent one in the 1970's (Table 10). The share of direct taxes also increased from 8 percent to 14 percent, while indirect taxes declined. As mentioned above, these increasing shares of the petroleum tax and direct tax revenues imply two things: 1) the government becomes more and more dependent on the petroleum tax, and 2) direct tax shares increases can only be interpreted as an expansion of the non-petroleum sector (GDPNOR), including, of course, employment, as these taxes are levied on employment and corporate incomes. With respect to direct taxes, it would be of great interest to know the impact that changes in an endogenous GDPNOR (as shown in Eq.(19), Section 4.1.2) would have as a causal effect on this type of taxes and on the simulation model. This will be carried out in future exercises.

The allocation of the tax revenues is an important element in the economic development of the country. We can see that public consumption increased from an average annual rate of growth of 4 percent in the 1960's to 7.7 percent in the 1970's, keeping pace with the private sector (4.4 percent in the 1960's to 7.9 percent in the 1970's); however, it is in the investment sector that the government became more active, due to its import-substitution industrial policy. Public investment grew at an average annual rate of 6 percent in the 1950's and jumped to 20.2 percent in the 1970's, while private investment rose from 2.4 percent to 9.4 percent.

The second objective was carried out by means of regression and statistical analysis through the macro-econometric model constructed in Chapter IV. An important feature of this model is the endogenization of the petroleum export sector, according to the specification of the petroleum sub-model presented in Subsection 2.5.2. Here, petroleum exports were directed to three important regions; North-America (XONAR), Latin-America (XOLAR) and Western Europe (XOWER), and a residual to other parts of the world (XORESTR). It was found that XONAR accounted for an average annual share of about 57 percent of the total volume of petroleum exports from Venezuela in the 1970's, while XOLAR accounted for about 19 percent and Western Europe for 13 percent during the said decade. As can be seen, North-America is the main trading partner of Venezuela, accounting for an average share of about 66.2 percent of total Venezuelan petroleum exports in constant value terms. The petroleum sub-model, then, takes North-America as endogenous in equation (10), and Latin-America in equation (11). Western Europe failed to produce a behavioural equation and, therefore, was taken as a datum, and the residual of exports (XORESTR) was also taken as a datum in the identity equation (12) (see The Model).

The test of the present model produced reasonable results within the sample period as well as beyond it. The simulation results, the accuracy of the model and an ex-post forecast for 1980 were analyzed in Chapter V. In Chapter VI, we carried out two ex-ante forecasts: 1981 and 1982. Besides this, three alternative scenarios were made to quantify the impact that changes in the relevant exogenous variables of the petroleum sub-model would have on petroleum exports, on government revenues and other key endogenous variables. We took the North-American market for the experiments, and we allowed changes in its gross domestic product (GDPNAR) and/or changes in the world petroleum prices (POVWR). By comparing the scenario results, we were able to quantify the impacts on the Venezuelan economy. For instance, a 1.75 percent increase in the GDPNAR generated an expansion of 1.52 percent in XONAR and, therefore, an increase of 1.15 percent in petroleum tax revenues, while the gross domestic product of Venezuela showed a rise of .13 percent and a .71 percent increase for employment. An increase in POVWR, alone, produced a larger impact on each of the said variables, while a combination of both changes would generate much larger results (See Table 22).

Some observations should be added to this conclusion. First, because of the nature itself of any econometric model, compounded in this case with a highly aggregative structure, some limitations exist as to the extent to analyzing fundamental Venezuelan economic problems. For instance, the model does not go in depth to identify concretely the systematic recycling of the petroleum tax revenues into the process of accumulation in the real sectors of the economy; neither does it study the adverse effects that these revenues have been having on the distribution of income, wealth and unemployment. And, second, due to its structure, aggregative character and the quality of the data, this model could only be use for annual forecasting, for testing alternative policies and for further research.

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Appendix A

THE SIMULATION MODEL

EQ.(1) CPR = 1.830 + 0.479 CPR(-1) + 0.209 YNR + 0.598 SMR

(t's)(5.6) (8.5) (7.7) (9.4)

NOBS = 29 NDF = 25 SEE = 0.5456 RBSQ = 0.9984

D-W = 2.301 F(3/25) = 5739.77

EQ.(2) CTR = 1.000 CPR + 1.000 CGR

NOBS= 29 NDF= 27 SEE= 0.0000

EQ.(3) IPGR = 4.517 + 1.000 ADJT1 + 0.644 IPGR(-1) -

(t's) (4.47) (-) (4.50)

-0.129 KGR(-2) + 0.179 GDPR + 0.309 SLMR

(-5.17) (3.95) (5.58)

NOBS = 28 NDF = 22 SEE = 0.8504 RBSQ = 0.9585

D-W = 1.993 F(5/ 22)= 208.58

EQ.(4) ITGR = 1.000 IPGR + 1.000 IGGR

NOBS= 29 NDF= 27 SEE= 0.0000

EQ.(5) YNR = -1.526 + 0.490 YNR(-1) + 0.430 GDPR

(t's) (-2.2) (5.1) (5.1)

+0.185 TXTR

(4.5)

NOBS = 29 NDF = 25 SEE = 0.8905 RBSQ = 0.9977

D-W = 2.051 F(3/25) = 4004.22

EQ.(6) TXIR = 0.321 + 0.429 TXIR(-1) + 0.070 MNKR

(t's) (2.5) (2.3) (3.4)

NOBS = 19 NDF = 16 SEE = 0.1363 RBSQ=0.9258

D-W = 1.574 F(2/16) = 113.27

EQ.(7) TXDR = -1.045 + 0.394 TXDR(-1) + 0.057 GDPNOR

(t's) (-3.3) (2.5) (4.0)

NOBS = 19 NDF = 16 SEE = 0.2222 RBSQ = 0.9521

D-W = 1.611 F(2/16) = 179.89

EQ.(8) TXOR = -2.686 + 0.206 TXOR(-1) + 1.179 XTOR -

(t's) (-0.5) (2.4) (6.7)

NOBS = 19 NDF = 15 SEE = 1.8750 RBSQ = 0.9484

D-W = 1.867 F(3/15) = 111.36

EQ.(9) TXTR = 1.000 TXIR + 1.000 TXDR + 1.000 TXOR

NOBS = 30 NDF = 27 SEE = 0.0000

EQ.(10) XONAR = 13.357 + 1.000 ADJT2 + 0.002 GDPNAR -

(t's) (6.9) (-) (3.8)

