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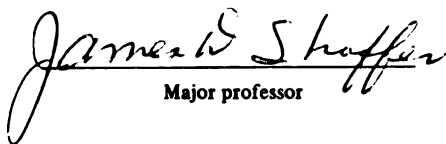
A MULTIPLE FARM SIMULATION MODEL OF THE IMPACT OF INCOME TAX
AND COMMODITY POLICIES ON THE OPPORTUNITIES FOR GROWTH
OF VARIED SIZE CORN/SOYBEAN FARMS

presented by

Jerry R. Skees

has been accepted towards fulfillment
of the requirements for

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Major professor

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AND COMMODITY POLICIES ON THE OPPORTUNITIES FOR GROWTH OF
VARIED SIZE CORN/SOYBEAN FARMS

By

Jerry R. Skees

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics

1981

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ABSTRACT

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By

Jerry R. Skees

This study was undertaken in response to re-emerging concerns over structural trends in the agricultural sector. Since these concerns relate to the trend toward larger and fewer farms, this study focused on the growth phase of the farm firm. The political and economic environment in which farm firms operate was created by using the systems approach and institutional economics to develop a multiple farm firm-household growth simulation model. The model was used to provide insights into the probable opportunity sets to grow provided to different size farmers under alternative economic and institutional environments.

The model demonstrated the additional opportunities for growth that are available to larger farmers. Smaller farmers must depend heavily on outside income and leasing of land for growth opportunities. The tradeoffs between family living expenditures and growth were also emphasized by the model. Use of alternative inflation rates and varied initial leverage positions clearly demonstrated the advantage of being highly leveraged during inflationary periods. (This was especially true when land inflates at higher rates than the general

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inflation rate.) It was concluded that, if inflation is brought under control, those farmers that are not highly leveraged will be in a better relative position to gain control over additional resources. This study also lends support to the hypothesis that price instability contributes to the trend toward larger and fewer farms. Controlled experiments were conducted that demonstrated that the combined influence of penalizing larger farmers for not growing (by forcing them into higher tax brackets) and rewarding farmers for growing (by providing tax write-offs for interest on loans and depreciation for newly-purchased machinery) provides far greater incentives to grow than anticipated. Other conclusions concerning specific tax policies are: 1) Rapid depreciation techniques do not necessarily benefit larger farmers more than smaller farmers; 2) Cash accounting benefits farmers more than rapid depreciation techniques; 3) Taxing capital gains at lower rates encourages growth and benefits larger farmers more than smaller farmers; and 4) Indexing taxes to inflation may actually slow the trend toward larger and fewer farms.

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LIST

LIST

CHAPT

I

II

III

IV

TABLE OF CONTENTS

	Page
LIST OF TABLES	x
LIST OF FIGURES	xix
 CHAPTER	
I INTRODUCTION	1
Research Objectives	6
Selection of Commodities and Region	9
II DEVELOPING AN APPROPRIATE METHODOLOGY	11
Institutional Economics	11
The Systems Approach	15
A Conceptual Framework for Studying the Farm Firm	19
Participants of the System and Their Interactions	20
The Life Cycle and Farmer Goals	26
Decisions and Functions to be Performed by Farm Firm-Households	29
Summary	30
III A SELECTED REVIEW OF THE LITERATURE	31
The Evolution of Farm Firm Growth Models	31
Land Market Literature	36
Decision Making Under Uncertainty	46
A Concluding Quote on Simulation Models	49
IV THE SIMULATION MODEL	52
Model Overview	53
Section 1--Start-up Sequence.....	57
Section 2--Subroutine PREXP	63
Section 3--Subroutine LANDPR	64
Section 4--Subroutine BALANC	66
Section 5--Subroutine LANEXP	70
Section 6--Subroutine MAXBID and LANBID	78
Section 7--Subroutine LANALC	83
Section 8--Subroutine INVEST	85
Section 9--Subroutine REPL	87
Section 10--Subroutine DEPR	91
Section 11--Subroutine LOAN	93

CHAPTER

V

V

TABLE OF CONTENTS -- Continued

CHAPTER		Page
	Section 12--Subroutine BOR	94
	Section 13--Subroutine COSTS	94
	Section 14--Subroutine MIX, FERTI, and YIELD	98
	Section 15--Subroutine CASHFO	100
	Section 16--Subroutine TAXES, INCAV, TAXCOM, and MINTAX	106
	Section 17--Subroutine FAMILY	108
	Summary	110
V	DEVELOPING DATA FOR THE SIMULATION MODEL	111
	Production Data	112
	The Almon Lag Land Model	116
	Land Availability Data	122
	Random Prices and Yields	126
	Procedure for Developing the Data	127
	Parameters Used to Develop Random Prices and Yields	134
	Properties of Actual Random Prices and Yields Used	135
	Developing General Equilibrium Conditions	149
	Summary	155
VI	PROPERTIES OF THE MODEL-DEVELOPING DESIGN	
	PARAMETERS AND PERFORMING SENSITIVITY ANALYSIS	156
	Proper Use of the Model	157
	Developing Behavioral Parameters for	
	a Base Run	162
	The Influence of Credit Control Behavior ...	164
	Credit and Cash Reserves	173
	Using Existing Acres to Support New Purchases	177
	Changing Cash Flow Requirements	179
	Changing Required Average Owner Equity	183
	Inflating Control Variables at Different Rates	183
	Combining Changes in Control Variables to Provide More for More Growth	188
	The Impact of Changing Assumptions	
	Concerning Family Living Expenses	191
	Decreasing Family Living Expenditures	191
	Increasing Family Living Requirements	193

TABLE OF CONTENTS -- Continued

CHAPTER	Page
Allowing More Variability in Family	
Living Expenditures	193
Eliminating Off-Farm Employment	195
Altering Cash Flow and Income Tax Management	195
Eliminating Cash Flow and Income	
Tax Management	195
Maximum Cash Flow and Income Tax	
Management	197
Altering Other Investment and Production	
Assumptions	200
Allowing Only Average Machinery	
Complements	200
Allowing Complete Adjustments in Crop Mix ..	202
Altering Development of Price Expectations	202
Purchase Land Randomly Allocated	205
Concluding Comments on Developing Behavioral	
Assumptions	208
Alternative Inflation Rates	210
Inflation on Land the Same as the	
General Economy	210
Inflation on Land 2 Percent Less Than	
the General Economy	212
Inflation Under Control (2 Percent	
Per Year)	214
Testing Basic Land Availability and Land	
Expansion Assumptions	217
Allowing for Twice as Much Lease Land	218
Eliminating Lease Land	220
Changing the Allocative Procedure	
for Lease Land	220
Allowing for Twice as Much Purchase Land ...	222
Eliminating Land Purchases	224
No Land Expansion - Stochastic Analysis	227
Deterministic Analyses to Test the Model	229
No Land Expansion - Deterministic	
Analysis	229
Deterministic Analysis With Random	
Land Availability	231
Deterministic Analysis With Smaller	
Parcels of Land	233
Altering the Initial Farm Structures	235
All Farms Initial Debt/Asset Ratio = .5	236

CHAPTER

VII

VIII

TABLE OF CONTENTS -- Continued

CHAPTER	Page
	All Farms Own 67 Percent of Operated Land .. 238
	Tying Family Living Expenditures to Net Worth ... 240
	Allowing Better Marketing by Larger Farmers 242
	A New Set of Low Equity, Minimum Land
	Ownership Farms 242
	Summary 244
VII	USING THE MODEL FOR POLICY ANALYSIS 247
	The Experimental Design 247
	Developing a New Measurement Variable 249
	Alternative Commodity Policies 250
	The Current Market vs the Free Market 251
	The Restrictive Market vs the Free Market .. 254
	The Current Market Versus the Free
	Market Under the Maximum Growth
	Strategy 257
	The Current Market Versus the Free
	Market When Inflation on Land is
	the Same as the General Economy 257
	The Current Market Versus the Free
	Market With Farmers Owning 67
	Percent of the Operated Land 260
	The Current Market Versus the Free
	Market With Farmers Having a Higher
	Initial Debt/Asset Ratio 260
	Interpretation of Commodity Policy Results 266
	Analyzing Alternative Income Tax Policies 268
	The Tax Incentives to Grow 270
	Eliminating Rapid Depreciation Techniques .. 273
	Eliminating the Use of Cash Accounting 285
	Reducing the Capital Gains Tax to 25
	Percent 290
	Indexing Taxes to Inflation 294
	President Reagan's Tax Cut Proposals 294
	Other Tax Policy Experiments 298
	Concluding Comment on Tax Policy Analyses 301
VIII	SUMMARY AND CONCLUSIONS 302
	Review of the Methodology 303
	Testing the Credibility of the Model 307
	Conclusions and Policy Implications 309
	Behavior and Growth 309

CHAPTER

APPENDIX

APPENDIX

APPENDIX

APPENDIX

TABLE OF CONTENTS -- Continued

CHAPTER	Page
Inflation and Growth	311
The Important Role of Leasing Land	312
Using the Model for Policy Analysis	313
Price Stability and Farm Structure	314
Income Tax Policies and Farm Structure	315
A Future Research Agenda	319
APPENDIX A	
BASE DATA AND SUMMARY OF BEGINNING YEAR FOR DIFFERENT FARM STRUCTURES	324
APPENDIX B	
MORE DETAIL ON THE COMPUTER SIMULATION MODEL	334
APPENDIX C	
UNIVERSITY OF ILLINOIS COSTS DATA	370
APPENDIX D	
LESS REVEALING MONTE CARLO SUMMARY TABLES	375

TABLE

1.1

4.1

4.2

4.3

4.4

4.5

5.1

5.2

5.3

5.4

5.5

5.6

5.7

5.8

LIST OF TABLES

TABLE		Page
1.1	SUMMARY OF FARM LAND OWNERSHIP CHARACTERISTICS FOR THE U.S. AND THE CORN BELT (GISTRIBUTION OF PERCENT OF ACRES OWNED, 1978)	10
4.1	SAMPLE BALANCE SHEET, DECEMBER 31, 1979	67-8
4.2	SAMPLE STATEMENT OF CHANGE IN OWNER EQUITY	71
4.3	SUMMARY OF THE DISCOUNTED CASH FLOWS PER ACRE FOR THE CONDITIONS BELOW	80
4.4	SENSITIVITY ON CONDITIONS IN TABLE 4.3 - INCREASE MARGINAL TAX TO .5	82
4.5	SAMPLE PHYSICAL DEPRECIATION SCHEDULE FOR A \$10,000 INVESTMENT (1979 DOLLARS)	90
5.1	VARIABLE COSTS RELATIONSHIPS FOR CORN BY FARM SIZE	117
5.2	VARIABLE COSTS RELATIONSHIPS FOR SOYBEANS BY FARM SIZE	117
5.3	VARIOUS PRODUCTION AND COSTS RELATIONSHIPS RELATED TO FARM SIZE	118
5.4	DATA USED FOR ALMON LAG	120
5.5	RESULTS OF ALMON LAG, ILLINOIS LAND MODEL, 1959-79	121
5.6	ANNUAL LAND AVAILABILITY PROBABILITIES AND FREQUENCY FOR AN EFFECTIVE MARKET WITH A 10 MILE RADIUS	123
5.7	PARAMETERS FOR PROBABILITY DISTRIBUTIONS - USED TO GENERATE MULTIVARIATE BETA DISTRIBUTIONS	136
5.8	CORRELATIONS - WITHIN AND BETWEEN YEARS FOR CORN AND SOYBEAN PRICES AND YIELDS - USED TO GENERATE MULTIVARIATE BETA RANDOM VALUES	137

TABLE

5.9

5.10

5.11

5.12

5.13

5.14

5.15

5.16

5.17

5.18

6.1

LIST OF TABLES -- Continued

TABLE		Page
5.9	STATISTICS FOR RANDOM CORN AND SOYBEAN YIELDS	138
5.10	STATISTICS FOR RANDOM CORN PRICES UNDER THREE COMMODITY POLICY SCENARIOS	139
5.11	STATISTICS FOR RANDOM SOYBEAN PRICES UNDER THREE COMMODITY POLICY SCENARIOS	140
5.12	STATISTICAL PROPERTIES OF RANDOM CORN AND SOYBEAN YIELDS (SAME DRAWS UNDER EACH POLICY SCENARIO)	142
5.13	STATISTICAL PROPERTIES OF RANDOM CORN PRICES UNDER THREE ALTERNATIVE COMMODITY POLICY SCENARIOS	143
5.14	STATISTICAL PROPERTIES OF RANDOM SOYBEAN PRICES UNDER THREE ALTERNATIVE COMMODITY POLICY SCENARIOS	144
5.15	STATISTICAL PROPERTIES OF BUDGETED RETURNS ABOVE LAND COSTS UNDER THREE ALTERNATIVE COMMODITY POLICY SCENARIOS	145
5.16	STATISTICAL PROPERTIES OF ALMON LAG LAND PRICE ESTIMATES UNDER THREE ALTERNATIVE COMMODITY POLICY SCENARIOS	146
5.17	RELATIONSHIP BETWEEN THE FEDERAL LAND BANK MORTGAGE INTEREST RATE, THE CONSUMER PRICE INDEX, AND THE ILLINOIS LAND PRICE INDEX	150
5.18	ASSUMPTIONS AND DEVELOPMENT OF SPECIFIC VALUES TO OBTAIN A GENERAL EQUILIBRIUM, DETERMINISTIC ECONOMY	153-4
6.1	BASE ANALYSIS (SEE APPENDIX A FOR BASE ASSUMPTIONS AND TABLE A.1 FOR A SUMMARY OF YEAR 1)	163

TABLE

6.2

6.3

6.4

6.5

6.6

6.7

6.8

6.9

6.10

6.11

6.12

6.13

6.14

LIST OF TABLES -- Continued

TABLE		Page
6.2	FEASIBLE BOUNDS AND BASE VALUES FOR FARMER CREDIT BEHAVIORAL PARAMETERS	166
6.3	MORE AGGRESSIVE GROWTH (I.E., INTERNAL LEVERAGE RATIO = 1.8)	167
6.4	DEVELOPMENT OF LOCAL LAND MARKET CHARACTERISTICS UNDER DIFFERENT LEVERAGE ASSUMPTIONS	170
6.5	LESS AGGRESSIVE GROWTH (I.E., INTERNAL LEVERAGE RATIO = 1.0)	171
6.6	LESS AGGRESSIVE GROWTH (I.E., REQUIRED RESERVE YEARS = 3)	174
6.7	MORE AGGRESSIVE GROWTH (I.E., REQUIRED RESERVE YEARS = 1)	175
6.8	MORE AGGRESSIVE GROWTH (I.E., CASH FLOW REQUIREMENT = -\$150/AC)	180
6.9	LESS AGGRESSIVE GROWTH (I.E., CASH FLOW REQUIREMENT = \$0/AC)	181
6.10	LESS AGGRESSIVE GROWTH (I.E., OWNER EQUITY = -\$10/AC)	184
6.11	MORE AGGRESSIVE GROWTH (I.E., INFLATING CONTROL VARIABLES AT 9%)	186
6.12	LESS AGGRESSIVE GROWTH (I.E., NO INFLATION ON CONTROL VARIABLES)	187
6.13	MORE AGGRESSIVE GROWTH (I.E., INTERNAL LEVERAGE RATIO = 1.6 AND CASH FLOW REQUIREMENT = -\$150/AC)	189
6.14	MOST AGGRESSIVE GROWTH (I.E., INTERNAL LEVERAGE RATIO = 1.8, OWNER EQUITY = -\$60/AC, AND CASH FLOW REQUIREMENT = -\$200/AC)	190

