Bangladesh J. Agric. Econ. X, 2 (December 1987) 25-38

AN IMPORT DEMAND FUNCTION FOR FOODGRAINS: SOME RESULTS FROM BANGLADESH DATA

Md. Akhtar Hossain

ABSTRACT

This paper estimates an import demand function for foodgrains into Bangladesh during the period 1974 (I)-1985(I). An important finding is that the income elasticity of the demand for imports of foodgrains exceeds unity. The empirical results also suggest that in Bangladesh, the imports of foodgrains are price inelastic. A dynamic simulation test suggests a good-fit of the import demand function and importantly, the estimated equation is able to track the wide fluctuations of the imports of foodgrauis reasonably well.

I. INTRODUCTION

In estimating a demand function of foodgrains imports into India Biswas and Ram (1980) used a basic theoretical model. The model was a blend of the standard import demand function with the government's food-imports decision function, where the imports decision function takes into account such factors as the level of demestic food production, foodgrains stocks and the real foreign exchange reserves of the country. Since there is no reason *(a priori)* to expect there to be any fundamental difference between the import behaviour of foodgrains in Bangladesh and India, we find such a model appealing for any quantitative analysis of foodgrains imports into Bangladesh. However, we will modify their model in order to make it better reflect institutional arrangements in Bangladesh. Furthermore, whereas Biswas and Ram used annual data, we will estimate the model using quarterly data. We will also take into account lags in the adjustment of actual foodgrains imports to the desired level by specifying a partial adjustment function.

The plan of the paper is as follows. Section 2 provides a background information about the production and imports of foodgrains in Bangladesh during the last three and a half decades. Section 3 develops the model. Section 4 estimates the model and

The author is in the Department of Economics, University of Melbourne, Australia.

analyses the results. In order to assess the goodness-of-fit, a dynamic simulation test is conducted and the results are also reported. Section 5 summarises the empirical results and draws the conclusions. Data sources and simulation error structure are reported in Appendices A and B respectively.

II. FOODGRAINS PRODUCTION AND IMPORTS

Rice and wheat are the major foodgrains in Bangladesh ; where, historically, rice has been the staple food, and wheat has emerged as an important food item only since early 60s. In terms of consumers' choice, rice is preferable to wheat under normal circumstances, and many people still consider wheat as the poor man's diet. Of the major crops in Bangladesh,rice tops the list and occupies more than 80 percent of the total cropped area. Rice also constitutes more than 90 percent of the total production of food grains in Bangladesh. Table 1 presents the production and imports of foodgrains in Bangladesh during the last three and a half decades. In the global context, Bangladesh is the fourth largest rice producer in the world, ranked below China, India and Indonesia, and its level of production exceeded 14 million long tons in 1984-85. In contrast wheat production stood at 100 thousand tons in 1969-70, but had reached 1300 thousand tons in 1984-85. Despite this level of foodgrains production, Bangladesh has been a net importer of foodgrains since early 1950s. Until the early 1960s, Bangladsh used to import rice only, but since then, because of increasing food deficits, wheat has been included in import list. During the post-independence period, wheat has emerged as the major imported foodgrain, and has exceeded rice imports by many folds. For example, during 1969-70, to 1984-85, total rice imports were 5.4 million tons, whereas during the same period, total wheat imports were 20.7 million tons. It shows that rice constituted about 20 percent of total foodgrains imports of Bangladesh during the above period. Bangladesh's annual imports of foodgrains now range between 1.2 to 2.0 million tons, which is about 10 to 15 percent of its total foodgrains consumption. The major reasons behind food deficits in Bangladesh are : (i) rapid population growth, (ii) slower growth of foodgrains production, (iii) frequent crop losses due to floodsand other natural calamities, and (iv) unknown but significant quantities of foodgrains smuggled to India.

