

# Stochastic Simulations for the Economy of Republic of Yemen: An Application of Macro Modelling

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## INTRODUCTION

Present Republic of Yemen came into existence on the 22 May 1990, as a result of unification of two entirely different economies, viz, Yemen Arab Republic (YAR or North Yemen) and People's Democratic Republic of Yemen (PDRY of South Yemen). The Unification brought together two countries which in modern times had operated with fundamentally different economic systems orientation. The North Yemen had operated along relatively liberal lines and had allowed private sector to play a dominant role in her economic activity. Although certain commercial activities had been carried out by state with a few controls in some areas, such as trade policy, etc., widespread state ownership and control of the means of production were absent. In the South Yemen, by contrast, economic organisation for many years had been along explicitly socialist and centrally-planned lines involving the widespread state intervention, state not only in the ownership and management of productive assets but also in setting and control of wide range of consumer and other prices.

The unification process led to a formal period of transition, commencing in May 1990 and ending in November 1992, is governed by specific code, which with the constitution, forms the legal and operating frame-work for the present government of the Republic of Yemen. The constitution was later ratified through a referendum held in May 1991. The power was shared between three parties, viz. the Public General Congress, the Socialist Party and Attagammu Yemeni Lei Eslah (Islamic party). Among several agreements signed between the erstwhile governments of the North Yemen and the South Yemen, one specified the need to hold election before November 1992 facilitating a multi-party system. It also set the requirement for the full merger of the two former administrative and legal systems.

Ever since its formation, the Republic of Yemen has been facing serious fiscal, economic and political adjustment problems. The Gulf crisis of August 1990, jeopardised the financing of the cost of unification.

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However, the unification process created dramatic changes in the society, specially in South Yemen, which was under the command economy. The people in there had to adapt with competitive market economy. It was not a gradual process and sufficient time for organisation of the two different systems was not provided. The unification process was announced in a hurry without taking into the account the large economic and political problems to be followed. All these problems have increased the burden of unification on the present government, which had associated with the normal agenda of development tasks aimed at relieving poverty. Thus, the economy of Republic of Yemen have confronted a large number of major pressures and difficulties. But by the end of 1990, these problems were further complicated by the Gulf crisis which led to returning of the migrant workers from neighbouring countries resulting in the 15 percent increase in the labour force. The loans and grants from neighbouring countries and Western European countries declined affecting the economy. During the period 1990-1993 the age of the unification, political tension appeared between the parties which shared the power, particularly after the election held on April 27, 1993. At the election, the Public General Congress emerged as the strongest party followed by the Islamic Party and the Socialist Party. Notwithstanding the Document of Accord and Pledge signed among various parties in the country such as the Congress, the Socialists and others, the intervention by most of the Arab Countries who aimed for prevention and protection of the Yemen unification as another example of the German unification and was regarded as the first step towards comprehensive unification of the whole Arab world, failed to prevent civil war which erupted on May 1994 as a result of the domestic political crisis following the election. The war caused huge damage in buildings, military equipments, etc. Cost of the war has been estimated around US \$ 11 billion. Although the period after the end of the civil war has witnessed political peace since July 1994, the economy has experienced severe inflation with low growth rate. The present government launched several reforms to improve the slow economic growth resulted from the civil war and the unification burden. In other words, the burden of unification was being reduced gradually.

The economies of former parts of the Yemen were characterised by capitalist and socialist systems, the difference was only in degree. The structure of both the economies tended towards the services sector rather than productive sector. The difference prevailed only in terms of polity and ideology. Comparative macro-economic structures of the economies of PDRY and YAR are presented in Table 1.

**Table 1**  
**Comparison Between YAR and PDRY 1969-98**

Percent

S. No.	Indicators	YAR	PDRY
1.	C/GNP	85	79
2.	C/GDP	1.05	1.06
3.	I/GDP	20	34
4.	G/GDP	34	71
5.	(M-X)/GDP	+31.6	+61.5
6.	X/GDP	7	7
7.	M/GDP	38.6	68.5
8.	FD/GDP	8.3	28.6
9.	MS/GDP	76.7	127
10.	GDP (Per capita)	US\$ 76 in 1969 US\$ 572 in 1988	US\$ 100 in 1969 US\$ 508 in 1988
11.	GNP (Per capita)	US\$ 640 in 1988	US\$ 430 in 1988

**Source:** Central Statistical Organisation, Statistical Year Books, Various Issues.

World Development Report 1993, P. 238, WB

The present government of Republic of Yemen has adopted the following strategic objectives for the development of the economy :

- Applied the financial, administrative and economic reforms.
- On the advice of International Monetary Fund (IMF), regarding reduction in government expenditure, reduction in labour force, privatization, fixed exchange rate and removal of the subsidies on the main supported commodities.
- Higher growth rates in the main productive sectors.
- Improved standard of living.
- Expanded base of government revenues.

The present study attempts to provide macro-econometric analysis of the economy of the Republic of Yemen. It has been conceived at a time when not many macro-models are available for the Arab economies. It is a modest and the first attempt of macro modeling of the former economies and to generate simulation for the present economy.

The objective in the present study is to estimate a macro-econometric model of the macro-aggregates of the erstwhile economies of Yemen Arab Republic (YAR) and People's Democratic Republic of Yemen (PDRY). through econometric models, estimated one each for YAR and PDRY economy. These two macro-econometric models have

been used for simulation of the economy of Republic of Yemen for the period 1990-94. The plan of the paper is to deal with the background of the Republic of Yemen. The basic macro model is also discussed while the estimated model is also given. Simulation of the model is given and conclusions are presented at the end.