-7.713 POVER/POVWR - 6.690 COVER

(-9.4) (-2.6)

NOBS = 20 NDF = 15 SEE = 1.0498 RBSQ = 0.9307

D-W = 2.202 F(4/15) = 92.2

EQ.(11) XOLAR = 0.922 + 1.000 ADJT3 + 0.003 GDPLAR

(t's) (4.0) (-) (5.4)

+0.089 QOVER - 2.089 COVER

(5.4) (-4.2)

NOBS = 20 NDF = 15 SEE = 0.1764 RBSQ = 0.9701

D-W = 2.121 F(4/15) = 155.12

EQ.(12) XTOR = 1.000 XONAR + 1.000 XOLAR + 1.000 XOWER

+1.000 XORESTR

NOBS = 20 NDF = 16 SEE = 0.0000

EQ.(13) XTR = 1.000 XTOR + 1.000 XNOR

NOBS= 20 NDF = 18 SEE= 0.0000

EQ.(14) MKR = -0.251 + 1.000 ADJT4 + 0.546 ITGR

(t's) (-5.6) (0.0) (14.7)

+ 0.022 MWKI*100/DWPI - 0.091 CTR

(3.3) (-4.7)

NOBS = 29 NDF = 21 SEE = 0.305 RBSQ = 0.949

D-W = 1.778 F(3/25) = 306.50

EQ.(15) MNKR = 6.773 + 1.000 ADJ4 + 0.400 MNKR(-1)

(t's) (3.2) (-) (4.7)

-.010 MWPI*100/DWPI

(-3.4)

NOBS = 29 NDF = 24 SEE = 0.8458 RBSQ = 0.9573

D-W = 1.616 F(4/24) = 157.78

EQ.(16) MTR = 1.000 MKR + 1.000 MNKR

NOBS = 30 NDF = 28 SEE = 0.0000

EQ.(17) GDPR = 1.000 CTR + 1.000 ITGR + 1.000 XTR -1.000 MTR

1.000 MFSR + 1.000 ADJT

NOBS = 30 NDF = 24 SEE= 0.0000

EQ.(18) LABOUR = −0.580 + 0.420 LABOUR(−1) + 0.137 GDPR −

−0.057 GDPR − 0.116 TIME

NOBS = 29 NDF = 23 SEE = 0.1478

NOTE: For further details on employment see the production function in Section 4.8.1, Chapter IV.

Appendix B

THE MODEL ESTIMATES BY THE METHOD OF TWO STAGE LEAST SQUARES

Eq. (1) CPR = 1.819 + .483 CPR(-1) + .207 YNR + .596 SMR

(t's) (5.9) (9.3) (8.2) (10.0)

R2=.999 F(3/25)=5738.9 D-W=2.317 h=-.856 SEE=.507

Eq. (2) CTR = 1.000 CPR + 1.000 CGR

Eq. (3) IPGR = 4.494 + .653 IPGR(-1) - .131 KGR(-2)

(t's) (6.0) (5.0) (-5.8)

+ .183 GDPR + .307 SLMR

(4.5) (6.1)

R2=.984 F(4/23)=208.2 D-W=1.997 h=.0110 SEE=.672

Eq. (4) ITGR = 1.000 IPGR + 1.000 IGGR

Eq. (5) YNR = -1.506 + .495 YNR(-1) + .425 GDPR + .185 TXTR

(t's) (-2.4) (5.4) (5.4) (4.8)

R2=.998 F(3/25)=4003.7 D-W=2.068 h=-.211 SEE=.827

Eq. (6) TXIR = .323 + .424 TXIR(-1) + .071 MNKR

(t's) (2.7) (2.5) (3.8)

R2=.962 F(2/16)=113.3 D-W=1.564 h=1.204 SEE=.125

Eq. (7) TXDR = -1.045 + .394 TXDR(-1) + .057 GDPNOR

(t's) (-3.6) (2.7) (4.4)

R2=.975 F(2/16)=179.9 D-W=1.611 h=1.099 SEE=.204

Eq. (8) TXOR = -2.738 + .213 TXOR(-1) + 1.169 XTOR -

(t's) (-.6) (2.8) (7.4)

-1.001 COVER*100/QOVER

(-2.0)

R2=.973 F(3/15)=111.3 D-W=1.887 h=1.917 SEE=1.666

Eq. (9) TXTR = 1.000 TXIR + 1.000 TXDR + 1.000 TXOR

Eq.(10) XONAR= 13.357 + .002 GDPNAR - 7.713 POVER/POVWR -

(t's) (8.0) (4.4) (-10.9)

-6.690 COVER

(-2.9)

R2=.966 F(3/16)=92.2 D-W=2.202 SEE=.909

Eq.(11) XOLAR= .922 + .003 GDPLAR + .089 QOVER - 2.089 COVER

(t's) (4.6) (6.2) (5.1) (-4.8)

R2=.985 F(3/16)=220.6 D-W=2.121 SEE=.153

Eq.(12) XTOR = 1.000 XONAR + 1.000 XOLAR + 1.000 XOWER

+ 1.000 XORESTR

Eq.(13) XTR = 1.000 XTOR + 1.000 XNOR

Eq.(14) MKR = -2.251 + .546 ITGR + .022 MWKI*100/DWPI -

(t's) (-5.5) (14.7) (3.3)

- .091 CTR

(-4.7)

RHO=.460 R2=.974 F(3/26)=306.5 D-W=1.778 SEE=.305

Eq.(15) MNKR = 6.681 + .404 MNKR(-1) + .183 YNR -

(t's) (3.5) (3.2) (5.2)

-.010 MWPI*100/DWPI

(3.7)

R2=.976 F(3/25)=219.1 D-W=1.618 h=1.403 SEE=.770

Eq.(16) MTR = 1.000 MKR + 1.000 MNKR

Eq.(17) GDPR = 1.000 CTR + 1.000 ITGR + 1.000 XTR -

-1.000 MTR + 1.000 MFSR + 1.000 ADJT

Eq.(18) GDPR = -1.650 + 7.315 LABOUR + 1.460 TIME

(t's) (-1.95) (10.88) (1767)

