77

BARD

FINAL REPORT

PROJECT No. I-509-82

Aggregation in Regional Agricultural Planning: The Role of Human Capital and Risk

E. Hochman, G. Vitkon, R.E. Just, D. Zilberman

1986

Yain
Date: February 6, 1986

BARD

P.O.B.6

Bet Dagan, ISRAEL

BARD No. of Proposal: I-509-82

Title of Proposed Research: Aggregation in Regional Agricultural Planning:
The Role of Human Capital and Risk.

Names of Investigators: Eithan Hochman, Israel

Richard E. Just, U.S.A

David Zilberman, U.S.A

Gideon Vitkon, Israel

Names and Address of Affiliated Institutions:

Grantee Institution: Ben-Gurion University of the Negev, Beer Sheva,
Israel 84120

Cooperating Institution: U.C. Berkeley, Berkeley Cal. 94720, U.S.A.

Project's starting date: November 1983

Project's Duration: Two Years

Type of Report: Final

Signatures:

Principal Investigator

Eithan Hochman

Cooperating Investigator

D. Zilberman

Institution's Authorizing Official

[Signature]
BEN-GURION UNIVERSITY of the NEGEV
Research & Development Authority
BEER SHEVA, P. O. B. 183, ISRAEL

2. Table of Contents

	<u>Page</u>
3. List of Figures.....	None
4. List of abbreviations used.....	None
5. Abstract.....	1
6. Main Results.....	2
7. Description and results of cooperation.....	5
8. Thesis.....	None
9. Inventions.....	None
10. List of Publications.....	6

5. Abstract

The project focused on developing methodologies for analysis of regional development of agricultural industries.

It derived industry wide relationships, studying behavior at the microlevel and aggregating over the individual producers.

It emphasized:

- (a) Estimation of production and human capital parameters of farmers in the Arava.
- (b) The study of the aggregate supply response-explicitly recognizing risk aversion in behavior under uncertainty.
- (c) Developed dynamic framework for cost-benefit analysis of development and settlement projects and applied it to the Arava.
- (d) Analyzed the impacts of agricultural policies on industries with heterogeneous farms: equity Vs. efficiency.

6. Main Results

Government policies have played an important role in directing the development of the agricultural sector in the U.S. and Israel.

Agricultural economists can and should supply the government with both information and conceptual thinking useful for planning and policy making processes.

This project (I-509-82) considers explicit patterns of data collection and information gathering at the microlevel with the intention to develop both statistical tools and theoretical concepts.

The main theme that unified the work done within this project is that in order to develop policies on the macrolevel one has to understand the behavior on the microlevel.

In this context several major research efforts were conducted; they aimed at filling voids in existing literature either at the microlevel or in the aggregation and policy analysis at the macrolevel.

Following is the summary of the effort in each of the research areas:

- (a) Estimation of parameters of multiactivity technology and resource allocation.
- (b) Analysis of farmers' decisions under uncertainty.
- (c) Analysis of impacts of agricultural policies on industries with heterogeneous farms: equity Vs. efficiency.
- (d) Cost-benefit analysis of development and settlement projects with particular references to dynamic and uncertainty aspects.

(a) Quantitative estimation of technological parameters of multiactivity farm units. Many farms utilize their productive capacity to produce several outputs. Farmers, for example, may allocate their land among several crops, to deal with risk or overcome input constraints. These

multiproduct firms tend to record their external transactions, both their sales of outputs and their purchases of inputs. However, the accounting systems of most firms are much less likely to record internal transactions, such as the allocation of variable input to specific activities. Nevertheless, such information may be useful in performance evaluation and production function estimation. Thus, the production parameters of a multiproduct production function were estimated in a neo-classical framework assuming profit maximizing behavior of the producers [1]*, and in an alternative behavioristic formulation using informational externalities of technological and behavioral patterns among the critical mass of farms in a region to estimate missing variables and parameters. (see the Initial Technical Report of this project: Appendix).

(b) The framework of farmers' decisions under uncertainty allows for analysis of multicrop production under uncertainty - and uses a general utility function as well as a variety of yield and price risk conditions (additive risks, multiplicative risks, linear risks) to obtain properties of supply function and supply response. The results are useful for econometric estimation - but have also important theoretical implications. In particular, they derive conditions under which supply response of farmers is negatively sloped. In a paper forthcoming in the Economic Journal [2] these conditions are developed and empirical examples are used to analyze their feasibility. Also, the applications of the approximations based on mean and mean absolute deviations, are forthcoming early in 1986 [3].

* The numbers in brackets through this section refer to the list of publications in section 10.

(c) Theoretical economic analysis in agriculture emphasizes valuation of efficiency implications of government policies. The new theories of political economy and regulation, (as well as common sense), suggest that equity implications are as important. In particular it is important to know the impact of agricultural policy on agricultural structure, or how income distribution among farmers is allocated by agricultural policies. The framework for such analysis is introduced and developed in the following papers [4, 5, 6, 7]. It assumes risk aversion, multicrops production, imperfect credit market, farm size variation among farmers, and analysis of the intrafarm welfare implications of insurance, price support, extension and other government policies. The exact distributional results are derived as function of yield and price distributions' parameters, farm size distribution, credit availability constraint etc. Overall it is shown, that existing agricultural policies in the U.S. are likely to have regressive affect on farm size distribution and favor the big and very small farmers Vs. the middle size family farmers.