### **BASIC MACRO MODEL**

Construction of national economic models of the market economies has witnessed a rapid development over the past decades. Not only have the size and conceptual sophistication of these models increased but the number of nations of which models have been built has grown as well. Macro-econometric description of an economic system has proved useful in organizing and combining theoretical beliefs and economic time series for policy prescription and forecasting. However, with respect to the socialist countries, such econometric models have not been popular. Among the socialist economists there was a skepticism regarding the usefulness of such stochastic, behaviourally oriented models in describing the macro economic realities of a planned economy. Western econometricians also tended to ignore the socialist economies, partly because they shared the concerns of their socialist colleagues regarding the conceptual feasibility of building national models of planned economies and partly because of their doubts regarding the quality, availability and conceptual consistency of macro economic data available in the socialist countries (King 1979 P. 98).

In the case of the Arab countries, the construction of econometric models is still at its infancy not so much because of lack of expertise but quality of data make their use in economic planning and forecasting less reliable. However, Al-Sharbaji (1985) has estimated a few equations based on time series data for some Arab economies as illustration while explaining some econometric concepts. As the Republic of Yemen came into existence only on 22 May 1990, it was not possible to have a macro model for it due to very few observations. However, it is possible to construct macro models separately for erstwhile economies of Yemen Arab Republic (YAR) and People's Democratic Republic of Yemen (PDRY). As has been pointed out earlier that the structures of these two former economies were more or less identical. Both the economies manifest features of socialist as well as capitalist systems, the difference was of the degree only. It was more ideology and polity rather than economic in nature. So much so that relatively similar planning process started with three year programme followed by five years plans in both the economies. In both the cases, planning process was nominal because of its dependency on the external resources. The objectives, sources of finance and the strategy of planning process in the former economies were also remarkably similar.

An attempt is being made in this section to capture the common structural features of the former two economies, viz., YAR and PDRY economies; through macro modelling. The task was not an easy one, because one part of the present Republic of Yemen (YAR) had developed on the lines of the market economy, while the other part (PDRY) followed the centralised planning.

The model presented here manifests the basic characteristics of any developing economy resembling the former Yemen economies, and is the first and modest attempt. Basic model is an annual model in nominal and real variables and the variables and the equations of the model in each case can be classified into five sectors, viz:

- (i) Production sector.
- (ii) Aggregate expenditure sector.
- (iii) Fiscal sector.
- (iv) External sector, and
- (v) Monetary sector.

The equations are linear both in variables and parameters.

In this section, specifications of the equations comprising a macro-model that illustrate the structure of the former Yemen economies during the period 1969-1989 are presented. Each endogenous variable determined by an equation is shown against it on the extreme right of the margin.

### Production Sector

$$GPD_t = GDP(LAB, K, GDP_{t-1}) \quad : GDP$$

$$K_t = K_{t-1} + I_t \quad : K_t$$

### Aggregate Expenditure Sector

$$CONS = CONS(YDIS, CONS_{t-1}, Trend) \quad : CONS$$

$$INVG = INVG(GNP, r, IMP, F, GRANTS, Trend, INVG_{t-1}) \quad : INVG$$

$$YDIS = GNP - TXD \quad : YDIS$$

$$GNP = GDP + NIA \quad : GNP$$

$$CONS = GNP - INVG - GOVT - EXP + IMP \quad : CONS$$

$$TXD = GREV - TXIND - N.TXR - F, GRANTS \quad : TXD$$

### Fiscal Sector

$$GOVT = GOVT(GNP, MS, GOVT_{t-1}, F, GRANTS, Trend) \quad : GOVT$$

$$GREV = GREV(GNP, GREV_{t-1}) \quad : GREV$$

$$FD = GOVT - GREV \quad : FD$$

### External Sector

$$IMP = IMP(GNP, IMP_{t-1}, F, GRANTS, NIA, F, LOANS) \quad : IMP$$

$$EXP = EXP(GNP, EXP_{t-1}) \quad : EXP$$

**Monetary Sector**

$$MS = MS(\text{Trend}, r, P, \text{GNP}, MS_{-1}, \text{FD}, \text{VEL}) \quad ; \text{MS}$$

$$P = P(\text{MS}, MS, \Delta MS_{-1}, \text{FD}, \text{NIA}) \quad ; P$$

$$\Delta MS = (MS - MS_{-1}) \quad ; \text{MS}$$

$$r = r(\text{MS}, r_{-1}, \text{Trend}) \quad ; r$$

**List of Endogenous Variables**

CONS	=	Private Consumption Expenditure
EXP	=	Total Exports
FD	=	Fiscal Deficit
GDP	=	Gross Domestic Product
GOVT	=	Total Government Expenditure
GNP	=	Gross National Product
GREV	=	Total Government Revenue
IMP	=	Total Imports
MS	=	Money Supply
YDIS	=	Private Disposable Income
TXD	=	Director Tax
INVG	=	Gross Investment
r	=	Interest Rate for 12 month
Pgdp	=	Implicit GDP Deflator
$\Delta MS$	=	Change in Money Supply
K	=	Capital Stock
P	=	General Index Number

**Pre-determined Variables**

FGRANTS	=	Foreign Grants
NIA	=	Net Income from Abroad
INVG <sub>-1</sub>	=	Lagged Investment
GREV <sub>-1</sub>	=	Lagged Government Revenue
EXP <sub>-1</sub>	=	Lagged Total Exports
IMP <sub>-1</sub>	=	Lagged Total Imports
MS <sub>-1</sub>	=	Lagged Money Supply
Pgdp <sub>-1</sub>	=	Lagged Implicit GDP Deflator
$\varphi, r_{-1}$	=	Lagged Rate of Interest

**ESTIMATED MODEL**

The estimated model comprising stochastic equations and definitional identities are listed below separately for former Yemen economies. This would serve as an econometric description of the erstwhile components of the present economy of the Republic of Yemen.

As stated earlier the former Yemen economies combined the elements of socialism or interventionist features and market features. However, the different was a matter of degree (Abdi 1996).

These models have been used to simulate the time path of major macro-variables of the present Republic of Yemen economy, for the period 1990.

