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A LINK MODEL FOR PAKISTAN, INDIA, BANGLADESH AND SRI LANKA

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CHAPTER I

INTRODUCTION

Rapid progress has been made in the field of econometric modelling in both developed and developing countries since the first econometric model of the United States was presented by Klein and Goldberger. Much use has been made of econometric models, particularly for policy-making purposes. These models are generally constructed for a specific country without an explicit linkage with other countries, and assume that policy measures taken in one country do not affect other countries or regions. In reality, national economies are linked through foreign trade, capital movements and migration. It was this realization that led to the creation of Project Link in 1968 with the express purpose of tying together national models to provide a *consistent* framework for studying the phenomenon of inter-dependence of national economies. Similar efforts are now being pursued by the ESCAP Secretariat through the Project Asian Sub-Link to promote a better understanding of the extent of inter-dependence among the economies of the region.

In recent years, there has been an increased interest in promoting economic cooperation among the developing countries. Such concerns have also been voiced by Pakistan, India, Bangladesh and Sri Lanka. However, these expressions of 'concern' are more in the nature of political statements which implicitly lay the blame on the other country for *not* recognizing the inter-dependent nature - potentially if not actually -

of the economies of the region. Such statements, however, serve no useful purpose. A better approach, indeed the only one, is to talk through numbers. And this number game is best played with a regional econometric model in hand.

Even though trade among these countries constitutes an insignificant proportion of their total world trade, a modelling of these trade relations could provide a quantitative basis for evaluating 'facts', and for exploring future possibilities of expanding regional trade in a meaningful way. An example of the utility of a regional econometric model is the finding of the present study that trade between Pakistan and India is a *decreasing* function of GNP. We are more united in poverty than in prosperity. Even worse is the asymmetrical trade relationship, highlighted by this study, between Sri Lanka and India and between Sri Lanka and Pakistan: whereas Sri Lankan imports from India and Pakistan are an increasing function of its GNP, the Indian and Pakistani imports from Sri Lanka are a decreasing function of their GNPs. These are facts which must be changed if regional cooperation is to make any sense. However, the different ways of remedying these 'facts' are best explored by 'simulating' various policy options within the framework of an explicit regional econometric model, such as we propose in this study.

The purpose of this report is to examine the scope of trade activities among Pakistan, India, Bangladesh and Sri Lanka. To do this, an econometric model has been constructed

for each country, and these country models are then linked with each other through foreign trade equations.[1] The four models specified in this study are 'simple' but not entirely 'unrepresentative'. Another approach would have been to take existing national models and link them through trade equations. However, with the exception of Pakistan and India, no other country of the region yet possesses an elaborate econometric model. It is hoped that despite its simplicity the specifications prescribed in this study would form a good starting point for a bigger regional link model.

In Chapter II, a prototype linkage model is presented and the methodology used to estimate it is explained. The estimates of the parameters of the model are reported in Chapter III. The results of 'historical simulations' are reported in Chapters IV to VIII. In Chapter IX, policy implications, based on estimated results, are briefly examined, while Chapter X concludes the report.

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[1] It is interesting to note that the Project Link, based in University of Pennsylvania, also links national models by means of trade flows.

SPECIFICATION OF THE LINK MODEL

CHAPTER II

SPECIFICATION OF THE LINK MODEL

As already mentioned, data limitations have constrained us to specify a highly aggregated model. For expositional purposes, the link model is divided into six sectors, viz. private consumption expenditures, public consumption expenditures, investment, money demand, prices, and foreign trade. Each country model consists of 8 equations, out of which 5 are behavioural and 3 are definitional relations and identities. Also, for each country, there are 10 trade equations which together form the link. Of these, 4 are behavioural equations, while the rest are definitional relations. It should be noted that the link model presented below is predominantly demand-oriented since all the behavioural equations are specified as demand equations.[1] The complete link model is presented in Table 1 along with an explanation of the notation used in the model.

Equation (1) is the national income (GNP) identity[2], denoting 'domestic absorption'. Equation (2) is a simple Keynesian consumption function which treats private consumption expenditures (C) as positively related to disposable income (Y_d) and inflation ($\dot{P}$). Public consumption expenditure

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[1] In the context of developing countries, it is more appropriate to have supply-oriented models in which supplies of inputs, rather than the adequacy of effective demand, are decisive in determining output. However, where trade equations are the prime movers of the linked system, demand orientations become more relevant. Demand-oriented equations in link model are also used by Klien and Van Peeterssen [7] and Ezaki [3].

[2] Throughout this report, GNP is expressed in *real* terms.

Table I

Linking National Econometric Model:
Pakistan, Bangladesh, India, Sri Lanka

PAKISTAN

1. $Y_p = C_p + I_p + G_p + X_p - M_p$
2. $C_p^p = \alpha_0 + \alpha_1 Y_p^d + \alpha_2 \dot{P}_p$
3. $C_p^g = \alpha_0 + \alpha_1 Z_p + \alpha_2 N_p$
4. $C_p = C_p^p + C_p^g$
5. $I_p = \alpha_0 + \alpha_1 Y_p + \alpha_2 i_p + \alpha_3 m_p + \alpha_4 I_{p-1}$
6. $m_p = \alpha_0 + \alpha_1 Y_p + \alpha_2 \dot{P}_p$
7. $\dot{P}_p = \alpha_0 + \alpha_1 Y_p + \alpha_2 m_p + \alpha_3 \frac{M_p}{Y_p} + \alpha_4 \dot{P}_{p-1} + \alpha_5 \dot{P}_{p-2}$
8. $Y_p^d = Y_p - Z_{ip}$
9. $M_p = M_{PB} + M_{PI} + M_{PS} + M_{PROW}$
10. $X_p = X_{BP} + X_{IP} + X_{SP} + X_{ROWP}$

11-14. $M_{pj} = \alpha_0 + \alpha_1 Y_p$

15. $M_{PB} = X_{BP}$
16. $M_{PS} = X_{SP}$
17. $M_{PI} = X_{IP}$
18. $M_{PROW} = X_{ROWP}$

BANGLADESH

1. $Y_B = C_B + I_B + G_B + X_B - M_B$
2. $C_B^p = \beta_0 + \beta_1 Y_B^d + \beta_2 \dot{P}_B$
3. $C_B^g = \beta_0 + \beta_1 Z_B + \beta_2 N_B$
4. $C_B = C_B^p + C_B^g$
5. $I_B = \beta_0 + \beta_1 Y_B + \beta_2 i_B + \beta_3 m_B + \beta_4 I_{B-1}$
6. $m_B = \beta_0 + \beta_1 Y_B + \beta_2 \dot{P}_B$
7. $\dot{P}_B = \beta_0 + \beta_1 Y_B + \beta_2 m_B + \beta_3 \frac{M_B}{Y_B} + \beta_4 \dot{P}_{B-1} + \beta_5 \dot{P}_{B-2}$
8. $Y_B^d = Y_B - Z_{iB}$
9. $M_B = M_{BP} + M_{BI} + M_{BS} + M_{BROW}$
10. $X_B = X_{PB} + X_{IB} + X_{SB} + X_{ROWB}$

11-14. $M_{Bj} = \beta_0 + \beta_1 Y_B$

15. $M_{BP} = X_{PB}$
16. $M_{BI} = X_{IB}$
17. $M_{BS} = X_{SB}$
18. $M_{BROW} = X_{ROWB}$

INDIA

1. $Y_I = C_I + I_I + G_I + X_I - M_I$
2. $C_I^p = \gamma_0 + \gamma_1 Y_I^d + \gamma_2 \dot{P}_I$
3. $C_I^g = \gamma_0 + \gamma_1 Z_I + \gamma_2 N_I$
4. $C_I = C_I^p + C_I^g$
5. $I_I = \gamma_0 + \gamma_1 Y_I + \gamma_2 i_I + \gamma_3 m_I + \gamma_4 I_{I-1}$
6. $m_I = \gamma_0 + \gamma_1 Y_I + \gamma_2 \dot{P}_I$
7. $\dot{P}_I = \gamma_0 + \gamma_1 Y_I + \gamma_2 m_I + \gamma_3 \frac{M_I}{Y_I} + \gamma_4 \dot{P}_{I-1} + \gamma_5 \dot{P}_{I-2}$
8. $Y_I^d = Y_I - Z_{iI}$
9. $M_I = M_{IP} + M_{IB} + M_{IS} + M_{IROW}$
10. $X_I = X_{PI} + X_{BI} + X_{SI} + X_{ROWI}$

11-14. $M_{Ij} = \gamma_0 + \gamma_1 Y_I$

15. $M_{IP} = X_{PI}$
16. $M_{IB} = X_{BI}$
17. $M_{IS} = X_{SI}$
18. $M_{IROW} = X_{ROWI}$

SRI LANKA

1. $Y_S = C_S + I_S + G_S + X_S - M_S$
2. $C_S^p = \Psi_0 + \Psi_1 Y_S^d + \Psi_2 \dot{P}_S$
3. $C_S^g = \Psi_0 + \Psi_1 Z_S + \Psi_2 N_S$
4. $C_S = C_S^p + C_S^g$
5. $I_S = \Psi_0 + \Psi_1 Y_S + \Psi_2 i_S + \Psi_3 m_S + \Psi_4 I_{S-1}$
6. $m_S = \Psi_0 + \Psi_1 Y_S + \Psi_2 \dot{P}_S$
7. $\dot{P}_S = \Psi_0 + \Psi_1 Y_S + \Psi_2 m_S + \Psi_3 \frac{M_S}{Y_S} + \Psi_4 \dot{P}_{S-1} + \Psi_5 \dot{P}_{S-2}$
8. $Y_S^d = Y_S - Z_{iS}$
9. $M_S = M_{SP} + M_{SI} + M_{SB} + M_{SROW}$
10. $X_S = \dot{X}_{PS} + X_{IS} + M_{BS} + M_{ROWS}$

11-14. $M_{Sj} = \Psi_0 + \Psi_1 Y_S$

15. $M_{SP} = X_{PS}$
16. $M_{SI} = X_{IS}$
17. $M_{SB} = X_{BS}$
18. $M_{SROW} = X_{ROWS}$

Note: For explanations of notations, see the back of this page.

List of Variables

Endogenous Variables			Number
Y	=	Gross National Product	1
C^p	=	Private Consumption Expenditures	1
C^g	=	Public Consumption Expenditures	1
C	=	Total Consumption	1
I	=	Investment	1
m	=	Money Stock	1
$\dot{P}$	=	Rate of Inflation	1
Y^d	=	Disposable Income	1
M	=	Total Imports	1
X	=	Total Exports	1
M_{ij}	=	Imports of ith country from jth country	4
X_{ji}	=	Exports of jth country to ith country	4
			18

Exogenous Variables			
G	=	Public consumption plus public investment	1
Z	=	Total Government Revenue	1
N	=	Population	1
i	=	Interest rate of time deposits	1
M/Y	=	Import-to-GNP ratio	1
Z_i	=	Income and Corporation taxes	1
			6

*the subscript P = Pakistan, I = India, B = Bangladesh,
S = Sri Lanka and Row = Rest of the World.

in equation (3) depends on total public revenue (Z) and population (N), the coefficients of which are expected to bear positive signs. A more complete specification would include foreign aid as an additional explanatory variable. However, as comparable data were not available, we had to make do with the simpler functional relationship postulated in this study. Total consumption expenditures in equation (4) are *defined* as the sum of private and public consumption expenditures. In equation (5), investment (I) is treated as a function of real GNP (Y), interest rate (i), one-year lagged investment (I_{-1}), and real money balances (m). The rationale for including real money balances in the investment equation is that credit rationing is expected to exercise a positive influence on total investment.[3] We expect a positive sign for the coefficients of real money balances, GNP, and lagged investment, while a negative sign is expected for the interest rate coefficient. We specify in equation (6) a money demand function with GNP and inflation ($\dot{P}$) as arguments (elements) of the function. It may be noted that interest rate is treated, quite appropriately, as a policy variable. Inflation is determined in equation (7).[4] Disposable income in equation (8) is defined as GNP minus total direct taxes net of subsidies.

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[3]Fischer and Mayer [4] also use real money balances as a *proxy* for credit rationing.

[4]While identical specifications are reported in Table I to explain inflation, limitations of data did not permit a uniform treatment of this equation across the countries. As will be noted in Chapter III, in the case of Pakistan, inflation is assumed to be determined by real GNP, money supply and the import-to-GNP ratio. For Sri Lanka, inflation is related to real GNP and a one-year lagged money supply; and for India inflation is estimated in terms of the lagged values of inflation alone.

Equation (9) and (10) are simply identities showing that imports and exports of each country are a sum of its intra-regional trade and its trade with the rest of the world (ROW). The four countries of the region are linked with each other through these equations. For example, Pakistan's imports from Sri Lanka are also exports of Sri Lanka to Pakistan.[5] Equations 11 to 14, which are the key equations for linkage, make imports of the ith country from the jth country to depend linearly on GNP in each country. Equations 15 to 18 are *ex post* identities, noting that, for example, Pakistan's imports from Bangladesh are the exports of Bangladesh to Pakistan etc.[6] However, it should be noted that these identities do not require *ex post* bilateral trade balance.

[5]For estimation purposes, one can estimate either the export functions or import functions, but not both. In order to keep the model demand-oriented, we specify import functions instead of export functions.

[6]Imports and exports of goods alone are included while trade in services is excluded.

RESULTS OF ESTIMATION

CHAPTER III

RESULTS OF ESTIMATION

This section reports the estimation results of the link model described in Chapter II. The Ordinary Least Squares (OLS) estimation method has been used to get estimates of parameters. Also, to make corrections for serial correlation that many of the estimated equations suffered from, the Cochrane-Orcutt technique was used. It may be noted that the number of observations are not the same for each country because of the non-availability of consistent time-series data: the total number of observations are 20 (1959-60 to 1978-79) for Pakistan and Sri Lanka, but 19 for India (1960-61-61 to 1978-79) and only 10 for Bangladesh (1959-60 to 1969-70).[1] The results of estimation are reported in Table 2. (A comparison of Tables 1 and 2 shows that model estimation did not alter very much the specified relationships. However, a few changes in the explanatory variables had to be made for individual countries because of the insignificance or wrong signs of some of the variables. In other cases, the data were not available for the four countries on all the variables.)

Private Consumption

Estimates of private consumption expenditure for all the countries, reported in equations 1-4 under Panel I, show that

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[1] The data for Bangladesh are taken from (2) where inter-regional trade between Bangladesh (then East Pakistan) and Pakistan (then West Pakistan) has been treated as international trade.

disposable income is the most important determinant of private consumption.[2] It may be noted that the size of the mpc (marginal propensity to consume) coefficient differs in each of the four countries, suggesting inter-country differences in consumption patterns. However, the mpc is high in all the four countries. This is simply a reflection of the very low income levels prevailing in these countries. Bangladesh has the highest mpc (0.88); i.e. 88 percent of incremental income is consumed.[3] In Pakistan, mpc is 0.84 which is also high compared with those in India (0.77) and Sri Lanka (0.72).[4] It may be noted that almost all the variation in private consumption in these countries is explained by disposable income: $\bar{R}^2$ is close to unity.

Public Consumption

Equations 5-8, under Panel II, show that changes in public consumption in Pakistan, India and Sri Lanka are a function of public revenues alone, while in Bangladesh such changes are explained entirely in terms of the needs of a large population. Again, the elasticity of public consumption with respect to public revenues differs in each country

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[2]Non-availability of disposable-income series made us use gross domestic output for Sri Lanka (GDP).

[3]The mpc estimates are derived from the coefficients of disposable income ($_{y}d$), which, being in log form, are elasticities.

[4]The estimates of the mpc for Pakistan are consistent with those obtained by Khilji[6] and by Naqvi *et al.* in the *PIDE Econometric Model of Pakistan Economy* [10].

suggesting inter-country differences in expenditure patterns of the governments. Equation 6 shows that in India a one-percent increase in public revenue leads to a 0.81-percent increase in public consumption. The elasticity estimates for Pakistan and Sri Lanka suggest that a one-percent increase in public revenues leads to an increase in public consumption by 0.6 percent. In sharp contrast, equation 7 shows that the coefficient of public revenue is insignificant in Bangladesh. This result may appear to be a little odd at first sight. A possible explanation seems to be the relative failure of public revenue to rise sufficiently in Bangladesh to finance government expenditure, which was devoted mostly to coping with the economic consequences of a large and sharply rising population. However, there is a need for respecifying this equation differently.