This conceptual results need to be further verified empirically, and our models supply a framework for such analysis.

(d) This body of research explores the conditions for successful development processes of frontier zones. We start with a stylized dynamic model that assumes putty-clay properties, i.e. labor and capital have quality variations according to their vintages. The dynamic path depends on the demand feedback, on the stocks of private and public infrastructures, and on the natural and human resources.

The American and Israeli case studies are used to include more realistic conditions such as uncertainty to explore the temporal stages of development that include: search, consolidation, development and halt.

Both analytic and descriptive results indicate the close cooperation

between manpower and the local structure in developing the appropriate technologies.

The Israeli Arava case study was discussed in detail in [8] and [9]. The stylized model and both case studies, were presented in an international conference at Venice, 21-26 October 1985 and a colloquium at the Hebrew University, Jerusalem (see [10]).

This research included, also, cost-benefit analysis of optimal size and water flow in water canal projects - with application to the Mediteranean - Dead Sea canal. This work that was reported in the BARD I-10-79, Technical Report, was extended and published in 1984-1985 (see the paper in JEEM [11] and in the WRR [12]).

7. Description and results of cooperation

The actual work started at the beginning of 1983 (before the formal approval of the project). Zilberman visited Israel in the summer of 1983, and worked with the Israeli team on developing the data base for the micro level and regional models. One of the main results of our cooperation was to estimate microlevel production functions emphasizing the role of human capital and asset characteristics was met completely. Moreover the modeling approach received an award as the outstanding research work in 1984, by the Western Agricultural Economics Association.

Hochman and Vitkon visited Berkeley, during the summer of 1984, to work with the American team on the conceptual and historical framework of the regional development model. This cooperation resulted in the construction of an optimal control model of regional development and used historical analysis of the settlement processes of the Arava to demonstrate the model's viability. The main results to the model seem to apply to another case study, i.e. the settlement of the United States.

A specific project that was evaluated in the Arava context both conceptually and empirically was the Mediteranean - Dead Sea canal.

During the summer of 1985, Hochman visited Berkeley for 2 months and then later in December Zilberman visited Israel. The paper presented in Venice and the summary of the project results were done during this summer. One area of research that unexpectedly became prominent in the project is the distributional analysis of implication of agricultural policies. There is no wonder that this research direction has emerged, since this project emphasized heterogeneity among farmers, and that led to different impacts of agricultural policies on different types of farms.

8. Thesis - None

9. Inventions - None

10. Publications

- [1] Richard E. Just, David Zilberman, and Eithan Hochman, "Estimation of Multicrop Production Functions, "American Journal of Agricultural Economics, Vol. 65, No. 4 (November, 1983).
- [2] Richard E. Just and David Zilberman, "Does the Law of Supply Hold Under Uncertainty?" Economic Journal (forthcoming).
- [3] Ben-Tal, A., and E. Hochman. "Approximation of Expected Returns and Optimal Decision Under Uncertainty Using Mean and Mean Absolute Deviation," Zor-Zeitschrift Fur Operation Research. Wursburg: Physica Verlag (forthcoming).
- [4] Richard E. Just and David Zilberman, "Income Distributional Implication of Water Policy Decisions, "Western Journal of Agricultural Economics (December, 1985).
- [5] Richard E. Just and D. Zilberman, "Risk Aversion, Technology Choice and Equality Effects of Agricultural Policy" American Journal of Agricultural Economics Vol 67, No. 2, May 1985.
- [6] Richard E. Just and David Zilberman, "Equity Implications of Market Policies," University of California, Department of Agricultural and Resource Economics, July, 1984.
- [7] Richard E. Just and David Zilberman, "The Effects of Agricultural Development Policies on Income Distribution and Technological Change in Agriculture," University of California, Department of Agricultural and Resource Economics. Berkeley, July, 1984.
- [8] Hochman Eithan, Gideon Vitkon, and David Zilberman. "The Arava: The Case of Development of an Arid Zone Under Conditions of Uncertainty."

In A. Rosenman (ed.), Human Settlement and Regional Development in Honor of Raana Wetx, 1984 (Hebrew).

- [9] Hochman Eithan, Richard E. Just, Gideon Vitkon, and David Zilberman. "The Dynamic of Agricultural Development in Sparsely Populated Areas: The Case of the Arava." In Y. Gradus (ed.), Desert Development: Man and Technology in Sparselands. D. Reidel Publishing Company. Dordrecht, 1985.
- [10] E. Hochman and D. Zilberman, "Optimal Strategies of Development Processes of Frontier Environments" Presented at the International Conference on Man's Role in Changing the Global Environment, Venice, 21-26 October, 1985.
- [11] Eithan Hochman and David Zilberman, "Optimal Exploitation of Energy Resources: Solar Power and Electricity Generation in Below Sea Level Basins," Journal of Environmental and Economics Management (forthcoming).
- [12] Eithan Hochman, Jeffrey La France, and David Zilberman, "Solar Energy and Hydroelectric Power Generation in the Dead Sea: A Dynamic Analysis," Water Resources Research, Vol. 20, No. 11 (November, 1984).