For the each regression t-values are given in parentheses directly under the regression coefficient. Coefficient of determination  $R^2$ , adjusted  $\bar{R}^2$  for degrees of freedom  $\bar{R}^2$  and Durbin-Watson (DW) statistic are also given. Single asterisk on a coefficient shows that it is significantly different from zero at 5 percent level of significance; and double asterisks indicate that is significant at 10 per cent level of significance.

### Estimated Model of the Former South Yemen (PDRY) Economy

Model for the former South Yemen (PDRY) economy contains 10 equations and seven definitional identities explaining 17 endogenous variables. The macro-variables have been expressed in current prices. The variables in PDRY are measured at million of Yemeni Dinar at current market prices, because the inflation was more or less negligible. The choice has been dictated by two features. First, the degree of inflation was kept moderate because of interventionist approach of the former South Yemen Government. Secondly, suitable deflators which represent wide economy were not readily available.

#### Production Equation

$$\text{GDP} = -11.10 + 525.50^* \text{LAB} + 0.18^* \text{K} \quad \dots (1)$$

(4.50)                      (9.30)

$$R^2 = 0.95 \quad \bar{R}^2 = 0.94$$

$$\text{DW} = 1.64 \quad \text{Log likelihood} = -99.7$$

#### Aggregate Expenditure Equations

$$\text{CONS} = 56.30 + 0.46 \text{YDIS} \quad \dots (2)$$

(5.83)

$$R^2 = 0.64 \quad \bar{R}^2 = 0.62$$

$$\text{DW} = 0.53 \quad \text{Log likelihood} = -144.7$$

$$\text{INVG} = -8.85 + 0.17^* \text{GNP} + 0.51^* \text{INVG-1} \quad \dots (3)$$

(2.16)                      (2.12)

$$R^2 = 0.93 \quad \bar{R}^2 = 0.92$$

$$\text{DW} = 0.91 \quad \text{Log likelihood} = -83.6$$

#### Fiscal Equations

$$\text{GOVT} = 17.72 + 0.31^* \text{GNP} + 0.28^* \text{MS} \quad \dots (4)$$

(4.01)                      (5.01)

$$R^2 = 0.98 \quad \bar{R}^2 = 0.97 \quad \text{DW} = 1.53 \quad \text{Log likelihood} = -91.4$$

$$\text{GREV} = -7.31 + 0.18^* \text{GNP} + 0.44^* \text{GREV-1} \quad \dots (5)$$

(3.33)                      (2.54)

$$\begin{aligned} R^2 &= 0.95 & \bar{R}^2 &= 0.94 \\ DW &= 2.16 & \text{Log likelihood} &= -77.5 \end{aligned}$$

*External Equations*

$$\text{IMP} = 13.77 + 1.31^* \text{FGRANTS} + 0.82^* \text{NIA} + 0.27^* \text{GDP} \quad \dots (6)$$

(2.71)                      (5.25)                      (5.41)

$$\begin{aligned} R^2 &= 0.95 & \bar{R}^2 &= 0.92 \\ DW &= 1.73 & \text{Log likelihood} &= -90.2 \end{aligned}$$

$$\text{EXP} = -0.55 + 0.01 \text{GNP} + 0.81^* \text{EXP-1} \quad \dots (7)$$

(1.80)                      (3.78)

$$\begin{aligned} R^2 &= 0.57 & \bar{R}^2 &= 0.52 \\ DW &= 0.56 & \text{Log likelihood} &= 70.6 \end{aligned}$$

*Monetary Equations*

$$\text{MS} = 16.23 + 0.47^* \text{FD} + 0.91^* \text{MS-1} \quad \dots (8)$$

(2.59)                      (17.00)

$$\begin{aligned} R^2 &= 0.99 & \bar{R}^2 &= 0.98 \\ DW &= 1.48 & \text{Log likelihood} &= 83.6 \end{aligned}$$

$$\text{P} = 164.60 + 1.02^* \text{FD} + 1.76^* \text{MS} \quad \dots (9)$$

(5.50)                      (3.20)

$$\begin{aligned} R^2 &= 0.86 & \bar{R}^2 &= 0.84 \\ DW &= 0.87 & \text{Log likelihood} &= -101.4 \end{aligned}$$

$$\text{r} = 2.01 + 0.01 \text{MS} + 0.66^* \text{r-1} \quad \dots (10)$$

(0.02)                      (4.73)

$$\begin{aligned} R^2 &= 0.62 & \bar{R}^2 &= 0.58 \\ Dw &= 2.16 & \text{Log likelihood} &= 563.4 \end{aligned}$$

In addition there are seven definitional identities (2,5,6,7,8,11,16) are given in Section 2.

In the former PDRY, the data on private consumption expenditure were not available. It has been obtained as a residue from the GNP identity as follows (Krishnamurty 1964).

Thus,  $\text{CONS} = \text{GNP} - \text{INVG} - \text{GOVT} - \text{EXP} - \text{IMP}$

at current market prices, because the inflation was more or less negligible.

The equations selected for the model for PDRY was as given below.

$$\text{CONS} = 56.30^* + 0.46^* \text{YDIS} \quad \dots (1)$$

t-ratio (2.15) (5.83)

$$\begin{aligned} R^2 &= 0.64 & \bar{R}^2 &= 0.62 \\ DW &= 0.53 & \text{Log likelihood} &= -144.7 \end{aligned}$$

The interpretation of regression (1) shows that disposable income explains about 64 percent of the variation in the consumption expenditure and the slope coefficient (Marginal Propensity to Consume) is 0.46 and is statistically significant. This indicates that an increase by 100 Dinar in disposable income, the private consumption expenditure increases by 46 Dinar at current market prices.

