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## BOOK REVIEWS

*The Challenge of World Poverty—A World Anti-Poverty Programme in Outline.* By GUNNAR MYRDAL. (Harmondsworth: Penguin, 1971.) Pp. 464, \$1.70.

*Seeds of Change—The Green Revolution and Development in the 1970s.* By LESTER R. BROWN. (New York: Praeger, 1970.) Pp. 205.

This is a delayed review but ironically this probably enables greater justice to be done to both books. I have been re-reading them at a time when there is much greater general public attention and official attention to the problems of the very poor in the developing countries. I believe we have left the days of regarding aid, for example, as something done by a 'donor' in relation to a homogeneous entity called a developing country. This is because we have at last awakened to the fact that each country contains many economic and social contradictions within it and great extremes of wealth even where the average is low comparatively to other developing countries. We are now being urged by such people as Robert McNamara of the World Bank to pay more attention not only to the poorest countries as measured by average GNP but to the poorest sectors in each country. All too often the poorest sectors turn out to be the rural people. If this is the injunction to be followed, and one cannot help but be sympathetic to it, these two books are timely rather than dated.

Myrdal's book is a sequel to his major *Asian Drama: An Inquiry into the Poverty of Nations*. It is his attempt to supply what he calls 'that missing eighth part of the book (*Asian Drama*) which should have contained the main policy conclusions I have wanted to draw from my study'. We have the benefit of over 400 pages of viewpoint and advice, always stimulating and almost always relevant to the poorest countries. It ought not to be used, however, without continual reference back to the original work for only in this way can we become fully conscious of the complexity of the problems of development in any sector, but especially in the rural domain.

The book, written in 1968-69, inevitably suffers a little from the inadequate recognition then possible of the promise inherent in the new technologies being developed on the basis of new high yielding varieties of wheat, rice and other grain. Nevertheless, the comments on pages 133-34 are perceptive throughout. Myrdal seems to hover between pessimism and optimism, but who would not waver when confronted with poverty on the scale to be found in India, not to mention the enormous difficulty presented by institutions which are either inadequate to their task or all too often indifferent to the problems around them.

To one engaged day by day in attempting to wrestle with some of these problems, the realism of the book is fully acceptable if only because chapter after chapter offers one stimulating idea after another. Myrdal is not alone in realising that for many countries it is nonsense to talk of industrialization as a simple provider of employment for

surplus labour from rural areas: employment opportunities are mostly inadequate in both cities and rural areas. Nor is he alone in stressing the foolishness in most instances of transfer of labour-saving agricultural technology from the United States or Australia to countries where labour is the abundant resource and water and land scarce. Again he had early seen the value of international agricultural research as a means of economizing scarce skills and costly equipment and as a means of making best use of fortunately now accumulating stocks of genetic material. Again he deals sensibly with the institutional problems of helping poor farmers and landless labourers.

All these matters I mention only to give instances of the many aspects of the agricultural sector to which Myrdal addresses himself. The book covers much more. *Asian Drama* remains a classic and required reading for anyone concerned particularly with the problems of Asia but the concerned person will also gain a great deal from this further contribution from his pen. Despite the pace of change since 1969, *The Challenge of World Poverty* is not out of date.

Lester Brown's work is of much lighter character but appropriately serves a rather different function. Brown's purpose was to write a more popular book on the implications and possibilities of the Green Revolution. His book is written later than Myrdal's monumental works and is able to take more note of the beginnings of the Green Revolution in India, Pakistan and Mexico. Nevertheless, he is not starry-eyed and would readily concede the importance of the Myrdal warnings about political and social constraints. Both are aware that at best time only is bought by technological advance in agriculture in the sense that it remains imperative that densely populated countries bring their rate of growth under much stricter control. Both also show a welcome recognition that major changes in any one large developing country like India are bound to have implications for future world trade in grain products. The recent drought in India could have been calamitous but for the marked contribution of the Green Revolution of 1971-72, particularly to wheat production. And yet, the buffer stocks proved inadequate. A coincidence of drought in Australia, India and Russia and in the event less than adequate crops in North America together with the unexpectedly large entry into the world market by Russia as importer have warned us of the dangers of relying on the normal free market in food grain if we wish for general price stability. The warning is even more imperative if we wish to ensure that no large group of people is ever without adequate supplies. There have been many attempts since the War to develop a world food supply system. Perhaps we will now tackle this more seriously.

