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A MACRO ECONOMETRIC MODEL OF FOOD FOR THE INDIAN ECONOMY

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Abstract: *This study made an attempt to project demand and supply of food for Indian economy up to the 2030 on the basis of 2011-12 data. For this purposes the study used macro econometric analysis which is motivated from Kline model and developed six equation that is demand for food, output of food, price of food, supply of food, stock of food and excess supply of food. Out of six equations last three which is supply, stock and excess supply of food is identity and rest of the function/structural equation will be estimate. On the basis of data available the study project the demand for food grain in 2030 will be 285.84 million ton, supply of food will be 345 million ton, stock of food grain will be 126.9 million ton, price of food will be 8390.7 rupees per quintal, according to 2004-05 prices per capita income will be 97179 rupees and projected population will be 165 crore. All the projection about variable based on Compound Average Growth Rate (CAGR).*

Keywords: Macro, Econometric, Model Food, Indian Economy

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INTRODUCTION

In recent year, many econometric models have been estimated for use by the government. Forecasts from small and large models are regularly published and used by many business corporations in making their investment plants. Models have proved an informative tool. Their use can best be describe as prediction. In addition, a government may use an econometric model in policy formulation. Macroeconomic models have grown in size and number very rapidly in recent years. At the begging of the 1950's, the largest econometric model of United. States. was the Kline-Goldberger this was an annual model estimated for 1929-1952 with 22 simultaneous equations this was an advanced over Kline's model known model one published in 1950 which had only three stochastic equations. Today, the largest models are quarterly and run into two to three hundred equations. Similar examples can be cited for the United Kingdome econometric models. Why large models are clearly advantages, there is no universal agreement on the desirability of larger modes. Macroeconomic models are not the only example of larger econometric model. Another type of model is the commodity model. Commodity model are also simultaneous equations models, but pertained to demand and supply of one are many commodity. The theoretical framework for macro models is provided by

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Keynesian Economics. Econometric models, in fact, derive from macroeconomic theory and national income statistics. In a model of the Keynesian cross we have two equations-one stochastic and the second an identity. The stochastic equation is the consumption function expressing real consumption (Ct) as a function of total real income (Yt), i.e. Ct = $\alpha_0 + \alpha_1$ Yt + ut the second relationship is the income identity, Yt = Ct + It where It is real investment. We have two endogenous variables Ct and Yt and one exogenous variable It. But this is a very abstract and unrealistic picture of how economy works. It height the fact that there is no subscribe constant in the model. All expenditure is translated into output and income. It also neglects the labour market and the money market. This model has been improved by IS-LM model with six equations. The Kline model one is a model for the U.S. economy estimated for the inter-war period 1921-41. It is a model with three stochastic equations and three identities. It is known in econometric literature as the Kline model one. We have therefore a small income-expenditure model which explains six endogenous variables and there are nine pre-determined variables. By order conditions, each stochastic equation is over identified. The model is stochastic, linear, simultaneous, and dynamic. (Applied Econometrics, Meghnad Desai,0-07-099277-0, Tata McGraw-Hill Publishing Company Ltd. N. Delhi). Problems in the task of model building for the Indian economy and for most less developed country are enumerated in Meghnad J. Desai's survey- 'Macro econometric models for India: A survey'.

At the back of our mind is a model of a commodity model of the food markets. If we confine to the market for food we can clearly take income as a datum since income influences the market for food. Income is thus treated as an exogenous variable in the proposed model but we still have to say how many equations there should be in the proposed model. Clearly, economic theory suggests that we need a supply equation for food together with a market clearing price determining equation. Since food is storable supply for food (SFt) consist of the out of food (QFt) and the previous stocks of food (STFt-1). We have setup our model as follow; (Applied Econometrics, Meghnad Desai, 0-07-099277-0, Tata McGraw-Hill Publishing Company Ltd. N. Delhi).

1) DF_t = D (PFt, Yt, LRt, U1t) (Demand for food)
2) PFt = P (ESFt, U2t) (Market clearing equation)
3) QFt = Q (PFt, U3t) (Output of food)
4) $SF_t = QF_t + STF_{t-1}$ (Supply of food)
5) $STF_t = STF_{t-1} + (QF_t - DF_t)$ (Stocks level)
6) ESF = SFt - DFt (Excess supply)

The symbols used and their description are given below;

Symbol	Description
DFt	Demand for food at time t,
PFt	Price of food at time t,
Yt	Income at time t,
LRt	Literacy rate at time t,

SFt Supply of food at time t,
QFt Output of food at time t,
STF_{t-1} Previous stock of food, i,e, stock at time $_{t-1}$,
$STFt$ Current stock of food at time t,
$ESFt$ Excess supply of food at time t.

