Modelling for Risk and Uncertainty, Resource Use Efficiency and Agricultural Marketing

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1. Introduction

The nature of challenges in Indian Agriculture has changed in the recent years. It is no more a question of substituting imports of cereals through rapid growth in their production. The additional production of cereals of course needed in a cost-effective manner to facilitate employment oriented growth. Farmers often prefer farm plans that provide a satisfactory level of security. It is therefore becomes essential for the farm economist to incorporate risk in the farm planning models. Emerging scenario of input utilization of the factors of production under farmer's control has been assessed in a manner that a scientific insight for resolving the problem of measuring management input component present in economically defined concept of Residual due to Risk and Management which has direct bearing for determining rational minimum support price policy with the help of heuristically deduced results of actual and frontier figures relating to levels of output, gross revenue and net returns**.** Crop insurance may be considered as a viable alternative to mitigate the risk & uncertainty. Presently, crop insurance in India is following as area based approach and insures for yield losses only. However, in general, farmers are prone to the price risk along with yield risk. Whenever there is glut in the market due to good yield, there is more than proportional drop in the prices of commodities leading to heavy losses to the farmers. A new risk management tool known as crop revenue insurance (CRI) can address this problem. Crop insurance may help us to minimize the extent of uncertainty and level of risk factor. The next step is how to improve the resource use efficiency in our farming system as most of our inputs bears low marginal productivity which indicates that inputs are underutilized or not properly used. Therefore increasing efficiency in resource use is another approach to enhance farm profitability. The history of economic development of various advanced countries shows that technological change has been the most powerful factor of economic growth. Technological change has helped not only in raising the factor productivity but also in generating surplus for overall development. The adoption of modern technology might disturb the traditional resource equilibrium. Adjustment in resource use in response to technological change is based largely on trial and error method. The study on resource use efficiency at different levels of technology adoption assumes considerable importance in resource allocation pattern. Technological change may affect the relative economic position of the factors of production in terms of their share in total output and thus has implication on income distribution. The marketing is the next area of research to increase profitability in the farm sector. Agricultural marketing plays an important role not only in stimulating production and consumption but in accelerating the pace of economic development. Market information is needed by farmers in planning production and marketing, and is equally required by other market participants in arriving at optimal trading decisions. The existence and dissemination of complete and accurate marketing information is the key to achieving both operational and pricing efficiency in the marketing system. There are several areas of agricultural marketing with which farmers need to be fully familiarized in order to improve price realization. Agricultural marketing is witnessing major changes owing to liberalization and globalization of markets. In this context agriculture has to be market driven, more cost effective, competitive, innovative

and responsive to high tech and I.T applications. In marketing, the Technical Efficiency is said to have increased when operational cost is reduced for performing a function for each unit of output. This can be achieved by reducing physical losses and improvement in technology to carry out a particular function viz storage, transportation, handling and processing. A change in the technique may result in the reduction of per unit cost. Allocative efficiency of the market system refers to efficient allocation of farm products either over time or across the space among the traders, processors and consumers so as to protect the economic interests of producers and consumers. Market integration refers to those markets where prices are determined interdependently. It is assumed that price changes in one market will be fully transmitted to other markets (Engle and Granger, 1987. The Price Spreads represent the difference between retail and farm prices of a specific product at a given point in time. The length of price spread depends upon the number of channels involved in the marketing of a particular product. If the number of marketing channel or middlemen is large consumer has to pay more price because every channel will add its own cost &margin to the price of the commodity. Therefore it is argued that efforts should be to minimise the number of channel and especially unproductive channels should be eliminated from the marketing chain through market reforms.