RHO = .420 R2 = 998 F(2/27) = 2845.6

D-W = 1.713 SEE = .803

Appendix C

THE DATA SET

		ADJT	CGR	CGPR	COLAQ	CONAQ
YR	1950	-1.87	1.87	369.08	-	-
YR	1951	-1.15	2.07	394.64	-	-
YR	1952	-1.63	2.15	434.64	-	-
YR	1953	-2.78	2.29	456.14	-	-
YR	1954	-3.21	2.53	483.94	-	-
YR	1955	-2.41	2.68	486.42	-	-
YR	1956	-0.69	2.70	477.94	-	-
YR	1957	0.62	3.10	692.67	-	-
YR	1958	-1.68	4.13	595.12	-	-
YR	1959	-2.28	3.44	533.20	-	-
YR	1960	-0.06	3.91	508.82	418.36	3282.43
YR	1961	1.44	3.97	487.15	435.86	3339.87
YR	1962	3.14	3.85	461.07	468.99	3464.52
YR	1963	3.44	4.42	517.47	466.19	3615.50
YR	1964	5.49	4.45	513.45	505.64	3740.10
YR	1965	6.27	4.82	533.84	538.02	3933.93
YR	1966	5.77	5.19	561.89	577.30	4195.64
YR	1967	5.75	5.50	563.12	605.11	4292.81
YR	1968	6.20	5.56	596.01	675.11	4566.14
YR	1969	6.68	5.75	611.17	710.51	4812.03
YR	1970	7.08	6.56	638.54	815.65	5236.08
YR	1971	5.83	7.16	674.76	898.30	5439.25
YR	1972	3.48	7.62	696.73	944.91	5846.69
YR	1973	-0.05	8.26	732.28	1028.60	6127.89
YR	1974	-13.81	10.16	873.51	1073.61	5915.62
YR	1975	-11.91	11.50	959.13	1087.28	5767.66
YR	1976	-15.00	13.27	1073.51	1151.12	6171.58
YR	1977	-14.85	14.26	1119.59	1222.82	6429.76
YR	1978	-14.74	14.70	1120.65	1290.14	6489.79
YR	1979	-20.86	14.98	1100.25	1333.76	6308.34

<u>Sources and Descriptions</u>: Acronyms ending in 'R' or 'C' refer to 1968 prices and nominal prices, respectively.

ADJT = Adjustment Term to Expenditures, (Subsection 3.8.1).
CGR = Public Consumption, Bn. Bs., (Section 3.4).
CGPR = Percapita CGR.
COLAQ = Petroleum Consumption of Latin-America, Mn. Bbl., (Subsection 3.6.2).
CONAQ = Petroleum Consumption of North-America, Mn. Bbl.

		COWEQ	COVEQ	COVER	CPI	CPR
YR	1950	-	-	-	78.40	8.24
YR	1951	-	-	-	84.00	8.78
YR	1952	-	-	-	85.00	9.20
YR	1953	-	-	-	83.90	10.62
YR	1954	-	-	-	83.90	11.27
YR	1955	-	-	-	83.60	12.24
YR	1956	-	-	-	84.40	12.56
YR	1957	-	-	-	82.60	14.01
YR	1958	-	-	-	86.50	15.08
YR	1959	-	-	-	91.00	17.53
YR	1960	1167.33	46.68	0.52	94.10	16.46
YR	1961	1328.69	46.47	0.56	91.40	16.70
YR	1962	1543.75	55.30	0.60	92.30	17.27
YR	1963	1798.40	57.16	0.64	93.40	17.78
YR	1964	2033.22	60.65	0.70	95.40	19.48
YR	1965	2272.51	64.17	0.79	97.00	21.00
YR	1966	2520.61	65.57	0.87	98.70	21.68
YR	1967	2700.44	66.86	0.86	98.70	22.45
YR	1968	2970.97	70.89	0.86	100.00	23.90
YR	1969	3272.76	70.20	0.90	102.40	25.23
YR	1970	3732.43	73.14	0.88	105.00	26.27
YR	1971	3871.27	76.96	0.91	108.40	26.78
YR	1972	4151.27	83.48	0.97	111.50	28.79
YR	1973	4399.01	92.55	0.94	116.10	30.52
YR	1974	4129.89	90.82	0.81	125.70	35.94
YR	1975	3952.24	88.84	0.99	138.60	40.78
YR	1976	4230.31	93.87	1.00	149.10	44.71
YR	1977	4171.21	98.76	1.08	161.00	49.90
YR	1978	4234.27	109.18	1.25	172.00	55.20
YR	1979	4275.31	121.55	1.45	193.00	56.38

<u>Sources and Description</u>: Section 3.4 and Subsection 3.6.2:
COWEQ = Petroleum Consumption of Western Europe, Mn. Bbl.
COVEQ = Petroleum Consumption of Venezuela, Mn. Bbl.
COVER = Petroleum Consumption of Venezuela, Bn. Bs.
CPI = Consumer Price Index, 1968 =100.
CPR = Private Consumption, Bn. Bs.

		CPPR	CTR	CTPR	DEPR	DWPI
YR	1950	1.63	10.11	2.00	2.52	80.30
YR	1951	1.66	10.85	2.05	2.70	84.80
YR	1952	1.66	11.35	2.09	2.84	84.80
YR	1953	1.84	12.91	2.29	3.07	83.40
YR	1954	1.87	13.80	2.35	3.34	84.90
YR	1955	1.95	14.92	2.44	3.65	84.10
YR	1956	1.93	15.26	2.41	3.91	85.80
YR	1957	2.07	17.11	2.77	4.20	84.90
YR	1958	2.15	19.21	2.75	4.51	87.30
YR	1959	2.42	20.97	2.95	4.79	90.40
YR	1960	2.24	20.37	2.74	5.07	90.10
YR	1961	2.19	20.67	2.68	5.23	90.60
YR	1962	2.19	21.12	2.66	5.26	90.30
YR	1963	2.19	22.20	2.70	5.36	90.20
YR	1964	2.31	23.93	2.83	4.76	95.00
YR	1965	2.41	25.82	2.94	4.78	98.20
YR	1966	2.40	26.87	2.96	4.93	98.10
YR	1967	2.40	27.95	2.96	5.21	98.50
YR	1968	2.48	29.46	3.08	5.21	100.00
YR	1969	2.54	30.98	3.15	5.67	101.20
YR	1970	2.56	32.83	3.20	5.13	101.80
YR	1971	2.52	33.94	3.15	4.88	104.10
YR	1972	2.63	36.41	3.33	4.87	106.90
YR	1973	2.71	38.78	3.44	4.92	114.60
YR	1974	3.09	46.10	3.96	4.71	133.90
YR	1975	3.40	52.23	4.36	4.68	153.00
YR	1976	3.62	57.98	4.69	4.86	165.30
YR	1977	3.92	64.16	5.04	5.01	185.80
YR	1978	4.21	69.90	5.33	5.69	199.80
YR	1979	4.14	71.36	5.24	5.93	220.60