During the period 1960-61 to 1984-85, foodgrains grew at the compound rate of 2.1 percent per annum, whereas during the same period population increased at the compound rate of 2.5 percent per annum. So, the growth of population outpaced the growth of foodgrains production, and resulted an increasing food deficits. Historically, West Bengal depended on East Bengal (now Bangladesh) for its staple food supply (which continued till 1947). Since then Bangladesh itself has turned into a food deficit region. Nonetheless, food prices (which are regulated) have increased at the lower rates in Bangladesh than in India. As a result, a lucrative food smuggling business began to operate since early

TABLE 1. PRODUCTION AND IMPORTS OF FOODGRAINS (RICE AND WHEAT) IN BANGLADESH 1961-1985 (THOUSAND LONG TONS)

Years[a]	Production			Imports			Popul'n
	Rice	Wheat	All grains	Rice	Wheat	All grains	
1961	9519	32	9551	402	177	579	50.8
1962	9465	39	9504	357	187	544	55·9
1963	8730	44	8774	270	504	774	57.4
1964	10457	34	10491	347	143	490	58.9
1965	10337	31	10368	95	349	444	60.4
1966	10335	35	10370	380	529	909	61.9
1967	9424	53	9477	432	646	1078	63.4
1968	10995	58	11053	307	712	1019	64.9
1969	11165	92	11257	236	884	1120	66.5
1970	11716	103	11819	502	1045	1547	69.3
1971	10967	110	11077	342	804	1146	71.0
1972	9774	113	9887	670	1018	1688	72.6
1973	9932	90	10022	390	2435	2825	74.3
1974	11721	109	11830	82	1584	1666	76.4
1975	11109	115	11224	266	292	2558	78.0
1976	12561	215	12776	396	1049	1445	79.9
1977	11567	255	11822	192	603	795	81.8
1978	12765	343	13107	300	1309	1609	83.7
1979	12543	486	13029	56	1106	1162	85.6
1980	12539	810	13349	903	1923	2826	87.7
1981	13662	1075	14737	83	978	1061	89.9
1982	13415	952	14367	144	1082	1226	91.6
1983	13991	1078	15069	316	1525	1841	93.6
1984	14278	1192	15470	144	1739	1883	95.7
1985	14308	1300	15608	650	2208	2858	98.7
Compound growth rates (estimated from log linear trends)							
	1.8	17.1	2.1	-1.9	8.0	5.1	2.5

Notes and Sources : (i) *a* indicates that year corresponds 1 July to 30 June ; (ii) the production figures are taken from the *Pakistan Economic Survey* (various issues), and the *Bangladesh Statistical Yearbook* (various issues) ; (iii) the imports figures from 1961 to 1964 are taken from Berlage (1972) and from 1965 to 1985 are taken from the *Bangladesh Statistical Yearbook* (various issues) ; (iv) the population figures are in millions and are taken from the *Bangladesh Statistical Yearbook* 1985 ; and (v) the compound growth rates are estimated by the author.

1950s, and a substantial amount of foodgrains have been smuggled to India during the last three and a half decades. In particular, it is believed that during the immediate post-liberation years of Bangladesh (1971-1975), owing to the lack of adequate border control measures, large quantities of (domestically produced and imported) foodgrains have been smuggled to India and significantly contributed to the creation of famine in 1974-75 (Faaland and Parkinson 1976, p. 127 and Mascarenhas 1986. p. 27). In addition, droughts and Foods have caused serious food deficits in many years.