2. Aims and Objectives

To achieve this thrust area followings are the broad objectives. In the study on, the farmer's behaviour towards risk and its effect on resource allocation and farm income the main objectives were, to study farmers behaviour towards risk with respect to purchased inputs, to identify the determinants of attitude towards risk for sampled farmers and to examine the impact of risk on cropping pattern, level of resource use and farm income. This study was based on primary data of the sampled cultivators spread over Umrain and Ram Garh, development blocks in District of Alwar (Rajasthan) and Loni and Bhojpur development blocks in district of Ghaziabad (U.P.). In the study on, Testing relative economic efficiency and determination of factor demand and output supply functions for wheat. The objectives were, to test the relative economic efficiency between large and small farms of wheat crop, to determine the demand for labour and fertilizer in the production, and to determine the output supply function. The farm level wheat data of Punjab and Haryana state for the year 1985-86 collected from Directorate of Economics and Statistics, New Delhi were utilized in this study. In the study on, An Econometric Approach for Measurement of Indemnity and Premium Rates under Crop Revenue Insurance with the objectives to examine the sources of instability for identifying critical variables for Crop Revenue Insurance, to estimate indemnity and premium rate of selected crops in different states of India for Crop Revenue Insurance and to explore the feasibility of Revenue Insurance approach vis-à-vis Yield Insurance approach in Indian agriculture. To measure the instability of economic variables (area, yield and price), Cuddy-Della Valle index (corrected coefficient of variation) is used which takes in to consideration the long-term trend. Premium rates have been estimated with the help of existing yield approach methodologies for different crops of Uttar Pradesh and Karnataka state. The specific objectives of the study on, "A Study on Production Efficiency and Resource Use in Poultry Production" were to study the pattern of poultry production, level of investment and capital requirement in poultry enterprises, to study the pattern of resource use and its efficiency in poultry production, to examine the profitability of poultry enterprises and to study the constraints faced by poultry producers. The data utilized in the study pertains to 41 poultry farms of varying size and spread over different poultry pockets of Ambala district of Haryana State. The data was

obtained from the Department of Animal Husbandry Statistics (AHS), Haryana Government, Chandigarh. The data was collected by Department of AHS under the Integrated Livestock Survey Scheme. Data used in the study was for the period of 1991-92 to 1994-95. In the study on, Econometric Study of Technological Dualism in Egg Production the specific objectives were to study extent of technological dualism and technological change in egg production, to study the effect of technological dualism and technological change on functional income distribution, and to examine economic efficiency under different levels of technology. The project is based on primary survey data of selected layer poultry farms spread over two districts of Punjab namely Ludhiana and Mansa. In Ludhiana district, 30 farms (including deep litter and cage system farms) were randomly selected for canvassing the specified data and in Mansa district, 50 farms were randomly selected. From the selected farms, primary data was collected at fortnightly interval. The primary data were collected for a period of 18 months, from the month of June 2002 to December 2003, as the egg layer bird has a productive life of 18 months. In the study on, Policy Analysis & Market Intelligence (NAIP Project), the objectives are to analyze the supply and demand of major agricultural commodities, to monitor price trends of major commodities in selected domestic and global markets, to study market integration and futures market, and to perform action research on smallholders' participation in futures market. In the, Study of Lac Marketing in India, the objectives were, to study existing marketing channels and price spread in Lac Marketing, to examine extent of market integration in Lac Markets and to suggest remedial measures for improving marketing environment of Lac in India. The three aspects namely Lac cultivation, Lac marketing and Lac processing were examined in the major producing states of Jharkhand, W.Bengal, Chhattisgarh, Madhya Pradesh and Maharashtra by primary Survey data.

3. Minimizing Risk and Uncertainty

The farmers are much concerned about risk in their decision making whether they are risk taker or risk averse. The two major source of crop income risk are prices of inputs, crop output and the resultant yield of the crop. More secure farm plan may involve producing less of risky enterprises, diversifying into large number of enterprises to spread risk, using established technology rather than adopting a new one. In our farm planning models a little progress has been made to incorporate risk in the production models. In this direction a study of Farmers behaviour towards risk and its impact on cropping pattern, level of resource use and farm income was undertaken in the division. The study was based on primary survey data of the sampled cultivators spread over Umrain and RamGarh development blocks in the district Alwar: Loni and Bhojpur, development blocks in the district of Ghaziabad. Stochastic linear programming model was used to incorporate risk in the optimal crop plans. The risk-aversion coefficient 'K' was measured through a formulation developedusing the following formulae.

$$K = \frac{1}{\theta}\left(1 - \frac{P_i}{Pf_i}\,\frac{X_i}{\mu_y}\right)$$

where $\theta = \frac{\sigma_y}{\mu_y} \times 100$, given coefficient of variation of yield, P = given factor prices, P_i = given product prices of i^{th} product, X_i = ith input vector, f_i = elasticity of production function of the input and y = yield.