Table 2

Estimates of Linking National Econometric Model: Pakistan, Bangladesh, India, Sir Lanka

I. Private Consumption Expenditure

(1)	$\ln C_P^p = 0.16 + 0.97 \ln y_P^d$ (43.72)	$\bar{R}^2$ =	0.99
		DW =	1.92
		F =	1911.22
(2)	$\ln C_I^p = 1.95 + 0.832 \ln Y_I^d$ (14.75)	$\bar{R}^2$ =	0.92
		DW =	0.65
		F =	217.70
(3)	$\ln C_B^p = 1.12 + 0.876 \ln Y_B^d$ (25.78)	$\bar{R}^2$ =	0.98
		DW =	1.58
		F =	664.90
(4)	$\ln C_S^p = 0.12 + 0.97 \ln Y_S^d$ (37.73)	$\bar{R}^2$ =	0.99
		DW =	1.93
		F =	1423.32

II. Public Consumption Expenditure

(5) $\ln C_P^g = 2.61 + 0.656 \ln Z_P$ (11.50)
$\bar{R}^2 = 0.87$, DW = 1.74, F = 132.28

(6) $\ln C_I^g = 1.84 + 0.81 \ln Z_I$ (8.41)
$\bar{R}^2 = 0.80$, DW = 1.31, F = 70.71

(7) $\ln C_B^g = -2.40 - 0.02 \ln Z_B + 2.29 \ln N_B$ (0.57) (8.12)
$\bar{R}^2 = 0.87$, DW = 1.81, F = 34.22

(8) $\ln C_S^g = 1.87 + 0.686 \ln Z_S$ (6.08)
$\bar{R}^2 = 0.65$, DW = 2.08, F = 37.01

III. Investment

(9) $\ln I_P = -1.06 + 0.98 \ln Y_P - 0.91 \ln i$ (3.26) (1.80)
$\bar{R}^2 = 0.66$, DW = 1.96, F = 18.38

(10) $\ln I_I = -3.32 + 1.09 \ln Y_I + 0.33 \ln i$ (4.79) (1.70)
$\bar{R}^2 = 0.80$, DW = 1.86, F = 32.86

(11) $\ln I_B = -22.02 + 3.03 \ln Y_B - 0.23 \ln i$ (5.03) (0.63)
$\bar{R}^2 = 0.96$, DW = 2.14, F = 101.31

(12) $\ln I_S = -1.06 + 0.71 \ln I_{S-1} - 0.06 \ln Y_S + 0.49 \ln m$ (4.00) (0.21) (2.02)
$\bar{R}^2 = 0.93$, DW = 1.69, F = 91.18

IV. Demand for Money

(13) $\ln m_P = -3.93 + 1.29 \ln Y_P - 0.39 \ln \dot{P}$ (7.96) (0.82)
$\bar{R}^2 = 0.80$, DW = 1.73, F = 32.88

(14) $\ln m_I = -10.58 + 1.77 \ln Y_I + 0.19 \ln \dot{P}$ (9.85) (0.88)
$\bar{R}^2 = 0.85$, DW = 1.90, F = 45.59

(15) $\ln m_S = -1.27 + 0.998 \ln Y_S + 0.67 \ln \dot{P}$ (6.80) (1.14)
$\bar{R}^2 = 0.81$, DW = 1.96, F = 38.45

V. Inflation

(16) $\ln P_P = -1.23 + 0.3 \ln Y_P - 0.19 \ln m - 0.02 \ln MP/YP$; (2.11) (1.68) (2.93) ; $\bar{R}^2 = 0.51$, DW = 1.35, F = 7.36

(17) $\ln P_I = 0.09 + 0.30 \ln \dot{P}_{I-1} - 0.43 \ln$; (1.22) (1.73) ; $\bar{R}^2 = 0.10$, DW = 1.95, F = 1.86

(18) $\ln \dot{P}_S = -0.66 - 0.12 \ln Y_S + 0.23 \ln M_{-1}$; (1.66) (3.54) ; $\bar{R}^2 = 0.63$, DW = 1.44, F = 16.02

VI. Foreign Trade

i. *Pakistan*

(19) $\ln MPB = -3.34 + 0.95 \ln Y_P$; (12.05) ; $\bar{R}^2 = 0.94$, DW = 1.78, F = 145.25

(20) $\ln MPI = 125.02 - 12.1 \ln Y_P$; (2.32) ; $\bar{R}^2 = 0.38$, DW = 1.82, F = 5.37

(21) $\ln MPS = 8.44 - 0.5 \ln Y_P + 1.78 D$; (0.79) (5.41) ; $\bar{R}^2 = 0.71$, DW = 1.76, F = 22.99

(22) $\ln MROW = -5.38 + 1.34 \ln Y_P - 0.38 D$; (6.18) (2.83) ; $\bar{R}^2 = 0.73$, DW = 1.97, F = 25.81

ii. *India*

(23) $\ln MIP = 95.60 - 7.64 \ln Y_I$; (1.77) ; $\bar{R}^2 = 0.26$, DW = 2.40, F = 3.13

(24) $\ln MIS = 36.03 - 2.71 \ln Y_I$; (1.84) ; $\bar{R}^2 = 0.12$, DW = 1.36, F = 3.41

(25) $\ln MROW = -5.54 + 1.22 \ln Y_I$; (2.23) ; $\bar{R}^2 = 0.19$, DW = 1.46, F = 5.00

iii. *Bangladesh*

(26) $\ln MBP = -4.78 + \underset{(6.77)}{1.18} \ln Y_B$ $\quad \bar{R}^2 = 0.83$, DW = 2.24, F = 45.82

(27) $\ln MROW = -15.29 + \underset{(1.39)}{2.27} \ln Y_B$ $\quad \bar{R}^2 = 0.09$, DW = 2.00, F = 1.93

iv. *Sri Lanka*

(28) $\ln MSP = -15.98 + \underset{(9.47)}{2.21} \ln Y_S$ $\quad \bar{R}^2 = 0.82$, DW = 1.79, F = 89.76

(29) $\ln MSI = -8.49 + \underset{(1.97)}{1.48} \ln Y_S$ $\quad \bar{R}^2 = 0.13$, DW = 1.77, F = 3.89

(30) $\ln MROW = -4.10 + \underset{(3.64)}{1.27} \ln Y_S$ $\quad \bar{R}^2 = 0.39$, DW = 1.80, F = 13.27

Investment Expenditure

Estimates of investment expenditure for all the four countries are reported in Equations 9-12 under Panel III. GNP and interest rate have been used as explanatory variables for Pakistan, India and Bangladesh. GNP turns out to be the most significant variable explaining the behaviour of investment in the three countries. Interest rate is significant for Pakistan (Eq. 9) but insignificant in Bangladesh and Sri Lanka (Eqs. 11, 12). In the case of India (Eq. 10), this variable is significant but has the wrong (positive) sign, suggesting that a higher rate of interest in India provokes more investment there. Indian investors must be real gluttons for a beating if this somewhat sadistic relationship were true.[5]

[5] An earlier econometric model of India also reported interest rate coefficient to be significant, and with a positive sign. See Agarvala [1].

For Sri Lanka (Eq. 12), a somewhat different specification was estimated, introducing lagged investment and real balances. Real balances are statistically significant.[6] The positive sign of the coefficient shows that the availability of credit has led to an increase in investment in Sri Lanka. Lagged investment is also significant, and bears the correct sign. However, as opposed to Equations 9 and 10, the GNP coefficient is insignificant; and the sign is wrong as well. It may be noted that investment equations are uniformly good for all the countries with a sufficiently high $\bar{R}^2$. The D.W. statistics are in the acceptable range, showing an absence of serial correlation.

Demand for Money

Equations 13 to 15 in Panel IV report estimates of money demand function for all countries except Bangladesh.[7] The GNP and the expected rate of inflation have been used as arguments (elements) of the equations. These equations show that, except for Bangladesh, changes in GNP have been the most important determinant of money demand in these countries. The relevant equation for Bangladesh could not be estimated owing to the unavailability of data. It may be noted that the elasticity of demand for money differs considerably across countries, but is

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[6] The real balance variable, which is a proxy for credit availability, turned out to be insignificant for Pakistan and India.

[7] Separate money stock data for Bangladesh are not available.

uniformly high.[8] In the case of Pakistan and India, this elasticity is greater than unity, while for Sri Lanka it is nearly unity. Such high elasticity values imply that there is considerable 'room' for non-inflationary monetary expansion, particularly in India and Pakistan. Another explanatory variable used to explain changes in the demand for money is the expected rate of inflation. However, this variable turned out to be insignificant. On the whole, the three equations in Panel IV explain satisfactorily the changes in the demand for money: $\bar{R}^2$ is uniformly high. Also D.W. statistic is in the acceptable range in all the equations, suggesting an absence of serial correlation.

Inflation

Equations 16 to 18 explain the phenomenon of inflation for India, Pakistan and Sri Lanka. The equation for Bangladesh could not be estimated owing to lack of relevant data. For Pakistan, GNP, money supply and import-to-GNP ratio have been used as arguments of the equation. Here the money-supply coefficient is negative, suggesting that money supply in Pakistan has expanded *accommodatingly* rather than *autonomously*. The import-to-GNP ratio, used as an explanatory variable to account for the effect of imported inflation, is statistically significant, with a negative sign. This suggests that *inflation in Pakistan is not imported*; instead, domestic factors

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[8] See Khan [5].

have borne the main responsibility.[9] Also, the positive sign of Y indicates that growth of GNP has led to higher inflation. This is mainly due to the fact that the share of services sector in GNP has exceeded that of the commodity-producing sectors. The same holds for imports which also appear to have adjusted themselves 'accommodatingly' to, instead of acting autonomously on, domestic inflation in Pakistan. The negative sign of the coefficient of this variable suggests that greater imports have had a *dampening* effect on inflation.

For Sri Lanka, GNP and lagged money supply have been used as explanatory variables. It appears that, in sharp contrast with the situation in Pakistan, *inflation in Sri Lanka has been primarily a monetary phenomenon.* The coefficient of lagged money supply is significant, with a positive sign. It may be noted that the GNP coefficient is also significant. The negative sign of this variable is correct and suggests that an increase in gross national income has tended to dampen inflation in Sri Lanka. The non-availability of consistent data did not permit estimation of a meaningful equation for India. It may be noted that the equations for Pakistan and Sri Lanka are reasonably satisfactory: $\bar{R}^2$ is 0.51 for Pakistan and 0.63 for Sri Lanka. D.W. statistic is also satisfactory, though only marginally. More work is required on the equation for India.

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[9] Similar views have been expressed by Naqvi [8] and Naqvi *et al.* [9] on the nature of inflation in Pakistan.

Foreign Trade

Foreign trade links the four economies. To keep the model simple and manageable, aggregate import functions, instead of export functions, have been estimated for each country.

Pakistan

Equations 19 to 22 show that an increase in GNP in Pakistan has led to a rise in Pakistan's imports from Bangladesh and the rest of the world, while imports from India and Sri Lanka declined. Pakistan's income elasticity is greater than unity and positive for imports from Bangladesh and the rest of the world. On the other hand, the negative elasticity of import demand for India and Sri Lanka shows that each time the GNP increases, Pakistan's imports go down from Sri Lanka and India - particularly from India. The large negative income elasticity for imports from India suggests that from Pakistan's point of view, Indian imports are in the nature of "inferior goods". In order to capture the effects of the separation of East Pakistan on Pakistan's imports, a dummy variable was introduced, taking the value of 1 for the period from 1971-72 to 1978-79 and 0 elsewhere. The coefficient is statistically significant with a positive sign in the case of Pakistani imports from Sri Lanka. This is expected because Pakistan's imports of tea from Bangladesh (former East Pakistan) were replaced by imports from Sri Lanka. Also, the negative and significant coefficient of the East Pakistan dummy for imports from the rest of the world suggests that the separation of East Pakistan from Pakistan led to a significant

decline of Pakistan's imports from the rest of the world - which is again a reasonable result because Pakistan's import needs were reduced by the amount of East Pakistan imports. On the whole, the regression results are highly satisfactory, with the exception of those relating to Pakistan's imports from India (Eq. 20).[10] $\bar{R}^2$ is fairly high, and the D.W. statistic is in the 'acceptance region', showing a near-absence of serial correlation.

India

Equations 23 to 25 of Panel VI display the regression results for India. These equations show that a one-percent increase in the GNP of India led to a *decline* of her imports from Pakistan and Sri Lanka, by 7.64 percent and 2.71 percent respectively, and to a 1.22-percent increase in her imports from the rest of the world. The results verify that both India and Pakistan have consistently followed import-substitution policies, which accounted for a substantial increase in value added (measured in domestic prices), particularly in large-scale manufacturing. Unfortunately all the three equations are statistically poor. More work needs to be done on these equations.

Bangladesh

Equations 26 and 27 report the regression results of imports of Bangladesh from Pakistan and the rest of the world,

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[10] It may be noted that MPI equation contains only 10 observations, from 1959-60 to 1968-69. Trade between India and Pakistan remained suspended from 1969-70 until 1974-75.

respectively. The GNP coefficient is statistically significant, and bears the correct sign. This suggests that a rise in the Bangladesh GNP increases its imports from Pakistan by more than 1 percent. Equation 27 shows a similar pattern of Bangladesh's imports from the rest of the world. Equation 26 is good: $\bar{R}^2$ is sufficiently high and D.W. statistics shows a near-absence of serial correlation. However, equation 27 is not good and needs further work. The equation for Bangladesh's imports from India and Sri Lanka could not be estimated owing to the non-availability of the relevant data.

Sri Lanka

Equations 28 to 30 report the results of Sri Lankan imports from the countries of the region.[11] It is interesting to note that the GNP coefficient (Equation 29) is significant, with a positive sign. This indicates that an increase in Sri Lankan GNP has led to a substantial increase in her imports from Pakistan, suggesting that Pakistan's goods are 'superior' or normal goods from Sri Lanka's point of view. The same is true of Sri Lankan imports from India and from the rest of the world. More work needs to be done on equations 29 and 30; but equation 31 is quite good.

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[11] No equation could be estimated for Sri Lanka's imports from Bangladesh.

VALIDATION (HISTORICAL SIMULATION) OF THE MODEL

CHAPTER IV

INTRODUCTION

In the preceding sections an attempt has been made to describe the working of a set of fairly homogeneous country models, which are 'linked' through trade equations. Considering the somewhat 'stylized' nature of the country models, the estimated equations, taken individually, 'explain' rather well the behaviour of the basic dependent variables. However, the explanatory power of the entire model is best established by showing that it 'tracks' the actual data fairly accurately - i.e. the values *predicted* by the model are close to the *actual* values observed during the sample period. This is called 'historical' simulation (validation) of the model. In Chapters V to VIII, such an exercise has been done to test the predictive power of the model. The criteria used to judge the forecasting accuracy of the model are Root-Mean-Square Error (RMSE) and Theil's Inequality Coefficients(TIC).[1]

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[1] These statistics are defined as:

$$\text{Root-Mean-Square Error (RMSE)} = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(P_t - A_t)^2} \qquad \ldots\ldots\ldots\ldots(1)$$

where P_t is the predicted value, A_t is the actual value over the sample period and n is the number of observations.

$$\text{Theil Inequality Coefficient (TIC)} = \mu = \frac{\sqrt{\frac{1}{n}\sum_{t=1}^{n}(P_t - A_t)^2}}{\sqrt{\frac{1}{n}\sum_{t=1}^{n}(P_t)^2} + \sqrt{\frac{1}{n}\sum_{t=1}^{n}(A_t)^2}}$$

where μ lies between 0 and 1. If $\mu = 0$, then $P_t = A_t$ for all t and there is a perfect fit. If $\mu = 1$, the predictive performance of the model is nil. The closer the μ lies to 0, the better is the prediction. The RMSE has to be read in conjunction with the size of the relevant variable.

In addition to these criteria, we also check how closely the model predicts the various turning points of the actual data. The historical series are presented by solid lines while the predicted series are shown by broken lines. The results of the validation exercise are given in the form of graphs, which have been drawn on the basis of the directions given in the computer print-outs. The values of the Root-Mean-Square Error (RMSE) and Theil Inequality Coefficient (TIC) are given besides all these graphs. The simulated and actual values for all endogenous variables are given in Appendix I.

Even a cursory look at these graphs shows that, on the whole, the estimated equations predict economic 'reality' fairly accurately. The accuracy of the prediction can be measured both by the horizontal distance between the predicted curves (dotted lines) and the actual curves (solid lines), and by the relation of the two curves at the turning points. On both these criteria the estimated results of the link model, as a whole, are not too bad: for approximately one-third of the total number of variables included in the model, the margin of error, measured by the Theil Inequality Coefficient (TIC), is within the 5-percent range, while for the rest of the variables it is in the 10-percent range. The details of validation for Pakistani, Indian, Bangladesh's and Sri Lankan models are set out in the Chapters V to VIII.