The intercept is statistically significant and shows positive relationship between consumption and disposable income. Some authors have suggested that the intercept term, in most cases has no economic meaning (Gujarati 1988, p. 125). In the present case, some economic explanation may be provided, i. e., the consumption function for former South Yemen was non-proportional and short-run in nature, and  $APC > MPC$  even on annual basis.

The estimates of MPC are very low, perhaps because the consumption expenditure derived from the GNP identity and used here does not include the expenditure incurred on the education, housing, health etc. This component of households expenditure in the former PDRY were provided by the government and covered under the head *materials and supplies*. If the private consumption expenditure is adjusted for this, then a separate series is generated which includes materials and supplies and this series (CONS 1) has been used in the following equation

$$\text{CONS 1} = 39.20 + 0.64 (\text{YDIS}) \quad \dots (2)$$

$$R^2 = 0.87 \quad \bar{R}^2 = 0.86$$

The MPC obtained here is now higher than that obtained with the unadjusted CONS. Similarly the estimate of  $R^2$  has also increased. The investment was allocated and implemented through the government as the result the GNP is significant. In government expenditure equation, the GNP is significant because all the items of expenditures were provided by the government. The responsiveness of GNP to government revenue was higher, it may be because of a tight tax administration.

Because of government control on foreign trade the GDP is higher and statistically significant for the explanation of imports. The fiscal deficit is the main source of money expansion and it was more important in explanation of prices. The role of monetary policy was very limited for both prices and interest rate were controlled by the Government and the money facilitated transaction.

### **Estimated Model of the Former North Yemen (YAR) Economy**

In the former North Yemen (i.e. YAR) economy, there are nine equations and six definitional identities explaining 15 endogenous variables. The model has been estimated in real prices, it was because the degree of inflation was higher than that in South Yemen during the period.

The variables in YAR are measured at million of Yemeni Rial at current market prices and these variables have been converted into real prices by using implicit GDP deflator at 1981 prices.

#### Aggregate Expenditure Equations

$$\text{CONS} = 2.268 + 0.67^* \text{YDIS} \quad \dots (1)$$

(9.07)

$$\begin{aligned} R^2 &= 0.81 & \bar{R}^2 &= 0.80 \\ \text{DW} &= 0.81 & \text{Log likelihood} &= 19.8 \\ \text{INVG} &= 1.04 + 0.05 \text{GNP} - 0.22 + 0.76^* \text{INVG-1} \quad \dots (2) \\ & (0.86) & & (0.21) (4.44) \end{aligned}$$

$$\begin{aligned} R^2 &= 0.78 & \bar{R}^2 &= 0.76 \\ \text{DW} &= 1.59 & \text{Log likelihood} &= -68.9 \end{aligned}$$

#### Fiscal Equations

$$\text{GOVT} = -2.74 + 1.53^{**} \text{FGRANTS} + 0.36^* \text{MS} \quad \dots (3)$$

(1.89) (4.89)

$$\begin{aligned} R^2 &= 0.74 & \bar{R}^2 &= 0.71 \\ \text{DW} &= 0.83 & \text{Log likelihood} &= -84.6 \\ \text{GREV} &= -7.68 + 0.13^* \text{GNP} + 0.71^* \text{GREV-1} \quad \dots (4) \\ & (2.39) & & (5.59) \end{aligned}$$

$$\begin{aligned} R^2 &= 0.89 & \bar{R}^2 &= 0.88 \\ \text{DW} &= 1.25 & \text{Log likelihood} &= -71.4 \end{aligned}$$

#### External Equations

$$\text{IMP} = -9.06 + 1.96^* \text{FGRANTS} + 0.61^* \text{NIA} + 0.19^* \text{GDP} \quad \dots (5)$$

(2.37) (3.65) (3.16)

$$\begin{aligned} R^2 &= 0.82 & \bar{R}^2 &= 0.79 \\ \text{DW} &= 1.02 & \text{Log likelihood} &= -81.4 \end{aligned}$$

$$\text{EXP} = 0.09 + 0.02 \text{GNP} + 0.63^* \text{EXP-1} \quad \dots (6)$$

(1.22) (8.01)

$$\begin{aligned} R^2 &= 0.76 & \bar{R}^2 &= 0.73 \\ \text{DW} &= 1.67 & \text{Log likelihood} &= 541 \end{aligned}$$

#### Monetary Equations

$$\text{MS} = -420.3 - 53.90 r + 158.90^* \text{Pgdp} \quad \dots (7)$$

(0.35) (19.69)

$$\begin{aligned} R^2 &= 0.96 & \bar{R}^2 &= 0.95 \\ \text{DW} &= 1.76 & \text{Log likelihood} &= -189.4 \\ r &= 2.51 + 2.25^* \text{MS} + 0.76^* r-1 \quad \dots (8) \\ & (5.53) & & (6.06) \end{aligned}$$

$$\begin{aligned} R^2 &= 0.82 & \bar{R}^2 &= 0.80 \end{aligned}$$

$$\begin{aligned}
 & DW = 1.54 \quad \text{Log likelihood} = -38.01 \\
 & \text{Pgdp} = 5.14 + 0.90 \cdot \text{Pgdp-1} + 0.01 \cdot \Delta \text{MS} \dots (9) \\
 & \quad (13.60) \quad (2.40) \\
 & R^2 = 0.96 \quad \bar{R}^2 = 0.95 \\
 & DW = 1.87 \quad \text{Log likelihood} = -83.4
 \end{aligned}$$

In addition six definitional identities close the system. These are equations 5,6,7,8,11,16, Viz YDIS, GNP, CONS, TXD, FD, MS.

The consumption expenditure was relatively higher because the YAR was an open economy and secondly the high consumption expenditure in neighbouring rich oil countries affected the consumption behaviour. The investment expenditure was also allocated through the government while the implementation was through the private sector as the result the GNP in investment equation is not statistically significant.