The specific results of the study indicated that use of chemical fertilizers was largely confined to the Rabi season crops like wheat, mustard and Barley. The rates of fertilizers application were significantly

higher in the district Ghaziabad as compared to district Alwar. The values obtained for risk-aversion coefficient 'K' indicates the extent of risk-aversion for a particular farmer in a particular crop on the purchased input. The observed value of 'K' was higher in wheat crop as compared to mustard, which indicates that returns were more attractive in mustard crop as compared to wheat crop. In the district of Ghaziabad the observed value of 'K' was higher as compared to district Alwar, which again indicates that district Alwar has much higher potential of net returns. Among different categories of farmers the observed value of 'K' reveals no set pattern as it depends mainly on the performance of individual farmer. The main determinants of the attitude towards risk as identified in the study were, age and education of the decision maker in the family, holding size and number of earners and helpers in the family. The optimum crop plans were obtained for the different categories of farmers in the four development block under study. The studies mentioned above help us to minimize the extent of uncertainty and level of risk factor. The next step is how to improve the resource use efficiency in our farming system as most of our inputs bears low marginal productivity which indicates that inputs are underutilized or not properly used. Therefore increasing efficiency in resource use is another approach to enhance farm profitability.

4. Testing Relative Economic Efficiency and Determination of Factor Demand and Output Supply Functions

The study aimed to test the relative economic efficiency between large and small farms of wheat crop, determine the demand for labour and fertilizer in the production, and determine the output supply function. The farm level wheat data of Punjab and Haryana state for the year 1985-86 collected from Directorate of Economics and Statistics, New Delhi were utilized in this study. By Unit Output Profit (UOP) function approach and applying the Lau-Yotopoulos test the study inferred that there is no significant difference between the large and small farmers in their relative economic efficiency in both the states. The same set of conclusions are also drawn when the data of both the categories of farmers are applied to Chow-test indicating the fact that the two groups of sample farms do not give different relationship. Therefore, there are reasons to believe that the Punjab and Haryana agriculture has been modernized, relying on new varieties of seeds, fertilizers, irrigation and other chemical inputs for which both the large and small farms have similar access. Further, the salient futures of the present study reveals that in all the estimating equations, the 1985-86 wheat data of Punjab and Haryana provides goodness of fit as witnessed by the values of coefficient of determination and F-statistic. In almost all the cases normalized price elasticities of variable inputs are less than one indicating inelastic response. However, the price elasticities of output obtained from relevant estimating equations are greater than one indicating elastic response. The estimated coefficient of land input is highly significant. Almost in all the cases unconstrained joint GLS coincides with the LS estimates. The reduction in the standard error and substantial improvement in the estimates of the coefficient of normalized prices of variable inputs is obviously a clear cut indication that constrained joint GLS should be preferred over unconstrained joint GLS of SURE methodology under the framework of UOP project function.

5. Measurement of Indemnity and Premium Rates under Crop Revenue Insurance

The study aimed to examine the sources of instability for identifying critical variables for Crop Revenue Insurance, to estimate indemnity and premium rate of selected crops in different states of India for Crop