CHAPTER V

VALIDATION OF PAKISTAN'S MODEL

In Figures 1 to 9 we present the actual results of historical simulation for Pakistan. Figures 1 to 6 depict the actual and predicted values for GNP, inflation, private and public consumption, total consumption and investment. The two summary statistics, RMSE and TIC, given along with the graphs lie below 10 percent. For private and public consumption, total consumption, inflation and investment these statistics indicate a good fit. The TIC and RMSE values lie between 1 percent and 7 percent while in the case of GNP these concentrate on 10 percent. In particular, the actual and predicted values of private consumption, investment, public consumption and total consumption are extremely close to each other. The turning points are also predicted rather accurately for GNP (Figure 2): the actual and predicted series are extremely close to each other till 1972-73 but diverge substantially thereafter. *Overall, the simulated series of all endogenous variables 'track' the historical data fairly well.*

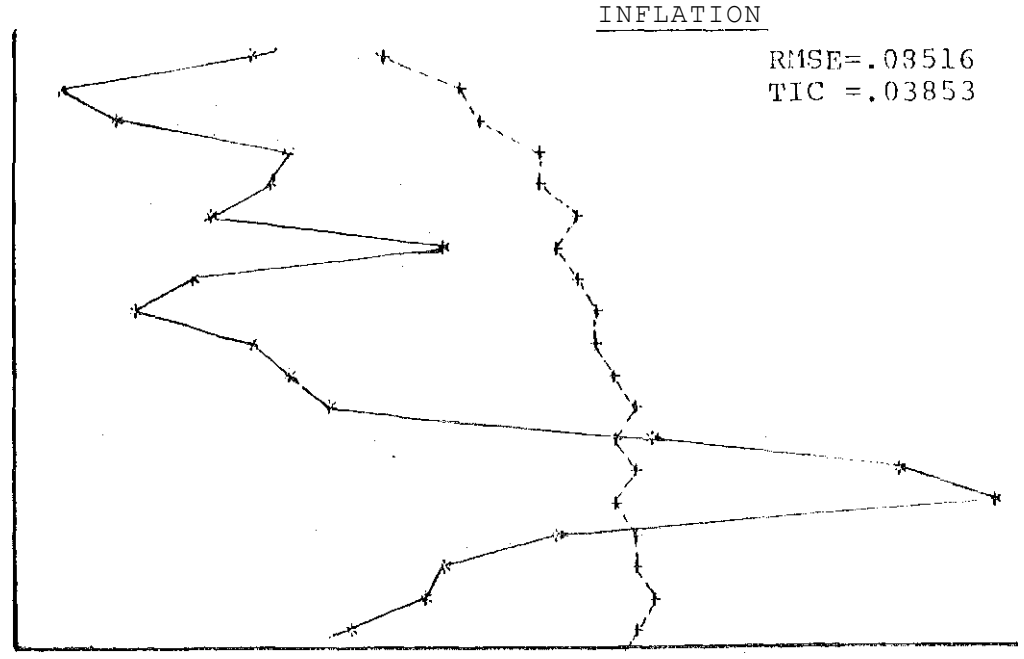
Figures 7 to 9 depict the actual and predicted values of money demand, imports of Pakistan from Sri Lanka (MPS), and imports of Pakistan from the rest of the world (MROW). The TIC values lie between 13 percent and 16 percent for these endogenous variables. For money demand (Figure 7), the actual and predicted series are extremely close to each other till 1972-73; but the predicted series behave erratically after-