The government control on government expenditure was limited and provided only for the necessities but it depend highly on the foreign grants. The rules of monetary policy was relatively larger, the prices determined by marked forces, interest rate relatively higher and determined by government. In other words the Intervention of the government was limited.

### Summing Up

The two models estimated separately for former two Yemen economies reveal the common structural features of these economies. In some cases difference are evident. In other words the economies had more or less identical features, but whatever differences appear, they were due to ideology and polity followed in then. In a nutshell the similarities are more pronounced and are as follows :

- In most of the cases the lagged behaviour was highly significant, because the planners depend heavily on the past experience for adopting the economic development planning in both the former economies.
- The estimates of marginal propensity to consume (MPC), in the two economies were quite close to each other. It can be concluded that the behaviour of private consumption expenditure did not differ significantly in the two former economies.
- As the domestic resources measured through Gross Domestic Product could not meet all the domestic needs, the imports are mainly financed through the external resources such as foreign grants and net income from abroad. However, it can be said that large part of imports went into the consumption needs rather the production requirements. Likewise, the exports were not enough to cover the import gap. On the other hand, most of the exports were in the kind of natural products such as fish, honey, salts and crude oil and this

explains the identical export ratios in both cases.

- The interest rate was not effective in the former economies because of the intervention of the former governments in their determination, as shown by the highly significant lagged interest rate.
- In both former economies the investment determined and allocated by the governments on the basis of past trend, this led the lagged investment to be highly significant.
- As is well known, the government expenditure is the engine of growth, but in former South Yemen (PDRY) it was mainly financed through the monetary expansion resulting in high fiscal deficit. In case of former North Yemen (YAR), the government expenditure was financed through monetary expansion and the foreign grants.

The major difference observed are given below:

- The money supply in the former South Yemen (PDRY) was created to meet the large fiscal deficit and to finance the economic development process because all the items of expenditure were financed through the government. This led to increase the burden on the government budget resulting in large fiscal deficit while in case of North Yemen (YAR) it was low and the money supply was created to meet the increase in prices.
- The rise in prices in former South Yemen (PDRY) was due to the large fiscal deficit, while in case of former North Yemen (YAR) the increase in prices was due to the money supply.
- The Gross Domestic Product in former South Yemen (PDRY) estimated through production method was influenced by two factors, i.e., labour employed and capital. The labour employed had high impact on production because the government policy was to employ all the labour force.

In case of former North Yemen (YAR) the Gross Domestic Product was estimated by expenditure method, i.e., by adding consumption, gross investment, government expenditure and exports net of imports.

#### **SIMULATION OF THE MODEL FOR THE ECONOMY OF REPUBLIC OF YEMEN**

It was not possible to have a macro-econometric model for the Republic of Yemen, because of data limitations and also because the country was divided into two economies with two orientations polar i.e., one socialist and the other market. Accordingly, two separate models have been estimated here one each for YAR (North Yemen) and PDRY (South Yemen). However, simulations have been obtained here, using these two models, for the Republic of Yemen covering a part of the sample period (i.e. 1981-89) as well as post-sample period (i.e., 1990-94)

## Model Validation

The sample period is 1969 through 1989, therefore the model validation exercise has been split into two parts. First, check how did it capture movements during the second half of the sample period namely 1981 through 1989. Second simulate the model beyond the sample period upto 1984 with 1990 as the initial year, namely 1990, 1991, 1992, 1993 and 1994.

The Republic of Yemen came into existence on May 22, 1990. The official data on some of the macro-economic variables are available separately for the former YAR (North Yemen) and PDRY (South Yemen) as well as combined, in the same currency, for the year 1989 only. Since 1990 onwards the data are available only for the Republic of Yemen as a whole given in Table 2.

**Table 2**  
**The Main-Economic Variables For Republic of Yemen**  
**At current Price, in Million Riols**

Variables	1990	1991	1992	1993	1994
1. Gross National Product (GNP)	90958	107067	130483	165369	210256
2. Private Consumption Expenditure (CONS)	74898	80892	100865	123024	159096
3. Gross Investment (INVG)	9795	9970	16623	20370	23370
4. Total Government Expenditure (GOVT)	35967	50979	57042	68983	77654
5. Total Exports (EXP)	9972	10797	8605	8615	9926
6. Total Imports (IMP)	27876	24425	34463	34599	36156
7. Total Government Revenue (GREV)	26011	37998	34170	38123	45772
8. Fiscal Deficit (FD)	9956	12981	22872	30860	31877
9. Trade Deficit (TD)	17904	13628	25858	25984	26230
10. Gross Domestic Product (GDP)	89290	106312	129111	164012	209438
11. Money Supply (MS)	75449	83143	102590	135866	176536
12. Net Factor Income from the rest world	1668	755	1372	1377	818
13. Disposable Income	102542	112490	144987	181501	22687*
14. Per Capita GNP (Riols)	7030	7979	9378	11462	14052
15. Population Resident at mid-year (000)	12939	13418	13914	14429	14963

\* Estimated.

**Source:** Ministry of Planning and Development, Central Statistical Organisation, Statistical Year book, 1994, P 276, P 282, P 255, P 256, P 257, P 262

For the purpose of simulation it was necessary to generate the data in combined form expressed in common currency covering second part of the sample period, i.e. 1981-89, the exchange rate for 1981-89 are given in Table 3.

**Table 3**  
**Exchange Rate for 1981-89**

Period	1981	1982	1983	1984	1985	1986	1987	1988	1989
Rial/Dinar average	13.2	13.2	13.2	15.4	18.6	21.5	26.0	28.1	28.3

**Source:** Central Bank of Yemen, Financial Statistical Bulletin, July-December, 1992, Vol. 3, p.2.

These generated data are treated as actual while the simulated values have been obtained separately for former North and South Yemen and then combined.