Revenue Insurance, to explore the feasibility of Revenue Insurance approach vis-à-vis Yield Insurance approach in Indian agriculture. To measure the instability of economic variables (area, yield and price), Cuddy-Della Valle index (corrected coefficient of variation) is used which takes in to consideration the long-term trend. Premium rates have been estimated with the help of existing yield approach methodologies for different crops of Uttar Pradesh and Karnataka state. Data sets have been subjected to Normality test wherever required. Premium rates were calculated by the normal curve technique with some exceptions indicating for the instability in the yield for that particular crop. For the nonparametric kernel approach, the window width has been estimated which are found in the range of 120 to 230. For premium estimation under crop revenue insurance, gross return is taken into consideration. In Karnataka state revenue and yield showed low instability compared to area. But in case of Uttar Pradesh, instability was low for all the parameters. Under crop revenue approach, the proportion of almost all the crop strata was having high revenue premium rates than yield premium in Karnataka State. However, in Uttar Pradesh, the revenue premium rates were low in comparison to the yield premium rates. A comparison of estimated revenue premium rates for Karnataka and Uttar Pradesh state showed that the majority of crop strata were having low premium rates in Uttar Pradesh in comparison to Karnataka state.

6. Production Efficiency and Resource Use

The study *was* undertaken to identify the factors responsible for inefficient resource use in production and imperfections in marketing of poultry products. The central points of interests that emerged out of the study are the role of size of farms and season on the economic viability and thus profitability of the poultry enterprises. The important features of the study are as follows:

1. Estimates of costs and returns on egg layer farms indicate that feed alone constitutes about 70 percent of the total cost of egg production. Small farms earning about Rs. 2 per bird in summer and rainy seasons and up to Rs.10 in winter season. Large farms on the other hand earning up to Rs.30 per bird. The seasonal effect on returns entered through price of eggs which are higher in winter season.
2. Returns on broiler farms indicate that feed constitutes about 55 percent of the total cost. In summer season the net returns on small farms are least i.e. Rs. 339 per 100 birds. While in other cases the net returns from broiler production remained around Rs. 800 per 100 birds.
3. The small farms are incurring more expenditure on inputs which ranges between Rs. 109 to 141 per 100 birds which is more as compared to medium and large farms. This high input cost lowers the profitability of small farms. However, the average bird's productivity in small farms is not affected by the prevailing inefficiency on the farms. These trends are almost identical in both cases i.e. egg layer farms and broiler farms.
4. Large and medium farms also enjoy the economies of scales and thus making the output-input ratio more favourable to them.
5. Marginal productivity of feed on egg layer farms remained around 3.0 on small and large farms in three seasons. The Marginal Productivity of labour remained high on medium and large farms and ranges 3.5 to 8.0. On small farms it remained less than 3.5.
6. In case of broiler farms marginal productivity of feed is very low on different farms and it ranges between 0.004 to 0.073 farms. Where as labour productivity farms remained less than 0.5 on all farms.

The existing and optimum levels of resource use reveal that funds have to be curtailed on feed consumption on all most all farms in three seasons. The optimum level of resource use indicates that labour input may be enhanced on poultry farms i.e. funds may be diverted to labour as the existing level of labour use is significantly low. The study indicates that poultry showed a high and positive marginal product of labour, this can provide more opportunities of employment. The role of technology is the recent development in enhancing farm profitability. Technological change may affect the relative economic position of the factors of production in terms of their share in total output and thus has implication on income distribution.