VALIDATION OF THE MODEL: PAKISTAN

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

Fig.1
INFLATION

RMSE=.03516
TIC =.03853



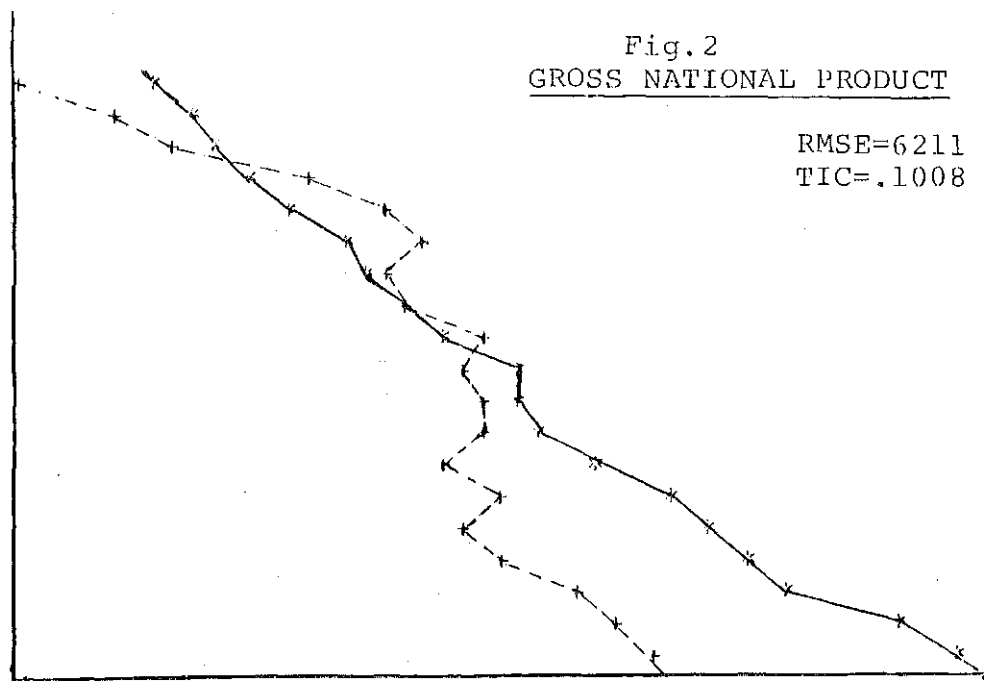
Actual

Predicted

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

Fig.2
GROSS NATIONAL PRODUCT

RMSE=6211
TIC=.1008



VALIDATION OF THE MODEL: PAKISTAN

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

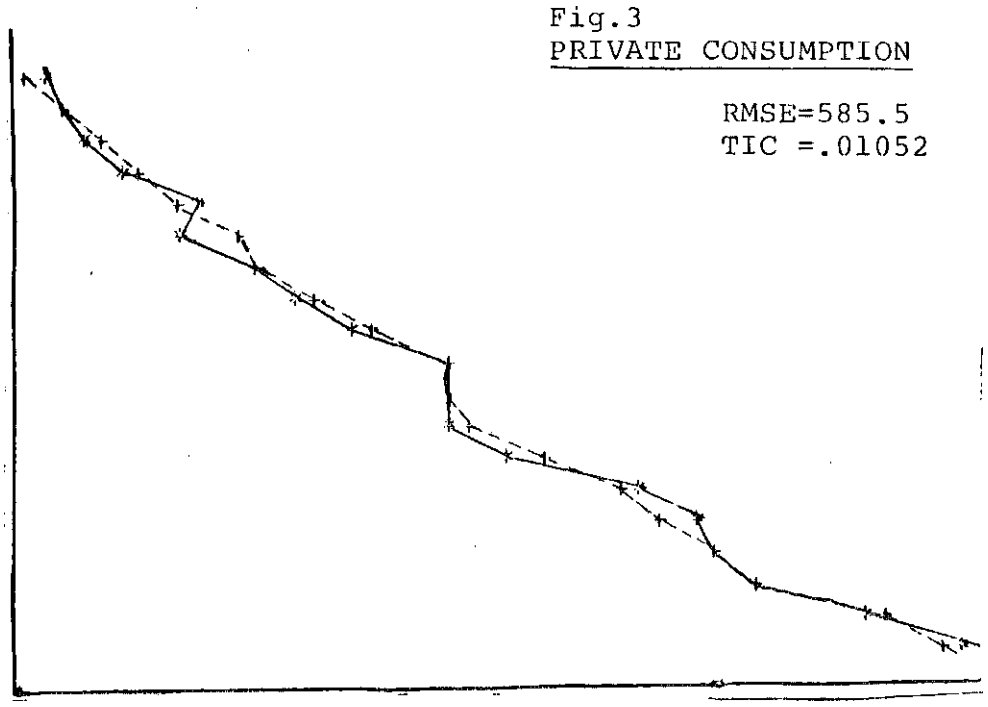


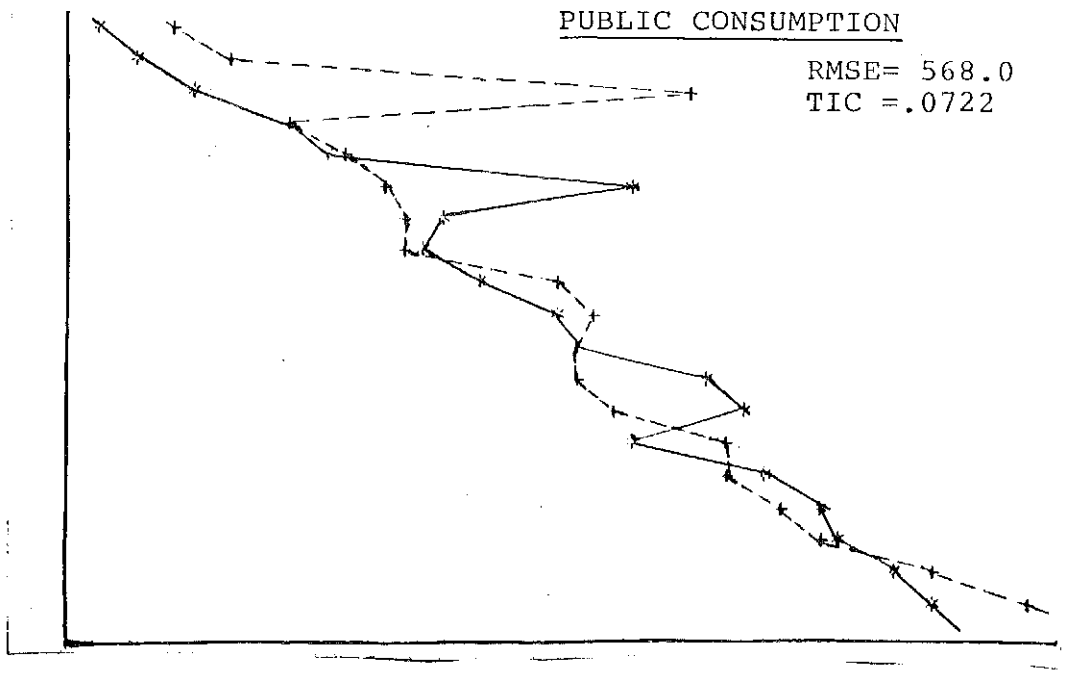
Fig.3
PRIVATE CONSUMPTION

RMSE=585.5
TIC =.01052

Actual_ _
Predicted

PUBLIC CONSUMPTION

RMSE= 568.0
TIC =.0722



VALIDATION OF THE MODEL: PAKISTAN

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

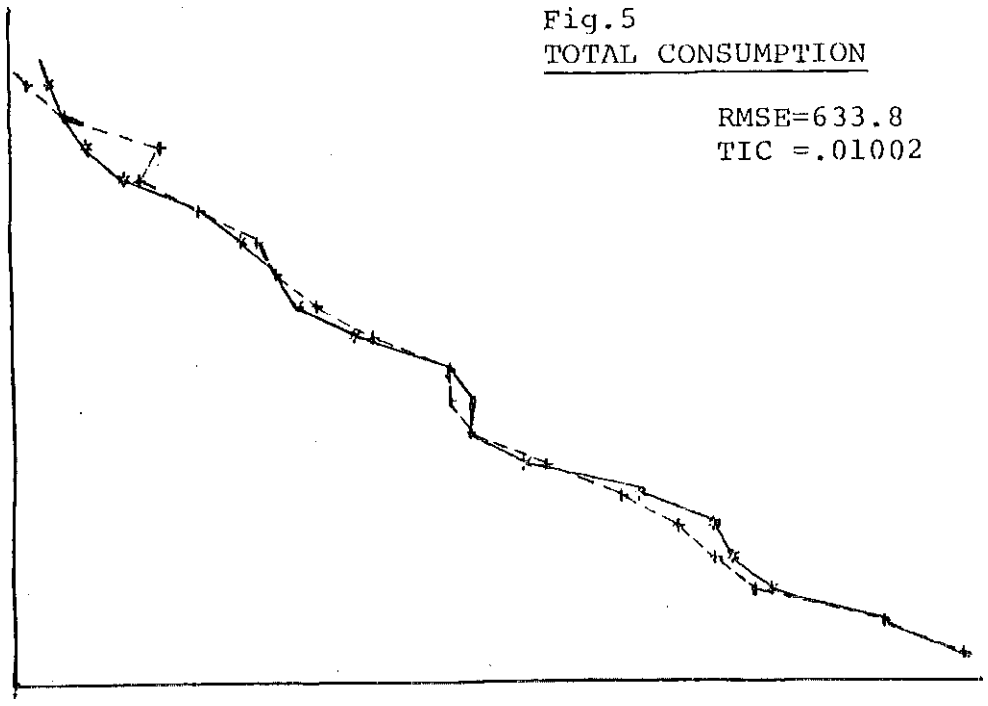


Fig.5
TOTAL CONSUMPTION

RMSE=633.8
TIC =.01002

Actual _____
Predicted------

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

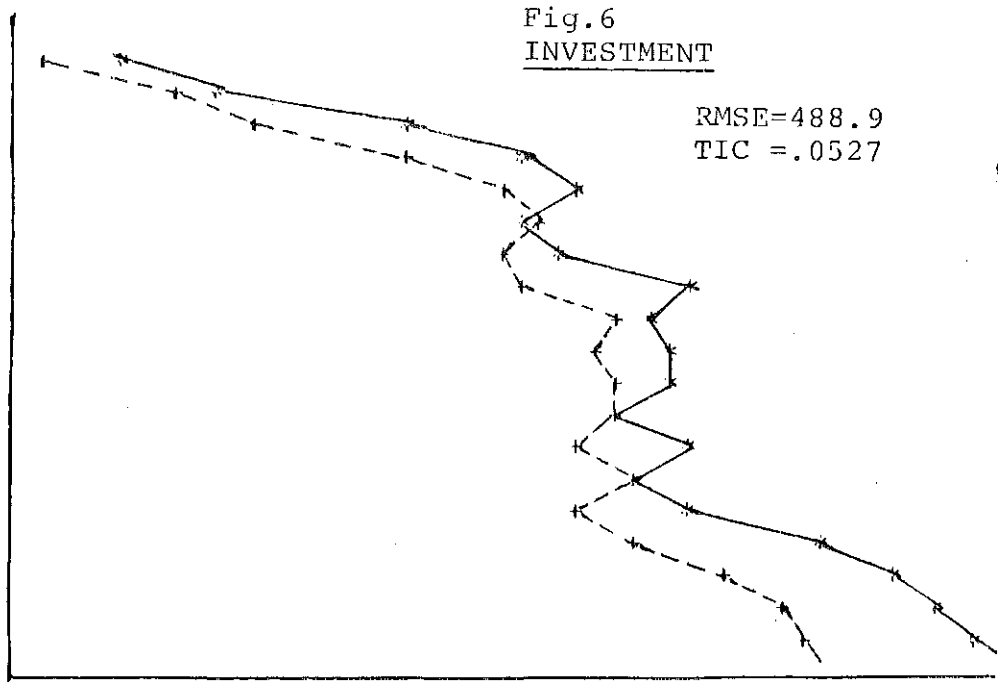


Fig.6
INVESTMENT

RMSE=488.9
TIC =.0527

VALIDATION OF THE MODEL: PAKISTAN

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

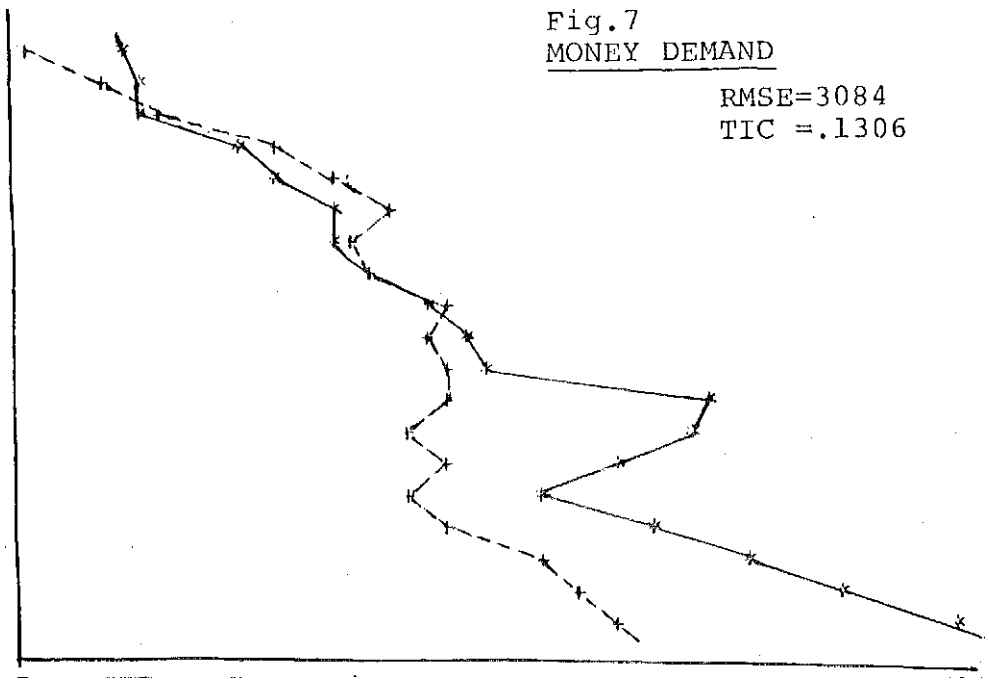


Fig.7
MONEY DEMAND

RMSE=3084
TIC =.1306

Actual_____
Predicted-------

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

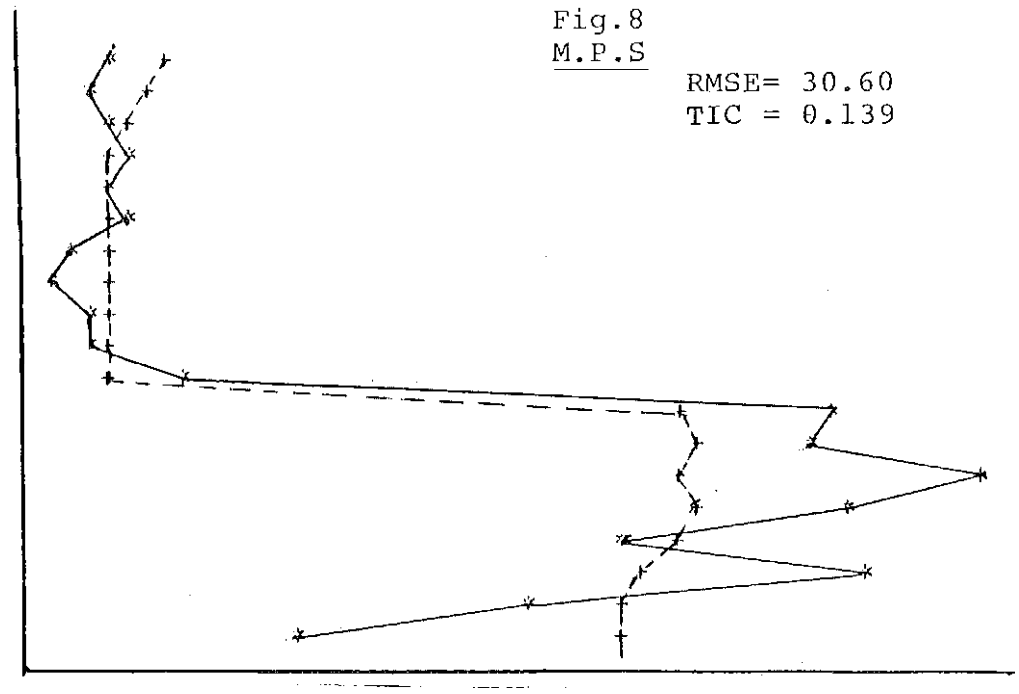


Fig.8
M.P.S

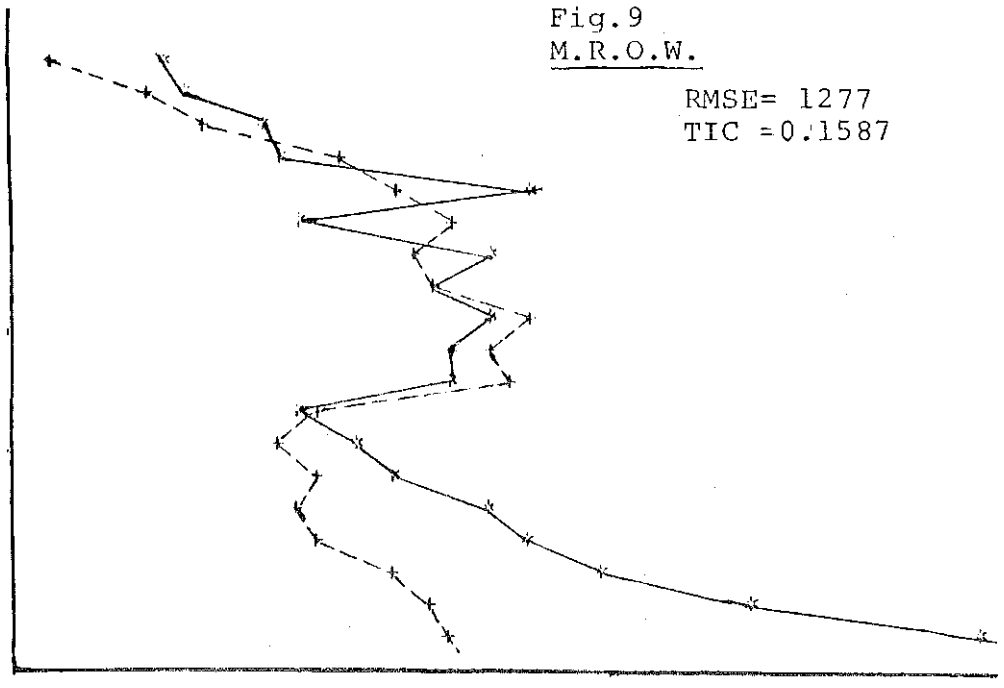
RMSE= 30.60
TIC = 0.139

VALIDATION OF THE MODEL: PAKISTAN

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

Fig.9
M.R.O.W.

RMSE= 1277
TIC =0.1587



Actual

Predicted

wards. The TIC statistic is around 13 percent. Further improvements in the money demand equation may improve the fit. It is Interesting to note that the actual series of MPS show two distinct clusters (Figure 8). The TIC is around 14 percent, and the predicted series track the historical data well. The predicted series are extremely close to the actual series and also come in two distinct clusters. The fit is also good in the sense that it predicts the turning points well. The two clusters indicate that imports of Pakistan from Sri Lanka took a distinct turn in 1972. As mentioned earlier, the bulk of Pakistan's tea, which until 1972 came from East Pakistan, was imported from Sri Lanka after 1972. As a result, a sharp jump is recorded in the imports of Pakistan from Sri Lanka. Fig. 9 depicts the actual and predicted series of imports from the rest of the world (MROW). The TIC is high (16 percent). It can be seen from the figure that simulated values capture every turning point in the historical data.

CHAPTER VI

VALIDATION OF INDIAN MODEL

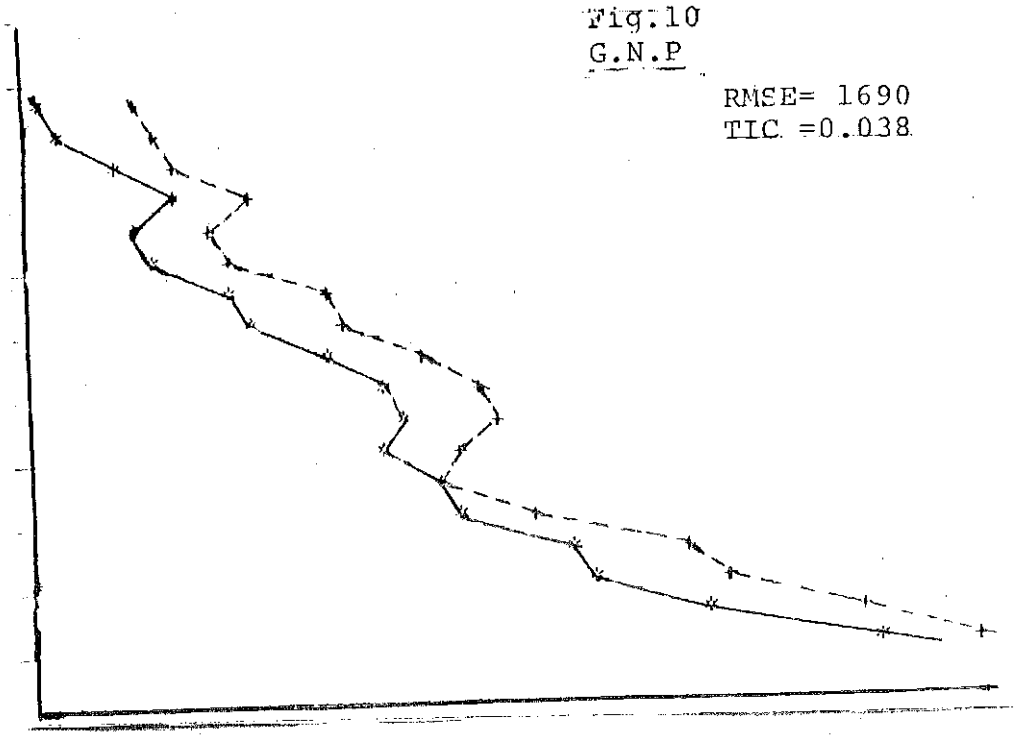
This chapter presents the results of historical simulation performed on the Indian Model. Figures 10 to 17 depict the actual and simulated series of all the endogenous variables in the Indian model -- viz. GNP, private and public consumption, total consumption, investment, money demand, imports of India from Sri Lanka (MIS) and the rest of the world (MROW). (The actual and simulated series of all the endogenous variables are reported in Appendix 2.) It is interesting to note that the Indian model also has a high predictive power. The actual and predicted series are extremely close to each other and the Root-Mean-Square Error (RMSE) and Theil Inequality Coefficient (TIC) for all the endogenous variables lie between 2 percent and 4 percent. Even more important, the simulated values of the endogenous variables capture all the turning points in the actual Indian data. However, the equation for Indian imports from Sri Lanka (MIS) is an exception. Figure 16 shows that the simulated series of MIS behaved erratically during the 1963-65 and 1977-79 periods. However, the simulated series capture most of the turning points in historical data. A better specification with additional information should improve this equation.