In Bangladesh, foodgrains are imported exclusively by the government and are distributed mainly among the urban population through the rationing system (which itself is an inequitable system of food distribution). The basic aim of foodgrains imports is to stabilise food prices (because rising food prices has serious social and political implications) As, Mascarenhas (1986, p.22) comments that "rice is the staple food of the Bengalis and its price is always the difinitive indicator of the public mood in Bangladesh. When the price is low the administration, however, unpopular it may be in other ways, can hope to muddle through. When the price is high all the danger signals start flashing and it is generally assumed that the government is on its way out". Indeed, the deficiency in calories and protein consumption of the majority of population is a serious concern of the government. Islam (1977. p. 110) suggests that in Bangladesh, imports of foodgrains are related to the need to prevent a fall or even to allow a certain increase in per capita consumption of essential commodities. Until 1971, Bangladesh on average had imported about 25 percent of its imports of foodgrains from Pakistan, and the rest from food-aid donor countries, mainly USA under U.S. Public Law 480. Since 1971, as the amount of food deficits began to increase, Bangladesh found itself in a precarious situation. Its official food-aid was no longer enough to meet its demand, and so, it had to buy substantial quantities of foodgrains from the international market (financed mainly from its own foreign exchange earnings as well as from foreign aid and loans). Availability of free foreign exchange[1] may then be one of the determinents of food imports in Bangladesh. Islam (1977, pp. 110-111), from his experience as the Deputy Chairman of the Bangladesh Planning Commission during 1972-1975, wrote that "in view of the seasonal fluctuations in the price of imported food, there was an advantage in purchasing when prices were low in the world market. In view of the shortage of foreign exchange, on the other hand, it was not always possible to make purchases of foodgrains advantageously when prices were low in the world market". He also wrote that, considering the limited storage facilities, a certain amount of foreign exchange was usually kept in reserve to import foodgrains as and when needed (p.113), Furthermore, food donors often fail to disburse on time the quantities of food aid they usually commit during the food budgeting of Bangladesh. In such a situation, food imports depend on the government's ability to allocate additional foreign exchange either from its reserves or by reducing imports of other items.

III. AN IMPORT DEMAND FUNCTION FOR FOODGRAINS

Despite the large share of foodgrains in the import trade, no systematic econometric analysis of the imports of foodgrains has been undertaken for Bangladesh. An apparent explanation for such a neglect may be that, since imports of foodgrains are regulated by the government, many people possibly consider that standard demand theory is inapplicable to the analysis of foodgrains imports. Biswas and Ram (1980, p.12), however, suggest that "even though controlled by the government, grain imports are made in accordance with a reasonable decision process capable of systematic analysis through appropriate behavioral postulates within the basic economic framework of commodity demand". The basic theoretical model they suggest for India is a blend of a standard import demand function with the government's food imports decision function, where the imports decision function takes into account such factors as the level of domestic food production, foodgrains stocks and the real foreign exchange reserves of the country. As we indicated before,there is no reason (*a priori*) to expect there to be any fundamental difference between the imports of foodgrains in Bangladesh and India, we find such a model appealing for any quantitative analysis of the imports of foodgrains into Bangladesh. As we will be estimating the model using quarterly data, we need to take into account any lag in the adjustment of actual food imports to the desired level. Lioi (1974) suggests that two types of lags usually arise during the process of importing. First there may be delay in getting approvals of imports from the authorities and second, a lag may exist between the approval of imports and the final arrival of imported goods. The duration of the first type of lag usually depends on the nature of products to be imported as well as on the government's import policies concerning the particular items. In the developing countries, because of the foreign exchange shortages, only the imports of foodgrains, raw materials and basic consumer goods get quick approval from the authorities. Imports of relatively non-essential items and capital goods ara usually delayed at least for a short period. The second type of lag is associated with tranesportation and other factors relating to import trading. Such lags in the adjustment of actual imports to the desired level can be taken into account by a partial adjustment func tion, and we will be using such an adjustment function in our import demand function. If there were no intervention by the government for imports of foodgrains, then following the methodology suggested by Biswas and Ram (1980). the foodgrains import demand function of the public can be specified as

$$M_{pt}^{d} = a^{0} \; y_t^{a1} \; (PR^{m}/PR^{d})_t^{b2} \qquad (1)$$

where

M_p^d = desired demand for foodgrains imports of the public (value of foodgrains imports deflated by the import price of foodgrains) ;

Y=real income ;

PR^m=import price of foodgrains in domestic currency ;

PR^d=demestic price of foodgrains ;

t=time subscript ; and

a^0 is the regression constant and a_1 and a_2 are the parameters.