Both these books under review give us good reason for doing so.

J. G. CRAWFORD

Canberra.

*Econometric Studies of Macro and Monetary Relations.* By ALAN A. POWELL and ROSS A. WILLIAMS (Eds.). (Amsterdam: North-Holland, 1973.) Pp. 358. \$US18.75, ISBN 0 7204 3068 2.

The second Australasian Conference of Econometricians was held at Monash University in August, 1971, and this book contains thirteen of the papers presented at this Conference. As the editors write in the

preface, 'the theme of the Conference was aggregative econometric models, with special emphasis on macroeconometrics and the monetary sector' and, accordingly, the papers have been classified into two parts, macroeconometrics and monetary sector models.

In the first paper on macroeconometrics Klein provides a clear exposition of the degrees of freedom problem in econometric systems. He explains why the problem is a common one, outlines the differing demands of estimation procedures on degrees of freedom and reviews possible modifications of these procedures which help overcome the problem.

'The more interesting mechanisms built into RDX2' (the Canadian Quarterly Model) and 'some of the simulation possibilities open to users' are presented by Helliwell *et al.* The features of RDX2 which the authors regard as innovative are (i) the relationship between aggregate demand and supply, derived factor demands and some equilibrating devices, (ii) disaggregation of the government sector to the level of provinces and municipalities, (iii) the treatment of certain aspects of monetary policy and government expenditure, (iv) the possibility of international linkages with a model of the U.S. economy, and (v) certain aspects of the financial sector such as the role of bank assets and liabilities and the supply price of capital. The article is more for the seasoned macroeconomic model builder than for one wishing to investigate the construction of the RDX2 model as it is difficult to view the above innovations in isolation from the remainder of the model. However, if one is enticed to consult some of the more detailed references the object of the authors would undoubtedly be achieved.

On the other hand the following two papers by Norton and Henderson and by Deane contain brief but complete descriptions of quarterly models of the Australian and New Zealand economies respectively. Each of these articles contains a flow chart of the model and a list of the estimated equations. The equations are discussed, sector by sector, in terms of economic theory, previous work, statistical problems and/or special features, thus making both papers a good starting point for the econometrics student who wishes to be initiated into the applied macroeconomic world.

In addition to the Australian quarterly model developed by Norton and others of the Reserve Bank another quarterly model has been developed jointly by the Australian Commonwealth Treasury and the Bureau of Census and Statistics. Higgins outlines the steps involved in the incorporation of a wage-price sector into this model. Each of the equations and variables in the wage and price sectors is discussed and the important findings in each sector are conveniently summarized. Some simulation results are provided and these are regarded by the author as indications of where future work should be carried out. At this time the next step in construction was the reformulation of the whole model at constant prices.

The results of two simulation experiments using the Federal Reserve-MIT-Penn Quarterly Econometric Model of the U.S. Economy are presented by Zellner and Peck. The first experiment uses suggested measures to test for linearity and symmetry in the model's responses whilst the second ascertains the model's ability to describe a major

depression. The authors' brief but pertinent review of the criteria used in testing econometric models should be digested by all model builders.

Fitzgerald uses simulation experiments to investigate frequency response patterns of the Treasury-Bureau of Census and Statistics (without the wage-price sector outlined by Higgins) model. He discusses spectral estimation in linear and non-linear systems, estimates some of the short-term cyclical characteristics of the model in the time domain and the longer term characteristics in the frequency domain.

A clear discussion of the methodology of stochastic simulation and an application to the Australian Reserve Bank Model is provided by Sowe. He categorizes different types of simulation, discusses the merits of stochastic simulation as opposed to deterministic simulation and reviews measures for validation of a model.