VALIDATION OF THE MODEL: INDIA

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

Fig.10
G.N.P

RMSE= 1690
TIC =0.038

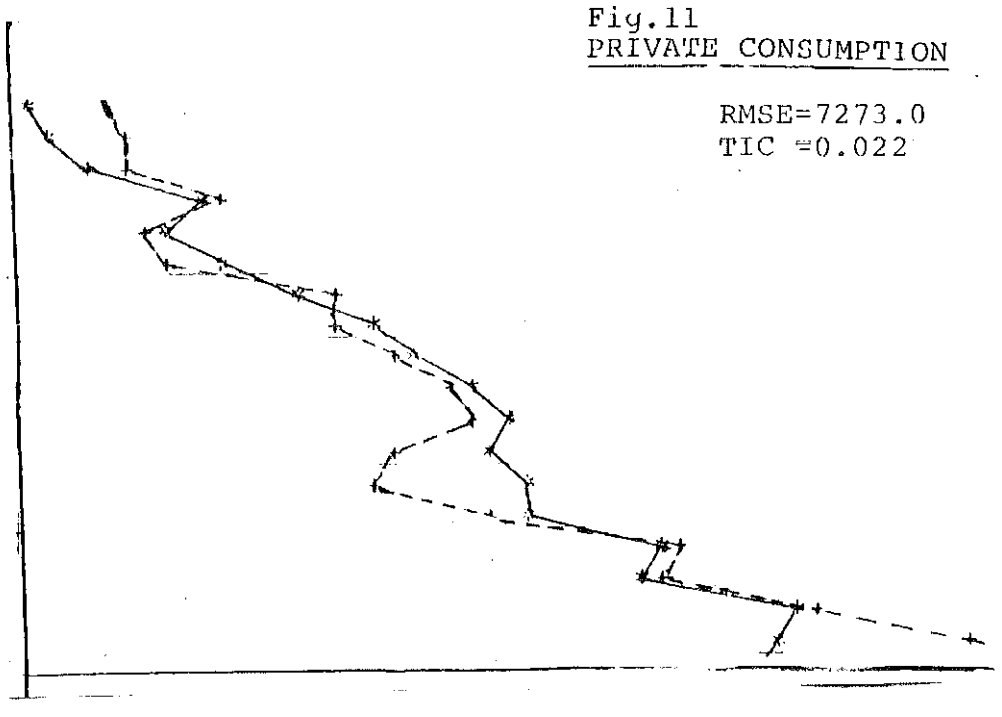


Actual_____
Predicted------

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

Fig.11
PRIVATE CONSUMPTION

RMSE=7273.0
TIC =0.022



PLOT OF ACTUAL(*) AND FITTED(+) VALUES

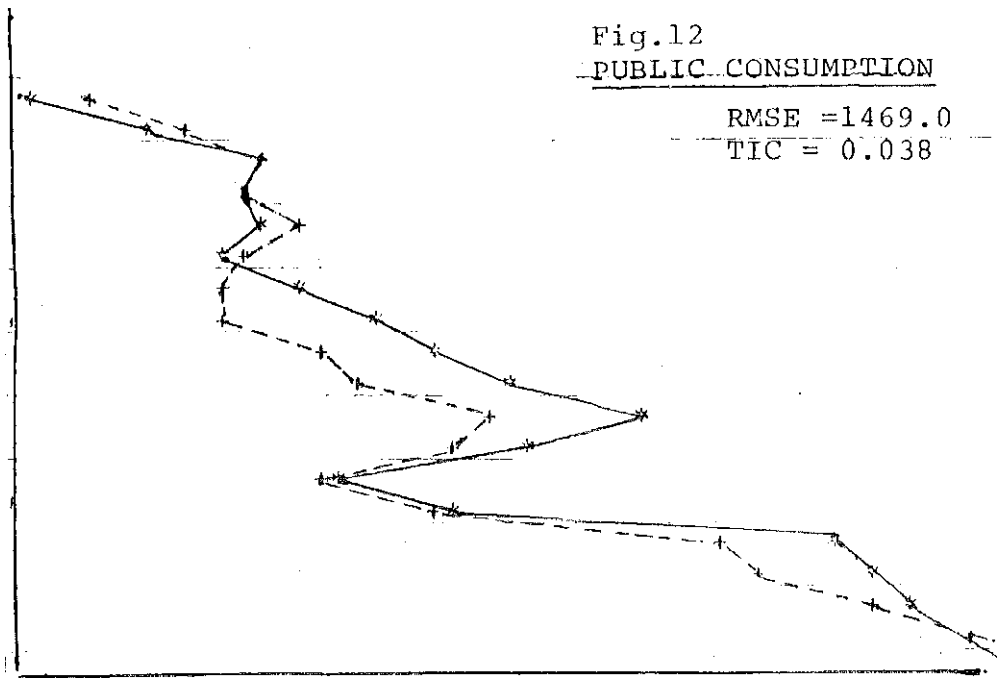


Fig.12
PUBLIC CONSUMPTION

RMSE =1469.0
TIC = 0.038

Actual ——
Predicted-----

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

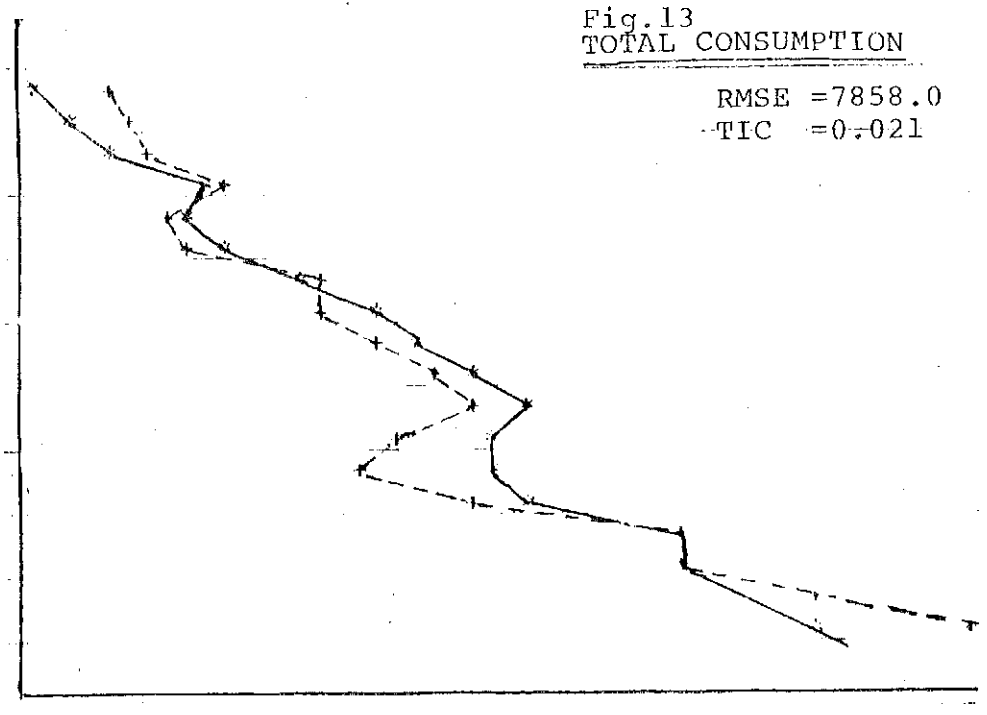


Fig.13
TOTAL CONSUMPTION

RMSE =7858.0
TIC =0.021

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

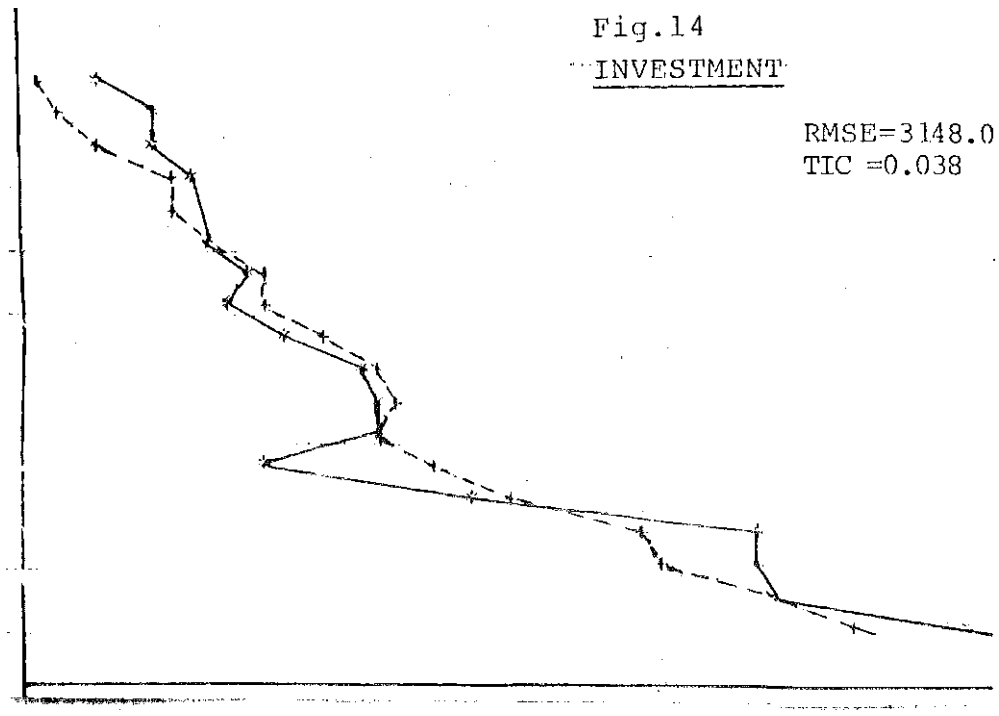


Fig.14
INVESTMENT

RMSE=3148.0
TIC =0.038

Actual_____
Predicted-------

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

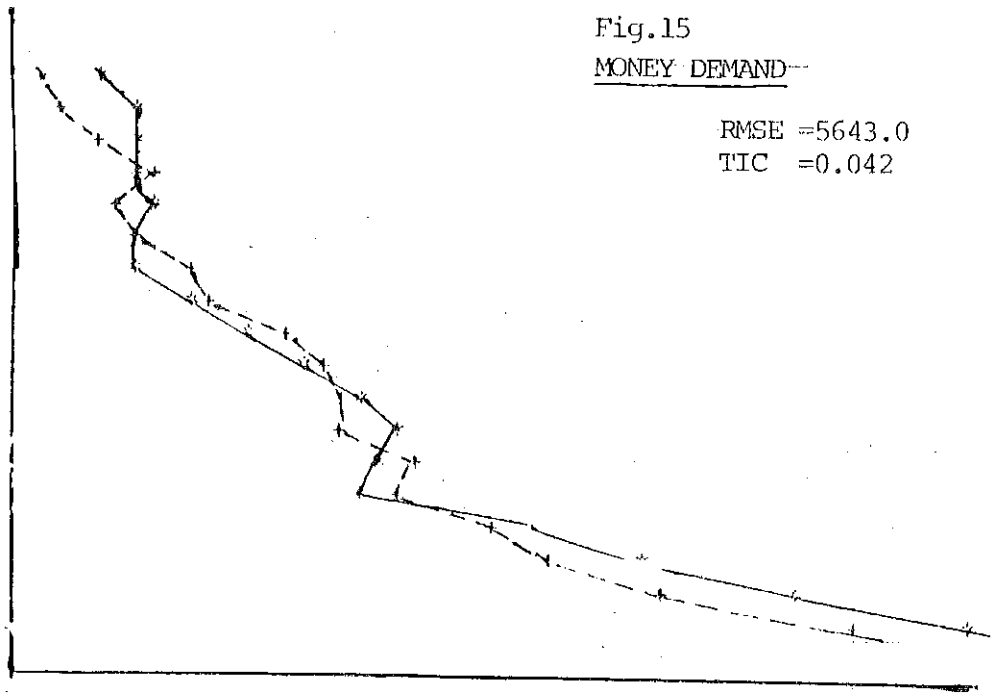


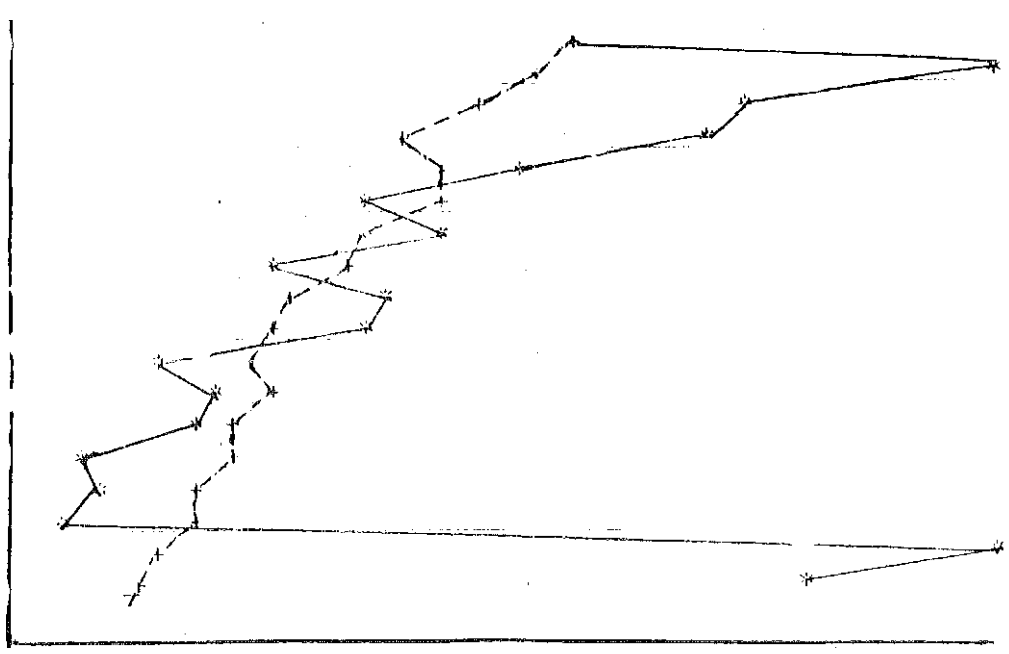
Fig.15
MONEY DEMAND

RMSE =5643.0
TIC =0.042

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

Fig.16 M.I.S.

RMSE=25.91
TIC=0.378

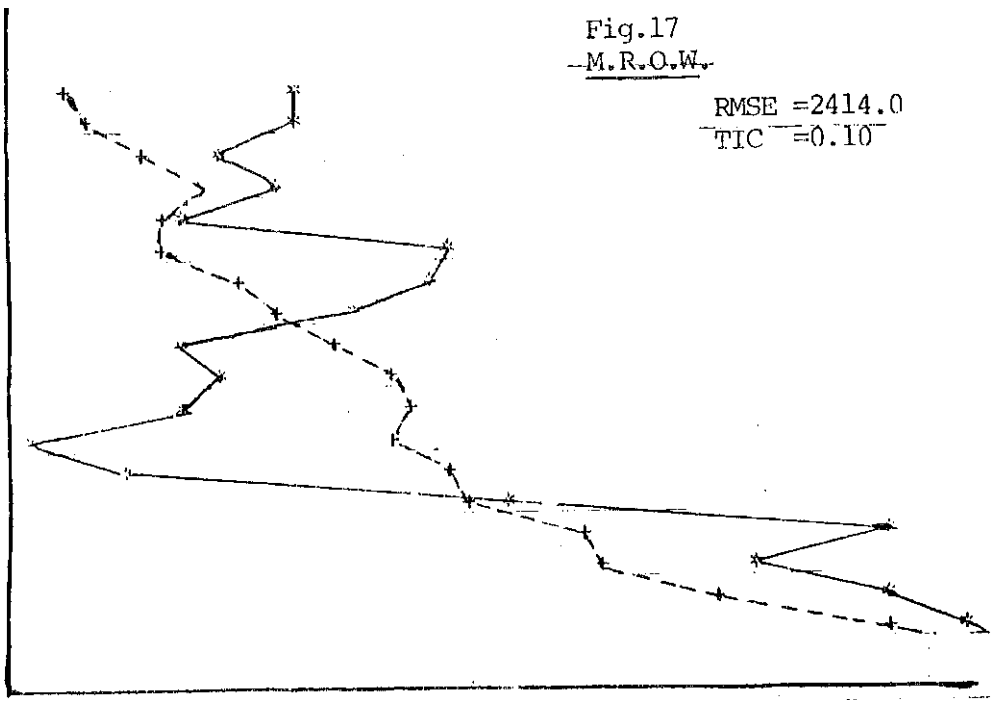


Actual
Predicted

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

Fig.17
M.R.O.W.

RMSE =2414.0
TIC =0.10



CHAPTER VII

VALIDATION OF BANGLADESH'S MODEL

In this chapter the predictive power of the Bangladesh Model has been tested by performing historical simulation. Figures 18 to 24 present the results of the validation exercise for all the endogenous variables used in the Bangladesh Model - viz. GNP, private and public consumption, investment, imports, of Bangladesh from Pakistan (BMBP), and the rest of the world (MROW), and the total trade of Bangladesh. It is encouraging to note that the actual and predicted series of all the endogenous variables are very close to each other. The summary statistics - i.e. RMSE and TIC - lie below 10 percent for all the endogenous variables except for MROW. (Figures 18-20 show that in the case of GNP, and private and public consumption, the TIC lies between 0.6 percent and 4 percent.) In the case of imports from the rest of the world (MROW), the actual and predicted values are very close to each other except for the year 1968-69. The large error in this particular year made other statistics worse compared with other endogenous variables. Overall, the predicted series of all endogenous variables track the historical data well and also capture almost all the turning points. (The actual and simulated series of all the endogenous variables are reported in Appendix 3.)

VALIDATION OF THE MODEL : BANGLADESH

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

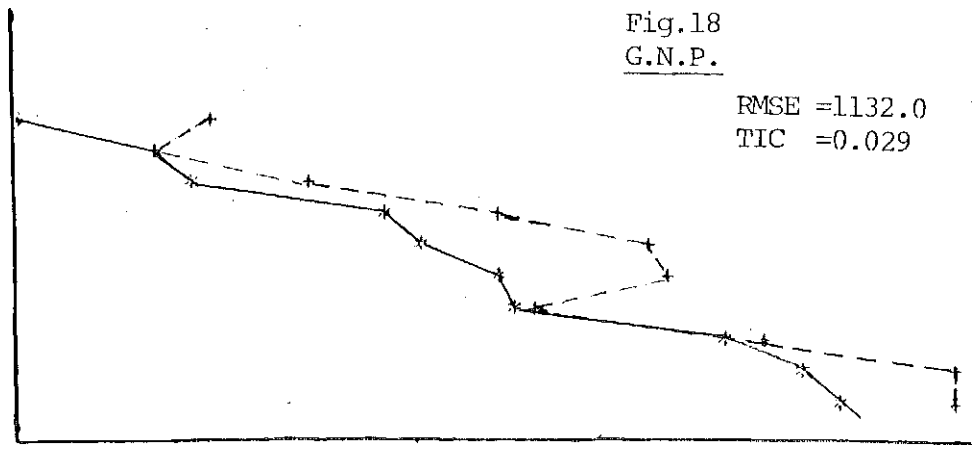


Fig.18
G.N.P.

RMSE =1132.0
TIC =0.029

Actual_____
Predicted

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

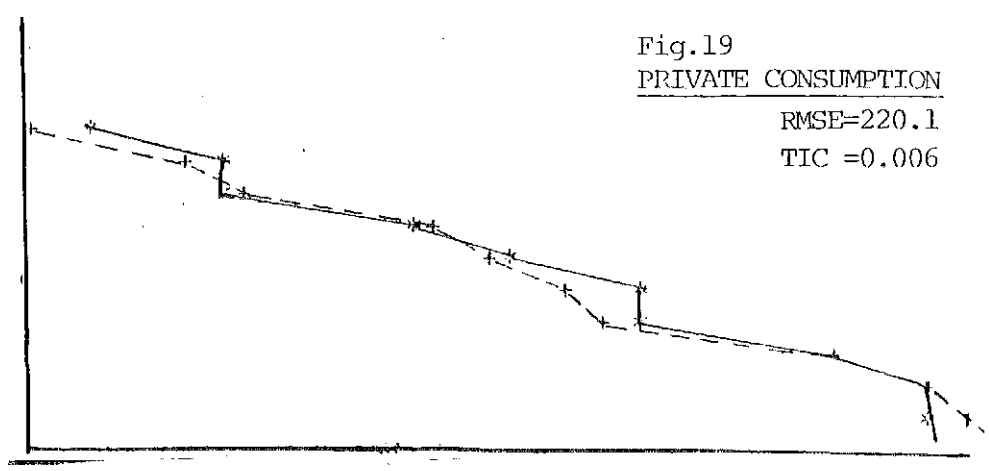


Fig.19
PRIVATE CONSUMPTION

RMSE=220.1
TIC =0.006

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

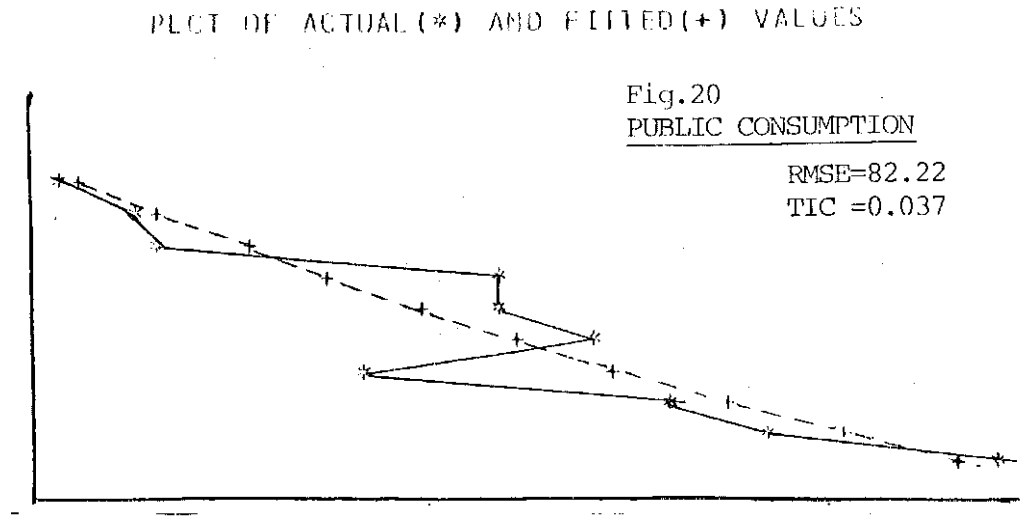


Fig.20
PUBLIC CONSUMPTION

RMSE=82.22
TIC =0.037

VALIDATION OF THE MODEL: BANGLADESH

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

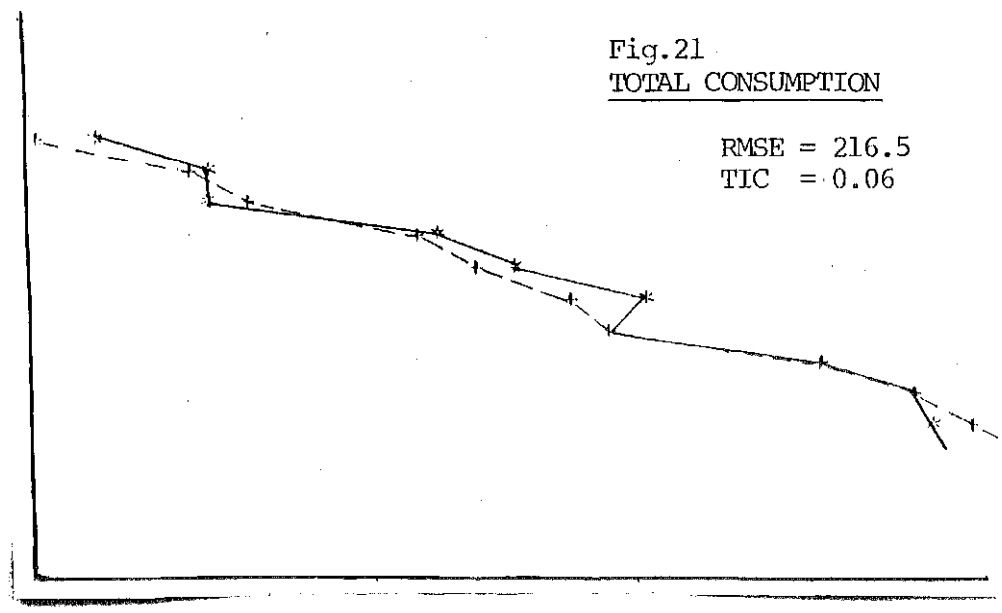


Fig.21
TOTAL CONSUMPTION

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

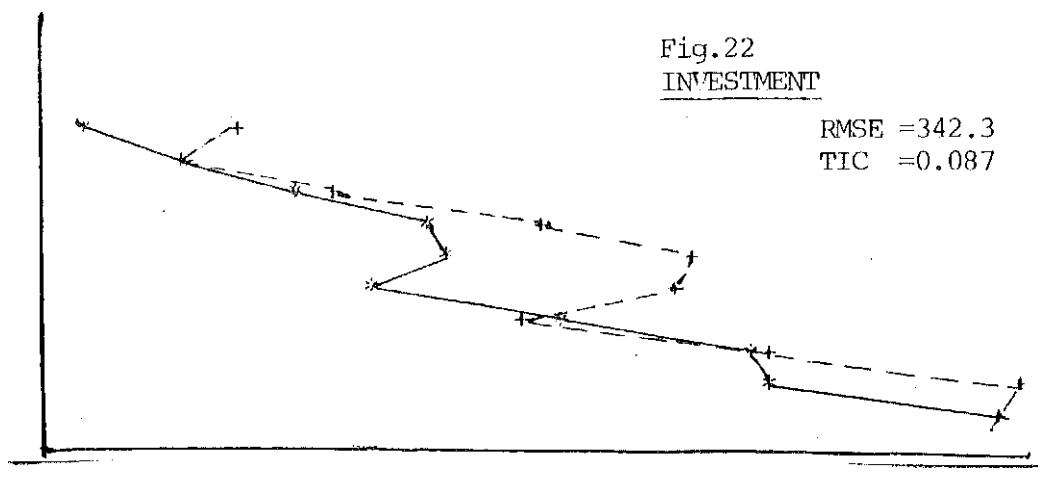
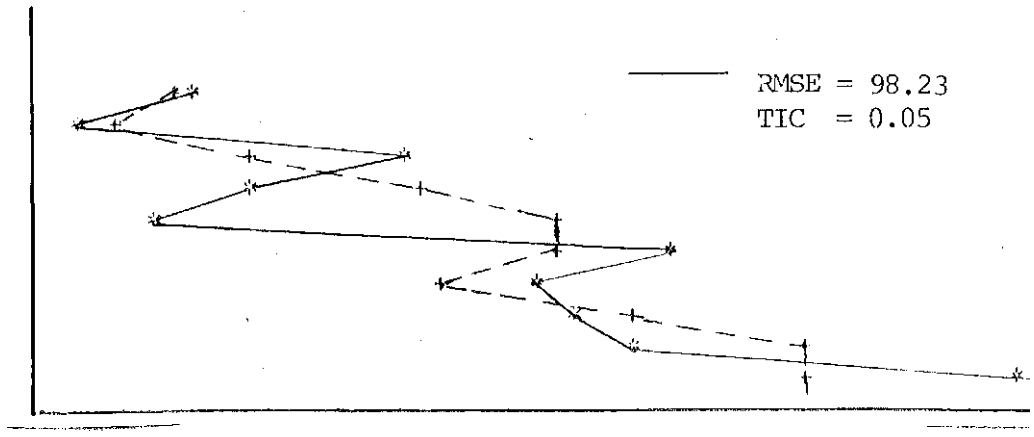