TABLE

6.15

6.16

6.17

6.18

6.19

6.20

6.21

6.22

6.23

6.24

6.25

6.26

6.27

6.28

6.29

6.30

6.31

LIST OF TABLES -- Continued

TABLE		Page
6.15	DECREASING FAMILY LIVING REQUIREMENTS (MINIMUM FAMILY LIVING = \$7,000)	192
6.16	INCREASING FAMILY LIVING REQUIREMENTS (MINIMUM FAMILY LIVING = \$15,000)	194
6.17	ELIMINATING OFF-FARM EMPLOYMENT	196
6.18	ELIMINATING CASH FLOW AND INCOME TAX MANAGEMENT NO STORAGE ADJUSTMENTS	198
6.19	MAXIMUM CASH FLOW AND INCOME TAX MANAGEMENT COMPLETE STORAGE ADJUSTMENTS	199
6.20	ALLOWING ONLY AVERAGE MACHINERY COMPLEMENTS	201
6.21	ALLOWING COMPLETE ADJUSTMENTS IN CROP MIX	203
6.22	ALTERING DEVELOPMENT OF PRICE EXPECTATIONS EXPONENTIAL WEIGHT = .6	204
6.23	PURCHASE LAND RANDOMLY ALLOCATED TO THOSE ABLE TO PLACE A BID	207
6.24	INFLATION ON LAND THE SAME AS THE GENERAL ECONOMY	211
6.25	INFLATION ON LAND 2 PERCENT LESS THAN THE GENERAL ECONOMY	213
6.26	INFLATION UNDER CONTROL (2 PERCENT PER YEAR)	215
6.27	ALLOWING FOR TWICE AS MUCH LEASE LAND	219
6.28	ELIMINATING LEASE LAND	221
6.29	ALLOWING PURCHASE AND LEASE OF LAND IN THE SAME YEAR	223
6.30	ALLOWING FOR TWICE AS MUCH PURCHASE LAND	225
6.31	ELIMINATING LAND PURCHASES	226

TABLE

6.32

6.33

6.34

6.35

6.36

6.37

6.38

6.39

6.40

7.1

7.2

7.3

7.4

7.5

7.6

LIST OF TABLES -- Continued

TABLE		Page
6.32	NO LAND EXPANSION - STOCHASTIC ANALYSIS	228
6.33	NO LAND EXPANSION - DETERMINISTIC ANALYSIS	230
6.34	DETERMINISTIC ANALYSIS WITH RANDOM LAND AVAILABILITY	232
6.35	DETERMINISTIC ANALYSIS WITH SMALLER PARCELS OF LAND	234
6.36	CHANGING THE INITIAL FARM STRUCTURE ALL FARMS' INITIAL DEBT/ASSET RATIO = .5 (SEE TABLE A.2 FOR A SUMMARY OF YEAR 1)	237
6.37	CHANGING THE INITIAL FARM STRUCTURE ALL FARMS OWN 67 PERCENT OF OPERATED LAND (SEE TABLE A.3 FOR A SUMMARY OF YEAR 1)	239
6.38	TYING FAMILY LIVING EXPENDITURES TO NET WORTH	241
6.39	ALLOWING BETTER MARKETING BY LARGER FARMERS (2 PERCENT PRICE DIFFERENTIAL BETWEEN FARMS)	243
6.40	A NEW SET OF LOW EQUITY, MINIMUM LAND OWNERSHIP FARMS (SEE TABLE A.4 FOR A SUMMARY OF YEAR 1)	245
7.1	FREE MARKET PRICES - 100 SIMULATIONS	252
7.2	CURRENT MARKET VERSUS FREE MARKET (100 SIMULATIONS - BASE DATA)	253
7.3	MORE RESTRICTIVE MARKET PRICES - 100 SIMULATIONS	255
7.4	RESTRICTIVE MARKET VERSUS FREE MARKET (100 SIMULATIONS - BASE DATA)	256
7.5	FREE MARKET UNDER THE MAXIMUM GROWTH STRATEGY	258
7.6	CURRENT MARKET VERSUS FREE MARKET MAXIMUM GROWTH STRATEGY	259

TABLE

7.7

7.8

7.9

7.10

7.11

7.12

7.13

7.14

7.15

7.16

7.17

7.18

7.19

7.20

LIST OF TABLES -- Continued

TABLE	Page
7.7	FREE MARKET WHEN INFLATION ON LAND IS THE SAME AS THE GENERAL ECONOMY 261
7.8	CURRENT MARKET VERSUS FREE MARKET INFLATION ON LAND SAME AS THE GENERAL ECONOMY 262
7.9	FREE MARKET WITH 67 PERCENT LAND TENURE 263
7.10	CURRENT MARKET VERSUS FREE MARKET 67 PERCENT OF LAND OWNED 264
7.11	FREE MARKET WITH FARMS HAVING .5 DEBT/ASSET RATIOS 265
7.12	CURRENT MARKET VERSUS FREE MARKET INITIAL DEBT/ASSET RATIO = .5 267
7.13	TAX INCENTIVES TO GROW - COMPARING GENERATED CAPITAL UNDER GROWTH AND NO GROWTH STRATEGIES WITH AND WITHOUT FEDERAL TAXATION 272
7.14	USE OF STRAIGHT LINE DEPRECIATION BASE STRUCTURE 274
7.15	USE OF STRAIGHT LINE DEPRECIATION INITIAL DEBT/ASSET RATIO = .5 275
7.16	USE OF STRAIGHT LINE DEPRECIATION 67 PERCENT LAND TENURE 276
7.17	USE OF STRAIGHT LINE DEPRECIATION UNDER LESS AGGRESSIVE GROWTH - (BREAKEVEN CASH FLOW) 277
7.18	USE OF STRAIGHT LINE DEPRECIATION UNDER HIGHER COMMODITY PRICES 278
7.19	GENERATED CAPITAL UNDER ALTERNATIVE TAX POLICIES AND INITIAL FARM STRUCTURE 281
7.20	GENERATED CAPITAL RATIOS FOR COMPARING THE RELATIVE IMPACT OF TAX POLICIES, GIVEN AN ALTERNATIVE INITIAL FARM STRUCTURE 282

TABLE

7.21

7.22

7.23

7.24

7.25

7.26

7.27

7.28

7.29

7.30

7.31

A.1

A.2

LIST OF TABLES — Continued

TABLE		Page
7.21	GENERATED CAPITAL VALUES FOR FURTHER ANALYSES USING STRAIGHT LINE DEPRECIATION	284
7.22	USE OF ACCRUAL ACCOUNTING BASE FARMS	287
7.23	USE OF ACCRUAL ACCOUNTING INITIAL DEBT/ASSET RATIO = .5	288
7.24	USE OF ACCRUAL ACCOUNTING 67 PERCENT LAND TENURE	289
7.25	REDUCING CAPITAL GAINS TAXES TO 25 PERCENT BASE FARMS	291
7.26	REDUCING CAPITAL GAINS TAXES TO 25 PERCENT INITIAL DEBT/ASSET RATIO = .5	292
7.27	REDUCING CAPITAL GAINS TAXES TO 25 PERCENT 67 PERCENT LAND TENURE	293
7.28	INDEXING TAXES TO INFLATION BASE FARMS	295
7.29	INDEXING TAXES TO INFLATION INITIAL DEBT/ASSET RATIO = .5	296
7.30	INDEXING TAXES TO INFLATION 67 PERCENT LAND TENURE	297
7.31	OTHER ANALYSES COMPARING THE RELATIVE IMPACT OF TAX POLICIES, GIVEN THE BASE FARM STRUCTURE	300
A.1	INITIAL YEAR FOR ALL ANALYSES WITH DEBT/ASSET RATIO = .3 AND PERCENT TENURE = 33 (BASE CONDITIONS)	330
A.2	INITIAL YEAR FOR ALL ANALYSES WITH DEBT/ASSET RATIO = .5 AND PERCENT TENURE = 33	331

TABLE

A.3

A.4

C.1

C.2

C.3

C.4

D.1

D.2

D.3

D.4

D.5

D.6

D.7

D.8

D.9

LIST OF TABLES -- Continued

TABLE		Page
A.3	INITIAL YEAR FOR ALL ANALYSES WITH DEBT/ASSET RATIO = .3 AND PERCENT TENURE = 67	332
A.4	INITIAL YEAR FOR A SPECIAL SET OF LOW EQUITY, MINIMUM LAND OWNERSHIP FARMS CREATED IN TABLE 6.40	333
C.1	AVERAGE COSTS, RETURNS, AND FINANCIAL SUMMARY OF GRAIN FARMS BY SIZE AND HIGH SOIL RATING, NORTHERN ILLINOIS, 1978	371
C.2	AVERAGE OPERATING COSTS, INVESTMENTS, AND LAND USE OF GRAIN FARMS BY HIGH SOIL RATING, NORTHERN ILLINOIS, 1978	372
C.3	COSTS FOR CORN, CENTRAL ILLINOIS GRAIN FARMS	373
C.4	COSTS FOR SOYBEANS, CENTRAL ILLINOIS GRAIN FARMS	374
D.1	BASE RUN WITH 50 SIMULATIONS	376
D.2	BASE RUN WITH 100 SIMULATIONS	377
D.3	EXISTING ACRES REQUIRED TO COVER A NEWLY PURCHASED ACRE INCREASED TO 5	378
D.4	INFLATING CONTROL VARIABLES AT 2 PERCENT PER YEAR	379
D.5	INFLATING CONTROL VARIABLES AT 5 PERCENT PER YEAR	380
D.6	ALLOWING MORE VARIABILITY IN FAMILY LIVING EXPENDITURES	381
D.7	USING THE PREVIOUS YEAR TO DEVELOP PRICE EXPECTATIONS	382
D.8	INFLATION UNDER CONTROL - 2 PERCENT PER YEAR INITIAL DEBT/ASSET RATIO = .5	383
D.9	CHANGING THE LANDLORD'S THRESHOLD TO .9	384

LIST OF TABLES -- Continued

TABLE		Page
D.10	ALLOWING BETTER MARKETING BY LARGER FARMERS (1 PERCENT PRICE DIFFERENTIAL BETWEEN FARMS)	385
D.11	BASE RUN WITH HIGHER COMMODITY PRICES	386
D.12	NO LAND EXPANSION AND NO FEDERAL TAXES	387
D.13	BASE GROWTH AND NO FEDERAL TAXES	388
D.14	PRESIDENT REAGAN'S 10 PERCENT TAX CUT BASE FARMS	389
D.15	PRESIDENT REAGAN'S 10 PERCENT TAX CUT INITIAL DEBT/ASSET RATIO = .5	390
D.16	PRESIDENT REAGAN'S 10 PERCENT TAX CUT 67 PERCENT LAND TENURE	391
D.17	EXTENDING PRESIDENT REAGAN'S TAX PLAN TO INCLUDE LESS YEARS FOR DEPRECIATION	392
D.18	ELIMINATING INCOME AVERAGING BASE CONDITIONS	393
D.19	REDUCING INVESTMENT TAX CREDITS TO 5 PERCENT	394
D.20	TAXING CAPITAL GAINS AS ORDINARY INCOME	395
D.21	FIRST THREE FARMS USING STRAIGHT LINE DEPRECIATION, FOURTH FARM USING MORE RAPID DEPRECIATION	396

FIGURE

2.1

4.1

5.1

LIST OF FIGURES

FIGURE		Page
2.1	THE SYSTEM IDENTIFICATION PROCESS	17
4.1	SEQUENTIAL DEVELOPMENT OF THE MODEL	58-60
5.1	EXPOSITION OF COST DATA DEVELOPMENT	115

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CHAPTER I

INTRODUCTION

Since the 1930's, a major farm problem has been one of resources disequilibrium. Throughout the 1950's and 60's, United States agriculture was plagued with excess capacity. Policy makers considered it necessary to implement supply reduction and price support mechanisms throughout this period. The recurring problem of overproduction precipitated major adjustments in the agricultural sector. The most dramatic evidence of these adjustments has been the rapid decline in farm numbers coupled with an increase in farm size. A major reason for this shift simply was that outside opportunities provided greater economic rewards than did farming. Adoption of technological developments during this period accompanied by better access to credit also contributed to making larger scale farms more efficient. Babb (1979) discusses other factors that have contributed to these trends:

1) variation in input prices, 2) economies of size, 3) variation in commodity prices, 4) risk and expectations, 5) price-cost margins; 6) exchange arrangements, 7) capital requirements, 8) taxes; 9) goals of the farmer, 10) managerial ability, and 11) macroeconomic policies.

Adjustments in the agricultural sector continue. However, recent events suggest that the relative importance of the factors contributing to these adjustments is changing. The problem of excess capacity appears to be less important. Shortages in the early to mid

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1970's and the introduction of international markets have decreased the need for supply control policies. Income from commercial farming is comparable to outside opportunities. Indeed, the agricultural sector may be reaching a relative state of resource equilibrium.

In considering the efficiency questions associated with farm size, Emerson (1979, p. 3) observes:

Past, and somewhat dated, studies of the relationship between average production costs and farm size support two major conclusions. First, most economies of size are apparently captured by the modern one-, two-, or three-man farm. Most of these farms are family size operations. Second, while the lowest average cost of production may be attainable on a two-man farm, average cost tends to remain relatively constant over a wide range of farm sizes.

Others have observed that while there has been a shortage of recent studies, the general "relationships have probably not changed" (Miller, 1979, p. 109). It is likely that for some types of farms the minimum cost point is shifting toward larger farms. Even though there is evidence to conclude that relatively modest size farms can achieve economic efficiency (Madden, Arsdell and Elder, Hall and LeVeen, etc.), farms continue to expand. It may require larger than efficient size operations to provide adequate cash flows to service debts and maintain a reasonable standard of family living.¹ Growth beyond the efficient size generally results in higher farm profits. Further, many farmers consider growth and control of more resources to be a major goal. The desire to grow was a major reason for the social unrest of the American Agricultural Movement of the late 1970's.

¹ Efficient size refers to technical efficiency where the concern is to obtain the most output at the least cost (i.e., the minimum point on the long run average cost curve).

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Farmers that made highly leveraged investments in land and/or machinery in the early 1970's, when price expectations were high due to international shortages, were unable to realize these prices as U.S. agriculture again found itself overproducing in the late 1970's. (This short-run disequilibrium was the result of unrealistic expectations and, therefore, should not threaten the earlier hypothesis that the agricultural sector is reaching a state of long-run equilibrium.) The overexpansion of the mid 1970's threatened the existence of many farm operations as cash flows were not adequate to service newly acquired debts.

The activity of the American Agricultural Movement, at a time when there was a general upturn in the national farm income number (1978), focused new attention on the heterogeneous nature of the farming sector. Further, it was an impetus for new discussions on the structure of agriculture as policy makers again began raising questions concerning organization and control of U.S. agriculture. Perceptions of the farm problem were in transition. Census data (starting in 1974) indicate a growth in small, part-time farmers and the continual growth in the largest classes of farms, whether measured in acres or sales. Cook and Marion (1981, p. 1) sum up the trends as follows:

Present trends suggest that a few very large farms will produce the bulk of farm commodities, and many small farms, although adding little to total farm production, will persist in spite of economic disadvantages and depend on nonfarm income for survival. This bimodal distribution of farms is becoming more apparent.

Thus, a concern has become the survival of relatively modest sized commercial farms. The trend toward larger farms reflects activity of

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well-established commercial farms buying out their neighbors in what has been termed "economic cannibalism within agriculture". Nearly two-thirds of all farm land is purchased by existing farmers (Raup, 1978). The existing political economy is incapable of reversing the current trends without major political action. Reversing the current trends would require a major redistribution policy. Still, policy makers have been asking: "What structural configuration will best meet the performance criteria for the agricultural sector in the future?"¹ This question centers around who determines the relative importance of various performance criteria. Penn (1979) outlines several criteria and discusses the possible consequences of different agricultural structures on these performance goals. He also questions the efficiency gains to society associated with the trend toward larger and fewer farms. The issue of adaptability and flexibility of different size farms appears to be increasing in importance. Social unrest of the American Agricultural Movement demonstrated that highly leveraged farmers are not as able to withstand major shocks as more established farmers who may not be making heavy use of credit. The relationship between credit and growth is clear. The advent of energy shortages also raises questions concerning how alternative technologies may alter the cost structure of agriculture in the future. Currently, U.S. agriculture is energy intensive; this is closely related to the huge capital investments required to farm. If new smaller scale,

¹ Only two structural configurations are considered feasible: 1) one that will result if the current trends are allowed to continue; and 2) one that would result from policies designed to slow current trends.

energy efficient technologies were developed, which structural configuration could adapt most quickly? Which structural configuration would be most responsible in care and preservation of the environment? Which configuration would produce the best quality of food at the lowest price? Which configuration would best aid in the welfare of rural communities? And finally, which configuration best contributes to the welfare of the participants? There are many opinions concerning how these and other issues may interact with alternative agricultural structures (Penn, Emerson, Brewster, Hightower, Breimyer and Barr, etc.).