Two papers in the section on Monetary Sector Models are theoretical investigations and in both these papers the authors are perturbed with Tobin's finding that the presence of money in the economy makes us worse off. Using a five-equation system including an aggregate production function which depends on real money balances, McGregor and Walters derive the equilibrium and stability characteristics of the model and analyze the influences of autonomous changes in the money supply and aggregate demand. Crouch treats monetization as a technological innovation in a neoclassical growth model and shows that this (reassuringly) brings an increase in per capita income, the wage rate and the capital labour ratio. Neither of these papers attempts to measure anything and so their classification as 'econometric studies' is doubtful. However, McGregor and Walters do indicate how their hypothesis could be tested empirically.

Helliwell, *et al.*, attempt to overcome the crude approximations to the 'supply price of capital' which have been utilized in macroeconomic models. They set up a theoretical model and based on this model estimate series of the real and nominal supply price of capital for both Australia and Canada. How these quantities can aid in explaining investment, consumption, international capital flows and price formation is explained.

'Based on the proposition that at a highly disaggregated level the behaviour of the economy can be represented more accurately by a continuous model which is recursive', Wymer estimates a differential equation system of the U.K. financial markets. Each equation, the economic theory upon which it is based and various post-estimation tests are discussed.

Zecher estimates a simple general equilibrium model to demonstrate that, in Australia, when reserve flows are allowed to influence changes in the money supply (1952-1959) there is a rapid adjustment to equilibrium in the money market but when reserve flows do not influence changes in money (1959-1970) the speed of adjustment to equilibrium is very slow.

In general, this book could not be recommended as a manual for the macroeconomic model builder, but it should prove particularly useful for those interested in the Australian and New Zealand quarterly models, as well as those concerned with different types, possible scope

and interpretation of simulation experiments in macroeconomic models.

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*Financial Management in Agriculture.* By JOHN A. HOPKIN, PETER J. BARRY and C. B. BAKER. (Danville, Illinois: The Interstate Printers and Publishers, Inc., 1973.) Pp. 459, \$US10.75.

This textbook is a welcome extension of the material available for the University teaching of farm management. Its approach and much of its subject matter are new. Most of the audience for whom it is intended (third- and fourth-year undergraduates with some exposure to basic micro-economics) should be able to handle it well. I anticipate that it will quickly become a major reference for many topics in advanced undergraduate farm management courses, though its focus on American financial and legal institutions will limit its usefulness as a basic text in Australia.

The authors observe that most managerial literature in agriculture has centred on production and marketing, and that little effort has been put into a systematic treatment of the principles of controlling the acquisition and disposition of farm business resources. They seek to set this right. The book deals with principles of managing cash, credit, debt, taxes, consumption and insurance in relation to the business organization and the resource base of farming.

The book is divided into five sections. Section I is a single introductory chapter on the nature and scope of financial management. It places the processes of financial management alongside the corresponding processes of production and marketing management, and it anticipates the issues and tools to be dealt with later in the book.

Section II consists of three chapters which deal with the institutional setting of financial management. Much of this material is of use only as a reference by which to judge parallels and gaps between the American and Australian situations. But Chapter 3 on the functions and processes of financial intermediation is fundamental to the major issues of the book, and it is of validity wherever commercial family farming operates in a market economy.

Section III deals with the farm-firm as a setting for financial management. Chapters deal with information flows, the treatment of time, a model of farm business growth, leverage and liquidity, capital budgeting, and the cost of capital. Most of the basic tools of financial management are developed in this section. The business growth model is a financial identity which serves to illustrate the interactions between leverage, the rate of taxation, and the rate of consumption on the growth performance of the farm.

Section IV deals with alternative methods of controlling resources and with organizing the farm business. Chapters deal with land, depreciable assets, annual operating inputs, and farm business organization. Many of the tools developed in Section III are applied in these chapters. American institutions are also dealt with, but little of this material detracts from the usefulness of this section to an Australian reader.

Section V deals with the financial management of the business in terms of overall financial analysis and control, and of tax and estate management. The chapters dealing with the latter topics again are heavily institutional, and are of interest mainly as a reference for judging parallels and differences between the U.S.A. and Australia.