Considering these as actual values and simulated values, respectively, root mean square percentage error (RMSPE) has obtained for the Republic of Yemen as follows :

$$\text{RMSPE} = \left[ \frac{1}{T} \sum_{i=1}^T \frac{(F_i - A_i)^2}{A_i^2} \right]^{1/2} \times 100$$

where A's are actual values and F's are simulated values.

Table 4 gives distribution of variables by the magnitude of root mean square percentage error (RMSPE). Nine endogenous variables have been considered for this exercise for both periods, viz., 1981-89 and 1990-94.

**Table 4**  
**Frequency Distribution of Root Mean Square Error**

Root Mean Square Percentage Error (RMSPE)	1981/89		1990/94	
	Frequency	Variables	Frequency	Variables
0-1	3	CONS, INVG GOVT	2	GNP, CONS
1-3	4	GNP, EXP, IMP, TD	6	GOVT, INVG IMP, GREV, TD, EXP
3+	2	FD, GREV	1	FD
	9	9	9	9

$$\text{RMSPE} = \left[ \frac{1}{T} \sum_{i=1}^T \frac{(F_i - A_i)^2}{A_i^2} \right]^{1/2} \times 100$$

where A's are actual values and F's are simulated values.

**Source :** Compiled by the Authors based on the Data of Table 2.

These nine variables are Gross National Product (GNP), Private Consumption Expenditure (CONS), Gross Investment (INVG), Total Government Expenditure (GOVT), Total Exports (EXP), Total Imports (IMP), Total Government Revenue (GREV), Fiscal Deficit (FD) and Trade Deficit (TD).

The values of RMPSE's have been grouped into three classes, viz., 0-1, 1-3 and above 3. Only three variables have RMSPE less than one percent during 1981-89, these are private consumption expenditure, gross investment and total government expenditure. In the period 1991-94, only two variables have RMSPE less than one percent, these are Gross National Product and Private Consumption expenditure. Similarly four variables have RMSPE that lie between one to three percent during 1981-89, these are gross national product, total exports, total imports and trade deficit. In the period 1990-94, only six variables have RMPSE that lie between one to three percent, these are, total government expenditure, gross investment, total imports, total exports, total government, revenue and trade deficit. Finally two variables have RMSPE more than three percent during 1981-89. These are fiscal deficit and government revenue. In the period 1990-94 only one variable have RMSPE more than three percent i.e. fiscal deficit. From this, it can be concluded that the simulation for the period 1990-94 is very close to perfect. This is evident in the charts 1-8.

### Summing UP

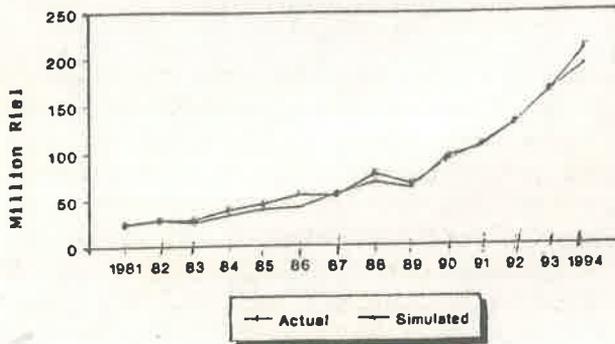
This section has aimed to show the trend path of some important variables, these are Gross National Product, Private Consumption Expenditure, Gross Investment, Government Expenditure, Total Exports, Total Imports, Government Revenue, Trade Deficit and Fiscal Deficit for the period 1981-89 as well as to simulate the trend path of the same variables for the period beyond the sample period, i.e., 1990-94.

Two separate models have been estimated one each for the former North Yemen (YAR) and former South Yemen (PDRY). However, simulations have been obtained here using these two models for the Republic of Yemen covering a part of the sample period (i.e. 1981-89) as well as post-sample period (i.e., 1990-94). Briefly, the main conclusion are that:

- (a) the trend path of the most variables for both periods has less RMSPE and is situated in the first and second range;
- (b) the fiscal deficit for both periods is high. Thus the government expenditure should be decreased to reduce the fiscal deficit;
- (c) the accelerated growth of the Yemen economy is not sustainable unless accompanied by policies to promote larger export earnings, and applying the policy of the reduction of government expenditure.

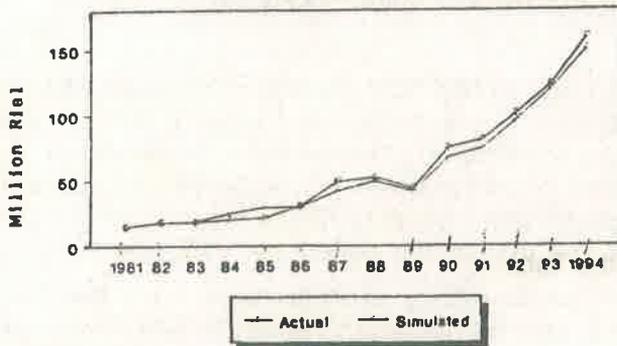
As shown from the Table 4 the fiscal deficit is the main feature of the former economies however, the present Republic of Yemen inherited it. As in case of German Unification observed by Chandra (1996), the high cost of unification and civil war has aggravated the fiscal crisis in the Republic.