<u>Sources and Description</u>: Sections 3.4, 3.5 and 3.7:
CPPR = Percapita CPR, Thousand Bs, (Th. Bs.).
CTR = Total Consumption, Bn. Bs.
CTPR = Percapita CTR, Th. Bs.
DEPR = Depreciation Allowances, Bn. Bs.
DWPI = Domestic Wholesale Price Index, 1968 =100.

		FEXC	GDPC	GDPID	GDPOC	GDPOR
YR	1950	3.22	12.10	89.66	3.06	3.41
YR	1951	3.22	13.30	88.31	3.61	4.08
YR	1952	3.22	14.30	88.50	3.86	4.36
YR	1953	3.22	15.14	88.21	3.85	4.37
YR	1954	3.22	16.76	89.08	4.24	4.76
YR	1955	3.22	18.31	89.37	4.84	5.41
YR	1956	3.22	20.87	92.17	5.84	6.34
YR	1957	3.22	24.40	96.51	7.46	7.73
YR	1958	3.22	25.14	98.15	6.64	6.76
YR	1959	3.22	25.46	92.17	6.18	6.70
YR	1960	3.22	26.26	91.39	5.93	6.49
YR	1961	3.22	27.62	91.49	6.21	6.78
YR	1962	3.22	30.13	91.68	6.91	7.53
YR	1963	3.22	32.89	93.52	6.93	7.41
YR	1964	4.45	36.42	94.39	9.44	10.00
YR	1965	4.45	38.72	94.77	9.83	10.37
YR	1966	4.45	40.39	96.61	9.44	9.77
YR	1967	4.45	42.52	97.76	9.90	10.13
YR	1968	4.45	45.76	100.00	10.19	10.19
YR	1969	4.45	47.92	100.95	10.11	10.02
YR	1970	4.45	52.31	102.73	10.93	10.64
YR	1971	4.35	57.42	109.44	12.65	11.56
YR	1972	4.35	61.80	114.07	12.43	10.90
YR	1973	4.29	73.48	127.85	18.24	14.27
YR	1974	4.29	112.51	184.50	45.48	24.65
YR	1975	4.29	118.23	188.12	35.39	18.81
YR	1976	4.29	135.32	193.27	37.46	19.38
YR	1977	4.29	155.88	208.41	39.52	18.96
YR	1978	4.29	170.96	221.56	36.00	16.25
YR	1979	4.29	210.22	270.46	56.89	21.03

Sources and Description:

FEXC = Foreign Exchange Rate (to the USA dollar). (Subsection 3.6.2).

GDPC = Gross Domestic Product, Bn. Bs., (current).

GDPID = Implicit Deflator of the Gross Domestic Product, (1968 = 100).

GDPOC = Petroleum Gross Domestic Product, Bn. Bs.

GDPOR = Petroleum Gross Domestic Product, Bn. Bs.

		GDPLAR	GDPNAR	GDPNOR	GDPR	GDPWER
YR	1950	-	-	10.08	13.49	-
YR	1951	-	-	10.98	15.06	-
YR	1952	-	-	11.80	16.16	-
YR	1953	-	-	12.80	17.16	-
YR	1954	-	-	14.06	18.81	-
YR	1955	-	-	15.07	20.48	-
YR	1956	-	-	16.31	22.65	-
YR	1957	-	-	17.54	25.28	-
YR	1958	-	-	18.85	25.61	-
YR	1959	-	-	20.92	27.63	-
YR	1960	320.74	2109.52	22.24	28.73	1292.38
YR	1961	342.51	2151.02	23.40	30.18	1350.69
YR	1962	357.03	2273.61	25.38	32.91	1414.22
YR	1963	369.11	2368.37	27.76	35.17	1476.27
YR	1964	548.33	3443.23	28.59	38.59	2163.41
YR	1965	578.01	3651.98	30.49	40.86	2259.93
YR	1966	605.16	3875.37	32.04	41.81	2342.66
YR	1967	631.05	3980.08	33.36	43.49	2418.84
YR	1968	672.35	4161.91	35.57	45.76	2546.87
YR	1969	718.32	4276.89	37.45	47.47	2701.73
YR	1970	768.29	4279.34	40.28	50.92	2837.76
YR	1971	801.14	4318.59	40.91	52.46	2871.39
YR	1972	854.91	4565.76	43.27	54.17	2991.93
YR	1973	913.09	4749.11	43.21	57.47	3122.14
YR	1974	978.31	4706.52	36.33	60.98	3187.18
YR	1975	1009.25	4669.96	45.78	64.59	3157.27
YR	1976	1053.29	4943.20	50.63	70.02	3318.49
YR	1977	1101.33	5184.44	55.83	74.80	3391.63
YR	1978	1152.62	5411.08	60.91	77.16	3496.67
YR	1979	1204.09	5543.85	56.67	77.73	3610.85

Sources and Description: (See Subsection 3.6.2):
GDPLAR = GDPR of Latin America, Bn. Bs.
GDPNAR = GDPR of North-America, Bn. Bs.
GDPNOR = Non-Petroleum GDPR of Venezuela, Bn. Bs.
GDPR = GDPR of Vanezuela, Bn. Bs.
GDPWER = GDPR of Western Europe, Bn. Bs.