As society examines these issues, the need to develop a better understanding of the forces behind the trend toward larger and fewer farms increases. It must be recognized that alternative policies will influence these trends. Research that accounts for the combined impact of the most important public policies, the environment created by these policies, and the behavior of farm managers in response to these policies and the environment is needed. An important issue involves how alternative policies alter the opportunity sets of different size producers. What are the distributional impacts? Knowledge of the intended and unintended consequences of alternative policies at the farm level has been lacking. Many policy analysts have made the case that part of the evaluation of new and existing policies should include consideration of the distributional aspects of those policies (Bonnen, 1969).

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Research Objectives

A better understanding of how alternative policies impact the opportunity sets of different size farm operations is needed. Since the trend toward larger farms has generated so much discussion, a primary concern should center around the growth opportunities of different size farms. This study is designed to develop an appropriate methodology for addressing these questions. More specifically, the objectives of this study are designed to:

- 1) Develop a corn/soybean farm growth and viability model that accounts for alternative assumptions involving initial endowments, behavioral responses of managers, the economic environment and policies.
- 2) Illustrate the probable outcome of different farmer behavior on farm growth and viability.
- 3) Evaluate possible outcomes associated with commodity policies involving more and less price stability on farms of different sizes.
- 4) Illustrate the probable outcome of use of alternative income tax policies on the growth of farms of different sizes.

The amount of interaction that occurs between farm firms, the general economy, and governmental policies makes it difficult to develop hypotheses that correspond with the objectives of this study. In general, it is hypothesized that larger farmers have more opportunities to grow than smaller farmers. Indeed, previous studies support this hypothesis. Farmer behavior is hypothesized to have the greatest influence on growth. Objective 2 of this study develops

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specific strategies that can lead to greater farm growth with less risk. Objective 3 develops markets to reflect more and less stable commodity prices that may be associated with different commodity policies. A number of commodity policies influence commodity price stability: 1) price-support programs, 2) reserve programs, 3) production control programs, 4) disaster programs, and 5) direct payment programs (i.e., deficiency payments for grain). Such programs are most relevant for cash grain farmers. This is one reason that this study focuses on cash grain farmers. Government policies can be designed to result in more stable and less stable commodity prices. The question here is - under which set of prices will larger farmers have relatively more opportunities? Cook and Marion (1981, p. 2) sum up the issue:

Some economists contend that lower production and price risks encourage larger and fewer farms by promoting investment, specialization, and the adoption of new technology. However, this view is far from unanimous. Cornell's Ken Robinson has argued that capital investment is positively linked to price instability. Robinson contends that high-price years spur investment because farmers have both the capacity and tax incentives to invest. Conversely, in years of low prices, inefficient (high-cost) producers are forced out of business. The combined effect of high- and low-price periods drives an industry toward larger and more efficient producers. Reversing the flow of causality, there are also conflicting views on the impact of farm structure on price stability.

Undoubtably, many factors are important in investigating whether stable or unstable prices benefit large farms (i.e., initial endowments, inflation on land, etc.). Therefore, there are no hypotheses concerning objective 3. The best that can be accomplished is to develop special conditions under which to analyze this objective.

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The general hypotheses that are related to objective 4 are:

1) the current income tax policies provide additional incentives to growth-oriented farmers; 2) larger growth-oriented farmers pay relatively less income taxes than smaller growth-oriented farmers; and 3) income tax policies such as investment tax credits, rapid depreciation techniques, cash accounting, and income averaging benefit larger farmers. The simulation model is used to more fully develop these hypotheses under objective 4.

It should be emphasized that this study addresses only one dimension of performance of the agricultural sector - distribution of property rights among the participants. This includes not only the property rights that exist because of the current structure of the industry and current policies, but more importantly, the new opportunities that may be provided by alternative policies. Any attempt to go beyond this study and design and/or implement policies that may have distributional consequences would necessarily need to consider other performance criteria such as efficiency, growth, and stability, as well as some of those mentioned above. Undoubtably, there would be tradeoffs to account for. Furthermore, this study does not propose to design new policies; rather the intent is to extend and demonstrate a methodology that can provide insights into factors influencing farm growth and the distribution of benefits from programs and taxes among farms of different size.

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Selection of Commodities and Region

The diversity of U.S. agriculture makes it impossible to consider the entire farming sector in a study such as this. Indeed, any farm level research that may be used to develop conclusions concerning national policy must proceed with a full awareness of this limitation. This increases the importance of selection of the commodities and region chosen for this study. For several reasons, this study focuses on specialized corn/soybean farms in the Corn Belt. More specifically, it focuses on corn and soybean farms in northern and central Illinois. The government continues to be heavily involved in grain policy. As commodity programs continue to influence prices, they will also influence the entire agricultural sector as U.S. grain exports continue to increase and because grain is essential to the U.S. livestock industry. The Corn Belt produces the bulk of the nation's corn and soybeans. Many of the characteristics of land ownership in the Corn Belt are similar to the national characteristics (See Table 1.1). Another reason for choosing specialized corn/soybean farms in Illinois was the need to provide control in the analysis. Analyzing the impact of policies on individual farms over a long planning horizon (10-15 years) requires some degree of confidence that the commodities being studied will remain in production over that period. Moreover, analysis of specialized corn/soybean farms simplifies development of the production process. Finally, the availability of good quality data from Illinois farm records made this section of the Corn Belt a logical selection.

TABLE 1.1 - SUMMARY OF FARM LAND OWNERSHIP CHARACTERISTICS FOR THE U.S. AND THE CORN BELT (Distribution of Percent of Acres Owned, 1978)*

TABLE 1.1 - SUMMARY OF FARM LAND OWNERSHIP CHARACTERISTICS FOR THE U.S. AND THE CORN BELT (Distribution of Percent of Acres Owned, 1978)*

	<u>Distribution by Type of Landowner</u>					
	<u>Sole Proprietor</u>	<u>Husband-Wife</u>	<u>Family Partnership</u>	<u>Non-Family Partnership</u>	<u>Family Corporation</u>	<u>Non-Family Corporation</u>
U.S.	36.6%	37.3	12.2	1.9	6.1	2.4
Corn Belt	35.2	47.3	9.1	1.1	2.8	1.0
						3.5
						3.5
	<u>Distribution by Occupation of Landowner</u>					
	<u>Farmer</u>	<u>White Collar</u>	<u>Blue Collar</u>	<u>Retired</u>	<u>Other</u>	
U.S.	56.4%	14.1	8.2	17.0	4.3	
Corn Belt	48.0	13.8	10.4	22.6	5.2	
	<u>Distribution by Method of Acquisition</u>					
	<u>Purchased From Non-Relative</u>	<u>Inherited</u>	<u>Purchased From Relative</u>	<u>Gift</u>	<u>Other</u>	
U.S.	59.9%	18.5	16.6	2.7	2.3	
Corn Belt	59.9	18.7	18.7	1.4	.9	
	<u>Distribution by Age of Landowner</u>					
	<u>Under 35</u>	<u>35-49</u>	<u>50-64</u>	<u>65 and over</u>		
U.S.	6.1%	24.2	38.9	30.8		
Corn Belt	6.4	24.7	37.2	31.7		
	<u>Distribution by Residence of Landowner</u>					
	<u>Same County</u>	<u>Other County</u>	<u>Out-of-State</u>			
U.S.	80.0%	14.5	5.5			
Corn Belt	84.5	11.6	3.9			

* Source - "Who Owns the Land? - A Preliminary Report of a U.S. Landownership Survey"; USDA; Economics, Statistics, and Cooperative Service; September 1979.

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CHAPTER II

DEVELOPING AN APPROPRIATE METHODOLOGY

The nature of this research requires development of two levels of conceptual thinking. The first involves development of a behavioral theory of the farm firm that can be mathematically modeled. Secondly, before such a model can be used for policy analyses, the linkage between a micro-level behavioral model and the macro-level economy must be made. These linkages are not easily completed. The problem is compounded by the need to focus on a specific region and specific commodities. However, institutional economics and the systems approach provide insights into development of these linkages.

This chapter begins by reviewing aspects of the institutional and the systems approach that can be used to bridge the gap between micro level behavior and the economy's performance. After developing the logic behind using a micro model to analyze macro policies, this chapter begins the process of placing bounds on the problem in order to develop a behavioral theory of the farm firm-household that can be mathematically modeled.

Institutional Economics

Institutional economics has evolved to expand neoclassical economics and the Industrial Organization Framework by accounting for the interaction between a market's structure, conduct, and performance.

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The basic premise upon which institutional economics rests and on which this study builds is that public policies alter the environment in which firms operate and in turn influence behavior. Behavior of a market's participants determines the industries's performance; and, ultimately, performance will feed back into the policy process causing changes in structure to occur. Behavior, then, is the link between structure and the ultimate performance of a market. Behavior can be altered with design of alternative policies, education, and/or development of new technologies. This is the essence of the structure-conduct-performance framework. And this is what lends credence to examining the impact of policies at the micro level.

Market structure refers to the general political, economic, and social environment in which market participants operate. The Industrial Organizational framework focuses on the size and number of firms, the ease of entry, and product differentiation when referring to market structure. Here, the concern is with an extended definition that includes the entire environment in which a firm operates. Institutions are established rules and/or laws which constitute an important part of the structure of a market. It is the institutional structure that creates alternative opportunity sets for different participants. Conduct or behavior is the response of the participants to the prevailing structure. The decisions and strategies practiced by the participants influence their ability to capture the potential benefits provided by the prevailing structure (i.e., Better managers will gain more). It could be that the better managers have received special training available only to them. Under such a scenario, structure would be responsible for behavior. Therefore, the

distinction is not clear. It is extremely important that these types of interaction be recognized in any framework designed to account for the evolution of human behavior and institutions. Finally,

performance involves measuring the outcome of the behavior of the participants. There are two overlapping levels of performance:

1) the outcome for the individual participants, and 2) the outcome for the community (or society). In the aggregate, the welfare of the individual participants should be a concern of society. In paraphrasing Marion and Mueller, Shaffer defines performance as being "concerned with allocative and technical efficiency, progressiveness, product characteristics, and equity."

The dynamic aspect of the structure-conduct-performance framework is its real strength. Shaffer (1979, p. 2-3) best sums up the evolutionary nature of this framework:

"At a point in time, participants in a political economy exist in an environmental situation which is their opportunity set. Each participant responds to his environmental situation, and the aggregate consequence is a change in the environment. The changes in the environment contain the benefits and costs for individuals and groups which follow from the behavioral responses. Changes in participants' perceptions of the environment and appropriate behavior follow from the change in the environment. The sequence continues, the system evolves. Call the total flow of consequences which follow from the organization of the political economy, performance. Then we can say that the evolving system is driven by this basic three-term sequence of environment, behavior responses, and performance - E-B-P...E-B-P....

(Here, E-B-P corresponds with structure, conduct, and performance.)

The premise that human behavior is shaped by the environment and that the environment is shaped by human behavior allows for the introduction of concepts and themes that go beyond traditional economic

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theory. Although the application of many of these themes is beyond the scope of this study, any decisions that might be made using results of this study would benefit from recognizing their importance. Therefore, a brief review of several of the major themes follows:

Property rights are the control over and/or access to assets in an economy. Institutions establish property rights. The relative distribution of property rights determines the power that one individual will have over another.

Power involves not only the ability to control, but also the ability to function effectively. Relative power can be enhanced by laws and regulations. Access to and control over information that reduces uncertainty can also enhance power.

Conflict is the ultimate byproduct of power. The existence of inequitable power and conflict reduces the role of the "invisible hand" in the allocation of resources and the distribution of wealth. The interaction between property rights, power, and conflict reduces the ability of policy makers to make institutional changes.

Bounded Rationality refers to the limited ability of individuals to search fully the entire set of opportunities provided them in an uncertain environment. It is because of this limit, that decision makers develop Standard Operating Procedures (SOP).

Standard Operating Procedures are an established response (rules of thumb) for managing a firm. SOP's evolve as the environment changes and decision makers discover that old SOP's are not leading to satisfactory results.

Satisficing behavior involves behavior that is satisfied with less than optimal choices. The introduction of multiple goals in an

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uncertain environment, where decision makers operate with bounded rationality, make optimizing behavior nearly impossible.

The Systems Approach

Manetsch and Park (1977) present five phases of the systems approach as a problem solving methodology: 1) feasibility evaluation, 2) abstract modeling, 3) implementation design, 4) implementation and 5) system operation. They emphasize movement "from a set of needs to be satisfied toward an operational system capable of satisfying the needs which exist." Feasibility evaluation involves development of alternative structural configurations or management strategies to satisfy identified needs. The abstract modeling phase is most relevant to this study. It is here that alternatives are put to the test and evaluation of the probable outcomes associated with each alternative are made. Under the usual case of having no one performance criteria to evaluate the problem, Manetsch and Park (1977, p. 4-5) describe the abstract modeling phase as:

an interactive process in which systems analysts and decision makers use the models to explore the impacts of various alternatives and decision variables upon the multiple system performance criteria which must be considered. This interaction explores tradeoffs that are possible among performance criteria, assists decision makers in arriving at normative judgments about what is "good" or "best" and leads to the creative synthesis of better system design and/or management strategies.

The other phases of the systems approach are beyond the scope of this study. However, they are worth reviewing. Implementation design involves specification of the details of the system and/or management strategy that is deemed most appropriate after completion of the

modeling phase. Once this is done the proposal is then implemented with the final phase involving operation of the new proposal with careful monitoring to be sure it is accomplishing what was intended.

Again, the feasibility evaluation and abstract modeling phases are most relevant to this study. System identification and development occurs in these phases. The breakdown of a system corresponds very closely to the structure-conduct-performance framework. Figure 2.1 represents the system identification process. The figure breaks the information needed into three categories: input, system parameters, and output. System inputs are stimuli which alter system behavior. Inputs may be endogenous (i.e., They are within the bounds of the identified system) or they may be exogenous (This would include environmental inputs or factors outside the bounds of the identified system). Manetsch and Park also classify inputs as being controllable or uncontrollable. The system structure involves the interaction that occurs within the specified system, tying the inputs and outputs together. The system parameters or the structure of the system can be influenced by a variety of inputs. Finally, two types of output come from a system--desirable and undesirable. Examination of undesirable or unintended consequences of policy options is also an important component of the structure-conduct-performance framework. An important contribution of the systems approach involves development of feedback mechanisms which evaluate performance criteria (output) to determine how closely they correspond with desired performance. If the feedback includes alteration of behavior to improve the systems performance, then management takes place. Indeed, there are three functions performed by the systems approach. Reviewing these functions

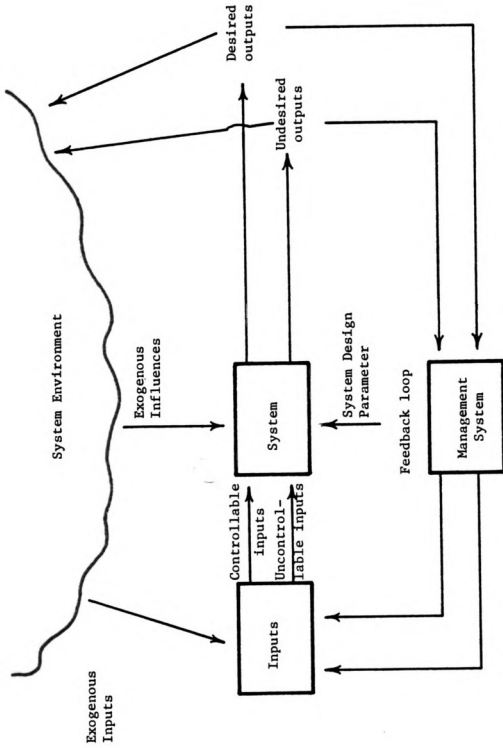


Figure 2.1

The System Identification Process

will demonstrate the similarity between the systems approach and the structure-conduct-performance framework.