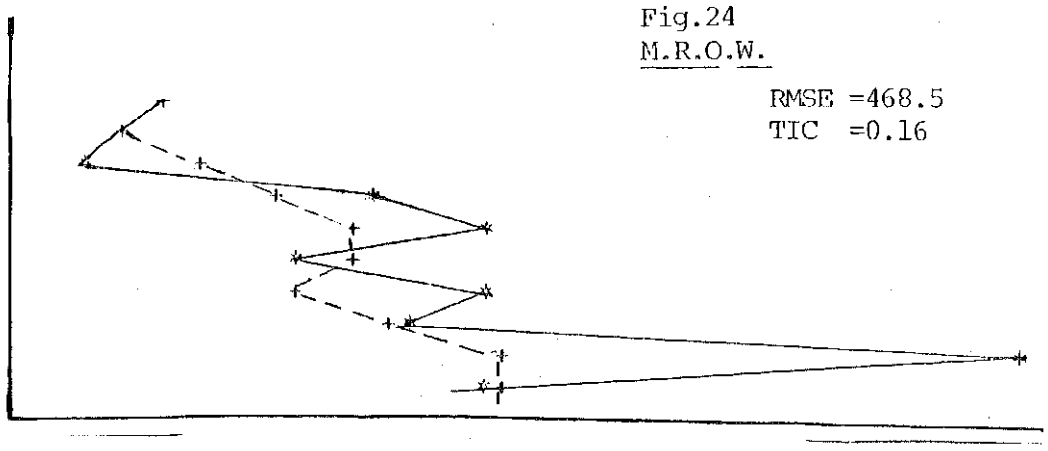
Fig.22
INVESTMENT

VALIDATION OF THE MODEL: BANGLADESH



PLOT OF ACTUAL(*) AND FITTED(+) VALUES

Fig.24
M.R.O.W.



CHAPTER VIII

VALIDATION OP SRI LANKAN MODEL

Figures 25 to 33 depict the actual and predicted series of all the endogenous variables of the Sri Lankan model - GNP, total and public consumption, inflation, investment, money demand, imports of Sri Lanka from Pakistan (MSP), India (MSI) and the rest of the world (MROW), and total imports. With the exception of those relating to foreign trade variables, the actual and predicted series of all the endogenous variables are extremely close to each other; the RMSEand TIC for these variables lie below 10 percent. Furthermore, the predicted series duplicate the actual series with a high degree of precision. All the turning points have also been captured very well.

As regards the trade equations, some of the simulated series overpredict in some years while they underpredict in other years. The equations estimated for trade in Sri Lanka do not perform well; except for MSP, the two equations (MSI and MROW) do not perform well. However, the TIC values for these variables lie between 20 percent and 30 percent. Further improvements are required in the trade equations for Sri Lanka. (The actual and simulated series for all the endogenous variables are reported in Appendix. 4.)

VALIDATION OF THE MODEL: SRI LANKA

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

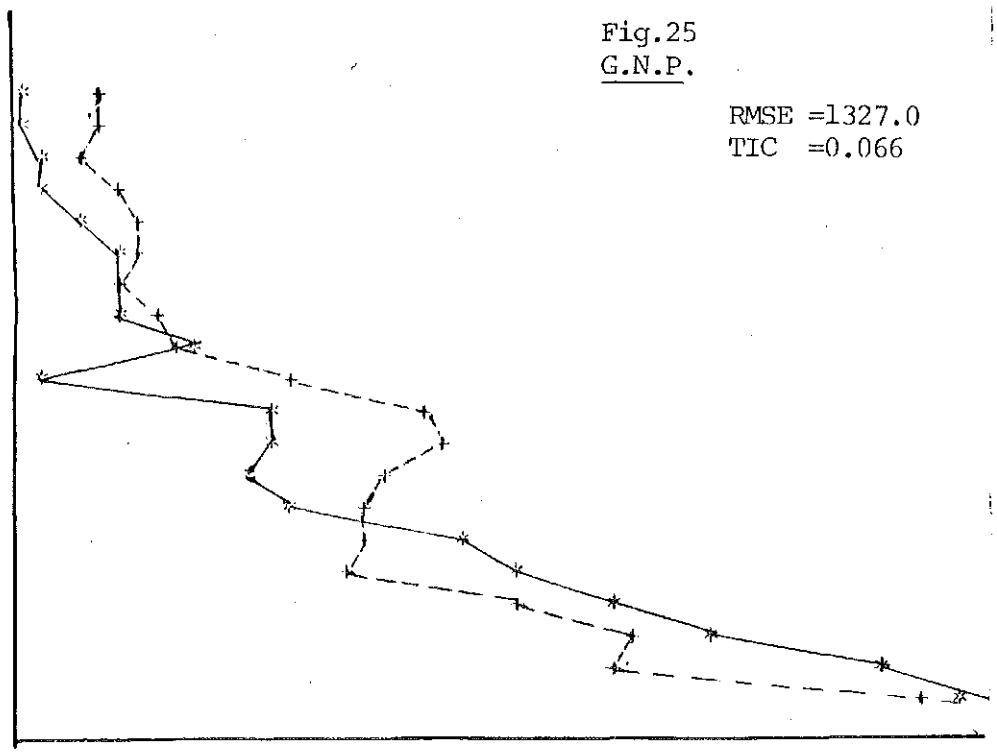


Fig.25
G.N.P.