		GDPPR	IGGR	IPGR	ITGR	KAPR
YR	1950	2.67	1.41	3.64	5.05	7.66
YR	1951	2.84	1.50	3.87	5.37	9.25
YR	1952	2.92	1.89	4.85	6.74	10.24
YR	1953	2.97	2.07	5.33	7.40	10.48
YR	1954	3.12	2.36	6.10	8.46	10.91
YR	1955	3.27	2.23	5.76	7.99	12.75
YR	1956	3.48	2.42	6.24	8.66	14.10
YR	1957	3.74	2.57	6.63	9.20	15.83
YR	1958	3.66	2.55	6.57	9.12	15.39
YR	1959	3.81	2.62	6.77	9.39	16.48
YR	1960	3.90	2.04	5.27	7.31	17.74
YR	1961	3.97	1.74	4.48	6.22	19.39
YR	1962	4.18	1.82	4.67	6.49	20.91
YR	1963	4.32	1.86	4.80	6.66	22.07
YR	1964	4.58	2.32	5.69	8.01	24.33
YR	1965	4.68	2.47	6.13	8.60	25.95
YR	1966	4.63	2.92	5.86	8.78	26.11
YR	1967	4.65	3.70	5.38	9.08	26.55
YR	1968	4.76	3.98	6.40	10.38	27.91
YR	1969	4.77	3.66	6.65	10.31	29.05
YR	1970	4.96	2.55	8.40	10.95	30.82
YR	1971	4.94	2.91	9.38	12.29	31.08
YR	1972	4.95	5.36	8.78	14.14	30.91
YR	1973	5.09	5.48	10.01	15.49	32.73
YR	1974	5.24	4.91	10.22	15.13	31.93
YR	1975	5.39	7.78	11.21	18.99	31.55
YR	1976	5.66	10.03	14.34	24.37	33.82
YR	1977	5.87	12.29	19.14	31.43	35.22
YR	1978	5.88	13.35	18.93	32.28	33.30
YR	1979	5.71	10.94	16.10	27.04	33.31

<u>Sources and Description</u>: Sections 3.2, 3.4 and 3.9:
GDPPR = Percapita GDPR, Th. Bs.
IGGR = Gross Fixed Public Investment, Bn. Bs.
IPGR = Gross Fixed Private Investment, Bn. Bs.
ITGR = Total Fixed Gross Investment, Bn. Bs.
KAPR = Income Shares to Capital, Bn. Bs.

		KGR	LABOUR	LWBRC	MFSR
YR	1950	43.76	1.61	5.83	-1.27
YR	1951	46.46	1.65	5.81	-1.56
YR	1952	50.37	1.73	5.92	-1.64
YR	1953	54.70	1.80	6.69	-1.66
YR	1954	59.82	1.87	7.28	-1.81
YR	1955	64.16	1.92	7.73	-2.14
YR	1956	68.90	1.96	8.55	-2.68
YR	1957	73.90	1.99	9.45	-3.37
YR	1958	78.52	2.02	10.22	-2.14
YR	1959	83.11	2.03	11.15	-2.05
YR	1960	85.35	2.03	10.99	-2.30
YR	1961	86.34	2.05	10.79	-2.54
YR	1962	88.68	2.10	12.00	-2.97
YR	1963	89.98	2.16	13.10	-3.05
YR	1964	93.23	2.32	14.27	-3.41
YR	1965	97.04	2.44	14.91	-3.68
YR	1966	100.89	2.52	15.70	-3.53
YR	1967	104.77	2.61	16.94	-3.34
YR	1968	109.93	2.79	17.85	-3.54
YR	1969	114.57	2.88	18.42	-3.64
YR	1970	120.36	2.89	20.10	-2.96
YR	1971	127.72	3.00	21.38	-3.69
YR	1972	136.87	3.16	23.26	-4.07
YR	1973	147.16	3.29	24.74	-5.26
YR	1974	157.29	3.66	29.05	-1.46
YR	1975	171.25	4.00	33.04	0.22
YR	1976	190.14	4.27	36.20	0.49
YR	1977	215.86	4.56	39.58	-0.17
YR	1978	236.86	4.93	43.86	-0.28
YR	1979	257.97	4.98	44.42	-0.08

Sources and Description: Sections 3.5, 3.9 and Subsection 3.8.1:

KGR = Real Gross Capital Stock, Bn. Bs.
LABOUR = Employment, Millions of Workers.
LWBRC = Income of Labour, Bn. Bs.
MFSR = Imports of Factor Services, Bn. Bs.

		MNKC	MNKR	MKC	MKR	MTC
YR	1950	1.75	1.94	0.90	1.00	2.64
YR	1951	1.85	2.10	0.96	1.09	2.81
YR	1952	2.19	2.47	1.15	1.30	3.34
YR	1953	2.43	2.76	1.14	1.29	3.57
YR	1954	2.55	2.87	1.25	1.40	3.80
YR	1955	2.65	2.96	1.36	1.53	4.01
YR	1956	3.17	3.43	1.81	1.97	4.98
YR	1957	4.65	4.75	2.28	2.36	6.93
YR	1958	4.24	4.35	2.48	2.53	6.72
YR	1959	4.35	4.72	1.97	2.14	6.32
YR	1960	3.78	4.15	1.36	1.48	5.14
YR	1961	3.87	4.23	1.18	1.29	5.05
YR	1962	4.23	4.62	1.27	1.38	5.50
YR	1963	4.02	4.29	1.37	1.47	5.39
YR	1964	5.27	5.59	1.80	1.90	7.07
YR	1965	5.86	6.18	2.14	2.26	8.00
YR	1966	5.27	5.45	2.23	2.31	7.50
YR	1967	5.64	5.87	2.27	2.33	7.91
YR	1968	7.03	6.47	2.59	2.59	9.62
YR	1969	7.10	6.68	2.68	2.66	9.78
YR	1970	6.50	6.32	3.51	3.42	10.01
YR	1971	6.71	6.13	4.41	4.03	11.12
YR	1972	7.42	6.51	5.17	4.53	12.60
YR	1973	8.50	6.65	5.89	4.61	14.39
YR	1974	15.00	8.13	6.62	3.59	21.61
YR	1975	19.96	10.61	10.49	5.58	30.45
YR	1976	23.02	11.91	14.95	7.74	39.79
YR	1977	33.18	15.92	23.68	11.36	56.86
YR	1978	39.65	17.89	25.76	11.63	65.41
YR	1979	42.39	15.67	21.56	7.97	63.95

<u>Sources and Description</u>: Section 3.7:
MNKC = Imports of Non-capital goods, Bn. Bs.
MNKR = Imports of Non-capital goods, Bn. Bs.
MKC = Imports of Capital Goods, Bn. Bs.
MKR = Imports of Capital Goods, Bn. Bs.
MTC = Total Imports, Bn. Bs.