Management involves alteration of system inputs (i.e., changing the structure in the SCP framework) when the conduct of the system and the outputs are given. Design involves determination of the system parameters (or the behavioral responses) when inputs are given and the desired output is known. Analysis involves identification of the systems output (or performance) when the inputs and system parameters are known. Thus, there is a correspondence between the sequence of the systems approach--inputs→system structure→outputs--and the Industrial Organization sequence of structure→conduct→performance.

The functions identified above serve the purposes of this study quite well. It is recognized that behavioral assumptions are the most difficult aspect of this study. Therefore, an important component will involve design. By taking the structure or inputs of the system as given and making assumptions concerning participant goals or desired output, appropriate behavioral responses can be developed. Then, by using these behavioral responses in conjunction with different policy options (inputs), analysis can be conducted to determine the probable impact (performance). This discussion discloses a major weakness of this study. The best that can be hoped for at this stage of development in the analysis presented here is to identify the potential opportunity sets that are available to various participants. That is, until behavioral responses can be more accurately accounted for, it is difficult to predict what the actual outcome of alternative policy options will be.

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A Conceptual Framework for Studying the Farm Firm

As is the case with problem solving research, placing appropriate bounds on the system to be studied is extremely important. The bounds must not be too restrictive so as to make the research meaningless, yet if restrictive bounds are not developed the research will not be manageable. Since every factor cannot be considered, it is left to the judgment of the researcher to identify the most important factors. Such a process can result in the introduction of researcher bias. Therefore, it is important to acknowledge the factors that will be simplified and ignored.

This section begins the process of placing bounds on the system. Special attention will be given to simplifying assumptions and factors that must be ignored. The intent is to develop a behavioral theory of the farm firm-household that can be mathematically modeled. Such an endeavor must go beyond traditional economic theory. Cyert and March were among the first to recognize the type of extensions that must be made when developing a behavioral theory of the firm. Their list of considerations included: 1) multiple and conflicting goals, 2) imperfect knowledge, 3) formation of expectations, and 4) ordering and selection between alternatives. Walker and Nelson (1977, p. 18) summarized a list of considerations for understanding the decision process that was developed by Eisgruber and Nielson: "1) change and uncertainty, 2) sequential analysis of alternatives, 3) multiple and shifting goals, 4) multiple means for obtaining goals, 5) actions may have multiple outcomes, 6) limits on human capabilities, and 7) satisfying versus maximizing."

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In concert with the systems approach, this discussion begins by identifying the participants of the system and their interactions. The focus is on the markets they interact in. After establishing which interactions are considered to be exogenous and endogenous, the focus turns to the functions performed by the primary participant--the farm firm-household.

Participants of the System and Their Interactions

In addition to the primary participants--the farm firm-household--other participants are: 1) creditors, 2) landlords, and 3) state and national government. There are four types of markets where interaction occurs: 1) the land purchase and rental market, 2) the credit markets (including short term, intermediate and long term), 3) markets for other inputs (machinery, buildings, seed, fertilizer, etc.), and 4) the commodity markets (corn and soybeans for this study). Interaction between each of these markets and the macro economy must be recognized if not explicitly accounted for. Much of the interaction between participants will be one way since the focus of this study is on the farm firm-household. This means that feedback from the farm firm to the other participants will be limited. Most of the interaction will involve farmer response to the other participants.

As Dent and Blackie (1979, p. 5) point out: "The most important characteristics of systems emerge over time so that the understanding of systems requires explicit consideration of time...." Introducing time complicates the interaction between participants. Realistically, adjustments in the behavior of all participants should be modified as

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time passes. However, such adjustments may not be appropriate due to the need to conduct controlled experiments with the simulation model. For example, the only way to gain insights into the consequences of one policy versus another is to fix each policy over a planning horizon and make comparisons. In the real world it is not likely that the policy would remain intact over the planning horizon needed to analyze its impact. Two factors may result in changes: 1) lobbying for change by the beneficiaries of the policy or 2) a realization by the government that the policy is not meeting the current national goals. This study abstracts from such possibilities and, thus, governmental policies become an exogenous input that are established at the beginning of the planning horizon. Therefore, interaction between the farm firm and the government is limited to responses by the farmer.

Further, the only governmental policies that are explicitly considered include: 1) the impact of commodity policies on the stability of prices, and 2) the response of farmers to social security and national and state income taxes. No local governmental policies are included.

Some of the laws and regulations that are ignored include: estate tax laws, incentives to form partnerships or to incorporate, pollution regulations, soil conservation programs, labor regulations (i.e., minimum wage laws, social security payments, occupational safety requirements, etc.), and any zoning or other land use laws. However, to the degree that some of the allocative impacts of these types of regulations are reflected in costs data from the previous several years, some of the regulations will be implicitly accounted for in the production relationships that are used. For example, the disincentives to use labor coupled with the incentives for capital

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investments (i.e., investment tax credits, rapid depreciation techniques, etc.) have very likely influenced the labor/capital ratio. And since there has been little change in these regulations over the past several years, the data should reflect the adjustments due to such regulations.

Turning to the interactions associated with the creditors, there are some simplifying assumptions that are necessary to make their role manageable. First, it is assumed that governmental monetary policy will not interrupt the availability of credit. Until the experience of 1980, this assumption would have been less questionable. Further, it is assumed that interest rates are a function of the general economy's inflation rate and that both rates are constant over the planning period. Although such an assumption is highly questionable, it is necessary in order to run controlled experiments. The primary interactions between creditors and farmers will be developed with standard operating procedures. There is no feedback from farmers in the form of lobbying creditors to obtain changes in these standard operating procedures. However, such procedures do allow for feedback from the farm operation to the creditor as time passes. Standard operating procedures are based on two criteria: 1) debt/asset positions and 2) ability to meet payments.

It is necessary to limit creditors to those in the formal financial markets. It must be recognized that private lenders and individuals do serve as creditors--especially in the real estate market. And the land contracts offered by some of these lenders can be highly competitive. Undoubtedly, any farm operator that can obtain a lower interest rate through a land contract should be in a better position

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than a competitor who obtains a higher interest rate from commercial sources. Again, the intent here is to control such factors in order to isolate the impact of governmental policies. This is the reason for assuming that all farmers face similar financial markets.

Finally, landlord interactions are also limited to those involving the farm firm. For example, the landlord will not sell his land over the planning horizon nor will government policies influence the standard leasing arrangements that are specified at the beginning of the period. Since the predominant practice is share leasing, the landlord's behavior will be influenced by which farm operation can help him/her obtain the largest profits. It is also assumed that leases will be renewed each year of the period unless financial problems threaten the farm firm's survival.

With this brief background on the interaction of the other participants and the farm firm, it is now appropriate to turn to how the farm firm-households operate within the markets identified above. This discussion is an introduction. Much more detail will be given in Chapter IV as the simulation model is developed. First, since this study is limited to corn and soybeans, it is assumed that these commodities will remain competitive (vis-a-vis other commodities in the region) throughout the planning horizon. Further, the relationship between corn and soybean prices will be roughly the same as it has been in the recent past. Naturally, the prices received by different producers can have a huge impact on their competitive position. Although there is evidence that suggests larger farmers may obtain higher prices for grain than smaller farmers (Krause and Kyle, 1971), this study assumes that all size farmers receive the same

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price. Differential prices are not assumed because empirical studies on the degree of the differences are not readily available and further use of differential prices may introduce a bias related to the basic hypothesis that larger farmers have more opportunities than smaller farmers due to the current structure. The level of abstraction associated with the marketing of grain must be recognized. However, such abstraction does not place the objectives of this study in jeopardy. For example, some of the market mechanisms used to reduce risk (i.e., futures markets and forward contracts) may change the year to year prices, but they do not influence long-run price expectations which are used to make expansion investments.

One of the most important interactions considered in this study occurs between different size farms in the land markets. There is a fixed supply of land that competing farms must bid on. This includes both the land purchase and land lease markets. The assumption that the supply of land is inelastic and thus the availability of land will be constant over the planning horizon regardless of grain prices is made to simplify matters. What is most important for a study such as this is that there be realistic constraints on land availability. Without such constraints farms may grow at an unrealistic rate.

The credit markets have been discussed previously. Other inputs are not handled like either credit or land. As long as the farmer can meet the market prices on items such as buildings, machinery, labor, seed, fertilizer, and other supplies they are able to obtain such items. It is assumed that these inputs are always available. Although this is somewhat unrealistic, the history of interruption in the supply of these items indicates that periods of interruption have generally

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been short-run. The prices paid by different size farmers are reflected in the data that is used to generate costs curves and relationships between farm size and investments in machinery and buildings. The cost data used reflect both pecuniary economies of size associated with volume discounts and the technical economies of size, since these data reflect actual prices paid by farmers of different size.

Finally, all farms in this study are limited to sole proprietor, single family operations. Limiting this study to only sole proprietorships oversimplifies the problem. Those that consider the trend toward larger farms to be undesirable may alter the intensity of this opinion if the largest farms are supporting two or more families. Although this may minimize the severity of any structural problem, the question of how alternative policies may alter the opportunity sets of farms of different size is relevant regardless of whether those farms are organized as sole proprietors, partnerships, or corporations. The model developed in this study could be adapted to consider different forms of organization, and this could be an important factor especially when the advantages of incorporation for the largest farms are considered. Ignoring this opportunity would be more serious if it were not for the tax write-offs that are associated with expansion. That is, while the largest farms are growing, the advantages of tax write-offs, such as rapid depreciation and investment tax credits, may offset the advantages associated with incorporation (i.e., Growth-oriented farmers will be in relatively low tax brackets whether they are incorporated or sole proprietorships).

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The Life Cycle and Farmer Goals

The most important element of human behavior involves the relative importance of multiple goals. Neoclassical economics assumes that producers seek to maximize profits. The introduction of a planning horizon makes consideration of multiple goals imperative. It is also likely that the relative importance of goals changes as time passes and conditions change. Capturing these changes is extremely difficult. Goals very likely change as managers grow older or as the financial position of the firm changes. Thus, the concept of life cycle is relevant. Four progressive phases of the life cycle are commonly identified: 1) establishment, 2) growth, 3) consolidation, and 4) disinvestment. Since this study focuses on the growth phase, growth is considered to be an important goal.

There have been a number of studies that have focused on farmers' goals. Patrick (1981) reviewed a number of these studies. Harmon et al. surveyed Oklahoma farmers and developed the following ranking among eight goals: 1) make the most profit each year, 2) maintain and improve family living standard, 3) avoid years of low profits and losses, 4) avoid being forced out of business, 5) reduce borrowing needs, 6) increase net worth, 7) control more acres, and 8) increase leisure time. In a survey of Indiana farmers, Fitzsimmons and Holmes found that all farmers expressed a desire to own their farm and provide for their children's education. Other goals included growth in farm size and income, becoming debt free, and socially related objectives. Smith and Capstick conducted a survey very similar to the Harmon et al. survey with quite different results in the ranking.

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Indeed, Patrick concludes his review of goal related studies by stating; "These studies indicate that farmers do consider multiple goals, but there is little agreement on the primary goal. Furthermore, although the rankings of goals differ with personal characteristics of the farm operator and resources of the farm, there is a great deal of variability in goals of farmers in similar circumstances" (p. 30). These conclusions support the qualifications that have been previously made with regard to this study. Until farmer behavior is better understood, it is difficult to use simulation models, such as the one developed here, for prediction. The best that can be hoped for is to gain insights into how different policies and economic environments alter the opportunity sets of different size farmers. Even this requires some assumptions concerning the relative importance of farmer goals.

In general, goal related surveys do reveal that most farmers rank goals related to short-run profits, family living, and risk aversion and staying in business ahead of growth related goals. Cyert and March developed the concept of using goals as constraints in order to handle the existence of multiple goals. This means that a minimally acceptable level must be reached for certain goals before attempts are made to satisfy other goals. Cyert and March also discuss the concept of sequential decision making.

In view of this discussion and given the focus of this study on the growth phase of the life cycle, the following assumptions are made:

- 1) Each farmer is approximately the same age and has a similar set of goals.

- 2) A primary goal is to maximize year-to-year profits from the corn and soybean enterprises subject to the existing resources.
- 3) There is a desire to have at least some minimum level of family consumption regardless of income.
- 4) Before making expansion decisions, a "safety first" criteria is used to evaluate the risk of going out of business if the investment is made.
- 5) Expansion in the form of land purchase takes precedent over the leasing of land.
- 6) Leisure time is not considered important and operator and family labor are used to the fullest extent, even if this means off-farm work.
- 7) The desire to stay in farming and to grow outweighs consideration of disinvestment or off-farm opportunities that would distract from the farm enterprise.
- 8) There is a desire to maintain some stability in year-to-year cash flows, family consumption, and income.
- 9) Every attempt is made to manage taxable income in such a manner that will result in the minimum possible tax payments.
- 10) Goals such as children's education and being a good community member are ignored.

Explanation of how these goals are incorporated into the simulation model appears in Chapter IV.

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Decisions and Functions to be Performed by
Farm Firm-Households

With the previous discussion of the bounds and simplifying assumptions in mind, it is now appropriate to summarize some of the decisions to be made and the functions to be performed by the primary participants--the farm firm-households. A primary concern involves the development of short and long run price and yield expectations. Expectations must also be developed on inflation (in particular, inflation on land). Given the expectations and the farm's current financial position, each farm manager must perform the following functions:

- 1) determine how much corn and soybeans to produce,
- 2) market corn and soybeans,
- 3) allocate residual income or
- 4) finance negative cash flows,
- 5) determine the level of family consumption,
- 6) expand land through purchase or lease,
- 7) borrow and repay loans,
- 8) hire labor,
- 9) earn off-farm income,
- 10) choose an appropriate method to depreciate machinery and buildings,
- 11) choose an appropriate level of investment in machinery and buildings,
- 12) choose an appropriate method for computing taxes, and
- 13) pay income and social security taxes.

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Summary

The most important conclusion of this chapter is that capturing behavioral responses to alternative environments (including policies) is extremely difficult. Until behavior is better understood, the only honest approach to conducting this research involves use of the system's concept of design. Therefore, this research proceeds from the perspective of the farm manager. As policies are altered, various changes in behavior are examined and the behavior that best aids in meeting the above multiple goals is chosen. From this point, conditional statements concerning how alternative policies may change the opportunity sets of farms of different size can be made. Since this study is most concerned with the trend toward larger and fewer farms and the distribution of property rights between farms of different size, a primary focus will be on how alternative policies may change the relative allocation of the primary agricultural resource--land.

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CHAPTER III

A SELECTED REVIEW OF THE LITERATURE

This chapter begins by reviewing the evolution of farm firm growth models. The emphasis is on computer simulation models. From there, the discussion turns to a review of the land market literature with emphasis on capitalization models used for placing bids on farm land. The next area for review is research on decision-making under uncertainty. Finally, the chapter concludes with a quote on the advantages and disadvantages of computer-based simulation models.

The Evolution of Farm Firm Growth Models

Irwin (1968) provides a review of several growth models developed prior to 1968. Some of these studies are reviewed here along with more recent efforts at modeling the farm firm growth process. The intent is to emphasize findings, as well as strengths and weaknesses of previous studies. By focusing on other modeling attempts, the reader can better appreciate the evolution of the model used in this study.