**Chart 1**  
**Actual and Simulated Values**  
**Gross National Product (GNP)**



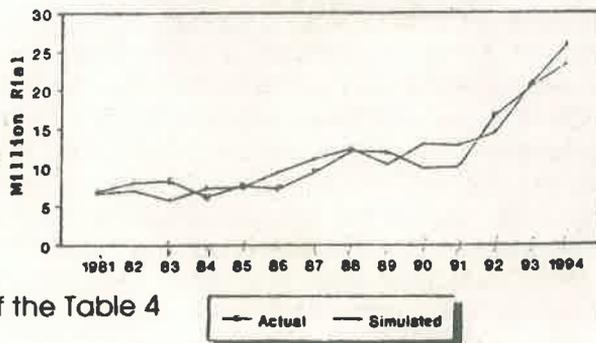
Source : As of the Table 4

**Chart 2**  
**Actual and Simulated Values**  
**Private Consumption Expenditure (CONS)**



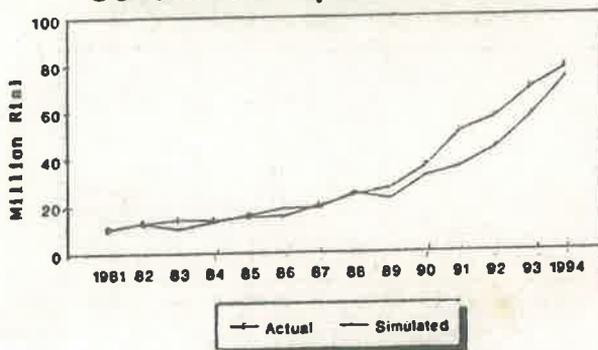
Source : As of the Table 4

**Chart 3**  
**Actual and Simulated Values**  
**Gross Investment (INVG)**

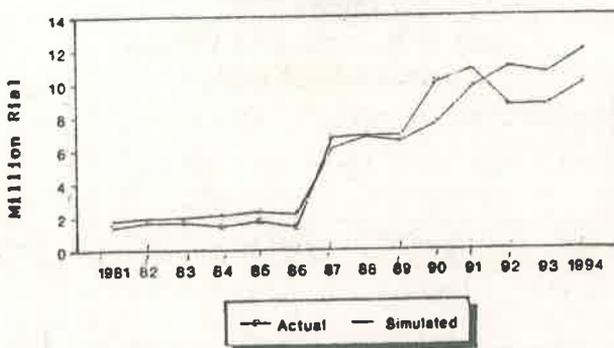


Source: As of the Table 4

**Chart 4**  
**Actual and Simulated Values**  
**Government Expenditure (GOVT)**

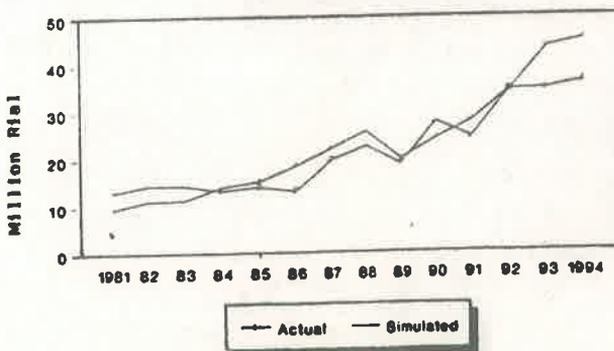


**Chart 5**  
**Actual and Simulated Values**  
**Total Exports (EXP)**



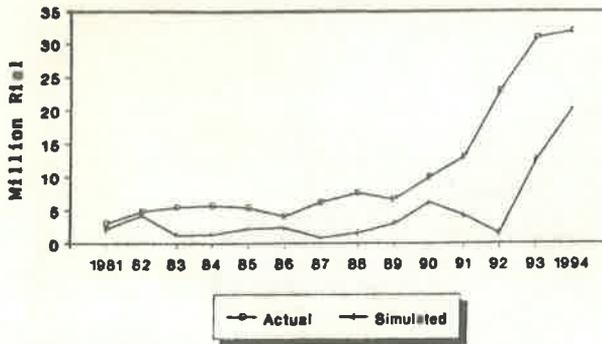
Source : As of the Table 4

**Chart 6**  
**Actual and Simulated Values**  
**Total Imports (IMP)**



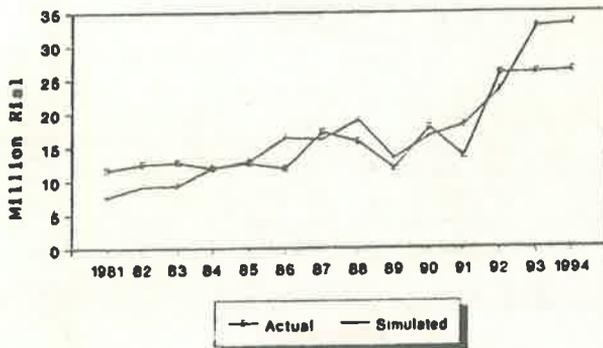
Source : As of the Table 4

**Chart 7**  
**Actual and Simulated Values**  
**Government Fiscal Deficit (FD)**



Source : As of the Table 4.

**Chart 8**  
**Actual and Simulated Values**  
**Trade Deficit (TD)**



Source : As of the Table 4

Table 5  
Actual and Simulated Variables

Year	GNP			CONS			INVG			GOVT			EXP		
	A	S	e	A	S	e	A	S	e	A	S	e	A	S	e
1918	23421	24461	-1040	14878	15008	-130	6917	6626	292	10077	10420	-348	1382	1761	-409
1922	28334	28730	-396	18279	18193	86	8044	7022	1022	12658	12707	-49	1629	1908	-279
1933	29371	25576	3795	18231	18802	571	8201	5742	246	14231	10312	3919	1641	1947	-306
1934	39230	33495	5735	20475	25373	-4898	6137	7247	-1110	13452	12658	794	1413	2035	-682
1966	46793	39737	6656	21621	29447	-7826	7541	7419	122	14974	15809	-835	1707	2272	-565
1966	54811	41269	13542	30447	29784	663	7200	9841	-2142	15312	18542	-3236	1381	2121	-740
1967	54097	55905	-1803	48977	42108	6868	9325	11062	-1740	19810	18912	898	6702	6072	624
1968	75981	67981	9000	52355	49375	2980	12042	12358	-317	24285	25288	-1003	4839	6763	76
1969	66000	61762	4238	44239	42129	2110	11920	10318	1602	27275	22711	4564	6853	6486	367
1990	90958	96869	4911	74898	67719.2	7179	9795	12917	-3123	36967	31887	4079	9972	7520	2459
1991	107068	104414	2653	80892	24284.9	6608	9970	12708	-2738	50929	36632	15347	10797	9697	1099
1992	130483	130394	89	100865	95732.9	5185	16623	14301	23321	57041	43734	13307	8405	10932	-2327
1993	163389	164897	492	123024	119833.1	3191	20370	20719	-349	69983	57175	11807	8615	10554	-1939
1994	210256	192956	17300	159096	149779.6	9317	23370	25847	-2477	77654	73779	3875	9926	11907	-1981

A : Actual  
S : Simulated  
e: Error

(contd.)