		MTR	MUVIR	MWKI	MWNKI	MWPI
YR	1950	2.94	61.10	39.04	85.46	60.90
YR	1951	3.18	66.90	37.73	118.49	68.50
YR	1952	3.77	69.80	38.16	111.66	67.20
YR	1953	4.05	70.00	39.53	94.11	65.30
YR	1954	4.27	72.40	40.33	89.39	63.90
YR	1955	4.49	71.90	39.85	93.73	64.20
YR	1956	5.40	77.10	45.62	84.27	64.40
YR	1957	7.11	84.50	43.40	87.26	65.50
YR	1958	6.88	84.40	43.67	93.21	65.70
YR	1959	6.86	99.50	52.44	76.09	66.70
YR	1960	5.63	101.50	55.24	74.14	68.00
YR	1961	5.52	102.20	63.78	72.00	69.90
YR	1962	6.00	107.10	75.31	78.05	77.40
YR	1963	5.76	97.10	75.46	85.49	82.70
YR	1964	7.49	93.20	81.59	84.03	83.40
YR	1965	8.44	99.80	89.66	92.19	91.50
YR	1966	7.76	95.40	93.87	96.22	95.50
YR	1967	8.20	95.40	98.80	97.83	98.10
YR	1968	9.06	100.00	100.00	100.00	100.00
YR	1969	9.33	101.80	94.18	105.45	102.10
YR	1970	9.74	113.00	106.20	104.67	105.20
YR	1971	10.16	126.30	112.50	109.55	110.70
YR	1972	11.04	145.00	119.00	113.53	115.80
YR	1973	11.26	166.20	125.80	120.14	122.40
YR	1974	11.71	243.80	144.20	142.19	142.80
YR	1975	16.19	349.50	165.30	158.98	161.10
YR	1976	19.65	445.80	173.50	156.96	170.90
YR	1977	27.28	641.80	185.70	181.96	183.50
YR	1978	29.52	696.60	200.20	194.16	196.50
YR	1979	23.64	674.90	215.30	209.47	211.40

<u>Sources</u> <u>and</u> <u>Description</u>: (See Section 3.7):

MTR = Total Imports, Bn. Bs.
MUVIR = Import Unit Value Index, 1968 = 100.
MWKI = Imports of Capital Wholesale Price Index, 1968=100.
MWNKI = Imports of Non-capital Goods Wholesale Price Index, 1968 = 100.
MWPI = Import Wholesale Price Index, 1968 = 100.

		POPV	POUSAR	POVER	POVWR	QOVER
YR	1950	5.06	-	-	8.58	-
YR	1951	5.30	-	-	8.03	-
YR	1952	5.54	-	-	7.67	-
YR	1953	5.79	-	-	8.12	-
YR	1954	6.03	-	-	8.21	-
YR	1955	6.27	-	-	8.28	-
YR	1956	6.52	-	-	8.11	-
YR	1957	6.76	-	-	8.79	-
YR	1958	7.00	-	-	8.14	-
YR	1959	7.24	-	-	8.28	-
YR	1960	7.36	11.19	11.03	8.19	8.30
YR	1961	7.61	11.03	11.94	9.28	9.62
YR	1962	7.87	10.89	10.83	9.60	10.84
YR	1963	8.14	10.71	11.19	9.86	11.38
YR	1964	8.43	14.47	11.60	9.82	11.96
YR	1965	8.72	14.12	12.32	9.87	12.21
YR	1966	9.03	13.77	13.28	9.50	11.65
YR	1967	9.35	13.51	12.88	9.34	12.05
YR	1968	9.62	13.08	12.10	9.42	12.29
YR	1969	9.44	13.09	12.77	9.15	12.29
YR	1970	10.27	12.77	11.97	9.10	12.40
YR	1971	10.61	12.67	11.78	10.98	14.06
YR	1972	10.94	12.16	11.60	12.43	14.91
YR	1973	11.28	13.01	10.11	15.24	18.46
YR	1974	11.63	20.62	10.62	25.36	26.28
YR	1975	11.99	21.14	11.13	26.33	21.04
YR	1976	12.36	21.69	10.68	26.36	21.57
YR	1977	12.74	21.54	10.90	28.63	21.60
YR	1978	13.12	21.04	11.45	26.20	19.82
YR	1979	13.62	26.57	11.91	29.43	23.94

<u>Sources and Description</u>: Subsection 3.6.2:

POPV = Population of Venezuela, Mn. People.
POUSAR = Petroleum Prices in the USA, Bs./Bbl.
POVER = Petroleum Prices in Venezuela, Bs./Bbl.
POVWR = Realized Venezuelan Petroleum World Prices.
QOVER = Venezuelan Petroleum Production, Bn. Bs.

		QUATX	SLMC	SLMR	SLMPR	SMC
YR	1950	35.80	1.76	2.25	0.44	1.56
YR	1951	38.39	1.87	2.22	0.42	1.62
YR	1952	41.48	2.21	2.60	0.47	1.88
YR	1953	43.34	2.48	2.96	0.51	2.05
YR	1954	47.40	2.69	3.21	0.53	2.13
YR	1955	53.65	3.10	3.70	0.59	2.34
YR	1956	60.88	3.66	4.34	0.67	2.68
YR	1957	71.67	5.06	6.13	0.91	3.51
YR	1958	64.77	5.82	6.73	0.96	3.94
YR	1959	68.67	5.87	6.46	0.89	3.74
YR	1960	73.38	5.28	5.62	0.76	3.54
YR	1961	80.44	5.36	5.86	0.77	3.63
YR	1962	90.34	5.39	5.84	0.74	3.50
YR	1963	94.81	6.04	6.47	0.79	3.73
YR	1964	97.89	6.95	7.29	0.86	4.23
YR	1965	99.76	7.64	7.88	0.90	4.63
YR	1966	94.81	7.75	7.85	0.87	4.74
YR	1967	99.43	8.86	8.98	0.96	5.27
YR	1968	100.00	9.87	9.87	1.03	5.80
YR	1969	101.22	11.09	10.83	1.09	6.34
YR	1970	103.57	12.12	11.54	1.12	6.60
YR	1971	115.67	14.57	13.44	1.27	7.92
YR	1972	123.78	17.20	15.43	1.41	8.98
YR	1973	160.47	21.28	18.33	1.63	11.01
YR	1974	216.96	28.05	22.31	1.92	15.56
YR	1975	172.08	41.41	29.87	2.49	23.99
YR	1976	177.19	51.19	34.33	2.78	26.98
YR	1977	174.59	63.53	39.46	3.10	34.00
YR	1978	158.44	73.18	42.55	3.24	41.13
YR	1979	194.07	84.04	43.55	3.20	43.89

Sources and Description: Section 3.3 and Subsection 2.6.1:
QUATX = Quantum Index of Exports, 1968 = 100.
SLMC = Money Supply (broad concept, current terms).
SLMR = Money Supply (broad concept, real terms).
SLMPR = Percapita SLMR.
SMC = Money Supply (narrow concept, current terms).