Irwin reviewed three types of growth models: multiperiod linear programming, recursive linear programming, and simulation. He points out that the strength of linear programming lies in its deductive appeal and the ability to optimize a single-goal objective function. In most cases, simulation models do not optimize. Irwin dismisses the

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importance of this distinction by pointing out that linear programming solutions generally involve "relatively flat profit surfaces near the optimum." Since this means that changes in enterprise combinations will have relatively little impact on profit levels, simulation should provide similar profit levels. Indeed, Lins (1969) found little difference in growth of net worth when using recursive linear programming versus simulation to analyze an investment policy that excluded land purchases. However, when divisible land purchases were allowed, Lins found that the linear programming solution overestimated growth potential. This led Lins to conclude that "an assumption of divisible inputs may lead to the wrong conclusions, if in fact inputs are indivisible" (p. 12). (These findings emphasize the need to capture the availability of different size parcels of land.)

Other drawbacks associated with the use of optimizing models were discussed by Chien and Bradford (1974). They point out that the multiperiod linear programming approach solves for all periods simultaneously, thus making it a better tool for prescriptive analysis and less desirable for description and prediction. Further, such an approach represents a dynamic-certainty model, whereby perfect knowledge about input-output prices and yields exist. Linear programming provides limited opportunity to merge the production process and the balance sheet. It is also difficult to consider multiple goals when using linear programming. As Irwin concludes: "Simulation models have their place when the decision process to be described is extremely complex" (p. 94). Strickland (1970) and others have combined simulation and linear programming in order to take advantage of the

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strengths of both approaches.¹

Patrick and Eisgruber (1968) developed one of the first farm growth simulators. Their central Indiana grain and livestock model merged the production process and the financial position of the firm as they evaluated the growth process under three levels of managerial ability. The major contributions of the Patrick and Eisgruber study include: 1) the use of stochastic prices and yields, 2) an attempt to account for multiple goals, 3) adjustments in crop mix, 4) the inclusion of a family consumption function, and 5) the development of price and yield expectations. Although the assigned weights to four farmer goals (living standard, farm ownership, leisure, and risk preferences) were based on survey results, this attempt raises many questions regarding the ability to represent farmer goals accurately. However, their recognition of the importance of multiple goals was a significant contribution. A simulation model should provide flexibility for changing both goals and the corresponding behavior of farm managers.

Patrick and Eisgruber tied management to yields (i.e., as management ability increased, yields also increased) and found that managerial ability "was the major factor...determining the rate of growth of the farm firm" (p. 499). This finding illustrates the importance of controlling management when performing analyses on farms of different

¹ Since the study at hand involves only two commodities, there are techniques (discussed in Chapter IV) that can be used to obtain an appropriate crop mix. (Linear programming is not necessary.) This factor coupled with the flexibility associated with simulation are major reasons that this study uses simulation. Therefore, the remainder of this discussion will focus only on previous simulation models.

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size. As expected, the model also demonstrated that increasing interest rates slowed the rate of net worth accumulation, while easing the restrictions on long-term debts increased the rate of net worth accumulation. Another important finding was that farmers who acquired land earlier in the planning period were able to accumulate greater final net worth. The influence of federal taxes was not fully accounted for as the model calculated taxes using only tax tables and did not include the possibility of such tax advantages as income averaging, alternative depreciation techniques, and investment tax credits.

Umberger and Whittlesey (1973) developed a simulator for farms in Washington's Columbia Basin that was similar to the Patrick and Eisgruber model but which also analyzed the impact of selected federal tax provisions. They analyzed the impact of using declining-balance methods of depreciation, first-year additional depreciation, investment credits, and income averaging. They concluded that "tax policies can affect the direction and speed of the changes in the farm sector, including investment, growth, and consolidation of farms...This analysis shows that many current tax provisions increase the competitive position of the large farm more than the small farm and of the growing farm more than the stable farm" (p. 13). A methodological contribution of their study was the manner in which they randomly allowed for the availability of two different size parcels of purchase and lease land. Although the empirical base for generating these values was extremely limited, this simulation model is unique in its recognition that there is some constraint on the availability of land for expansion. The model is also unique in its inclusion of lease

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land. However, it is limited in that only one farm is modeled at a time, thus ignoring the important interaction that occurs between farms of different size in a local land market.

This interaction was first introduced in a simulation model of Iowa corn farms developed by Boehlje and Griffen (1979). Farms of different size were allowed to place bids on land using the Lee-Rask capitalization model. Boehlje and Griffen used their model to analyze the probable distributional impact and the impact on land prices of a support price that is tied to the costs of production. The model assumes that price expectations are tied to the support program in such a manner that, as time passes, farmers view the market as being less risky; and thus, price expectations increase through time.

Further, the model uses only deterministic prices and yields (for only one crop), thus, eliminating risk. This alone raises many questions regarding the development of expectations. They conclude that: "The results summarized here indicate that with current price expectations and government program parameters and conservative inflation rates, the cost-of-production-based support price mechanism could increase land prices dramatically within a short period of time" (p. 295).

Although these conclusions appear logical, the fact that the model does not develop random prices from an empirically based distribution and then allows for adjustments in expectations raises serious questions regarding the power of the model to predict. The basic premise that this mechanism of price supports would reduce price risk and, thus, can be capitalized into land values is not unfounded (Hedrick and Boxley and Gibson). Also, the use of a capital budgeting model to allocate land to farms of different size was a major

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contribution to the development of farm firm growth models.

Pederson (1980) extended the Boehlje and Griffen model to analyze the distributional impact of alternative agricultural credit policies. He improved the model by introducing federal tax tables. A basic conclusion of this study was that credit policies that are tied to the value of assets and debt/asset positions benefit larger farms relatively more than credit policies based on the borrower's income-generating repayment capacity. Again, the model does not adequately account for risk and variation in cash flows that result with random prices and yields. This might alter the conclusions of the study. However, the findings by Pederson demonstrate the importance of lender behavior when considering farm firm growth.

Land Market Literature

Clearly, land is the primary agricultural resource. This is particularly true for cash grain farms. In the region used in this study, land value is over 80 percent of the total assets engaged in farming. The ability to control land lies at the very core of this study. How do alternative policies impact the potential for different size farmers to gain control over land? This concern includes the control over owned as well as leased land. Much has been written about the purchase land market. The intent here is to review only the most relevant literature.

Rapid price increases have been the most dominant feature of the land market in recent years. Over the twenty year period from 1960-1979, land prices in Illinois increased at an annual rate of 9.6 percent. The rate of increase was the most severe in the seven years

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from 1972-1979 (an annual rate of 21.0 percent). Boxley and Walker (1979) provide an analysis of the "Impact of Rising Land Values on Agricultural Structure". They question whether land prices are the cause of structural changes in agriculture or a result of the structural changes. Their argument is that since land ownership is unevenly distributed, those that own land will benefit the most from increases in land prices (i.e., Landowners will have a competitive advantage over non-landowners in the land market). This compounds the trend toward larger and fewer farms. On the other hand, a change in structure is also likely to change the relative position of some landowners. And this also will influence land prices. Thus, the cycle is continuous and the cause and effect are difficult to ascertain. Boxley and Walker argue that the wealthy are in a better position to take advantage "of favorable financing arrangements, tax advantages, and leverage opportunities" when purchasing land. And, since wealth compounds itself, those that own land will reap even more benefits (than the simple capital gains) from land inflation.

Boxley and Walker also discuss the "income paradox". The paradox is that the price of land cannot be justified when considering only the returns to land as productive assets. Therefore, there has been a search for other factors to explain the price of land. They use two studies to raise questions concerning the income paradox: 1) a study by Melichar which demonstrates that recognition of increases in productivity and the substitution of capital for labor "indicates that the relative returns to productive assets other than labor increased faster than asset prices in 1954-1971" (p. 93); and 2) a study by Walker that identified that a strong relationship between land values

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and returns (measured by cash rents) did exist from 1950-1979. Boxley and Walker conclude: "The two studies suggest that land prices do follow land returns, which denies the existence of an income paradox" (p. 93). (Other studies that support his conclusion include Hauschen and Herr, and Robison.)

Still, the recent trends have been difficult to explain. Traditional approaches for estimating land values have become obsolete. The most common method has been the capitalization formula:

$$V = I/r$$

where V = value of land,

I = annual returns to land, and

r = discount or capitalization rate.

Using this method and the 1980 Illinois land rental charges with a ten percent discount rate, the land value estimate is \$1250 (i.e., $\$125/.1 = \1250). Given that 1980 land prices were in excess of \$3000, this estimate is clearly unacceptable. Lee (1976) summarizes Crowley's list of conditions that must be met in order for the capitalization model to be valid: "1) the investment is expected to produce the same annual net rent over time; 2) the capitalization rate used to discount future net rent remains constant; and 3) an infinite or very long planning period is considered" (p. 1).

These shortcomings prompted Lee and others to develop alternative capital budgeting models that incorporate more of the decision variables in the land valuation process. The major advantage of capital budgeting is that it provides for consideration of income tax effects

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and the time value of money. Therefore, the objective is to estimate the net after-tax cash flow for each year and discount each of these cash flows - placing the entire stream into a current value. The Lee-Rask model considers a number of variables in estimating a maximum bid price for an individual farmer. Those variables and their corresponding notation are presented in Lee and Rask (1976, p. 984-86):

- $\bar{P}$ is average price per acre from recent sales of comparable parcels;
 - CC is the buyer's opportunity cost of capital after taxes;
 - n is the buyer's planning horizon in years;
 - ANI is expected annual net return per acre before taxes;
 - GNI is expected annual rate of growth in annual net returns per acre;
 - MTR is the buyer's marginal income tax (combined federal and state tax rate based on estimated taxable income after the parcel is purchased);
 - DP is the proportion of the purchase price paid down;
 - IR is the nominal rate of interest charged on the mortgage loan;
 - t is the amortization period on the loan;
 - INF is the expected annual rate of inflation in land value;
 - T* is the tax rate that will apply to capital gains income in year n when the parcel is sold;
 - and P* is the maximum bid price, given values for the preceding eleven variables.
- The maximum bid price (P*) or the price that gives a net present value of zero is given by:

$$\begin{aligned}
P^* = & \sum_{i=1}^n \frac{(1 + GNI)^i}{(1 + CC)^i} (ANI)(1 - MTR) \\
& + \frac{(1 + INF)^n}{(1 + CC)^n} (\bar{P})(1 - T^*) \\
& \div DP + (1 - DP) \frac{(1 + CC)^t - 1}{CC(1 + CC)^t} \frac{IR(1 + IR)^t}{(1 + IR)^t - 1} \\
& - (1 - DP)(MTR)(IR) \\
& \frac{IR(1 + IR)^t}{(1 + IR)^t - 1} \sum_{i=1}^t \frac{1}{(1 + CC)^i} \frac{(1 + IR)^{t-i+1} - 1}{IR(1 + IR)^{t-i+1}} \\
& - \frac{T^*}{(1 + CC)^n} ,
\end{aligned}$$

Where $t < n$.

Lee and Rask go on to demonstrate the properties of their bid model. It is useful to summarize some of their comments concerning the general sensitivity of each of the eleven variables. They found the bid price was most responsive to these four variables: 1) expected return per acre, 2) expected increase in returns per acre, 3) expected increase in inflation, and 4) after-tax opportunity cost. As each of the first three variables increase (decrease), the bid price should increase (decrease). If the farmer is willing to accept a lower opportunity cost, the bid price will also increase. Lee and Rask also point out that increases in the down payment and/or the interest rates will decrease the bid price. However, they go on to explain that the leverage effect of less down payment resulting in a higher bid price will only be true if the after-tax opportunity cost of capital is greater than the after-tax interest rate on the

mortgage (i.e., Any time the opportunity cost of the money spent on the down payment is less than the interest charges, if the money were borrowed, it is better to increase the down payment). Finally, they conclude that bid prices are not as sensitive to the marginal tax rate or the capital gains tax rate as they are to the other variables.¹

Harris and Nehring (1976) also developed a bid price model for agricultural land. Their model includes expected income, variability in income, initial wealth, degree of risk aversion, marginal income tax rates, discount rates, and expected inflation rates on returns and land prices. They apply their model to different classes of cash grain farms in Iowa. Use of their model requires explicit knowledge of the utility functions across farms of different size. Risk aversion coefficients are developed using this utility function, given the initial wealth position of each farmer and the expected income and variance in income. Harris and Nehring make what they admit are "heroic leaps of faith" to apply parameters of utility functions developed by Lin, Dean, and Moore for California farms to the Iowa farms. The general result is a decrease in the risk aversion as wealth increases (i.e., More wealthy farmers are willing to take greater risk). Their approach, although theoretically sound, suffers from the lack of good estimates of the important parameters. As they conclude: "The issues of ownership and control cannot be resolved until more accurate and complete specifications of the important parameters are made." Moreover, as shall be discussed below, recent

¹ These conclusions are not supported by findings in this study. Chapter IV discusses some peculiar problems associated with the Lee-Rask model and the manner in which the model is used in this study.

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research in developing farmer utility functions and resulting risk aversion coefficients has been unable to substantiate consistent relationships between farmer characteristics and risk preferences.

A limitation of both the Lee-Rask and the Harris-Nehring models is the assumption that all parameters will remain the same over the planning horizon. It may be reasonable to incorporate the life cycle into such a model to allow for different marginal tax rates and expectations through time. Miles (1980) developed a budgeting model that also uses risk preferences, but allows for incorporation of more risk existing in later planning years (i.e., through use of "increasingly dispersed probability distributions" on returns in more distant years). She concludes that ignoring the existence of increasing risk "in subsequent years led to a 10 percent overstatement of the buyer's maximum bid price" (p. 68). Her study of a hypothetical bidder also revealed that the reduction in the capital gains tax rate in 1978 (i.e., from 50 to 40 percent) had relatively little impact on the bid price of land. The impact was greater when the bidder was risk neutral.

The purpose of this brief review of land bid models is to illustrate the problems associated with such models and, therefore, some of the problems in this study. Varying assumptions regarding the appropriate parameters to be used in these models can greatly affect the bid price. The Lee-Rask model was chosen for this study simply because of the difficulties associated with developing varying risk parameters for farms of different size. This bid model accounts for the basic parameters that are considered important when placing a bid on land. Although the problems of developing parameters to be used in

this study is still paramount, the importance of this limitation is reduced when developing a whole farm approach as in this study. Other constraints (in particular, the ability to finance alternative size parcels of land) can be accounted for when using a simulation model to analyze the whole farm. This aspect lends credence to simulating different size farms that compete for limited and alternative size parcels of land.¹

Regarding the leased land market, problems associated with ignoring this market in a farm simulation model have been discussed above. Hottel and Harrington (1979) discuss the importance of tenure patterns on the viability of farms. As they point out: "Part owners - those who both own and rent farmland - have dominated the changes in the tenure pattern since the thirties. This group nearly tripled its proportion of farm numbers and more than doubled its proportion of land operated since 1935" (p. 97). Hottel and Harrington go on to discuss the difficulty of using tenure and equity statistics to measure the welfare of farmers. Strategies that maximize wealth accumulation will adversely impact short-run income and, likewise, a strategy that focuses on accumulation of income will slow growth in wealth. Farmers that are more interested in increasing wealth and control of land will opt to purchase land before leasing. Likewise, farmers that are more interested in higher incomes in early years will be inclined to lease before purchasing. Leasing land is one of the only ways to gain entry into farming other than through inheritance or use of funds which have been accumulated from other sources. Hottel

¹ Chapter V presents more discussion on the specific characteristics of the Illinois land purchase market.

and Harrington summarize the proportion of total acres that are leased for different commodities. The U.S. average for corn is 55 percent and, for soybeans, it is 62 percent. This clearly demonstrates the important role of the lease land market in cash grain farming.