Since food imports are controlled by the government , we cannot use the above specification directly. We assume that the government does not import foodgrains in accordance with the import demand function specified above. Instead, it (implicitly) utilises a decision function which can be related to the level of the most recent domestic food production, foodgrains stocks and the real foreign exchange reserves (nominal foreign exchange reserves deflated by the import price of foodgrains) of the country. The government's (implied) decision function for food imports (GDF) in Bangladesh can be specified[2] as

$$GDF_t = GDF_t\ [QF_{t-1},\ (FER/PR^m)_t] \qquad (2)$$

where QF=level of foodgrains production ; and FER=foreign exchange reserves.

Combining equations (1) and (2) we find the government's foodgrains import demand function

$$M^d_{gt} = a^0\ Y_t^{a_1}\ (PR^m/PR^d)_t^{b_2}\ GDF_t\ [QF_{t-1},\ (FER/PR^m)_t] \qquad (3)$$

Since equation (3) is not fully parameterised, we assume that GDF_t (•••) takes the following Cobb-Douglas form

$$GDF_t = QF_{t-1}^{\beta_1}\ (FER/PR^m)_t^{\beta_2} \qquad (4)$$

where β_1 and β_2 are the elasticities of foodgrains imports with respect to the levels of foodgrains production and the real foreign exchange reserves of the country. Equation (3) then becomes

$$M^d_{gt} = a^0\ Y_t^{a_1}\ (PR^m/PR^d)_t^{b_2}\ QF_{t-1}^{\beta_1}\ (FER/PR^m)_t^{\beta_2} \qquad (5)$$

Take logarithms of equation (5) and then we obtain the following equation

$$\text{In } M^d_{gt} = a_0 + a_1 \text{ ln } Y_t + a_2 \text{ In}(PR^m/PR^d)_t + \beta_1 \text{ In } GF_{t-1} + \beta_2 \text{ In } (FER/PR^m)_t \quad (6)$$

We will now suggest the expected signs of the coefficients in equaion (6). As the real income increases, the demand for food also increases, and a part of that increased demand is for imported foodgrains. Since the majority of people in Bangladesh live on or below the subsistence level, it is expected that an increase in realin come will increase the demand for foodgrains substantially. The coefficient on real income is therefore expected to be positive. Since the consumers prefer domestic foodgrains to imported foodgrains, an increase in the level of domestic foodgrains production (ceteris paribus) will reduce the level of foodgrains imports. The expected sign of the coefficient on foodgrains production is therefore expected to be negative. It is also to be expected that the higher the import price (relative to domestic price), the lower will be the imports of foodgrains. This is because, unless there is an emergency situation, the government may delay food imports if food prices are found to be relatively higher in the international market. On the other hand, the higher the prices of foodgrains at home, the greater the likelihood that the government will import more foodgrains in order to stabilise domestic food prices. The expected sign of the coefficient on relative food price is negative. As the level of real foreign exchange reserve rises, the government will find it easier to import foodgrains without reducing other imports. The expected sign of the coefficient on real foreign exchange reserves is therefore expected to be positive.

Usually, the timing of the decision of food imports and the actual arrival of imports are syncronised in such a way that the imported foodgrains become available in the market at the (projected) time of need. In order to take into account lags in the adjustment of actual foodgrains imports (Mg) to the desired level, we specify the following partial adjustment function.

$$\ln Mg_t - \ln Mg_{t-1} = \gamma (\ln M^{d}_{gt} - \ln Mg_{t-1}) + U_t \qquad (7)$$

where γ is the adjustment coefficient, and its value is expected to lie between zero and unity. U_t is the disturbance term which allows rendom influences in carrying out the adjustment process.

Substituting equation (6) into equation (7) and after rearrangement we obtain the following estimating equation

$$\ln Mg_t = \gamma a_0 + \gamma a_1 \ln Y_t + \gamma a_2 \ln(PR^m/PR^d)_t + \gamma \beta_1 \ln GF_{t-1} + \gamma \beta_2 \ln(FER/PR^m)_t + (1-\gamma) \ln Mg_{t-1} + U_t \qquad (8)$$