		SMR	SMPR	TXIR	TXDR	TXOR
YR	1950	1.99	0.39	0.85	0.13	1.70
YR	1951	1.93	0.36	0.81	0.13	1.63
YR	1952	2.22	0.40	0.82	0.15	1.66
YR	1953	2.45	0.42	0.85	0.18	1.69
YR	1954	2.54	0.42	0.92	0.21	1.68
YR	1955	2.81	0.45	1.00	0.24	1.94
YR	1956	3.17	0.49	1.04	0.28	2.29
YR	1957	4.25	0.63	1.28	0.35	2.99
YR	1958	4.55	0.65	1.27	0.48	2.96
YR	1959	4.11	0.57	1.20	0.59	3.41
YR	1960	3.76	0.51	0.96	0.59	3.07
YR	1961	3.97	0.52	0.97	0.78	3.42
YR	1962	3.79	0.48	0.97	0.76	3.36
YR	1963	4.00	0.49	0.97	0.79	3.72
YR	1964	4.44	0.53	1.09	0.86	4.88
YR	1965	4.78	0.55	1.12	1.09	4.87
YR	1966	4.81	0.53	1.22	1.21	4.98
YR	1967	5.34	0.57	1.24	1.27	5.28
YR	1968	5.80	0.60	1.30	1.31	5.54
YR	1969	6.19	0.62	1.34	1.43	5.69
YR	1970	6.29	0.61	1.36	1.77	5.91
YR	1971	7.30	0.69	1.35	1.79	7.59
YR	1972	8.05	0.74	1.40	1.89	7.64
YR	1973	9.48	0.84	1.38	2.15	10.29
YR	1974	12.38	1.06	1.68	2.16	30.02
YR	1975	17.31	1.44	2.19	2.86	24.44
YR	1976	18.10	1.46	2.02	3.03	20.51
YR	1977	21.12	1.66	2.09	3.19	19.86
YR	1978	23.92	1.82	2.54	4.11	16.68
YR	1979	22.74	1.67	2.43	3.54	19.06

Sources and Description: Sections 3.3 and 3.8:
SMR = Money Supply (narrow concept, real terms).
SMPR = Percapita SMR.
TXIR = Indirect Tax Receipts, Bn. Bs.
TXDR = Direct Tax Receipts, Bn. Bs.
TXOR = Petroleum Tax Receipts, Bn. Bs.

		TXTR	TXTPR	TERMT	XNOR	XOLAQ
YR	1950	2.68	0.53	179.21	0.17	-
YR	1951	2.57	0.49	164.28	0.20	-
YR	1952	2.63	0.47	164.61	0.30	-
YR	1953	2.72	0.47	176.43	0.33	-
YR	1954	2.81	0.47	172.93	0.37	-
YR	1955	3.18	0.51	173.99	0.42	-
YR	1956	3.61	0.55	163.68	0.50	-
YR	1957	4.62	0.68	165.92	0.68	-
YR	1958	4.71	0.67	159.12	0.72	-
YR	1959	5.20	0.72	120.30	0.87	-
YR	1960	4.62	0.63	113.30	1.26	205.53
YR	1961	5.17	0.68	112.72	0.85	184.88
YR	1962	5.09	0.65	104.48	0.89	184.67
YR	1963	5.48	0.68	112.15	0.94	193.07
YR	1964	6.83	0.81	112.02	0.80	223.37
YR	1965	7.08	0.81	102.00	0.87	231.90
YR	1966	7.41	0.82	105.14	0.90	246.24
YR	1967	7.79	0.83	104.30	1.06	254.57
YR	1968	8.15	0.85	100.00	0.89	290.47
YR	1969	8.46	0.85	95.28	1.08	302.80
YR	1970	9.04	0.88	90.27	1.24	281.86
YR	1971	10.73	1.01	95.41	1.10	255.13
YR	1972	10.93	1.00	85.03	1.31	243.60
YR	1973	13.82	1.23	108.24	2.25	243.14
YR	1974	33.86	2.91	174.12	1.26	190.35
YR	1975	29.49	2.46	96.57	1.15	163.18
YR	1976	25.56	2.07	80.08	1.26	157.87
YR	1977	25.14	1.97	57.17	0.99	163.27
YR	1978	23.33	1.73	50.66	0.95	147.61
YR	1979	25.03	1.84	80.59	1.42	134.62

<u>Sources and Description</u>: Sections 3.8, 3.7.1, 3.6.1:
TXTR = Real Total Taxes, Bn. Bs.
TXTPR = per capita TXTR.
TERMT = Terms of Trade (Subs. 3.7.1).
XNOR = Real Non-petroleum Exports, Bn. Bs., (Subs. 3.6.1)
XOLAQ = Petroleum Exports to Latin-America, Mb. Bbl.