There have been relatively few in-depth studies of the lease land market. A somewhat dated study by Johnson (1972) is still one of the most detailed analyses of the farmland rental market in the Corn Belt. Johnson's study involved a survey of 60 farmers in Champaign County, Illinois (within the region of this study) and 63 farmers in Lenawee County, Michigan.¹ Although the study is nearly ten years old, more recent studies (Reiss and Gutman, 1979) indicate that leasing practices have not undergone significant changes during the last ten years. Johnson (p. 2) raises questions regarding the nature of the lease land market:

The market process itself was found to be low-keyed informal, due in part to the significant influence of kinship or prior friendship. Information flows were largely through informal channels and frequently distorted, reducing greatly any potential competition. In less than half the cases, tenants knew of other operators who were aware the land was available to rent; more frequently such knowledge is after the fact.

His findings demonstrate that the lease market is more of a social market than a competitive market. Although nearly 90 percent of the lease agreements were renewed year-to-year (with two-thirds being verbal agreements), the average length of tenure in Illinois was 14 years. The survey also revealed that the most common reason for

¹ Specific results of this study will be discussed further in Chapters IV and V as the empirical findings are incorporated into this study.

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termination of a contract was because the tenant quit farming. In only 15 percent of the cases did the landlord terminate the lease. Thus, leasing land has traditionally been a relatively secure proposition. Although there appeared to be no competitive market for lease land, the fact that most of the landlords had farm backgrounds and lived in the same county (only 15 percent were classified as non-residents), led Johnson (p. 23) to conclude:

The landlord may have no incentive to advertise if he intends to rent on a typical crop share arrangement. Under this condition, the profitability to the landlord depends on the attributes of the tenant; and his operation such as his equipment, size of operation, managerial ability, and other personal qualities such as honesty. These characteristics are generally appraised from close personal contact over the course of time. Consequently, the landlord may prefer to rent to an operator he knows, not only as a favor, but also because he has evaluated the potential tenant on traits which normally do not surface in a more competitive market exchange between strangers.

Other important findings (for Illinois) of the Johnson study include: 1) 97 percent of the lease arrangements were share-leases; 2) over 80 percent of the land operated by tenants was lease land; 3) over 50 percent of the lease land was eventually purchased by the tenant; 4) 57 percent of the tenants had annual gross sales (1970) of \$40,000 and over; 5) over 60 percent of the tenants had farmed for 20 years or more; 6) over 50 percent of the tenants were related to the landlord; 7) 93 percent of the tenants intended to continue renting the land; 8) the tenants rented from an average of three different landlords; and 9) 45 percent of the tenants intended to expand their rented acreage.

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Decision Making Under Uncertainty

A wealth of literature exists across disciplines and time on decision-making under uncertainty. Walker and Nelson (1977) provide a comprehensive review of the most relevant literature for agricultural research and education. Anderson, Dillon, and Hardaker (1977) also provide for applications in Agricultural Decision Analysis. The study at hand must address the decision process under risk and uncertainty (i.e., The introduction of random prices and yields places the firm in an uncertain environment). Statistical measures of dispersion (variance and standard deviation) have been commonly used as indicators of risk. More variance indicates greater risk with the specified strategy. "Risk" can be thought of as increasing the chances of an adverse outcome with an action choice. Friedman and Savage (1952) were among the first to place decision choices in the context of maximization of the expected value of the outcome. They created an E-V frontier (E - expected value and V - variance) where the decision maker balances increases in expected value against risk. The risk averse individual will settle for less expected value in order to reduce risk.

Walker and Nelson (1977, p. 7) sum up components of decision making theory as involving a systematic approach of identifying the following:

1. Actions available to the decision maker;
2. States of nature;
3. Consequences of each action-state combination;

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4. Prior information (possibly "subjective") about occurrence of the states;
5. An experiment relating current or new information to the states;
6. Strategy alternatives;
7. Consequences of each strategy; and
8. A choice criterion.

Note the similarity between this sequence and the concept of "systems design" presented in Chapter II. Monte Carlo simulations, as conducted in this study, have been recognized as an important decision tool. Walker and Nelson acknowledge this: "Simulation provides a feasible method for comparing alternatives when relationships are complex." They also acknowledge the use of statistical dominance for ordering outcomes from alternative decisions. Hoskin (1981) and Hardin (1978) have demonstrated the use of stochastic dominance to order alternative farm management strategies. The advantage of this technique is that it allows for moving from less restrictive to more restrictive assumptions concerning the risk preferences of the decision maker. The drawback of this approach is similar to all decision theory that trades off utility and risk; that is, when multiple goals make up the utility function, there is no common denominator that will allow for trade-offs between conflicting goals. This is of particular importance in the study at hand. Short-run income suffers when farmers seek to maximize control of acres. Aggressive growth strategies result in increased variability in income and cash flows. It would be inappropriate for this study to use a technique such as stochastic dominance to develop preferred strategies for farmers to meet the

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multiple goals outlined at the end of Chapter II.

Finally, the literature on measuring individual farmer's risk preferences is somewhat inconclusive. The Lin, Dean, and Moore (1974) study (mentioned above) attempted to derive the mean-variance (E-V) frontier from six large farms in the San Joaquin Valley of California. Although they concluded that the concept of producers being risk averse probably represented true behavior better than profit maximization, their study failed to provide any absolute value for risk preferences. In addressing the issue of measuring risk preferences, Young et al., agree that most decision makers are risk averse. They also conclude that previous studies support the hypothesis that there is a "greater incidence of risk aversion in developing countries." They take this as support for the hypothesis that farmers become less risk averse as their wealth increases. However, they go on to cite a study of Oregon grass seed growers by Halter and Dean that found a positive correlation between percent of ownership and risk aversion. (If percent of ownership can be used as a proxy for wealth, this contradicts that hypothesis.) In general, they conclude that the number of studies measuring risk preferences and the results to-date leave many questions unanswered. Lin, Dean, and Moore (1974, p. 25) conclude:

Farm size, legal form of ownership, and financial measures of ability to bear risk are producer attributes whose relationship to risk preferences particularly merit empirical research. The impact of changing risk levels on the historical survival and profit performances of varying types and sizes of farms also deserves further examination.

The lack of reliable measures of risk aversion for different size farms under different financial conditions is the reason that this

study assumes all farmers perceive of risk in the same manner.

A Concluding Quote on Simulation Models

The methodology used by this research is a "computer-based simulation model." J. B. Dent and M. J. Blackie (1979, p. 11-12), in their book Systems Simulation in Agriculture, sum up this methodology as well as any of the literature. Their discussion of advantages and disadvantages of simulation cannot be improved upon. Therefore, this discussion is reproduced below:

What we are calling computer-based simulation models are free-form models which are not encumbered with any of the problems of the mathematical programming model. These models are "run" rather than "solved" which implies that use of the model involves learning by exploration of the system vicariously via the model. Ackoff (1973) has coined the phrase "decision-support" and it is an apt one in relation to computer-based simulation models; it implies that the model provides objective information in guiding decision making or in extending understanding of the system. In this regard all such models are "input-output" in nature, in that they predict the output of the system (in terms of any number of criteria) given the "input" to its interacting subsystems. For these reasons this text is exclusively concerned with computer-based simulation models which from this point on will be referred to as simulation models.

The use of simulation in the study of systems has become standard procedure in many disciplinary areas within agriculture, ranging from natural-resource system planning, through grazing-livestock systems, ruminant metabolic systems, plant physiological systems, to biochemical and cellular systems. This widespread application reflects a number of specific advantages associated with the approach:

1. It enables the study of systems where real-live experimentation would be either impossible, inordinately costly or disruptive.
2. By synthesising systems in model-form, it permits the exploration of systems that do not exist.

3. It permits the study of long-term effects since the time horizon over which a model is run is within the control of the model-builder.
4. It forces those concerned with building the simulation model to examine the system objectively and consequently undertake a thorough and critical review of knowledge concerning the system. The enlightenment that this process provides is often surprising.

A simulation approach, however, is not without its difficulties and dangers. The more obvious problem areas include the following:

1. It tends to be a relatively expensive and time-consuming process. Of course, today there are few types of agricultural systems that have not been subject to analysis and/or experimentation. Whether this has provided sufficient data for successful model-building depends on the system concerned. Nevertheless the process of analysis, assembly of data, model-construction and proving absorbs a lot of costly resources in the form of skilled man hours and computer time. The costs involved and the time taken are frequently underestimated, though as Dillon (1976) points out, the time taken can often be a function of the time available, the implication being that model-builders are prone to continue development of their creation beyond the point where satisfactory implementation could take place.
2. Frequently, data about, and knowledge of, the essential structure of a system will be inadequate; simplifying assumptions about the system structure will nearly always have to be made and compromises in using data from varying sources will be involved together with interpretation of data which have been developed or presented in an inappropriate form.
3. Problems will be encountered in proving (validating) a model. It will never be possible to prove a simulation model "true," yet the use of the computer can lead the unwary to accord the results a greater degree of precision than is justified. The model may contain undetected flaws, poor data transformations and intentional or unintentional biases included by the model-builder. All of these can seriously affect the

validity of information provided by the model.

Simulation modeling is not simply a matter of transcribing known formulae into a form suitable for computer analysis. It is rather an art which requires ingenuity, foresight, resourcefulness and, above all, integrity on the part of the model-builder. And, as with other arts, it is how the technique is used, and not the technique itself, which determines success or failure.

This quotation provides much of the foundation for this study. There are three points that merit further emphasis as the reader reviews this study: 1) the concept of using simulation to learn "by exploration of the system vicariously via the model", 2) using the model to run controlled experiments which permit "the exploration of systems that do not exist", and 3) the emphasis that simulation is "an art which requires ingenuity, foresight, resourcefulness and, above all, integrity on the part of the model-builder."

CHAPTER IV

THE SIMULATION MODEL

The extensive quote from Dent and Blackie presented at the end of the preceding Chapter emphasized the need for "integrity on the part of the model builder." A major demonstration of integrity involves the full disclosure of assumptions and explicit equations used in the model. Anything less should be considered unacceptable for a methodology such as simulation that allows for researcher bias. This is a tedious, but necessary process. There is no simple approach to covering the details of a model as complex as the one developed for this study. This chapter begins that process by narrating the sequence of model development, explaining why certain assumptions are made, and reviewing the logic of the model. Much of the focus here will center around assumptions that are peculiar to this study. The full flexibility of the model and the ability to relax many of these assumptions is best appreciated by reviewing Appendix A and B. Appendix A presents all of the user controlled input data and variables that can be changed as certain assumptions are modified. The values presented in Appendix A are those used for the base analysis in this study.

The reader should review Appendix A before reading this chapter. Only the most persistent reader needs to review Appendix B which contains the important equations of the model. And it should be reviewed only after reading this chapter. This chapter is written to

stand alone. However, sections on the model sequence are numbered and presented in a corresponding fashion to that in Appendix B for easy reference. If the reader desires more detail or wants to review equations associated with a particular section, that section can be reviewed in Appendix B without seriously interrupting the continuity of this chapter.

Model Overview

This FORTRAN computer simulation model was developed to perform the functions of the farm firm-household presented at the end of Chapter II. The model is designed to illuminate the probable opportunity sets available to different size corn/soybean farms given alternative commodity programs, income tax policies, and assumptions concerning the general economy, initial endowments, and farmer behavior. Although the model is currently developed using data for Central Illinois farms with better soils, corn/soybean farms from any region could be incorporated given adequate data and modification of certain sections. The model is similar to many previous farm firm simulation models in its dependence on the farm's financial position to perform the functions of the farm firm-household.

Development of this dynamic simulation model in a fashion to allow for performance of all of the functions listed above within the confines of the goals and environment outlined in Chapter II required a great deal of researcher interaction as the model evolved. That is, development of the model involved modifications as intermediate results were analyzed. It was necessary for the researcher to place himself in the position of the farm manager, developing effective

feedback mechanisms that would aid in obtaining the specified multiple goals. As with any economic research, this provided many opportunities for bias. Great care was taken in an attempt to avoid this. However, any unintended biases that may have been introduced into farmer behavior are reduced by the fact that this study assumes similar behavior across farms of different size unless otherwise specified.

Choosing feedback mechanisms that aided in reaching the specified multiple goals presented one of the greatest challenges. The use of random prices and yields provided real world variability in year-to-year total revenue available. Many previous simulation models have used the most recent year in different equations to control activity in the current year (i.e., Only the previous year's value is used as a control variable). This was considered unacceptable due to the great amount of variability introduced by using random elements and by allowing for expansion. Therefore, one mechanism used by this simulation model is the exponentially smoothed average of previous year's feedback variables. An exponentially smoothed average assumes that the decision maker places the heaviest weight on the most recent years with less emphasis on distant past observations when developing expectations concerning the value of the variable in the near future. Different weights can be used to provide for different emphases on the most recent past. For example, if expectations are being developed for the longer term, one may expect the decision maker to weight the most recent year's less than if short term expectations are being developed.

Another mechanism used to cope with the variability was the concept of placing upper and lower bounds on important control variables. This assumes that decision makers are aware of variability and attempt to control it by placing limits on such things as family consumption and grain storage.

Since the review of the model is organized by subroutines, it is useful to summarize the function of each subroutine in the model. A brief description of their function follows:

1. DATA reads all input data required for a deterministic run from file FARM.
2. STODAT reads all stochastic data.
3. PREXP develops both short-run and long-run price expectations as well as breaking each annual average price into a before the end-of-the-year and after the end-of-the-year price.
4. LANDPR develops an average price of land based on recent years' budgeted returns.
5. BALANC is used for special calculations in the start-up phase and for developing both a market value and a cost basis balance sheet.
6. LANEXP determines which farmers are eligible to bid on new purchase land and which farmers are in the running for new lease land.
7. MAXBID and LANBID are used to place a maximum bid price on new purchase land and to evaluate the net present value of the expected stream of cash flows that would accompany the purchase of the land.

8. LANALC allocates both purchase and lease land to competitive farms of different size.
9. INVEST determines the level of machinery and building investment for both replacement and new land.
10. REPL accounts for all previous years' machinery and buildings and provides for a constant wearout period.
11. DEPR depreciates all previous machinery and buildings and sets up depreciation schedules on new purchases.
12. BOR tracts all previous years' intermediate and fixed loans, separating out principal and interest charges.
13. LOAN sets up amortization schedules on new intermediate and new fixed loans.
14. COSTS is used to develop expectations on returns and to determine actual costs and returns associated with each year's grain production.
15. MIX uses expectations to develop an appropriate crop mix based on machinery complement.
16. FERTI is part of MIX used to determine the nitrogen requirement for corn.
17. YIELD is also part of MIX used to develop yield expectations given crop mix and machinery complement.
18. CASHFO balances end-of-year cash flows, determining how to finance deficits or to dispose of surpluses.
19. TAXES chooses the best method for calculating taxes and calculates federal and state income taxes and social security taxes.

20. TAXCOM uses standard tax tables to calculate federal taxes in the usual manner.
21. INCAV uses the tax tables to calculate federal taxes under income averaging.
22. MINTAX calculates the minimum taxes that must be paid regardless of investment tax credits.
23. FAMILY develops a family living expense based on accrual income and minimum acceptable levels.
24. WRITE prints detailed information for one iteration.
25. STAT prints less detail for up to ten iterations.
26. ACC develops and prints summary statistics for the Monte Carlo analyses.
27. DATANL is used in conjunction with ACC to develop means, standard deviations, and coefficients of variation for the summary variables.

Figure 4.1 presents the logical flow of the model. Reviewing this figure will provide the proper prospective as the details of the model are developed below.