IV RESULTS AND DISCUSSION

Estimation and Results

Preliminary estimation results (by OLS) suggest that autocorrelation is significant. The presence of autocorrelation may be a sign of specification error. It is expected that in

the foodgrains import demand function, some non-economic factors may be important which we have not been able to incorporate in our model for lack of our knowledge about those factors, However, in order to correct the autocorrelation problem we have used the Cochrane-Orcutt iterative procedure. Since rice is the major foodgrain in Bangladesh, the production of rice has been used as a proxy for foodgrains production. The weighted average of the prices of rice and wheat in the U.S. market (expressed in Bangladesh currency) (where weights are the proportions of rice and wheat imports into Bangladesh) has been used as proxy for the import price of foodgrains in Bangladesh. Quarterly data for real income are not available for Bangladesh. We have, therefore, interpolated the annual data using Gandolfo's (1981) methodology. DJ, DS and DD are the seasonal dummies (DJ for June quarter, DS for September quarter and DD for December quarter). It is sometimes argued that relative price lagged by one period is more appropriate in the import demand function. We have therefore estimated the equation using both current and relative price lagged by one period alternatively. The preferred equations (one with the current relative import price and the other with relative import price lagged by one period) are presented below. As the coefficient on real foreign exchange reserve is not statistically significant, it has not been included in the preferred equations. The figures in parentheses are t-ratios. SER and SSR represent the standarde rror of regression, and the sum of squared residuals respectively. ρ represents the first-order autocorrelation coefficient. LM is the lagrange multiplier statistic about the normality of residuals. h represents the Durbin-Watson h-statistic which needs to be used when the lagged dependent variable is used in the regression equation.

Estimates of the Foodgrains Import Demand Function (with current relative import price):

$$\begin{aligned} \ln Mg_t = &-2.614 + 1.808 \ln Y_t - 1.999 \ln QF_{t=1} - \\ &\quad (0.615)\ (4.205)\qquad (3.702) \\ &0.302 \ln(PR^m/PR^d)_t + 0.416 \ln Mg_{t-1} + \\ &\quad (1.782)\qquad\qquad (3.182) \\ &0.801\ DJ_t - 0.925\ DS_t - -0.317\ DD_t \\ &(2.402)\qquad (2.226)\qquad (0.926) \end{aligned}$$

$\rho = -0.596$, SSR=5.924, SER=0.406, Adjusted R^2=0.538, F=7.933, N=44, h=0.80, LM=0.669

Correlogram

Coeff : −0.007 −0.070 −0.204 −0.001 0.214 −0.114 0.070

t-stat −0.048 −0.468 −1.366 −0.008 1.438 −0.762 0.471

Estimates of the Foodgrains Import Demand Function (with relative import price lagged by one period):

$$\ln Mg_t = -3.199 + 1.842 \ln Y_t - 1.957 \ln QF_{t-1} - 0.358 \ln(PR^m/PR^d)_{t-1} + 0.327 \ln Mg_{t-1} + 0.748\, DJ_t - 0.936\, DS_t - 0.328\, DD_t$$

(0.849) (4.277) (3.640) (2.090) (2.408) (2.391) (2.281) (1.026)

$\rho = -0.568$, SSR=5.746, SER=0.399, Adjusted $R^2=0.541$, F=8.011, N=44. h=0.91, LM=0.681