The linear version of the model in equations 1-6 can we written in terms of system of stochastic, simultaneous and dynamic equations as follows;

1. $DF_t + \beta_{12}PF_t + \gamma_{11}Y_t + \gamma_{12}LRt + C_1 = u_{1t}$
2. 2) $-\beta_{21} DF_t + PFt + \beta_{21} SF_t + C_2 = u_{2t}$ $(PFt = C2 + \beta_{21} ESFt + U2t)$
3. $\beta_{32} PF_t + QFt + C_3 = u_{3t}$
4. $SF_t = QF_t + STF_{t-1}$
5. $STF_t = (QF_t - DF_t) + STF_{t-1}$
6. $ESF = SFt - DFt$

The above proposed macro econometric model consist of six equations with six endogenous variables- DF, PF, SF, QF, STF, ESF- and three exogenous variables- Y, $STF_{t-1,}$ and LR. In fact STF_{t-1} is a lagged endogenous and hence pre-determined. In the model there are three stochastic equations which are in implicit function form an include random error term U1, U2 and U3 in the arguments. The three other equations are definitional identities for supply, stock, and excess supply. We have added excess supply of food (ESF) as an auxiliary variable. The identification status of the model is checked and the equations are identified, equation No. 1 is exactly identified and whereas 2, 3 are over identified. As identities do not involve any parameters we need not discuss their identification. This is the reason why 2SLS is used for estimating parameters of the model. To estimate the parameters of the model we have used the data collected by NSSO various rounds, CSO, FCI, Agriculture prices in India, Census and agricultural statistics at glance, ministry of agriculture (GoI), for the period 1991-2011. On the basis of these data we have made prediction about demand for foodgarin, supply of foodgrain, stock of foodgrain, price of foodgrain, per capita income, and population of the India up to the 2030.

The estimated model is given as under;

1) $DFt = - 2.97 +.012\ PFt - .002\ Yt + 3.61\ LRt$,	$R2 = 0.97$, Root MSE = 2.13
2) $QFt = 154.88 + 0.035\ PFt$,	$R^2 = 0.077$, Root MSE =10.73
3) $PFt = 301.28 + 20.851\ ESFt$	$R^2 = 0.356$, Root MSE = 449.34
4) $SFt = STF_{t-1} + (QF_t - DF_t)$	Identity
5) $STF_t = QF_t + STF_{t-1,}$	Identity
6) $ESF = SFt - DFt$,	Identity

From the above equation the regression coefficients of the functional equations are significant.

Predicted Value of Various Items (On the Basis of 2011 data):

Years	Food-grain demand (million tonnes.)	Food-grain supply (million tonnes)	Food-grain stock (million tonnes)	Food-grain price In Rs./ quint.)	Per-capita income (at 2004-05 prices)	Population (millions)
2012	213.25	261.4	56.9	2759.2	40078	1230433863
2013	216.75	265.5	59.5	2935.1	42100	1250624107
2014	220.31	269.6	62.2	3122.2	44223	1271145654
2015	223.92	273.8	65.0	3321.2	46454	1292003939
2016	227.60	278.1	68.0	3532.8	48797	1313204490
2017	231.33	282.4	71.1	3758.0	51258	1334752921
2018	235.13	286.8	74.3	3997.5	53843	1356654941
2019	238.98	291.2	77.7	4252.3	56559	1378916352
2020	242.91	295.7	81.2	5423.3	59411	1401543052
2021	246.89	300.3	84.9	4811.6	62408	1424541034
2022	250.94	305.0	88.8	5118.3	65556	1447916392
2023	255.06	309.7	92.9	5444.5	68868	1471675316
2024	259.25	314.6	97.1	5791.5	72335	1495824102
2025	263.50	319.4	101.5	6160.7	75984	1520369146
2026	267.82	324.4	106.1	6553.3	79816	1545316951
2027	272.22	329.4	111.0	6971.0	83842	1570674126
2028	276.68	334.6	116.0	7415.3	88071	1596447388
2029	281.22	339.8	121.3	7887.9	92513	1622643564
2030	285.84	345.0	126.9	8390.7	97179	1649269594

CONCLUSION

Estimated equations such as demand, output and market clearing equations are significant, the coefficients of the all three functional equations are also significant and R square of demand and output equations are very high but the market clearing equation are not high. It means what we have estimated and projected about demand for foodgrain, output of foodgrain, price of foodgrain, per capita income of the population, and number of population is correct. Projection about various variables said that if we really wants to reduce food security and increase per capita income then government must be concern about all these things and to maintain agricultural production government must be increased investment to creating agriculture infrastructure and introduce new employment related programme so that people have income and they become able to get access to food for their active and healthy life.

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