Section 1--Start-up Sequence

Developing an initial position for each farm is most important. Two criteria had to be met for this study: 1) flexibility requiring a limited amount of user data to develop detail on a farm's position prior to the start-up year was necessary (i.e., The start-up year usually represents the position of a farm that has been in existence for several years), and 2) the technique had to be consistent across farms of different size. All previous years must be lumped together

FIGURE 4.1
SEQUENTIAL DEVELOPMENT OF THE MODEL

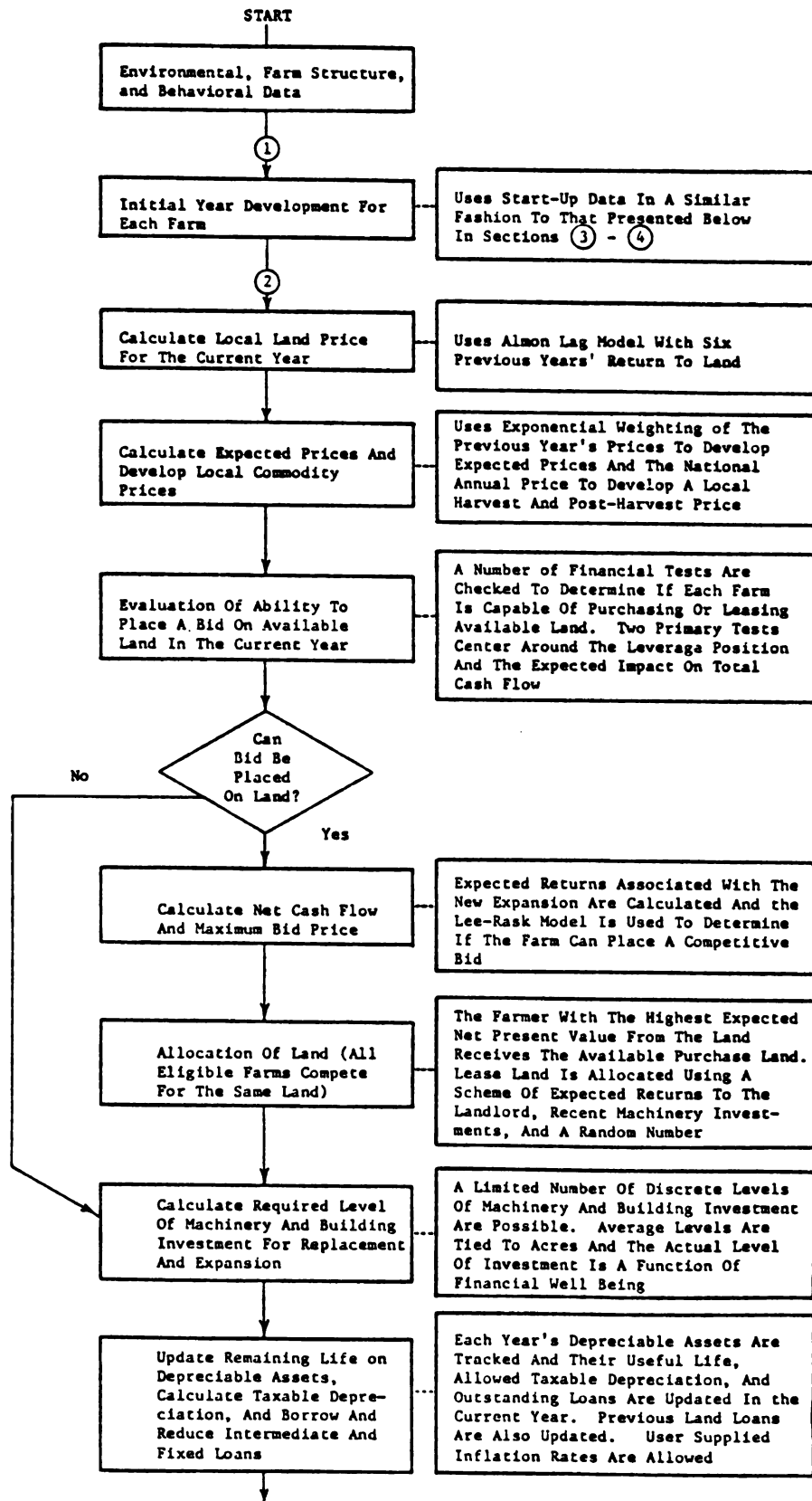


FIGURE 4.1 (Continued)

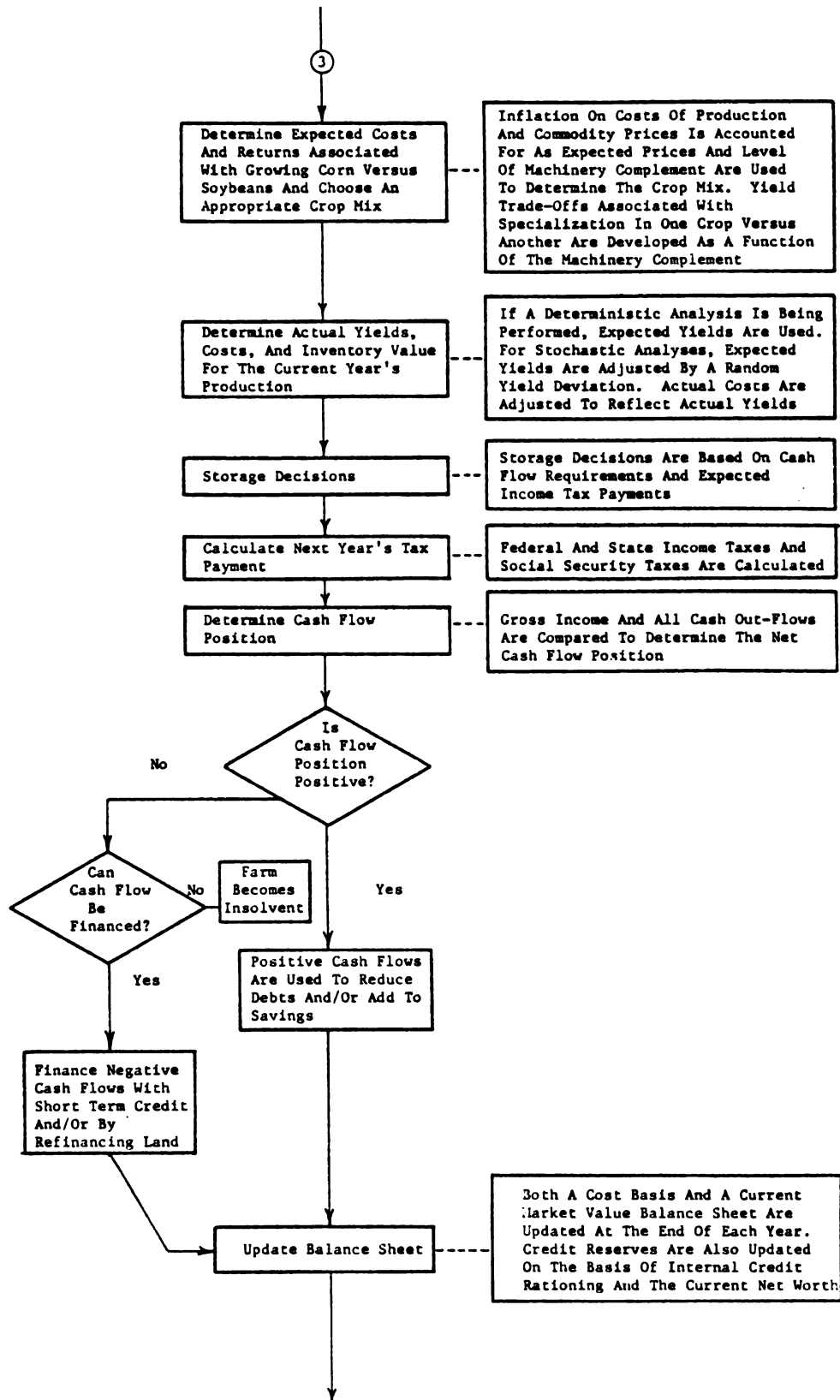
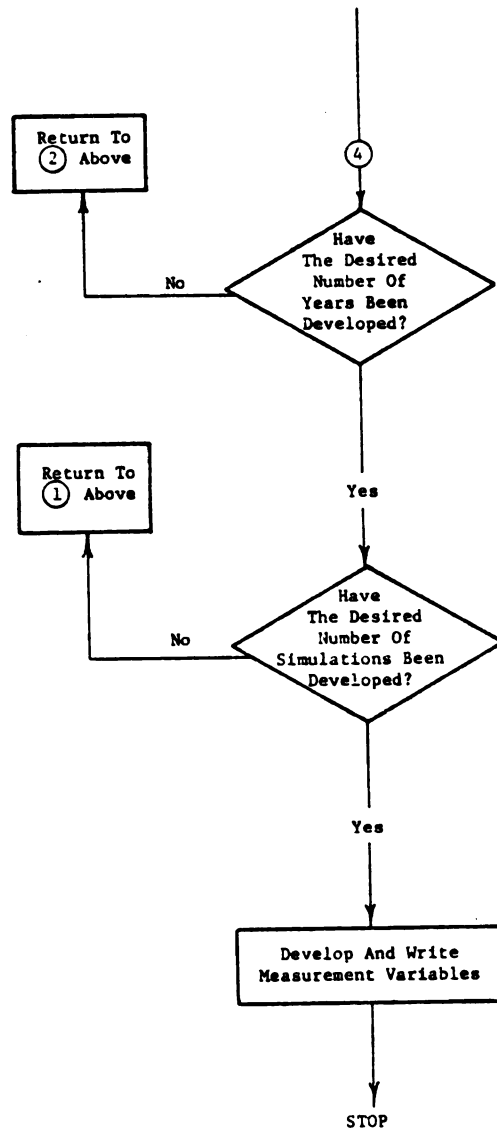


FIGURE 4.1 (Continued)



for the initial year. This takes place in a variety of ways. The user supplies average values for such information as average interest rates and remaining life for intermediate and fixed loans. Another average value is the remaining life of the initial building and machinery complement.

These values are used to develop an initial year that accounts for estimates of all years prior to the start-up year. Each farm is supplied with an average machinery and building complement in the initial year. Initial intermediate and fixed liabilities are calculated using the initial debt/asset ratio and the estimated value of intermediate and fixed assets. Amortization schedules for these "lumped" liabilities are established by using the average interest rates for prior years supplied by the user. A cost basis for intermediate and fixed assets is calculated by assuming all farmers began farming at age 25 and using the number of years engaged in farming to adjust the current value of assets by a deflator. The deflator is developed with the user supplied inflation rates on land and machinery. This approach provides a market value for the items when the farmer was 25 years of age. Although this is somewhat arbitrary, it does provide for a consistent method across farms for developing the initial farm structure.

Another assumption that is made to maintain this consistency involves the provision to each farm of an initial machinery and building complement with the same remaining life as a new purchase. This complement wears out at a constant rate beginning in the first year of the analysis. More detail on physical depreciation is provided in section 8 below. These assumptions were made to provide

relatively smooth replacement schedules throughout the planning horizon. An alternative approach would be to develop a history of complements accounting for a specified amount (given in dollars) of machinery and buildings purchased in the years prior to the initial year.

The initial year's complements are handled in a special manner for depreciation purposes. Since complements in the initial year represent a package of all previous years' purchases, caution was needed to insure that taxable depreciation in the initial year would not overestimate or underestimate this charge, so as to allow for developing a representative initial year. Through examination of historical data and by performing sensitivity tests on the model, it was determined that the initial years' current value of machinery and buildings should be depreciated with the straight line method plus an additional first year depreciation of 20 percent. This provides for relatively representative values. The book value that remains after start-up is then depreciated using the method chosen by the user. Additionally, depreciation is fixed in the initial year in order to provide for consistent initial positions in certain sensitivity analyses.

After establishing the initial balance sheet for each farm, the model uses subroutines PREXP, COSTS, CASHFO, and BALANC to complete production for an average year using average prices and yields. This base year is used to provide initial representative values for such variables as taxes paid, marginal tax brackets, change in owner equity, family living, etc. The model uses these average year values in the development of exponentially smoothed averages. The base year

can be assumed to be 1979 since data prior to 1979 are used to develop these initial year values.

Section 2--Subroutine PREXP

A model such as this that accounts for behavior in production and investment decisions must recognize that expected prices, and not actual prices, are the relevant price variable. Although it is recognized that farmers use past, present, and future (or forecast) information when developing price expectations, the only information available in this model is past information. There are no allowances for exogenous events such as wars, strikes, institutional changes, invasions, embargoes, economic collapse, etc. The model also abstracts from reality by ignoring the availability of price outlook information. However, these limitations are not considered severe, since past price information has been considered a major factor in forming expectations (Nerlove, 1958; Lerohl, 1972). This study uses a naive forecasting technique to formulate farmer expectations. It is assumed that farmers place the most weight on recent price observations with less weight on the more distant past. This amounts to adaptive forecasting.¹

¹ Chisholm and Whitaker demonstrate the properties of an exponentially smoothed equation in their book on Forecasting Methods. They demonstrate that "once an exponentially weighted, smoothed, moving average of a time series has been computed, it may be updated easily" (p. 22-24). All that is needed is the latest weighted average (In the initial year, this weighted average is calculated with user supplied values and averages from the base year), an appropriate weight (α , where $0 < \alpha < 1$) and the new observation. The forecast becomes:

$$\bar{X}_{t+1} = \alpha X_t + (1 - \alpha) \bar{X}_t \quad \text{where } \bar{X} = \text{weighted average} \\ \text{and } X = \text{actual observation}$$

The task then becomes one of choosing an appropriate weight for the adaptive forecast, an empirical question that is beyond the scope of this study. Of primary importance to this study is the establishment of a reasonable weight to develop the same expectations for all farmers. It is also important to distinguish between short-run expectations used in planting decisions versus long-run expectations used in expansion decisions. Lerohl (1972) estimated three equations reflecting what he called "own past price" for one, five, and ten year horizons. His findings support the assumption that longer term expectations will involve less emphasis on the most recent year and more emphasis on more distant past years. Therefore, this study uses a smaller value for the weights when developing long-run price expectations versus short-run price expectations.

In addition to developing price expectations, PREXP also adjusts the national average prices to reflect regional differences. Further, two regional prices are established to allow for before the end-of-the-year and after the end-of-the-year grain sales. This was considered necessary since the ability to store grain on and off the farm has been an essential mechanism for balancing cash flows and reducing tax commitments.

Section 3--Subroutine LANDPR

A basic simplifying assumption used in farm financial models such as the one here involves a user supplied inflation rate on land prices. Each year's average land price is inflated by this rate. The problem with this approach is that when prices and yields are allowed to be random, land prices will be a function of the sequence of random

draws. That is, land prices will not go up as fast when the draws result in below average returns to land versus an iteration where above average returns are encountered. This calls for feedback so that the average selling price of land will more closely reflect the general agricultural economy in the region being modeled. Subroutine LANDPR provides such feedback.

Data from 1960-79 were used to fit an Almon-lag (equation 3.5 in Appendix B) whereby the index for land prices is a function of the Federal Land Bank interest rates, an inflation index, and the previous six years' budgeted returns above land costs. This equation is used each year to estimate an average price of land. Since an index is used, the user may set initial land prices at any level. Values used to calculate the budgeted return above land are initially set at levels associated with an "outside bidder". Expected yields, prices, and costs are adjusted for the outside bidder using the same constant trend that is used by individual farmers in the model. The outside bidder also encounters the same random yields and prices as the farms being analyzed.

In this study, the model does not allow land prices to go below the previous year's price. (Land prices are downward inflexible.) The average selling price established by LANDPR is used as the actual selling price to the farmer who obtains the land. (Land allocation is explained under subroutine LANALC.) It must be recognized that this is an oversimplification. In reality, farmers may overbid on land and using the average selling price may distort their balance sheet. This would depend on whether lenders would reevaluate all land at the new purchase price.

Section 4--Subroutine BALANC¹

Both a current market value basis and a modified cost basis balance sheet are updated at the end of each year by subroutine BALANC. Some of the most crucial behavioral assumptions made in models such as this center around how assets are valued by creditors. Nelson and Harris surveyed lenders from 13 northwestern states and found that "70% of the lenders indicated that less than 25% of their clients brought in completed (financial) statements" (p. 20). Therefore, the lender's decision concerning how to value such assets as land, machinery, and buildings is extremely important. It is not unlikely that different lenders will have different perceptions and that the same lender may even value similar assets differently for different farmers. This study assumes that all lenders behave the same and that they treat all farmers similarly, regardless of size.