Year	IMP			GREY			FD			TD		
	A	S	e	A	S	e	A	S	e	A	S	e
1918	12920	9854	3566	7034	8229	-1195	3041	2191	850	11563	7593	3925
1982	14414	11111	3302	7881	8547	-666	4789	4175	614	12520	9203	3317
1983	14382	11233	3149	7262	9076	-1814	5535	1242	4293	12737	9287	3450
1984	13326	14079	-754	7902	11531	-3629	5760	1327	4433	11909	11984	-75
1985	14013	15211	-1198	9609	13637	-4028	5363	2172	3191	12615	12939	-324
1986	13234	18527	-5293	11494	16268	-4774	4018	2280	1738	11853	16406	-4553
1987	19693	22258	-2565	13666	18098	-4432	6147	814	5334	17234	16181	1063
1988	22671	25804	3133	16729	23729	-7000	7555	1559	5996	15831	19041	-3210
1989	18779	19884	1104	20583	25627	-5044	6632	2916	3721	11924	13398	-1474
1990	27876	24174	2702	26011	25686	325	9956	6201	3755	17904	16654	1250
1991	24425	27915	-3490	37998	31361	6637	12981	4272	8704	13628	18217	-4589
1992	34463	34306	157	34170	42191	-3021	22872	1543	21329	25858	23374	2484
1993	34599	43383	-8785	38123	44657	-6544	30860	12508	18352	25984	32829	-6845
1994	36156	45096	-8940	45777	53439	-7662	31877	20840	11537	26230	33189	-6959

A : Actual  
S : Simulated  
e: Error

## CONCLUSION

The present study aims to show, in a quantitative fashion, the macro-economic structure of the Yemen economies for the period 1969 through 1994. It is a modest attempt to construct macro models for these economies. Basic features of the two economies reveal some similarities and differences between them.

The main similarities were the existence of central economic planning, controlling prices of necessary goods, the rate of interest kept at a low level and controlled by the government, exports very modest, imports at a large size at similar composition and direction, the main component of government revenue was indirect taxes, etc.

The estimates of marginal propensity to consume are quite close and the lagged variable are highly significant for both economies. While the main differences include the public sectors playing the leading role in the former PDRY economy, whereas the private sector had the dominance in the former YAR economy. The shares in GDP of government expenditure, money supply, fiscal deficit, were higher in the former PDRY because all the kinds of expenditures were provided by the government. The money supply was the major source of finance for the government expenditures leading to higher fiscal deficit. Other difference is the per capita income is lower in former PDRY. According to the World Development Report (1990), the per capita income of PDRY was US\$ 430 and that of YAR US\$ 640 in 1988. Notwithstanding the differences, the economies of former parts of Yemen were characterised by some features of both capitalist and socialist systems.

The structural equations have been estimated by using the OLS technique. Major findings are given below:

- The marginal propensity to consume (MPC) in former PDRY at current prices is 0.64 very close to MPC (0.67) in former YAR at real prices. From this it can be concluded that the behaviour of private consumption expenditure did not differ significantly in two former economies.
- The current prices in former PDRY more or less stable due to the government control and the economic development has, therefore, been measured at current prices.
- The lagged investment is highly significant in both the former economies because the investment planning was dependent on past trend. This has affected the reliability of data also.
- The labour employed factor was highly significant on the production in former PDRY economy rather than the capital factor because the objective of the government policy was mainly the employment generation to absorb all the work force which entered the labour market.

- In external sector, the foreign grants, migrants remittances and loans were the main sources of finance for the imports gap. The specification of import equation for both economies reveals that the net income from abroad was highly significant, and the lagged export was significant in the export function.
- In the fiscal sector, the government expenditure had been financed mainly through three main sources, viz., money supply, foreign grants and national income. The government expenditure equations show that the above factors were significant but the money supply was the main source to finance government expenditure in PDRY whereas the foreign grant was in YAR. The lagged government revenue was highly significant as reflected by government revenue equations.
- The monetary policy instruments were not effective, and the money supply was highly influenced by its lag. Prices and rate of interest were affected by their respective lag, as the result of intervention of the former governments to keep the prices of necessary goods and rate of interest low and almost constant.
- In most of the estimated equations, the macro variables were highly affected their lagged variables. This was because the planners depended on the past experience rather the current need of the economy.
- Other observation is that both of the former economies were highly importing economies, depended heavily on foreign grants, loans and migrants remittances to finance their economic development process and the government needs. The domestic resources were very limited and could not meet all the requirements of economic plans. Former economies suffered from inherited structural imbalances as a result of economic and political policies. As the economies were heavily dependent on aids from foreign countries, no efforts were made to mobilise the domestic resources.

The Republic of Yemen has been greatly influenced by the Gulf crisis of August, 1990 when most of the foreign grants, aids discontinued, the remittances also dried-up due to mass influx of nationals migrants from the neighbouring countries. Recently, several Somalies refugees migrated into the Republic of Yemen which also increased the economic burden of the new government. Thus, the government of Republic of Yemen has always suffered and has so far not been able to recover from its past-economic burden of unification. These findings might help policy makers in the present Republic of Yemen to frame successful policies and enable them to learn from the follies of previous governments.

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