RMSE =1327.0
TIC =0.066

Actual _____

Predicted- - - - - - -

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

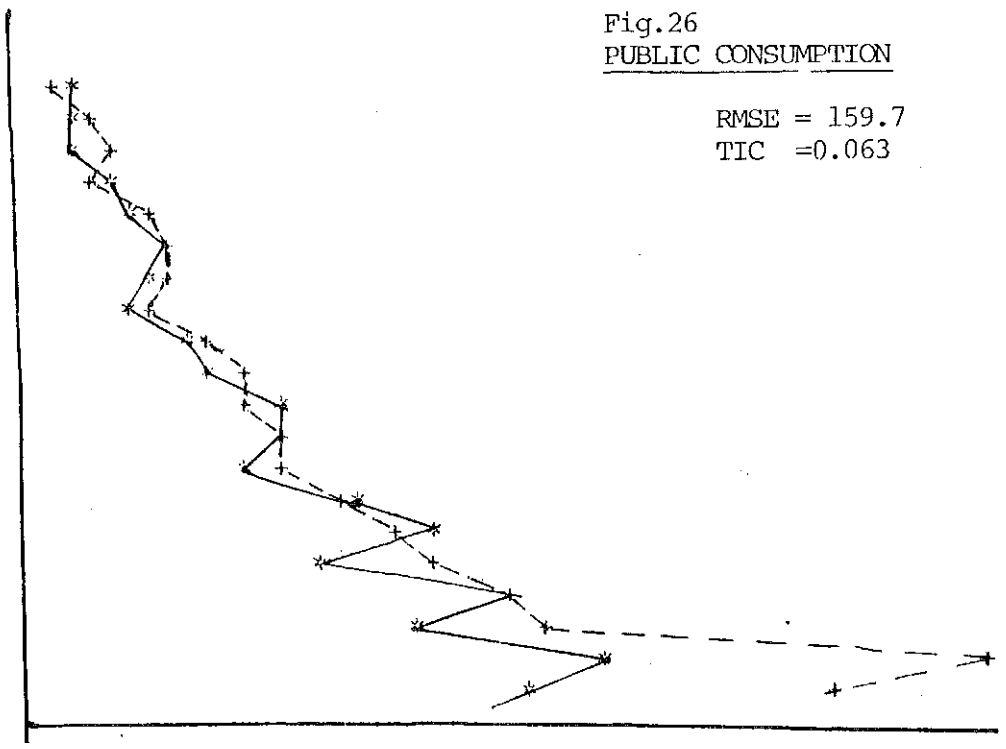


Fig.26
PUBLIC CONSUMPTION

RMSE = 159.7
TIC =0.063

VALIDATION OF THE MODEL: SRI LANKA

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

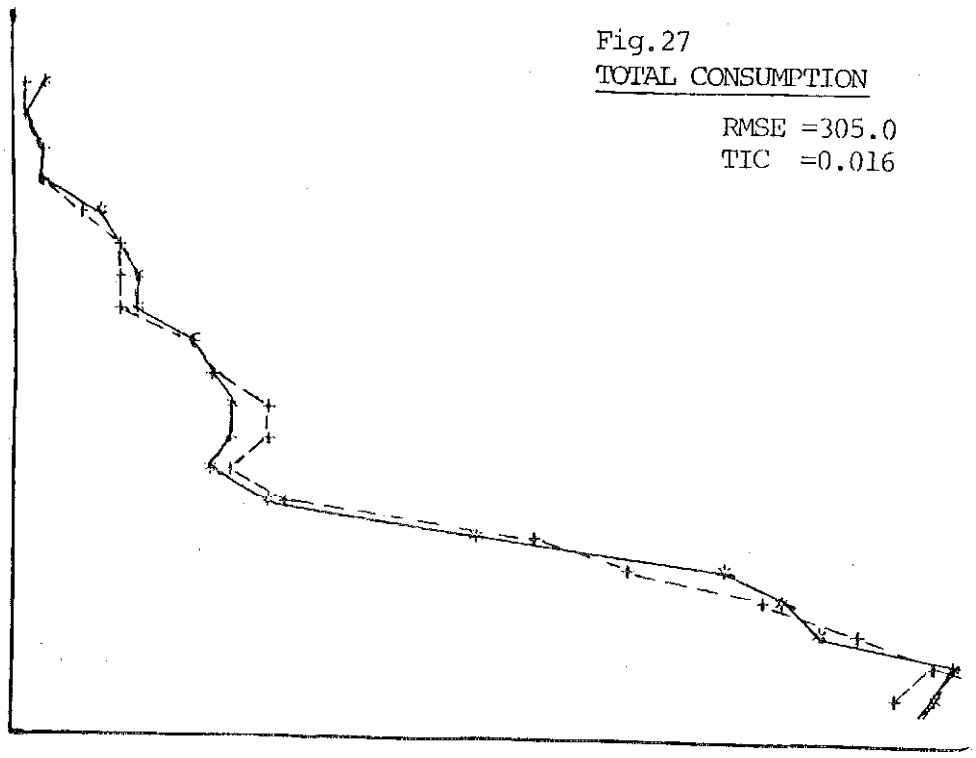


Fig.27
TOTAL CONSUMPTION

RMSE =305.0
TIC =0.016

Actual _____

Predicted -------

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

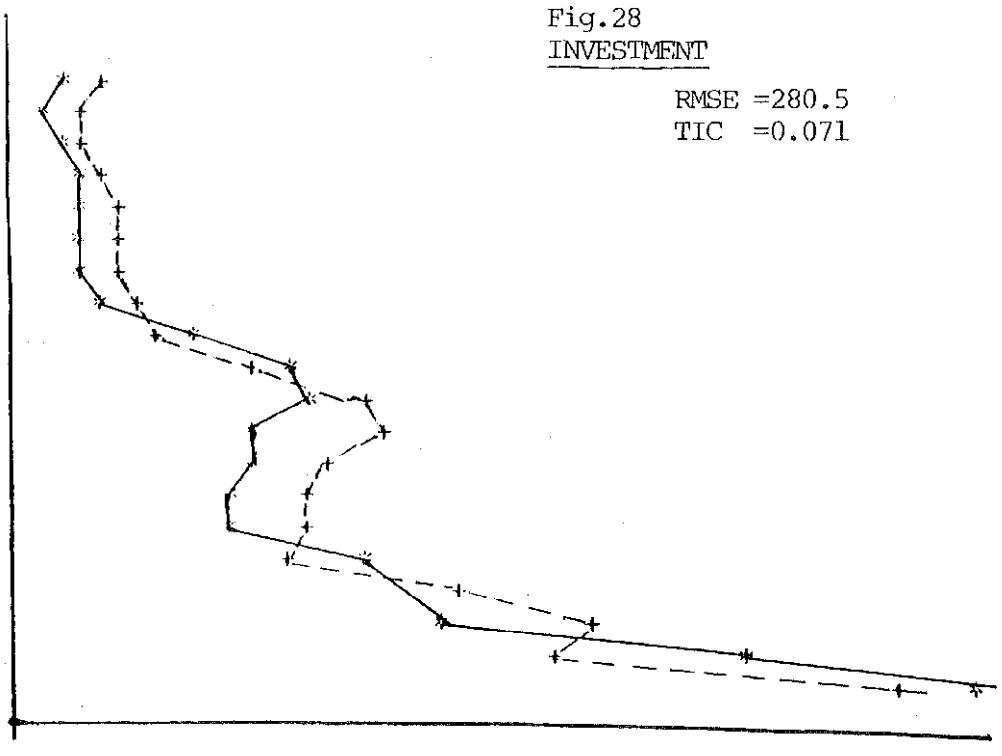


Fig.28
INVESTMENT

RMSE =280.5
TIC =0.071

VALIDATION OF THE MODEL: SRI LANKA

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

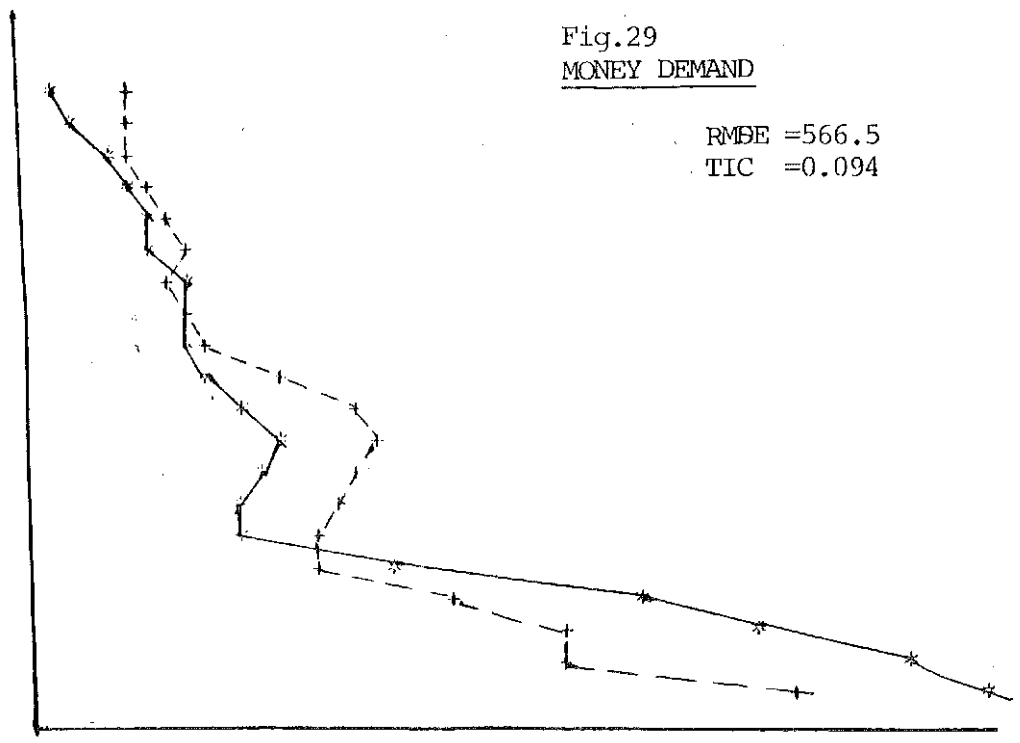


Fig.29
MONEY DEMAND

RMSE =566.5
TIC =0.094

Actual
Predicted

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

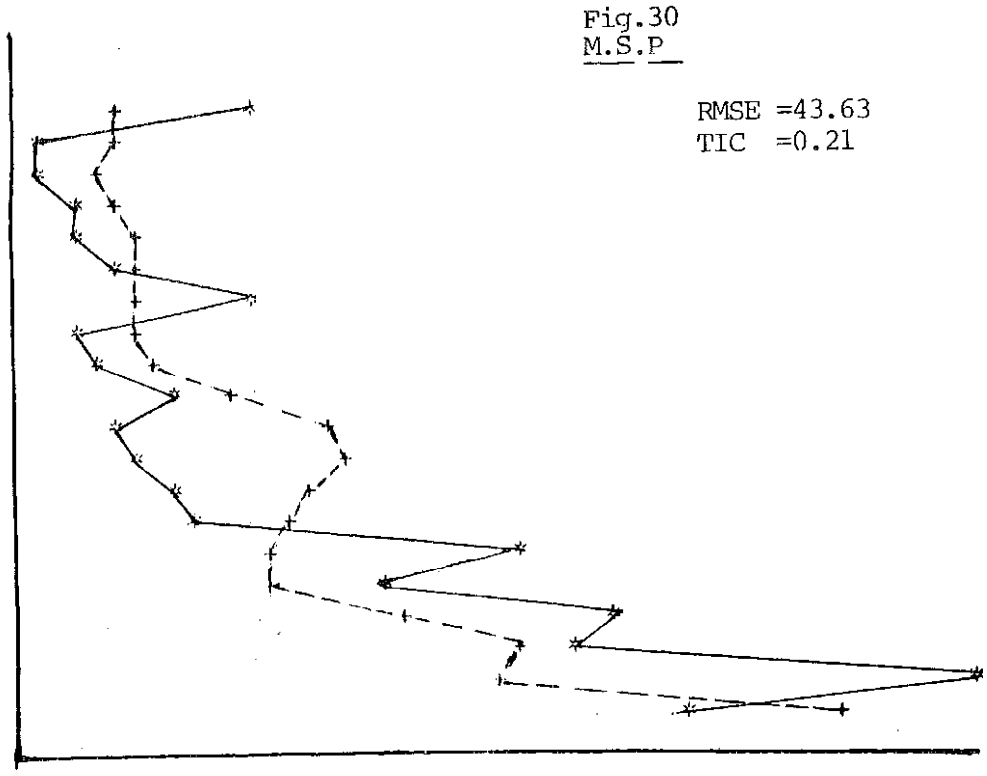


Fig.30
M.S.P

RMSE =43.63
TIC =0.21

VALIDATION OF THE MODEL: SRI LANKA

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

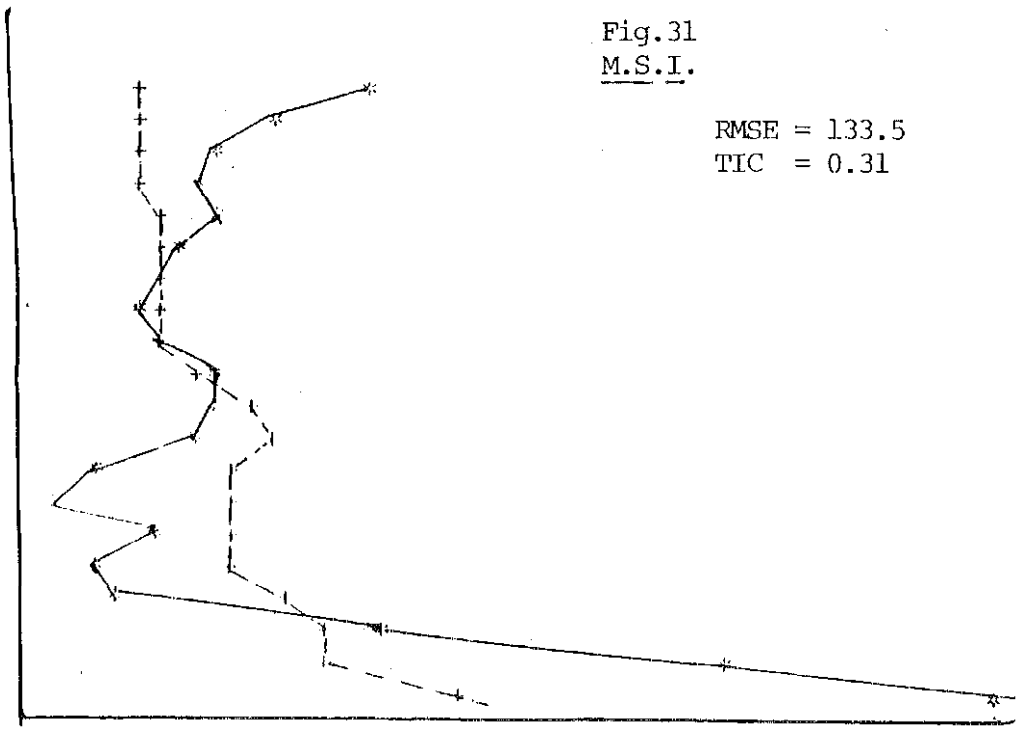


Fig.31
M.S.I.

RMSE = 133.5
TIC = 0.31

Actual_____
Predicted_____

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

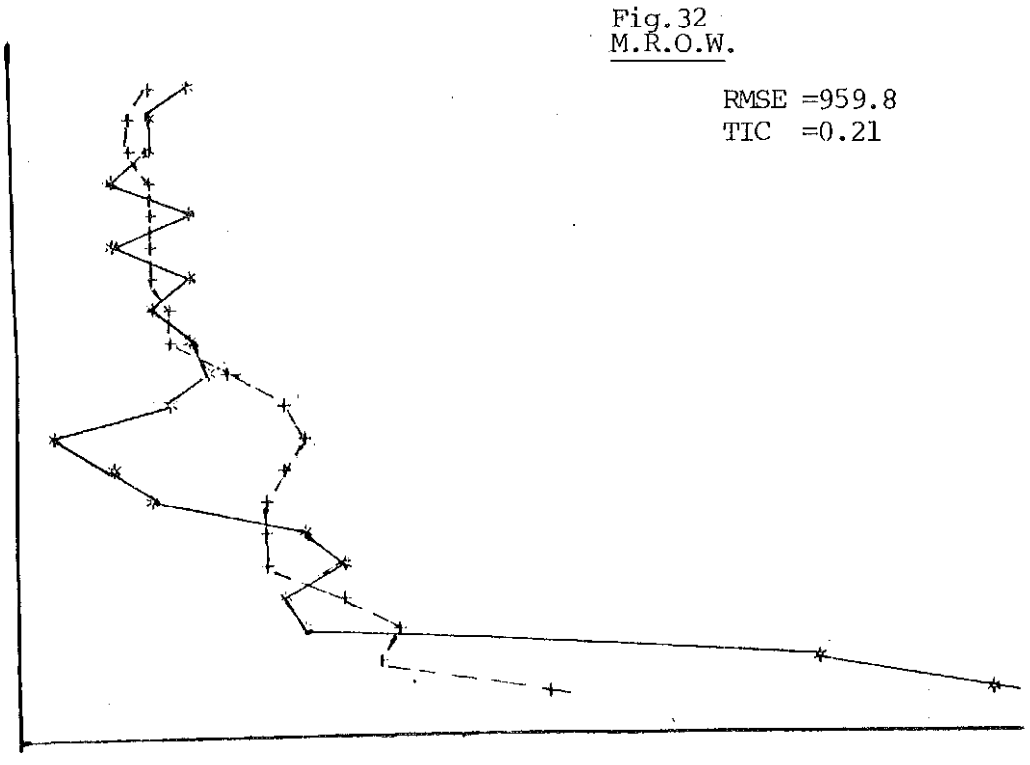


Fig.32
M.R.O.W.

RMSE =959.8
TIC =0.21

PLOT OF ACTUAL(*) AND FITTED(+) VALUES

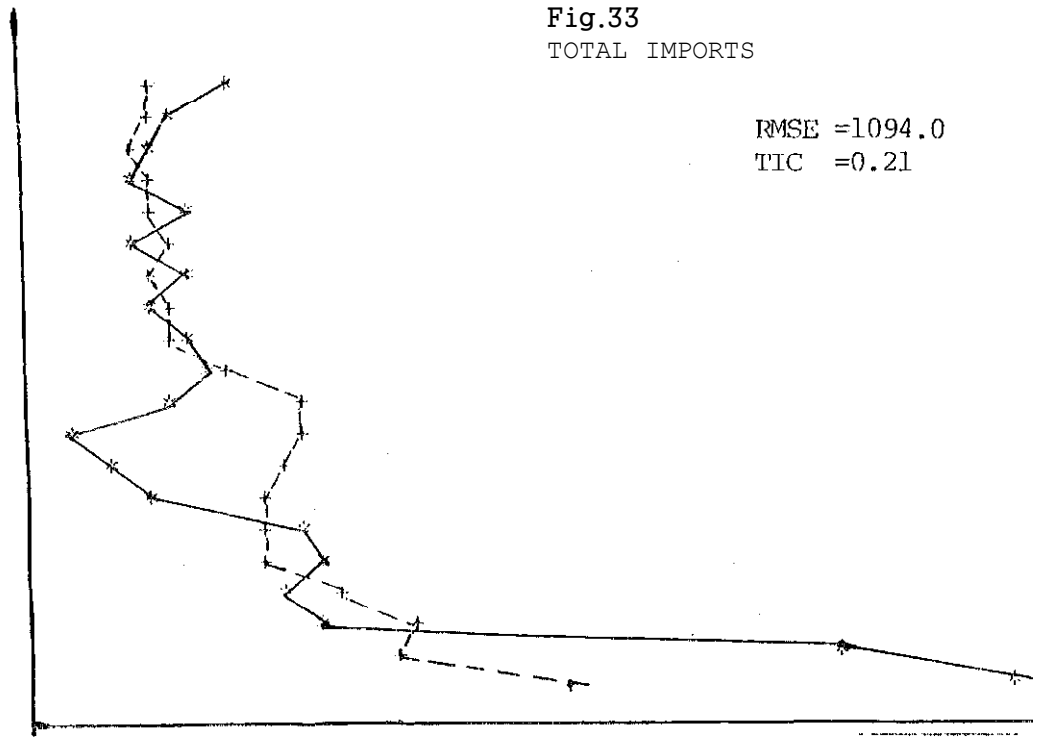


Fig.33
TOTAL IMPORTS

POLICY IMPLICATIONS

CHAPTER IX

POLICY IMPLICATIONS

The analysis presented so far shows that the link model represents a fairly reliable simulation of the 'reality on the ground'. It now remains to point out the policy implications of this exercise.

For policy purposes, the parameters of the estimated equations are important guides for informed policy action.[1] These values express the result of a one-percent change in the exogenous variables. Since the purpose of this paper is to examine the scope of trade expansion between Pakistan, India, Sri Lanka and Bangladesh, the discussion in this chapter is confined only to foreign trade elasticities.

Pakistan

The elasticities of Pakistan's demand for imports from Bangladesh, India, Sri Lanka and the rest of the world with respect to Pakistan's GNP are reported in Table 3.

Table 3

Import Elasticities for Pakistan

Countries	Value of Elasticity of demand for imports w.r. to Pakistan's GNP
1. Bangladesh	0.95
2. India	-12.1
3. Sri Lanka	0.5*
4. Rest of the world	1.34

Note: The elasticities reported here are taken from equations (19), (20), (21) and (22) in Panel VI.

[1] It may be noted that since all the equations in the present exercise have been estimated in log-linear form, the values of the parameters are also the values of elasticities.

These elasticities show that a one-percent rise in the GNP of Pakistan has led to increases of 0.95 percent and 1.34 percent in the imports of Pakistan from Bangladesh and the rest of the world respectively. In case of Bangladesh, the elasticity is approximately unity.[2] Pakistan's elasticity of demand for imports from India is -12.1 percent.[3] The same result holds for imports from Sri Lanka: a one-percent rise in the GNP of Pakistan has reduced imports from Sri Lanka by 0.5 percent. This is to be expected because Pakistan imports mainly tea from Sri Lanka. Hence, with a rise in Pakistan's national income, trade between the two countries is expected to decline as a percentage of GNP.

India

Table 4 shows that a one-percent rise in the GNP of India has led to a 7.64-percent decline in her imports from Pakistan. This is the obverse of Pakistan's trade with India.This is something to be watched by the policy-makers of these two countries. The present trend clearly shows that with a rise in their national incomes, trade between the two countries will decline.

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[2]The data regarding Pakistan's import from Bangladesh are up to 1969-70, when trade between Pakistan and Bangladesh was still interregional rather than international.

[3]Since there was no trade between Pakistan and India from 1969-70 to 1974-75, for the trade equation we used data from 1959-60 to 1967-68.

Table 4

Import Elasticities for India

Countries	Value of Elasticity of Demand for imports w.r. to Pakistan's GNP
1. Pakistan	-7.64
2. Sri Lanka	-2.71
3. Rest of the world	1.22

Note: The elasticities reported above are taken from equations (23), (24) and (25) in Panel VI.

Similarly, a one-percent rise in the GNP of India leads to a 2.71 percent decline in Indian imports from Sri Lanka. Again, to promote mutual cooperation, measures should be taken which may have the effect of increasing the income elasticity of Indian imports from Sri Lanka.

Bangladesh

Table 5 reports the elasticities of demand for Bangladesh for imports from Pakistan and the rest of the world, with respect to her GNP.

Table 5

Import Elasticities for Bangladesh

Countries	Value of Elasticity of demand for imports w.r. to Pakistan's GNP
1. Pakistan	1.18
2. Rest of the world	2.27*

Note: The elasticities reported here are taken from equations (26) and (27) in Panel VI.

*indicates that the coefficient is statistically insignificant.

It is clear that a one-percent rise in the GNP of Bangladesh has tended to increase her imports from Pakistan by 1.18 percent and those from the rest of the world by 2.27 percent. It may be recalled that this simply reflects the fact that during the period from 1959-60 to 1969-70, i.e. before the separation of East Pakistan, the economies of Pakistan and Bangladesh were complementary.

Sri Lanka

The values of elasticities of Sri Lanka's demand for imports from Pakistan, India and the rest of the world, with respect to Sri Lanka's GNP, are reported in Table 6.

Table 6

Import Elasticities for Sri Lanka

Countries	Value of Elasticity of demand for imports w.r. to Pakistan's GNP
1. Pakistan	2.21
2. India	1.48
3. Rest of the world	1.27

Note: The elasticities reported here are taken from equations (28), (29) and (30) in Panel VI.

An increase in the national income of Sri Lanka increases imports from Pakistan and India. The results reported in Table 6 show that a one-percent increase in the GNP of Sri Lanka has caused her imports from Pakistan and India to rise by 2.21 percent and 1.48 percent respectively.

CHAPTER X

CONCLUDING OBSERVATIONS

The 'facts' noted so far should make it clear that if historical -trends are not.reversed by conscious policy.

(i) Pakistan and India will, turn to extra-regional sources to satisfy, their demand for imports as their GNP rises with the passage of time;

(ii) Sri Lanka will turn more to regional sources for her imports, and the imports of the rest of the region from her will decline; and

(iii) while, in proportional terms, Bangladesh may not turn her 'back' on the regional imports as much as Indian and Pakistan will, the share of her imports *from* extra-regional sources will *rise as* GNP grows.

These trends arc by no means good pace-setters for greater regional trade cooperation. It should be obvious that a different development strategy is required which is consistent with the need for greater regional collaboration. The need for corrective action is obvious. However, the main question is: what kind of corrective action is called for? It is obvious that efforts to expand trade by signing bilateral trade agreements are, at best, of limited value. In the long run, the expansion of regional trade can only come about through a 'harmonization' of development strate gies pursued by the countries of the region. As pointed out

in this report, the elasticities of Indian and Pakistani demand for regional imports are *negative*, mainly because of the highly autarkic pattern of development followed by these countries. If the objective of the government policy is to promote trade between India and Pakistan, the historical trends will have to be reversed. New policy measures will have to be evolved to promote trade between India and Pakistan. More specifically, a redirection of imports from extra-regional sources to regional sources with respect to traded goods is recommended.

In the case of Sri Lanka, it will be essential for her to diversify her exports and decrease concentration on the exports of tea alone. Bangladesh will also have to make more strenuous efforts to stick to regional sources for satisfying her import needs in the future.