Correlogram

Coeff : 0.015 −0.028 −0.206 −0.045 0.169 −0.114 0.070

t-stat 0.102 −0.190 −1.381 −0.299 1.131 −0.763 0.466

As expected, the coefficient on real income is positive and statistically highly significant. The income elasticity of the demand for imported foodgrains is greater than unity. Biswas and Ram (1980) also found an income elasticity of the demand for food imports greater than unity (1.878) for India. This is presumably not unusual in a country where the majority of the people live on or below the subsistence level. The coefficient on rice production lagged by one period has turned out to be negative as expected and is also statistically significant at the 1 percent level. The negative coefficient suggests that an increase in rice production reduces the imports of foodgrains. Since there are limited public foodgrains storage facilities, the government cannot always import more than what is required (in order to fill deficits) and to build foodgrains stocks. So, the level of food grains production in the previous quarter influences the government's decisions for food imports. The estimated elasticity of the demand for foodgrains import with respect to domestic food production is greater than unity. This suggests that as the level of domestic production increases by one unit, the imports of foodgrains decrease more than one unit. The reason is that because of its vital importance, a production shortfall encourages hoarding by the speculators and traders, and the consumers, expecting higher prices in the future, also purchase more than their usual requirements. The opposite happens when there is a good harvest. The speculators and traders in such a situation supply more foodgrains in the market from their stocks and the consumers, expecting lower prices in the future, also purchase less, and as a result the government can import less than what the production level suggests. The coefficient on relative food price either current or lag by one period) is negative and is also statistically significant. However, instead of the current relative price, relative price lagged one period is found to have higher explanatory power. The latter specification may then be preferable to the former for simulation analysis. On the basis of this preferred equation, the short run price elasticity of the demand for foodgrains imports is 0.357 and given the adjustment coefficient of 0.673, the long run price elasticity is 0.53. The imports of foodgrains in Bangladesh therefore seem to be price inelastic. Given that foodgrains are essential imports, the esti-

mated price elasticity is quite sensible. The real foreign exchange reserve was used to capture the capacity to import foograins by the government, which, however, was not found to be statistically significant (although it carried a positive sign). It appears that foreign exchange reserves are not an effective constraint as far as foodgrains imports are concerned. In fact, Bangladesh, since its independence, had faced a real fooreign exchange crisis only in 1974-75 ; yet, it is possible that any constraint imposed by the foreign exchange reserves has not been captured in our model. Biswas and Ram also found that the coefficient on foreign exchange reserves was not statistically significant for India. The elasticity of the coefficient on adjustment is 0.673 which suggests an average lag in the adjustment of foodgrains impots less than a quarter. Suah a high adjustment coefficient reflects the essential nature of foodgrains imports in Bangladesh.

Dynamic Simulation Test

In order to assess the goodness-of-fit of the estimated equatin, we have conducted a dynamic simulation test for the estimation period 1974(1) to 1985(1). The simulation is dymamic in the sense that the endogenous and the lagged endogenous variables assume their solution values during simulation, while the other variables take their actual values. Klein and Young (1980, p. 65) suggest that "a dynamic simulation is clearly a stringent test of a model and is clearly the excercise most like forecasting. It is a test that a model must pass before we would be willing to use it for forecasting purposes. It can be used not only to evaluate the contemporaneous relationships within a model but also the dynamic characteristics". Actual and simulated values of the estimated equation are presented in the following chart. Since it is not always sufficient to analyse the simulation results just by presenting a simulation chart (while various statistical tests are available), we have also reported the error structure of the simulated variable in Appendix B. The major summary statistics used in evaluating the simulation results are root-mean-square simulation error, mean-square-error, regression coefficient of actual on predicted values and the Theil's inequality coefficient. From the viewpoint of a quarterly model, Klein and Young (1980) suggest that the most important dynamic statistics are those relating to turning point error and measures of deviations of variables from their historical paths. The Theil's inequality coefficient and its decomposition into inequality proportions (together with the root-mean-square simulation error) are the statistics related with the tracking performance of the individual equations. In theory, the Theil's inequality coefficient is expected to lie between zero and unity. When the simulated values perfectly coincide with the actual values, the inequality coefficient becomes zero, and the inequality coefficient becomes unity when the simulated values are totally different from the actual values. Another important measure of simulation fit is how well the model simulates turning points in the historical data series. The ability of a model to reproduce turning points or direction of actual data is an important criteria of model simulation. The model which can track the turning points of actual data is better than