The nature and management of credit is a theme throughout the book. Credit is seen to be 'an "economic good" to be produced, managed, and marketed'. The capacity of a farmer to create and sell debt instruments, and the principles for doing so, are asserted to be no less important in contributing to the criteria of farm business performance than is the capacity to produce and market any tangible commodity from the farm.

The uses for credit are to build leverage in order to contribute to farm business growth at diminishing average cost of capital, and to build liquidity in order to avoid adverse consequences of business risk. These uses compete and conflict, and their trade-offs form another theme of the book. In contrast to corporate business analysis, the costliness of equity capital is often overlooked in farm business analysis. The use of credit to lower cost structure is a concept which is foreign to many farmers and one which could well be investigated empirically. The authors have well illustrated the use of leverage to generate growth at declining cost, albeit at increasing financial risk.

Many of the tools developed in this book are treated in standard general texts on finance. The techniques of time discounting are a case in point. But the authors have rigorously sought to keep the commercial farm clearly before their readers. The nature of credit rationing and the evaluation of alternative ways of controlling resources are general problems but they have been dealt with lucidly and practically in the setting of commercial agriculture.

I have no hesitation in commending this book. However, it should be realized that two things are not attempted which could be important aims of a course in finance within an agricultural economics or a farm management curriculum. First, the authors do not develop an integrating theory of finance of the agricultural firm and its household which shows how factor inputs, product outputs, asset acquisitions and consumptions, and sources of finance are either co-determined or recursively determined. It may be premature to develop a textbook around such models of the farm, but they have been developed to serve as a basis for a theory of finance of the corporate firm. Without a behavioural theory it is not possible to identify an appropriate discount rate to determine internal value, and without a corresponding optimization theory it is not possible to equalize the utility of the marginal productivity of money capital in its various uses.

Second, the authors do not develop a procedure for working through farm management problems in financial terms. There is an increasing need to be able to lead students through complex production and marketing problems via an integrating financial procedure. Without a procedure which moves systematically from a present situation to fully tested set of plans and budgets ready for implementation and control, principles can be partially and even indiscriminately applied.

In pointing out what is not attempted I do not intend to imply any criticism of what is attempted and achieved. The theoretical problem

clearly goes beyond the intention of the book. The procedural problem needs to be worked out in terms of the planning packages, handbooks and information systems available in each teaching centre. The authors have done a good job introducing students to the concepts, techniques and principles of investment analysis and financial control. They have demonstrated the need for understanding the institutions of finance. And they have brought together a useful teaching resumé of some excellent work in these fields undertaken over the last two decades, much of it by the authors and their colleagues at the University of Illinois.

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*Introduction to Quantitative Methods in Economics.* By E. D. JAMES and C. D. THROSBY. (Sydney, John Wiley and Sons, 1973.) Pp. 335, \$9.00, soft covers \$6.00, ISBN 0 471 43917-7.

This book will be widely welcomed by those economics students interested in the quantitative aspects of their subject but who have weak mathematical backgrounds. It is seen as a precursor to more advanced works in this field, including some of the so-called 'introductory' texts. The book will particularly interest the student who wishes to continue beyond his first tertiary level economics course but who gave up mathematics before leaving school, probably disliked it, and has probably forgotten much of it. It will also interest those students with stronger mathematical backgrounds but who find it difficult to make the transition from abstract mathematics to applied economics. James and Throsby have designed the book for use in conjunction with standard economics textbooks in mainstream economics courses at tertiary institutions.

Many of the textbooks which deal with mathematics for students of economics are aimed at firstly teaching what is often quite rigorous mathematics and then following it with economic applications. In the present text, however, the authors have aimed at developing the student's appreciation of the role of quantitative methods through a mixture of accepted economic theory, mathematical technique and intuition. They have limited their scope to those mathematical concepts students will confront in their first two years of tertiary economics courses. The authors' teaching strategy, which has been developed while lecturing economics courses at Macquarie University, N.S.W., is by way of example, of putting forward mathematics in recognizable economic form. They feel students are eager to know *why* they are learning a particular technique and tend to lose interest if mathematical methods are presented in purely abstract terms lacking practical application.