7. Technological Dualism/Technological Change

The technological change in poultry farming has been defined by the system of keeping poultry birds. The cage system of keeping poultry birds termed as modern technology farms. It is called so for they adopt modern practices such as provision of water nipples, dehumidifiers, quality feed mix, proper medication, etc. The poultry farms operating on deep litter system of keeping birds have been referred as traditional farms. These farms also adopt the above mentioned modern technologies but to a limited extent. The results revealed that the initial capital investment for Cage System farms was more than two folds as that of Deep Litter system farms in Mansa and nearly three folds in Ludhiana District. However, the average investment for a particular technology was higher for farms set up at Ludhiana compared to those at Mansa probably because of urbanization. The estimates of Cost and Returns on Layer Farms indicate that Cage System farms were earning more profit compared to the Deep Litter System farms in both the selected districts. The major components of cost were cost of feed, cost of chicks, fixed cost and vaccination & medication charges. The result of regression analysis indicates that major factors influencing egg production are feed cost, labour cost, medicines and electricity cost. The study of regression analysis showed that on both types of farms most of the input variables except for feed cost are not properly utilized. The analysis showed that input factors are not being utilized efficiently on Deep Litter farms in both the district. However it was observed that if the poultry farms using Deep litter system shift over to Cage system of technology there will be a substantial saving in the input resources. The Chow test Statistics conducted to test the structural relationship between the two technologies proved the superiority of modern technology over the traditional one in terms of efficiency of inputs at both the Districts. The existence of Technological Dualism in egg production reveals that inputs are not being efficiently used on Deep Litter farms .The Chow test further confirms the fact that a shift to the modern Cage technology can save the inputs substantially. Factor share analysis in districts Mansa reveals that the share of labour factor remained about 4 percent, the share of poultry feed which is a proxy variable for capital, was maximum of about 62 percent on both types of farms. The proportionate change of ith factor share (Di) as a result of technological change reveals that there will be saving of inputs in shifting from Deep Litter to Cage Technology. The saving is observed in feed 1.00 percent, labour 36 percent, medicines 23 percent and in electricity cost by 20 percent on the poultry farms in the district. In District Ludhiana the share of labour factor remained about 4 percent on Cage farms and about 5 percent on Deep Litter farms, the share of poultry feed was about 76 percent on Cage farms and 55 percent on Deep Litter farm. The proportionate change of ith factor share(Di) as a result of technological change reveals that by shifting from Deep Litter to Cage system of Technology there will be a saving in Labour (33 percent), Electricity cost (40 percent), Feed (38 percent) and in Medicine cost (11 percent) on the poultry farms in the district. The available viable production technologies have resolved most of the problems related production sector. The marketing is

the next area of research to increase profitability in the farm sector.

8. Marketing Research

Agricultural marketing plays an important role not only in stimulating production and consumption but in accelerating the pace of economic development. In pursuance of the suggestions made at various levels, a manual on agricultural prices and marketing was prepared by IASRI, for planning and policy formulation relating to agricultural prices and marketing.

8.1 Benefits of efficient marketing

1. Any increase in the efficiency of the marketing process, which results in lower costs of distribution and lower prices to consumers, really brings about an increase in the National Income.
2. A reduction in the cost of marketing is a direct benefit to the society.
3. Marketing process brings new varieties, quality and beneficial goods to consumers. Approximately one third of all persons gainfully employed in the country are engaged in the field of marketing and about one forth of National Income is earned by marketing profession.
4. Scientific marketing has a stabilizing effect on the price level. If producers produce what consumers want and consumers have a wide choice of products there are no frequent ups and downs in price.
5. Marketing is a catalyst for the transmutation of latent resources in to actual resources, of desires into accomplishments and development of responsible economic leaders and informed economic citizens.
6. Marketing brings to the farmers useful implements, tools and fertilizers etc. and the benefits of the use of machines and free after-sales service, and make them modem farmers.

There are several areas in which farmers will be required to remain proactive to derive benefits from emerging scenario of technological changes and marketing system.

1. Direct Marketing: it encourages farmers to undertake grading of farm produce at the farm-gate and obviates the necessity to haul produce to regulated markets for sale. Direct marketing enables farmers and processors and other bulk buyers to economize on transportation costs and to considerably improve price realization. In South Korea, for instance, as a consequence of expansion of direct marketing of agricultural products, consumer prices declined by 20 to 30 per cent and producer-received prices rose by 10 to 20 per cent.
2. Contract Farming: A farming arrangements of different types have existed in various parts of the country for centuries for both subsistence and commercial crops. The commercial crops like sugarcane, cotton, tea, coffee etc. have always involved some forms of contract farming. Even in the case of some fruit crops and fisheries, contract farming arrangements, involving mainly the forward trading of commodities have been observed. However, in the wake of economic liberalization, the concept of contract farming in which national or multinational companies enter into contracts for marketing of the horticultural produce and also provide technologies and capital to contract farmers and has gained importance.