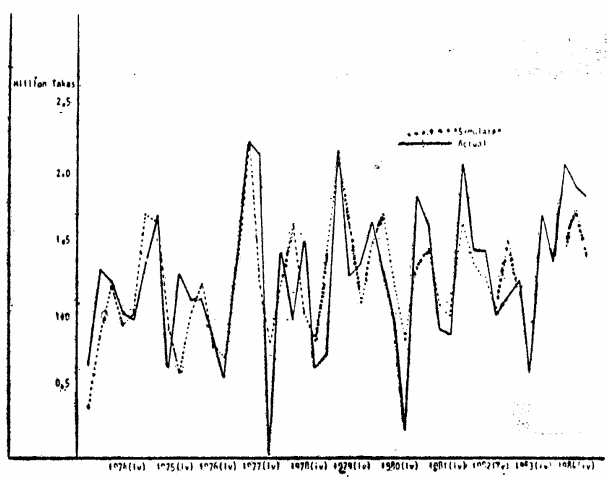

CHART 1: Rho-Transformed Actual and Simulated Values of the Real Imports of Foodgrains (million tonnes)

the model which cannot. As far as our model is concerned, the estimated equation is able to track the wide fluctuations of the imports of foodgrains reasonably well.

V. CONCLUDING REMARKS

In this paper we have analysed the pattern of foodgrains production and imports in Bangladesh during the last three and a half decades. In order to identify the major determinats of foodgrains imports in Bangladesh, we have specified and estimated an import demand function using quarterly data. Because of the lack of quarterly import price of foodgrains, we have been forced to use a proxy for the estimation of the model. The presence of autocorrelation may be a sign of specification error, possibly arising because non-economic factors were not included in the model. The empirical results therefore should be used with caution. Despite these shortcomings, the results suggest that it is possible to analyse the imports of foodgrains within the standard theoretical framework. The simulation results suggest that the model is able to track the wide fluctuations of the foodgrains imports into Bangladesh reasonably well.

Notes :

1. Bangladesh receives foreign exchanges from different sources which are not always substitutable. For example, foreign exchange earned from exports can be used for

financing any imports, but foreign aid and loans are mostly tied to specific projects. Also, foreign exchange earnings from exports under barter agreements do not constitute free foreign exchange. For details of the non-substitutability of foreign exchange earnings from different sources see Islam 1977, pp. 110-111.

2. For lack of quarterly data we have not included the foodgrains stocks in the specifi cation. Because there are limited public storage facilities in Bangladesh and it is assumed that any food deficits that arise are met from imports.

Acknowledgement

The author gratefully acknowledges the critical comments and useful suggesstions received from Dr Robert Dixon on early drafts of this paper. Any remaining errors and shortcomings are solely the author's own responsibility.

Appendix A : Data Sources

1. Quarterly values of foodgrains Imports (million takas) are taken from the *Quarterly Bulletin of Statistics for Asia and the Pacific* (various issus) :
2. Prices of rice and wheat in the US markets are taken from the *International Financial Statistics,* several issues ;
3. Food price index of Bangladesh are taken from the *Quarterly Bulletin of Statistics for Asia and the Pacific* (variousi ssues) :
4. Foreign exchange reserves of Bangladesh are taken from the *international Financial Statistics* (various issues) :
5. Rice production series from 1974 (I) to 1979 (iv) are taken from Ahmed (1984) and from 1980(I) to 1985(I) are estimated by the author using Ahmed's methodology :
6. Real gross national product data are interpolated from the annual figures by using Gandolfo's (1981) methodology. Annual figures are taken from the *International Financial Statistics Year Book* for the period 1973-1984, and figures for 1984-85, 1985-86 and 1986-87 are extrapolated on the basis of projected growth rates adopted by the Bangladesh Palanning Commission ;

Appendix B

Simulation Error Structure

a.	Mean of the Variable	2.043
b.	Correlation Coefficient	0.667
c.	Root-Mean-Squared Error	0.383
d.	Mean Absolute Error	0.301
e.	Mean Error	0.006
f.	Regression Coefficient of Actual on Predicted Values	0.905
g.	Theil's Inequality Coeff.	0.077
h.	Fraction of Error Due to Bias	—
i.	Fraction of Error Due to Different Variation	0.124
j.	Fraction of Error Due to Different Covariation	0.876
k.	Fraction of Error Due to Difference of Regression Coefficient from Unity	0.009
l.	Fraction of Error Due to Residual Error	0.991

Note :—=negligible

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