		XONAQ	XOWEQ	XOQ	XTOR	XOLAR
YR	1950	-	-	-	4.24	-
YR	1951	-	-	-	4.53	-
YR	1952	-	-	-	4.81	-
YR	1953	-	-	-	5.01	-
YR	1954	-	-	-	5.47	-
YR	1955	-	-	-	6.19	-
YR	1956	-	-	-	7.00	-
YR	1957	-	-	-	8.15	-
YR	1958	-	-	-	7.26	-
YR	1959	-	-	-	7.59	-
YR	1960	519.14	191.01	950.42	7.78	1.68
YR	1961	521.46	229.72	976.70	9.06	1.72
YR	1962	559.37	275.66	1067.05	10.24	1.77
YR	1963	560.92	296.28	1089.75	10.74	1.90
YR	1964	610.93	270.82	1146.42	11.26	2.19
YR	1965	624.94	261.30	1157.01	11.42	2.29
YR	1966	618.94	227.17	1134.53	10.78	2.34
YR	1967	649.48	247.65	1198.57	11.19	2.38
YR	1968	660.45	217.98	1213.51	11.43	2.74
YR	1969	691.68	210.10	1244.94	11.39	2.77
YR	1970	768.96	189.51	1266.41	11.52	2.56
YR	1971	761.56	177.14	1198.04	13.15	2.80
YR	1972	730.63	143.41	1121.76	13.94	3.03
YR	1973	773.66	129.23	1149.81	17.52	3.71
YR	1974	698.85	110.28	1004.45	25.47	4.83
YR	1975	495.28	98.74	761.44	20.05	4.30
YR	1976	517.49	101.82	780.27	20.57	4.16
YR	1977	479.96	69.72	716.85	20.52	4.67
YR	1978	466.14	85.04	708.86	18.57	3.87
YR	1979	486.43	125.30	764.11	22.49	3.96

Sources and Description: (See Subsection 3.6.2):
XONAQ = Petroleum Exports to North-America, Mn. Bbl.
XOWEQ = Petroleum Exports to Western Europe, Mn. Bbl.
XOQ = Total Petroleum Exports, Mn. Bbl.
XTOR = Total Petroleum Exports, Bn. Bs.
XOLAR = Petroleum Exports to Latin-America, Bn. Bs.

		XONAR	XOWER	XORESTR	XTR	XUVIR
YR	1950	-	-	-	4.41	109.50
YR	1951	-	-	-	4.73	109.90
YR	1952	-	-	-	5.11	114.90
YR	1953	-	-	-	5.34	123.50
YR	1954	-	-	-	5.84	125.20
YR	1955	-	-	-	6.61	125.10
YR	1956	-	-	-	7.50	126.20
YR	1957	-	-	-	8.83	140.20
YR	1958	-	-	-	7.98	134.30
YR	1959	-	-	-	8.46	119.70
YR	1960	4.25	1.56	0.28	9.04	115.00
YR	1961	4.84	2.13	0.38	9.91	115.20
YR	1962	5.37	2.65	0.46	11.13	111.90
YR	1963	5.53	2.92	0.39	11.68	108.90
YR	1964	6.00	2.66	0.41	12.06	104.40
YR	1965	6.17	2.58	0.38	12.29	101.80
YR	1966	5.88	2.16	0.40	11.68	100.30
YR	1967	6.06	2.31	0.44	12.25	99.50
YR	1968	6.22	2.05	0.42	12.32	100.00
YR	1969	6.33	1.92	0.37	12.47	97.00
YR	1970	7.00	1.72	0.24	12.76	102.00
YR	1971	8.36	1.94	0.05	14.25	120.50
YR	1972	9.08	1.78	0.05	15.25	123.30
YR	1973	11.79	1.97	0.06	19.77	179.90
YR	1974	17.72	2.80	0.13	26.73	424.50
YR	1975	13.04	2.60	0.11	21.20	337.50
YR	1976	13.64	2.68	0.08	21.83	357.00
YR	1977	13.74	2.00	0.11	21.51	366.90
YR	1978	12.21	2.23	0.26	19.52	352.90
YR	1979	14.32	3.69	0.52	23.91	543.90

<u>Sources</u> <u>and</u> <u>Description</u>: (See Section 3.6):
XONAR = Petroleum Exports to North-America, Bn. Bs.
XOWER = Petroleum Exports to Western Europe, Bn. Bs.
XORESTR = Real Petroleum Exports to the Rest of the World, Bn. Bs.
XTR = Real Total Exports, Bn. Bs.
XUVIR = Export Unit Value Index, 1968 = 100.

		YNC	YNR	YNPR	RVEN	RUSA
YR	1950	8.75	9.76	1945.29	2.00	1.75
YR	1951	9.71	10.99	2090.73	2.00	1.75
YR	1952	10.41	11.76	2138.70	2.00	1.75
YR	1953	11.09	12.57	2189.32	2.00	2.00
YR	1954	12.36	13.88	2319.54	2.00	1.50
YR	1955	13.28	14.86	2387.56	2.00	2.50
YR	1956	14.96	16.23	2511.18	2.00	3.00
YR	1957	17.07	17.68	2637.73	2.00	3.00
YR	1958	18.59	18.94	2820.33	2.00	2.50
YR	1959	20.08	21.78	3031.05	4.50	4.00
YR	1960	19.70	21.56	2950.02	4.50	3.00
YR	1961	20.33	22.22	2941.76	4.50	3.00
YR	1962	21.88	23.87	3055.52	4.50	3.00
YR	1963	23.96	25.62	3171.02	4.50	3.50
YR	1964	28.06	29.73	3555.85	4.50	4.00
YR	1965	29.97	31.62	3653.55	4.50	4.50
YR	1966	31.19	32.28	3603.32	4.50	4.50
YR	1967	33.06	33.82	3644.13	4.50	4.50
YR	1968	35.55	35.55	3723.72	4.50	5.50
YR	1969	37.24	36.89	3738.21	5.50	6.00
YR	1970	42.10	40.99	3988.91	5.00	5.50
YR	1971	46.06	42.09	3966.33	5.00	4.50
YR	1972	51.55	45.20	4131.63	5.00	4.50
YR	1973	61.88	48.40	4291.17	5.00	7.50
YR	1974	99.91	54.15	4655.27	5.00	7.75
YR	1975	106.51	56.62	4720.93	7.00	6.00
YR	1976	122.26	63.26	5117.77	7.00	5.25
YR	1977	139.76	67.06	5265.17	7.00	6.00
YR	1978	152.48	68.82	5244.64	7.50	9.50
YR	1979	189.60	70.10	5146.67	11.00	12.00

<u>Sources and Description</u>: (See Section 3.2):
YNC = National Income, Bn. Bs. (current terms).
YNR = National Income, Bn. Bs., (real terms).
YNPR= Percapita YNR.
RVEN = Venezuelan interest rate
RUSA = USA prime rate.