8.2 Market intelligence

Market intelligence is an important area for marketing research and a study has been undertaken

under Visioning, Policy Analysis and Gender (V-PAGe) (Sub-Prog. III): (NAIP Project). The study aimed to analyze the supply and demand of major agricultural commodities, monitor price trends of major commodities in selected domestic and global markets, market integration and futures market, and perform action research on smallholders' participation in futures market. The per capita monthly consumption expenditure and proportion of total food consumption expenditure incurred on major food groups (cereals, pulses, oils, milk & milk products, egg, meat & fish, vegetables, fresh fruits, sugar and others) for rural and urban households for different regions of the country were analyzed for different NSS rounds (i.e. 43rd, 50th, 55th and 61st) pertaining to consumer expenditure.

8.3 Price spread and market integration

"Study of Lac Marketing in India *was* undertaken to study existing marketing channels and price spread in Lac marketing, extent of integration in Lac markets and to suggest remedial measures for improving marketing environment of Lac in India. The study of Lac cultivation showed that there are three mainly identified Lac host in the country. Palas tree was the largely cultivated host tree in all the Lac growing areas in terms of number of host and scrap Lac production. The Level of net returns from Lac cultivation of selected cultivators from Lac cultivation was comparatively much higher in Maharashtra Rs. 2,14,848 (in this state cultivators have leased in large number of Lac host from Forest department), Rs. 62,114 in M.P and Rs.1217 in Chhattisgarh states respectively. Rs. 6467 in Ranchi district and Rs. 4229 in W.Singhbhum district of Jharkhand state respectively. Despite such a lucrative returns from Lac cultivation the *extent of Lac host exploitation* is low. Extent of Palas host exploitation in Chhattisgarh about 72% in M.P and Maharashtra about 50 with a little error of about 3%. The average Lac host exploitation rate in the three states was about 51 percent for Palas host respectively. In Jharkhand state the average rate of host tree exploitation in Ranchi district was 46.74%. The low extent of host tree exploitation was the prime factor for low crop production. The study of Price Spreads showed that cultivator receive better price in those markets where Primary Purchaser sold scrap Lac to Processing units directly. This implies that existence of Lac Processing units in Lac growing areas facilitates better price to the cultivators. The study of market integration suggests all the important Lac markets situated within the same state and among different states are not properly integrated and there exit a significant price difference in scrap Lac. The production of scrap Lac in the country can be increased by making timely availability of brood Lac or small funds to the Lac cultivator for the purchase of brood Lac (Brood Lac farms needs to be set up by forest department) , the extent of host exploitation will certainly improved which will result in higher crop production. Installation of Lac Processing units especially in cultivating zone will attract cultivators to produce more of Lac crop in anticipation of better crop price.

8.4 Price volatility

Another important aspect is the price volatility which influences marketing strategy and income of the farmers and the empirical research has produced mixed results. Thus a study on Price Volatility and Integration in Spot and Futures Market of Gram was undertaken to empirically evaluate integration of futures and spot market of gram. The analysis of cross correlations of error terms of both spot and future prices provides information on mutual feedback relationship between the two prices. The price series of Gram crop in spot and futures market shows that level data was non-stationary but at their first differences it became stationary (i.e. implying the presence of unit roots in the series). The occurrence of unit roots in

the price data gives a preliminary indication of shocks having permanent or long lasting effect. The same order of integration for both spot and futures prices reveals that there exists a long run price equilibrium relationship between these prices. The study of price series of Gram crop witnessed a persistence and asymmetry in volatility of prices both in spot and future markets. Spot price of gram crop shows a value of 0.57, which is relatively smaller than the value obtained in price series of future prices which is close to one. The results of Granger test detect unidirectional Granger causality from futures to Spot markets. The means of the spot market are greater than those for the futures market. The futures volatility (standard deviation) is greater than that of the spot market volatility. The distribution of the spot prices is comparatively more skewed than futures prices. It was observed that there was mutual feedback between the prices of spot and future markets. The statistically significant coefficient for Zero lag indicates that there is instantaneous transmission of price signals between the markets. The result also indicated that futures prices influence spot prices.