Examples have been drawn from both microeconomic and macroeconomic theory, often with an agricultural bias. On the micro side, the text deals with such topics as production and cost theory, supply and demand analysis, consumer behaviour, and the theory of the firm. The main macroeconomic topics are the construction of linear aggregative models, equilibrium analysis, and impact multipliers.

The book is divided into five parts. Part I, which deals with simple functions and economic relationships, is for the complete novice, or the student who has forgotten most of the maths he ever learnt. Part II



deals with the role of elementary calculus in economics in the context of functions of a single variable, while Part III considers functions of several variables, mainly in terms of production economics. Part IV is concerned with linear algebra, and includes chapters on input-output analysis and linear programming. The final section contains two chapters on elementary econometric method. The first of these chapters introduces the student to the ideas behind simple regression, in a way which does not presume any statistical expertise. The second looks at the basic assumptions and tests of significance in linear regression. While this latter chapter necessarily presupposes some elementary statistical knowledge, stress is laid on building the student's intuitive understanding of the distributional properties of the least squares estimators.

Each chapter contains numerous straightforward exercises, solutions of which are provided at the back of the book. One appendix lists some useful principles of basic algebra for the non-mathematical students, while three more appendices for the keener and more advanced students include further developments of calculus, linear algebra and econometrics. An annotated bibliography and a useful index complete the book.

How well have the authors covered their subject? In this reviewer's opinion they have done a very good job. The content is well laid out, and its logical flow from one topic to the next makes it easy to follow. The frequent references to examples used previously in the text may be slightly tiring, but if the student uses the book often he could find this approach helpful in consolidating his understanding. The only omitted mathematical topics normally covered by such texts are integration, differential equations and difference equations. However, it could be argued that these topics are beyond the scope of an introductory text.

Of particular interest to agricultural economists is the treatment of production economics to explain functions of several variables. Production theory is an essential part of agricultural microeconomics, but it often causes difficulties for the non-mathematical student. James and Throsby have provided clear explanations in this area, with the aid of simple three-dimensional diagrams.

The inclusion, too, of basic concepts of linear programming and input-output analysis to illustrate the algebra of matrices is a welcome change from the unapplied treatment of matrix algebra in most mathematical books for economists.

Few textbooks in the field make more than a passing reference to econometrics. They concentrate solely on mathematical economics, and leave economic statistics aside. This distinction is not particularly useful for the economist interested in working in the quantitative area, since at some stage he is bound to deal with statistics as well as mathematics. Students should at least know where econometrics fits into the quantitative economist's toolkit, and have some intuitive grasp of what it's about. It is therefore pleasing to see this topic appear in James and Throsby's book, although their section really requires an extra chapter on probability and statistical inference to be self-sufficient.

Perhaps two other points are worth making. Firstly, this book may not serve as an adequate textbook for conventional first level mathematical economics courses, in that it does not go to the depth of, say, Henderson and Quandt's *Microeconomic Theory*, *A Mathematical*

*Approach.* Secondly, the non-rigorous treatment of some of the mathematics may not leave readers with a very deep understanding of the mathematics involved, even if it provides an intuitive understanding of the concepts. On the other hand, this has not been the goal of the authors. The book has achieved its aim of explaining in simple economic terms the mathematical concepts most frequently encountered by first and second year economics students. Unlike so many texts in the quantitative field, it is *correctly* described as an introduction.

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Adelaide.*

*Soybeans and Their Products: Markets, Models, and Policy.* By JAMES P. HOUCK, MARY E. RYAN, and ABRAHAM SUBOTNIK. (Minneapolis, University of Minnesota Press, 1972.) Pp. 284, \$US10.00, ISBN 0 8166 0659 5.

The U.S.A. produces two-thirds of the world's soybean crop and accounts for 90 per cent of exports. Soybean is now the second most important crop in the U.S.A. and dominates the world fat, oil and meal markets.

