STOCHASTIC PRODUCTION FUNCTION AND ESTIMATING RISK IN RICE PRODUCTION

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OCTOBER 1984

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SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
UNIVERSITY OF THE PHILIPPINES AT LOS BAÑOS
IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE
DEGREE OF

MASTER OF SCIENCE
(STATISTICS)

October, 1980

ABSTRACT

MENDOZA, MARIA NIMFA FRANCISCO, University of the Philippines at Los Baños, October 1980. Stochastic Production Function and Estimating Risk in Rice Production. Major Professor: Dr. Ann Inez N. Gironella.

Risk is primarily defined as variability of outcome in conjunction with expected outcome. In a broader sense, risk estimation covers, in the case of rice production, the estimation of the probability distribution of rice yield. The major intent of this study is to investigate the sensitivity of risk measurement to functional form of and estimation technique for the production function. Specifically, the effect of nitrogen input on the probability distribution of rice yield outcome at nine agronomic zonal levels stratified according to season and water stress conditions is measured.

Stochastic production functions incorporating manageable inputs and environmental factors are estimated for 1972-1977 rice data from farmers' fields in Central Luzon, Philippines. Five basic models with different sets of linear and interaction stress variables are used. The multiple regression model with normally distributed zero mean constant variance errors is assumed to approximate the production process. Initial coefficient estimates are obtained by ordinary least squares. For

a sweep among empirical models indexed by transformation of the response variable, Box-Cox regression is performed. With the obtained response functions as input information, rice yield distributions at fixed levels of nitrogen and given solar radiation and water stress conditions are simulated. As descriptors of risk effects of nitrogen, the means, variances and skewness of the simulated yield distributions are analyzed.

It is observed that the risk effect of nitrogen is highly conditioned by solar radiation and water stress. Results indicate that the method of risk measurement used is not sensitive to the production function estimation technique. Therefore, the superiority of the simple and computationally economical least squares estimation for the standard multiple regression model is asserted. Differences in inferences on risk effects between models indicate that model formulation poses a greater problem.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1. Definition of Risk

Risk has been associated with the degree of uncertainty of the outcome of an action against a background of perceived alternative outcomes. There is no strict definition nor measure of risk. Some writers distinguish risk from uncertainty; risk is a situation in which probabilities of alternative outcomes of an action are known or can be estimated, whereas uncertainty describes a situation in which probabilities cannot be assigned to the possible outcomes for a given course of action. In modern decision theory, uncertainty is usually subsumed under risk.

Some studies define risk as a measure of dispersion of possible outcomes, for example, as variance. Risk has also been defined as the calculable probability of failure or loss. Along the same line, risk has been identified with the probability of values greater than, or smaller than, a given value. To maximize its usefulness as a concept, Roumasset (1979) has succintly defined risk as "a piece of information about a frequency distribution that, together with expected value, serves as an imperfect substitute for the density function in prescribing or explaining choice under uncertainty".