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RaNa

APPENDIX I

Simulation Results (Pakistan)

	GNP	CPR	CGR	I	MO	INF	MPS	MROW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1961	12096.8	15162.8	2122.82	2255.70	3523.75	1.07886	42.0835	1362.29
1962	16195.1	16007.2	2376.96	2844.00	5100.05	1.09744	36.3709	2014.03
1963	18663.5	17091.5	4201.67	3183.15	6109.46	1.10426	33.8804	2435.70
1964	23620.1	18193.1	2635.63	3837.98	8234.36	1.11951	30.1166	3339.56
1965	26397.2	19814.3	2859.51	4192.04	9501.37	1.12030	28.4884	3875.96
1966	28130.5	21301.9	3015.51	4409.62	10261.6	1.13496	27.5967	4220.76
1967	26560.9	21965.6	3037.00	4212.82	9562.47	1.12482	28.4004	3908.22
1968	27416.5	23452.8	3080.26	4320.36	9943.73	1.13002	27.9538	4077.82
1969	30855.5	24890.4	3644.84	4745.50	11553.0	1.13712	26.3499	4777.47
1970	29748.6	27207.5	3799.56	4609.90	11016.6	1.13832	26.8357	4549.22
1971	30431.2	27221.6	3772.99	4693.84	11325.6	1.14300	26.5330	4689.64
1972	30621.0	27557.7	3790.71	4717.34	11388.9	1.15022	156.848	3233.90
1973	29216.1	29767.2	3933.69	4544.56	10735.7	1.14571	160.575	3036.65
1974	31166.8	32106.9	4387.52	4783.95	11652.4	1.14995	155.469	3311.38
1975	29561.0	33438.9	4339.06	4587.02	10905.9	1.14400	159.636	3084.78
1976	31046.6	34725.4	4576.50	4769.18	11607.4	1.14667	155.770	3294.28
1977	34451.1	36022.8	4725.04	5179.98	13254.1	1.15127	147.873	3787.15
1978	36391.3	39673.2	5211.69	5410.31	14214.9	1.15332	143.877	4075.65
1979	37242.3	41657.9	5584.35	5510.41	14655.0	1.15134	142.223	4203.88

Actual Series (Pakistan)

	GNP	CPR	CGR	I	MO	INF
	(1)	(2)	(3)	(4)	(5)	(6)
1961	17624.0	15823.0	1846.00	2554.00	5261.00	1.03970
1962	18683.0	16477.0	2025.00	2965.00	5744.00	0.983842
1963	20008.0	17034.0	2227.00	3797.0	5588.00	0.998729
1964	21322.0	17935.0	2589.00	4270.00	7476.00	1.05178
1965	23299.0	20148.0	2741.00	4560.00	8315.00	1.04439
1966	25079.0	19818.0	3976.00	4296.00	9389.00	1.02753
1967	25853.0	21894.0	3201.00	4440.00	9500.00	1.09262
1968	27636.0	22808.0	3142.00	5027.00	10085.0	1.02008
1969	29425.0	24508.0	3377.00	4836.00	11184.0	1.00366
1970	32338.0	27329.0	3639.00	4951.00	11839.0	1.03923
1971	32362.0	27471.0	3738.00	4980.00	12382.0	1.05162
1972	32883.0	27178.0	4324.00	4741.00	16464.0	1.06285
1973	35360.0	28942.0	4458.00	5074.00	16308.0	1.15624
1974	38085.0	32863.0	4012.00	4801.00	14815.0	1.22853
1975	39611.0	34528.0	4479.00	5055.00	13426.0	1.25358
1976	41410.0	34918.0	4773.00	5640.00	15384.0	1.12612
1977	43022.0	36255.0	4820.00	5975.00	17463.0	1.09213
1978	47480.0	39559.0	5040.00	6124.00	19028.0	1.08683
1979	49953.0	42034.0	5179.00	6265.00	21285.0	1.06794

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	MPS	MROW	LI	YD	GRR	MRA
	(7)	(8)	(9)	(10)	(11)	(12)
1961	26.3000	2171.60	1880.00	17316.0	2206.00	0.153484
1962	24.2000	2380.20	2554.00	18311.0	2621.00	0.155114
1963	28.7000	2844.30	2965.00	19591.0	6246.00	0.171881
1964	33.8000	3015.80	3797.00	20894.0	3068.00	0.173858
1965	28.5000	4714.60	4270.00	22816.0	3474.00	0.228293
1966	33.8000	3085.10	4560.00	24584.0	3767.00	0.148929
1967	21.3000	4437.00	4296.00	25374.0	3808.00	0.192743
1968	15.3000	4071.50	4440.00	27147.0	3891.00	0.169815
1969	22.0000	4534.30	5027.00	28864.0	5029.00	0.175813
1970	22.2000	4241.80	4836.00	31638.0	5358.00	0.151432
1971	46.1000	4267.90	4951.00	31655.0	5301.00	0.133304
1972	189.400	3141.60	4980.00	32058.0	5339.00	0.101299
1973	184.700	3591.30	4741.00	34711.0	5649.00	0.106787
1974	224.700	3864.90	5074.00	37527.0	6672.00	0.107470
1975	195.200	4463.20	4801.00	39133.0	6560.00	0.118192
1976	142.700	4822.40	5055.00	40686.0	7115.00	0.121398
1977	197.000	5358.70	5640.00	42254.0	7470.00	0.134171
1978	123.800	6400.00	5975.00	46675.0	8674.00	0.143644
1979	68.9000	8022.00	6124.00	49084.0	9637.00	0.165738

APPENDIX II

Simulation Results (India)

	I	MO	MIS	MROW	CPR	CGR
	(1)	(2)	(3)	(4)	(5)	(6)
1962	24102.1	34910.5	45.6328	7786.62	127620.	12827.1
1963	24808.3	36606.2	42.6467	8027.51	129229.	14454.2
1964	26298.2	40914.7	36.9659	8561.11	129169.	15876.2
1965	30213.8	46167.0	30.3499	9355.90	139083.	15592.1
1966	30080.2	42712.0	34.3709	8846.28	131344.	16327.9
1967	31398.5	43902.7	33.1802	8987.81	134251.	15430.4
1968	34167.4	49446.9	26.8923	9879.47	150449.	15106.7
1969	34317.8	51960.9	24.7674	10252.4	151483.	15121.5
1970	36723.2	58454.7	20.9283	11060.0	157163.	16649.9
1971	39452.2	62419.6	18.8079	11604.9	162904.	17432.8
1972	40100.0	64423.2	18.0615	11818.4	163976.	19545.1
1973	39625.3	64451.4	18.6043	11661.9	156601.	18910.6
1974	41767.2	71292.1	16.3219	12369.7	154508.	16630.6
1975	45746.9	70090.0	15.8878	12520.7	165894.	18838.1
1976	51338.2	80295.4	12.3736	14012.2	185524.	23610.1
1977	52155.8	85066.3	11.8970	14262.2	184070.	24368.0
1978	57835.9	96483.0	9.64182	15677.5	199208.	26097.7
1979	61181.1	115786.	7.37117	17692.1	215591.	27828.6

APPENDIX II

Actual Series (India)

	I	MO	MIS	MROW	CPR	CGR
	(1)	(2)	(3)	(4)	(5)	(6)
1962	26321.0	40909.0	45.0000	10507.9	119960.	11844.0
1963	28933.0	43391.0	81.8000	10427.2	122390.	13826.0
1964	29408.0	44485.0	60.1000	9716.30	125930.	15633.0
1965	31082.0	44882.0	56.5000	10276.8	137620.	15316.0
1966	30436.0	45976.0	40.2000	9214.00	134390.	15785.0
1967	32143.0	44414.0	27.2000	12278.6	138880.	15116.0
1968	33409.0	44774.0	33.3000	12121.4	148170.	16295.0
1969	32428.0	50206.0	19.6000	11138.3	154380.	17658.0
1970	34958.0	54819.0	28.6000	9096.40	159490.	18793.0
1971	38970.0	60560.0	27.7500	9608.25	164760.	20147.0
1972	39842.0	66602.0	9.36000	9151.64	169540.	22363.0
1973	39299.0	70262.0	14.4000	7280.60	166040.	20290.0
1974	33951.0	68575.0	12.1500	8384.84	170510.	17064.0
1975	43428.0	66496.0	1.60000	12991.4	171660.	19012.0
1976	56782.0	82917.0	3.56200	17691.3	184730.	25478.0
1977	56400.0	94163.0	0.640000	16113.3	183260.	26089.0
1978	57194.0	109550.	82.0000	17837.1	198800.	26882.0
1979	65988.0	126035.	64.8000	18658.5	196354.	27709.0

Continued.....

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	GNP	R	INF	YD	GRR
	(7)	(8)	(9)	(10)	(11)
1962	145130.	3.97000	1.01820	131536.	12168.0
1963	148800.	3.99000	1.03565	133532.	14101.0
1964	156860.	4.00000	1.13798	133458.	15833.0
1965	168700.	4.79000	1.09092	145863.	15484.0
1966	161130.	5.50000	1.11107	136164.	16391.0
1967	163240.	6.00000	1.13750	139794.	15286.0
1968	176400.	6.00000	1.03300	160306.	14891.0
1969	181840.	5.50000	1.01059	161631.	14909.0
1970	193500.	5.50000	1.05259	168942.	16791.0
1971	201280.	6.00000	1.02997	176387.	17771.0
1972	204310.	6.00000	1.05826	177783.	20466.0
1973	202090.	6.00000	1.17434	168216.	19649.0
1974	212090.	6.00000	1.27341	165518.	16767.0
1975	214210.	7.65000	1.06134	180285.	19556.0
1976	234910.	8.00000	0.919039	206223.	25843.0
1977	238340.	8.00000	1.08803	204282.	26871.0
1978	257560.	8.47000	1.02502	224639.	29245.0
1979	284389.	7.24000	1.06340	247024.	31658.0

APPENDIX III

Simulation Results (Bangladesh)

	GNP	CPR	CGR	I	MBP	MROW	MT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1961	16398.3	13691.8	783.393	1252.02	789.829	845.726	1636
1962	15873.8	14568.6	836.797	1117.91	760.107	785.567	1546
1963	17251.5	14835.5	901.340	1439.60	838.545	948.929	1787
1964	18812.9	15955.8	958.781	1871.78	928.811	1155.18	2084
1965	20038.9	16234.5	1025.88	2217.25	1000.65	1333.19	2334
1966	20062.3	16717.6	1091.25	2165.64	1002.03	1336.73	2339
1967	19047.5	16873.1	1168.23	1830.62	942.496	1188.14	2131
1968	20834.1	18178.1	1242.75	2346.97	1047.67	1456.30	2504
1969	22452.3	18679.5	1327.59	2874.84	1144.35	1725.83	2870
1970	22421.1	18946.6	1412.89	2841.21	1142.47	1720.39	2863

Actual Series (Bangladesh)

	GNP	CPR	CGR	I	MBP	MROW
	(1)	(2)	(3)	(4)	(5)	(6)
1961	14866.0	14022.0	763.000	922.000	800.030	859.370
1962	15987.0	14711.0	812.000	1121.00	736.890	777.810
1963	16272.0	14785.0	830.000	1375.00	922.170	675.830
1964	17790.0	15888.0	1078.00	1633.00	836.000	1406.50
1965	18073.0	16383.0	1081.00	1685.00	778.900	1674.70
1966	18686.0	17146.0	1153.00	1508.00	1067.20	1218.00
1967	18869.0	17135.0	982.000	1909.00	998.750	1670.50
1968	20536.0	18240.0	1203.00	2335.00	1019.65	1483.35
1969	21139.0	18728.0	1270.00	2346.00	1052.58	3026.42
1970	21504.0	18687.0	1442.00	2833.00	1262.66	1688.04

Continued...

Continued

	LI	YD	GRR	N	R	MT
	(7)	(8)	(9)	(10)	(11)	(12)
1961	980.000	14680.0	992.300	55.6000	3.01000	1659.000
1962	922.000	15758.0	1154.20	57.3000	3.21000	1515.000
1963	1121.00	16088.0	970.300	59.1000	3.20000	1598.000
1964	1375.00	17482.0	1371.80	60.9000	3.20000	2242.000
1965	1633.00	17831.0	1570.60	62.8000	3.52000	2454.000
1966	1685.00	18438.0	1819.50	64.6000	3.96000	2285.000
1967	1508.00	18634.0	1664.30	66.5000	4.15000	2669.000
1968	1909.00	20288.0	1902.40	68.4000	4.59000	2503.000
1969	2335.00	20928.0	1899.00	70.4000	5.09000	4079.000
1970	2346.00	21270.0	2085.50	72.4000	5.26000	2951.000

APPENDIX IV

Simulation Results (Sri Lanka)

	GNP	CR	CGR	I	MO	MSP	MSI	MROW	INF
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1961	7298.92	5719.93	917.092	1077.15	1962.77	39.6070	103.516	1335.76	0.962547
1962	7261.19	5642.63	977.122	1069.58	1961.15	39.1560	102.727	1327.00	0.968814
1963	7097.46	5772.84	1000.09	1033.58	1933.17	37.2314	99.3263	1289.12	0.981019
1964	7440.51	5796.35	967.664	1119.22	2050.73	41.3250	106.493	1368.76	0.998641
1965	7666.73	6223.27	1045.01	1176.49	2124.67	44.1529	111.306	1421.82	1.00692
1966	7744.82	6508.77	1059.50	1198.74	2163.71	45.1529	112.984	1440.24	1.01916
1967	7631.05	6517.97	1073.66	1169.83	2127.88	43.7000	110.543	1413.43	1.01623
1968	7906.92	6611.66	1047.55	1242.08	2224.83	47.2680	116.492	1478.63	1.03014
1969	8155.28	7238.80	1116.99	1306.40	2299.64	50.6117	121.933	1537.87	1.03354
1970	9431.24	7473.01	1157.43	1644.04	2620.47	69.7860	151.112	1849.67	1.01146
1971	10917.2	8038.88	1179.70	2076.78	3011.53	96.4272	187.538	2227.38	1.00105
1972	11184.1	8024.75	1215.68	2165.17	3113.75	101.714	194.344	2296.76	1.01501
1973	10526.6	7717.82	1225.00	1974.44	2984.68	88.9660	177.718	2126.64	1.04286
1974	10290.6	8176.82	1292.63	1900.47	2901.76	84.6180	171.869	2066.28	1.03426
1975	10167.8	10558.0	1369.51	1862.85	2860.98	82.4021	168.850	2035.01	1.03091
1976	10079.6	11481.6	1422.54	1835.68	2829.[redacted]	80.8322	166.694	2012.64	1.02746
1977	12001.7	12838.1	1535.06	2451.92	3462.96	118.877	215.675	2512.06	1.07085
1978	13257.9	13775.2	1576.17	2912.84	3980.19	148.129	249.809	2850.58	1.13649
1979	12961.6	14556.8	2156.27	2824.38	3964.88	140.911	241.612	2769.91	1.16867
1980	16333.8	14177.2	1949.28	4100.65	4999.04	234.964	339.899	3715.44	1.17039

Actual Series (Sri Lanka)

	GNP	CR	CGR	I	MO	MSP
	(1)	(2)	(3)	(4)	(5)	(6)
1961	6561.00	5870.54	947.620	930.830	1588.00	76.0000
1962	6475.00	5683.25	948.670	894.120	1657.00	22.4000
1963	6624.00	5798.10	941.340	964.110	1835.00	20.2700
1964	6648.00	5809.42	992.900	1011.89	1932.00	30.7100
1965	7172.00	6329.57	1011.22	1026.86	2047.00	30.0800
1966	7532.00	6511.86	1075.17	1002.39	2006.00	42.3800
1967	7524.00	6757.99	1055.43	1060.83	2168.00	76.3400
1968	7624.00	6772.30	1019.93	1116.22	2235.00	29.2200
1969	8373.00	7237.16	1091.01	1427.43	2195.00	35.3800
1970	6620.00	7421.14	1110.02	1324.58	2265.00	55.8500
1971	9277.00	7688.88	1225.20	1894.69	2436.00	41.7300
1972	9284.00	7758.41	1220.93	1704.50	2655.00	45.5200
1973	8924.00	7463.84	1169.51	1643.82	2531.00	56.1600
1974	9486.00	8010.46	1317.98	1612.23	2480.00	60.3800
1975	11228.0	10143.2	1419.08	1590.00	2433.00	146.240
1976	12039.0	12448.8	1264.14	2110.30	3190.00	111.850
1977	12936.0	13091.9	1520.38	2464.01	4352.00	170.850
1978	14032.0	13382.9	1396.69	2361.04	4856.00	163.040
1979	15915.0	14659.1	1639.56	3468.91	5514.00	268.830
1980	16806.0	14517.2	1542.07	4347.55	5891.00	191.200

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	MSI	MROW	INF	LI	GDP	GRR
	(7)	(8)	(9)	(10)	(11)	(12)
1961	265.680	1654.46	1.01200	940.000	6605.00	1363.09
1962	201.420	1434.89	1.01453	930.830	6513.00	1495.08
1963	154.940	1404.68	1.02338	894.120	6668.00	1546.58
1964	137.530	1206.17	1.03179	964.110	6696.00	1474.03
1965	160.830	1626.35	1.00249	1011.89	7205.00	1648.87
1966	123.270	1192.37	0.998712	1026.86	7546.00	1682.32
1967	122.030	1629.48	1.02220	1002.39	7557.00	1715.18
1968	104.970	1347.57	1.05777	1060.83	7669.00	1654.73
1969	119.970	1575.00	1.07387	1116.22	8420.00	1817.02
1970	158.640	1690.23	1.05935	1427.43	8701.00	1913.71
1971	163.120	1481.26	1.02704	1824.58	9381.00	1967.61
1972	141.390	827.430	1.06323	1894.69	9364.00	2055.69
1973	74.7600	1146.84	1.09616	1704.50	8995.00	2078.71
1974	44.7200	1411.28	1.12283	1643.82	9547.00	2248.10
1975	114.800	2232.16	1.06621	1612.23	12425.0	2445.64
1976	76.5000	2460.23	1.02540	1590.00	13547.0	2584.90
1977	83.0700	2213.11	1.01285	2110.30	15200.0	2868.27
1978	292.120	2265.94	1.12099	2464.01	16345.0	3001.70
1979	543.270	5311.42	1.10707	2361.04	17302.0	4739.84
1980	741.930	6331.44	1.26177	3468.91	16837.0	4091.40