The aim of this timely book is to identify and measure empirically the forces, inter-relationships and processes which shape the behaviour of the soybean market. Key economic relationships in the export markets for U.S.A. soybeans in the 1947-67 period are identified and measured. In all regions there is substitution between U.S.A. soybean oil and other oil imports as well as between all imports and local oil production.

The model satisfactorily explains the effect on acreage of changes in policy both in soybean price support procedures and in price support and acreage restrictions for other competing crops. The authors' conclusion is that post-World War II international markets for U.S.A. soybeans and soybean products have behaved in ways that both economic theory and commonsense suggest.

This honest, if pedestrian conclusion follows from a thorough analysis of the effect of three policy instruments used by the U.S.A. government and now largely inoperative. Events have indeed overtaken the book and one must question the current value of a book which includes no data from the last six years.

The rapid development of the soybean industry since World War II, particularly the more than doubling of production in the last decade, has been stimulated by production restraints on alternative feed grains. A strong and growing demand has developed as consumers tend to eat fewer animal fats. Moreover, cheap and efficient means of processing soybeans have been developed.

Several interesting changes in the soybean market have occurred since 1967. The authors' dynamic supply and demand model could be used to determine the response of soybeans to the relaxation of acreage restrictions on alternative feed grain crops announced by the U.S.A. government earlier this year. Further analysis could embrace the reduction in concessional exports to developing countries. These have accounted for over 50 per cent of soybean oil export since 1954.

The book places little emphasis on the role of soybeans as an instrument of agri-politics. Soybeans are an essential ingredient for the

E.E.C. livestock industry and enter the E.E.C. free of tariff. The U.S.A. has used this as a bargaining tool for freer trade. Soybeans are a vital part of the Japanese diet and huge U.S.A. exports have helped to rectify the trade deficit with Japan.

Temporary export bans in the U.S.A. at the end of the 1972 season have not slowed the rate of increase in soybean production. The U.S.A. should have an extra 200 m bushels available from the 1973 crop and a harvest of 2,000 m bushels is possible by 1980. Brazil has substantial capacity to produce soybeans if the U.S.A. proves unable to satisfy the demand, the latter being increased because of reduced output of the Peruvian fish meal industry. The boom shows little sign of abating so long as overseas crushers remain confident of continuity of supplies. If not, or if prices rise too high, Malaysian palm oil and synthetic protein are possible alternatives.

Overall, the authors of this interesting book have produced a workable model of the soybean market which should prove useful to present day investigators.

ROY PATEMAN

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*Farm Planning by Computer.* By J. B. HARDAKER. (Ministry of Agriculture, Fisheries and Food, Technical Bulletin No. 19, London, Her Majesty's Stationery Office, 1971.) Pp. 132. U.K.£1.50, ISBN 11 240919 9.

This book deals with the practical problems of applying linear programming to farm planning. The author believes, as he has stated in the conclusion, 'that the considerable fund of operational experience with the technique has proved that linear programming is an efficient method of planning farms and is capable of giving results of practical value'. It is his aim with this book 'to explain in simple terms "how" to set up a linear programming model of a farm and to have the problem solved by electronic computer'.

The book was written for use by students of farm management, farm management advisers and research workers wanting to use linear programming for farm planning. The text is divided into ten chapters and supplemented by four appendices. The first three chapters explain in simple terms, how computers work, what is linear programming, the types of farm planning to which it is suited and the information necessary to solve these problems. A simple example of the application of linear programming to farm planning is given in the fourth chapter. Chapters five, six and seven detail the practical problems of specifying the various types of farm activities and planning constraints into a matrix suitable for linear programming. The economic interpretation of solutions, how near optimal solutions may be derived and how to make revisions to the linear programming model are explained in chapter eight. The ninth chapter gives the detailed planning of a mixed livestock and arable farm in the north-east of England, the solution, its interpretation and the solutions to four variants of the basic model. The limitations to linear programming imposed by the requirements of linearity, additivity, divisibility and the need for single valued coefficients are discussed in the final chapter together with ways of reducing their effects.

The first appendix provides a useful guide to the literature on the linear programming of farm planning problems. The algebraic formulation of linear programming and a very brief explanation of the simplex method of solution are given in the second. The third provides examples of forms for collecting the necessary farm planning data and in the last appendix is the linear programming matrix of the farm discussed in chapter nine.

There are many good texts available on linear programming, but very few deal adequately with the practical problems of collecting the necessary information and applying the technique to farm planning. This book is a notable exception. By concentrating on the practical problems of applying linear programming the author has produced a book that should meet a demand by lecturers for a text on linear programming that is suitable for students of farm management. It will also be a useful reference for farm management advisers and research workers wanting to apply the technique.

The strength of the book lies in the concise, methodical manner in which it explains how farm activities and planning constraints may be built into a matrix suitable for linear programming. The chapter on labour planning is most comprehensive and thorough. However, the coverage of livestock feeding is inadequate for Australasian conditions and in this area the book could be usefully supplemented by the 'livestock month' method of measuring feed supply and animal demands as outlined by Rickards and Passmore.<sup>1</sup>

There are many errors throughout the text, which is particularly confusing in chapter nine where many incorrect references are given to rows and columns of the matrix in Appendix Four. It is to be hoped that only a very limited first edition was published and that it will quickly be replaced with a second free from these errors. It is poorly bound and needs gentle care if its soft cover is to stay round the contents. However, its modest price is a very commendable feature.

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*Scheduling the Operations of the Bhakra System.* By B. S. MINHAS, K. A. PARIKH, and T. N. SRINIVASAN with S. A. MARGLIN and T. E. WEISSKOPF. (Calcutta, Statistical Publishing Society, 1972.) Pp. 89.

This study deals with the problem of reconciling irrigation water discharge and electrical power generation policies for the Bhakra Dam on the Sutlej River in the Punjab. The analysis is subsequently expanded to consider (1) strategies concerning the pumping of water from tube-wells at times when high irrigation demand results in surplus power generation and (2) alternative dead storage levels for the reservoir.

The first two chapters outline the characteristics of the system and the previous discharge policy. The problem is seen as the formulation of a policy at the start of the discharge period (Sept. 21st–May 31st) to provide the maximum irrigation output and the maximum power

<sup>1</sup>Rickards, P. A. and Passmore, A. L., 1971. *Planning for Profit in Livestock Grazing Systems*, Professional Farm Management Guidebook No. 7. Agricultural Business Research Institute, University of New England, Armidale, N.S.W.

output in the face of uncertain inflow to the reservoir during the discharge period. The previous discharge policy, essentially a maximin approach, involved the announcement of a reservoir factor (RF; ratio of deliveries to demands, which latter were assumed known and constant) at the start of the depletion period. The RF was set to allow at least a specified level of water and power throughout the driest year on record. If, however, water inflow to the reservoir was better than the worst year, the RF was increased at three-monthly intervals.

Predictably the policy was found to be highly conservative, and the RF was increased in almost every year. The study hypothesized that returns would be higher to a higher *announced* RF than to a lower *announced* RF which was subsequently increased. This effect arose because the announced RF affected farmers' land allocation decisions for the coming cropping season.

In the third chapter a probabilistic simulation model was described. The aim was to derive RF policies to maximize expected gain. Fifty-six years of inflow data were used in the construction of production possibility curves showing feasible combinations of announced RF against electrical power. Each was repeated for three confidence levels.

The study shows that even without a detailed knowledge of the marginal value of water in alternative uses for different periods of the year, a considerable array of water management strategies existed. However, it raises almost as many questions as it answers. The analysis displays the choices open to management but there is no evaluation of any of the policies as compared, for instance, with the existing one. Whilst the conservative policy may have denied the possibility of some gains in most years, an expected-value policy could well involve disastrous losses in poor years.

The book is concise and well presented. There is a wealth of information relating to the simulation output which makes origin of the conclusion relatively easy to trace. It is a useful contribution to the literature on the modelling of dam systems under uncertainty.

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