Intermediate assets are valued at their replacement costs for the balance sheet. In some cases this may overinflate their value, especially for lumpy assets such as grain storage which would be difficult to liquidate. However, the important aspect for this study is again that it provides consistent and equal treatment for farms of different size.

The basic balance sheets are developed using a similar format to that presented in Penson and Lins' book Agricultural Finance. An example of the balance sheet appears in Table 4.1. It should be noted

¹ Since the balance sheet is so crucial to simulation models such as this, that attempt to tract the financial position of the farm firm, subroutine BALANC is reviewed out of sequence (i.e., BALANC is used at the end of each year and after start-up).

TABLE 4.1

SAMPLE BALANCE SHEET, DECEMBER 31, 1979

ASSETS			
		Method of Valuation	
Item		Modified Cost Basis	Current Mkt. Value Basis
Current assets:			
Cash on hand		\$ 1,900	\$ 1,900
Savings (all outside investments)		10,000	10,000
Grain inventory		<u>210,000</u>	<u>210,000</u>
Total current assets		\$221,900	\$221,900
Intermediate assets:			
Machinery			
Cost	\$212,000		
Less accumulated depreciation	<u>80,000</u>		
	\$132,000	\$132,000	\$240,000
Buildings			
Cost	\$ 50,000		
Less accumulated depreciation	<u>25,000</u>		
	\$ 30,000	<u>30,000</u>	<u>64,800</u>
Total intermediate assets		\$152,000	\$304,800
Long term assets:			
Land		<u>\$1,430,000</u>	<u>\$2,232,000</u>
Total long term assets		\$1,430,000	\$2,232,000
TOTAL ASSETS		\$1,813,900	\$2,758,700

TABLE 4.1 (Continued)

LIABILITIES AND NET WORTH		
Item	Method of Valuation	
	Modified Cost Basis	Current Mkt. Value Basis
Current liabilities:		
Accrued taxes payable	\$ 15,100	\$ 15,100
Short term (12 months or less) loans	<u>9,000</u>	<u>9,000</u>
Total current liabilities	\$ 24,100	\$ 24,100
Intermediate liabilities:		
Machinery loans	\$ 38,000	\$ 38,000
Building loans	<u>14,600</u>	<u>14,600</u>
Total intermediate liabilities	\$ 52,600	\$ 52,600
Long term liabilities:		
Land loan	<u>\$601,300</u>	<u>\$601,300</u>
Total long term liabilities	\$601,300	\$601,300
Contingent liabilities:		
Contingent capital gains tax on land	na ¹	\$198,000
Contingent capital gains tax on machinery and buildings	<u>na</u>	<u>33,000</u>
Total contingent liabilities		\$231,000
TOTAL LIABILITIES	\$678,000	\$909,000
NET WORTH	\$1,135,900	\$1,849,700

¹ na: not applicable.

that the major driving force in determination of credit availability involves the market value net worth which is adjusted by contingent capital gains taxes. The contingent capital gains taxes are calculated on the basis of 40 percent of the capital gains associated with machinery, buildings and land. This value is taxed at the appropriate tax rate using TAXCOM.

One of the most important control mechanisms in this model is the total credit reserves. Penson and Lins discuss use of a maximum debt-to-equity ratio allowed by lenders as a major constraint on borrowing. "Let's assume that a farm operator's credit capacity is determined by multiplying existing equity by the maximum debt-to-equity ratio lenders will allow. For example, if a farm operator's equity is \$100,000 and lenders will allow a leverage ratio of 2.0, the farm operator's credit capacity is \$200,000" (p. 78). Equity in this study is the market value net worth. This value is reduced by contingent capital gains taxes. This study assumes that lenders will not be the constraint on this particular control mechanism. Instead, it is assumed that the farmer's own internal credit rationing will come into effect before the maximum debt allowed by the lender is used; that is, the lender's maximum leverage ratio is nearly always higher than the farmer's own internal credit rationing. This assumption is made in light of the goals outlined in Chapter II.

Finally, BALANC also updates an important measurement variable at the end of each year. The change in owner equity is calculated on a cost basis and a current market value basis. Again, this procedure is a modified version of that presented by Penson and Lins. As Penson and Lins point out: "The change in cost basis owner equity represents

the amount of additional funds (above credit and cash reserves) available to the farm operator to internally finance additional investments in physical and financial assets" (p. 26-27). Therefore, this variable represents a useful feedback mechanism on the well-being of the farm firm. (Use of this variable will be demonstrated below.) Table 4.2 builds on Table 4.1 to present the necessary calculations for the change in owner equity.

Section 5--Subroutine LANEXP

This subroutine examines the ability of each farm to expand land either through purchase or lease. (The user has the option to disallow expansion by either or both of these means.) The sequence of this subroutine forces land expansion to occur at the beginning of the year. Data on frequency of land transfers support this assumption. LANEXP goes through a sequence of criteria to determine if a bid can be placed on purchase land. The primary objective is to check the financial ability to purchase and service the debt associated with the land expansion and machinery complement required to accompany the expansion.

Developing random availability of purchase and lease land presents the greatest challenge and remains as one of the major limitations in models such as this. Previous farm level simulation studies have placed relatively few constraints on available land (i.e., As long as the farm was financially capable of acquiring more land, the land was available). This leads to unrealistic growth in a relatively short time (10-15 years). Another problem is that many simulation models ignore the illusive issue of lease land. If lease land were

TABLE 4.2
SAMPLE STATEMENT OF CHANGE IN OWNER EQUITY
1979

Item	1979
1. Net accrual farm income	\$ 62,500
2. Outside income	<u>3,000</u>
3. Total	65,000
Less withdrawals for:	
4. Family living expenses	25,100
5. Income and social security taxes	<u>15,100</u>
6. Total	40,200
Equals:	
7. Change in cost basis owner equity	25,300
Plus:	
8. Unrealized capital gains less change in contingent capital gains taxes ¹	155,000
Equals:	
9. Change in current market value owner equity	\$180,300

¹ The value in equation 8 represents the change in current market value net worth minus change in cost basis net worth. (See equation 4.9 in Appendix B.) Note that most of this capital gain is associated with inflation on land (i.e., An 8 percent inflation on the \$2 million value of land at the beginning of 1979 amounts to over \$160,000).

ignored in this study, larger farms would have an inordinate comparative advantage. Besides, approximately two-thirds of the land in Central Illinois is leased. Therefore, it was necessary to develop realistic purchase and lease land availability. This study makes the following simplifying assumptions: 1) The relevant market encompasses a circle with a ten-mile radius (i.e., The farmer will not purchase land that is more than ten miles from the base operation); 2) All farms being analyzed are in close proximity (This places them in the same relevant market); 3) The primary bidders for purchase land will be Class I farmers (i.e., sales of \$100,000 and greater); and 4) The primary bidders for lease land will be those farmers operating 180 acres or more. Using these assumptions coupled with census data and frequency data on land transfers obtained from the Illinois Crop Reporting Service, it was determined that annually allowing one parcel of purchase land and one of lease land to be competitively (and somewhat randomly) distributed to four farms, was a reasonable assumption. Replicating the appropriate size parcel was also considered essential since this affects which farms are financially able to bid on the land. This was accomplished using the frequency data to establish the odds concerning what size the one parcel would be. (Further discussion of the data and the assumptions used to develop availability of purchase and lease land appears in Chapter V.)

Farmer behavior concerning risk associated with use of credit is reflected in the internal credit rationing value and the years of emergency cash and credit reserves desired. The user controls the degree of risk aversion by the values associated with these variables. This study developed the values for these type of controls in an

iterative manner. (Sensitivity analysis on these controls was performed until the farms were able to remain solvent and grow simultaneously.) This procedure is justified by the concepts discussed in Chapter II, whereby the system design is developed before analysis on management can occur. Internal credit rationing was discussed in Section 4. The other major factor associated with farmer credit behavior is the years of credit and cash reserves required. This reflects the farmer's desire to be able to meet debt payments. The user provides the number of years of debt service (interest and principal on intermediate and fixed loans) that the farmer desires to have covered by credit and cash reserves. For example, the farmer may desire to have emergency credit and cash reserves that would cover at least three years of debt service.

Before placing a bid on land for sale, a number of tests must be passed. Whenever the credit reserves available do not cover the desired credit and cash reserves, no bid will be placed. It is also important that the credit requirement associated with the land purchase not exceed the available credit. Other criteria that will prevent new land purchase center around the financial well-being of the farm in the most recent years. There are three major feedback mechanisms that provide these indications. First, if the exponentially smoothed average cost basis owner equity is negative, this indicates that the firm has been unable to generate any internal financing in the most recent year. Second, if the current debt/asset ratio exceeds a desired level, this indicates that the firm is very likely to be having cash flow problems and it is not a good time to expand. Third, if the refinancing of land has been above a user

specified level in the previous two years, this indicates serious cash flow problems. Under any one of these situations, no bid on land will be made.

Assumptions concerning down payment requirements for land purchases can greatly impact the ability to place a bid on land. It is unrealistic to assume that farmers must have enough liquid assets to cover large down payments when in reality 100 percent financing of land does occur when the existing land base will support the new purchase. Therefore, this study uses two values that center around land down payment requirements: 1) It is assumed that lenders require equity in existing land and/or liquid assets that will cover some proportion of the land purchase (25 percent for this study); and 2) It is assumed that farmers will provide some down payment - even if this is done by refinancing existing land (10 percent for this study). If existing land and/or liquid assets will not cover the equity requirement from lenders, the farmer will be unable to bid on the land.

If all of the above constraints on land purchase are overcome, subroutines COSTS and MIX are used to develop an expected net return above land costs and to estimate the cash flow and income tax repercussions associated with the new purchase. It is assumed that each farmer is aware of how the new purchase will move his operation along the long-run average cost curve. An average machinery complement is also used to develop the expected returns per acre, unless the existing complement is below average. The expected return per acre is an important variable used to determine the bid price on land. Behavioral assumptions concerning the farmers desired returns for labor and management can impact this value and thus influence the relative

bidding position of farms of different size. This study assumes each farmer desires the same return regardless of size for most analyses. Sensitivity on this assumption is also provided by assuming smaller farmers are willing to settle for less return.

One of the major strengths of this model is the manner in which it evaluates probable income taxes and cash flows that will result if the new land were purchased. Subroutines COST and MIX provide estimates on all variable and fixed costs as well as expected total revenue and changes in outside income that would result if the land were purchased. The taxable costs are adjusted by estimating a depreciation cost associated with the machinery and building complement that would accompany the new purchase and the interest charges on new intermediate and fixed loans. Taxable farm income is then estimated and TAXCOM is used to calculate an expected tax payment and marginal tax bracket that may result if the land is purchased. This marginal tax bracket is used in calculating the bid price on land. (Other studies have used the previous year's marginal tax brackets to develop a bid price - it must be the expected marginal tax bracket.) Finally, the new debt service is used in conjunction with all other expected cash outflows (including a family living charge) and cash inflows to calculate the possible cash flow associated with the new purchase.

When inflation is causing the returns per acre to grow (in nominal dollars) and mortgages are also in (fixed) nominal dollars, the farmer and, perhaps, the creditors will be more likely to accept negative cash flows, since they should be short-run under these conditions. Short-run negative cash flows may also be acceptable

since refinancing of land is possible due to the inflation in land prices. Therefore, the model evaluates the expected short-run (using next year's expectations) cash flow before placing a bid on land. A user supplied dollar per acre (after purchase) is compared with the expected cash flow that would result if the purchase were made.

The expected return per acre is used in one last evaluation of whether or not to place a bid on new land. This final criterion centers on the ability of the new land to support the debt service associated with it. As with the criteria above, the intent is to develop the type of controls that reflect true farmer behavior. For example, the user supplies the maximum number of existing acres required to support a new acre. This number is multiplied by the returns above land costs (i.e., including charges for operator and family labor and management) and then compared to the debt service associated with one new acre. For example, if the user assumes farmers will purchase no new land when returns to three acres of existing land will not cover the debt service, then any time it requires more than three acres no bid will be placed. It must be recognized that the only way in which new land can be purchased is if the farmer is willing to accept the fact that in early years the new land will not be able to support the debt associated with it. Inflation in returns and land coupled with the fact that the debt service (under the traditional amortization techniques) will remain constant over the life of the loan justify this practice.

Once all of the tests for placing a bid on land have been passed, subroutine MAXBID uses the Lee/Rask model to determine a bid for each farmer. Subroutine LANBID is also used to rank farmers by their

ability to generate cash flow over the planning horizon. In addition to the expected return per acre, some of the other variables to be considered when placing a bid on land include the buyer's opportunity cost, marginal tax bracket, expected growth in income, expected land inflation, and planning horizon. Again, the user controls most of these variables and their relative position through start-up data. Currently, each of these variables are adjusted as the model goes through time, with the exception of opportunity costs. Since previous research has been unable to establish a correlation between farm size and risk aversion, this research uses the same opportunity cost (for land purchases) for all farmers. Adjustments in marginal tax brackets and expected growth in income and land prices are made using adaptive exponential smoothing. The degree of variability in inflation for income and land prices encouraged the use of small weights when exponentially smoothing these values.

Finally, LANEXP also evaluates the ability of each farm to purchase a new machinery complement to accompany the available parcel of lease land. Flexibility in meeting down payments on machinery and buildings is provided by assuming existing land loans can be refinanced, if necessary. This assumption also provides more opportunities for farms of all sizes to expand through leasing land. If the down payment and the financing requirements can be met on a new machinery complement for lease land, then the farmer has passed the first test in determination of who obtains lease land.

Section 6--Subroutines MAXBID and LANBID

Chapter III introduced the Lee and Rask land bid model and discussed how it has been used in previous farm firm simulation models. This study began by using the Lee-Rask model to establish both the absolute price level and the relative bidding potential between farms of different size. However, repeated analyses using the Lee-Rask model under the conditions of this study demonstrated the extreme sensitivity of the model and some serious inconsistencies in the relative position of bids from different farms under special conditions. Under nearly all reasonable assumptions, the model does provide bid prices that are within the range of the average price of land obtained from the Almon lag model. Therefore, this study uses the Lee-Rask model (subroutine MAXBID) to test the level of each farmer's bid (i.e., If the bid from the Lee-Rask model is more than 5 percent below the average selling price, that farmer is ineligible to purchase) and a modified version of the Lee-Rask model (subroutine LANBID) to allocate land between different farms.¹

The parameters required by the Lee-Rask model and discussion of their development appear earlier. Some of the most sensitive assumptions center around the sale of the land at the end of the planning period. Developing assumptions for so far into the future is tenuous at best. These assumptions are still made in order to use the Lee-Rask model to determine if the individual farmer can compete for land. However, for allocative purposes, it is assumed that all farmers will

¹ Future users have the option to use the Lee-Rask model to establish both the absolute value of land and the allocation of land.

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face and anticipate similar conditions in both consideration of the sale of the land and the down payments to be made on the land. Other factors that remain the same across farms include the average selling price of land, the down payment requirement, the expected inflation on returns, the loan life, and the interest rate on the loan. This leaves only the anticipated stream of cash flows over the next several years (30 years is used here) as the determining factor for which farmers can place the highest bid price on land. This is done by using some of the intermediate calculations used in the Lee-Rask model. Under this procedure, the determining factors become the farmer's expected return per acre (given his desired return to operator and family labor and management) and the expected marginal tax bracket (after the purchase is made).

Table 4.3 demonstrates the type of calculations that occur to obtain a present value of net cash flows from one acre of land over thirty years. (This table is a modified version of a table in the 1976 Lee article.) The conditions presented here are typical for one of the larger farmers in the first year of the analyses. Of primary importance is the fact that the interest payments in early years far outweigh the cash inflow. This causes tax losses to be associated with the purchase of the land in the first several years. As long as the expected tax payments (after the purchase) are positive, these losses can be written off. Therefore, the tax structure actually serves as an incentive for placing a higher bid under these conditions. If the farmer is only willing to consider a relatively short period in evaluating cash flow, then those with a high tax bracket (other things being equal) will be able to place a higher bid on land.

TABLE 4.3
SUMMARY OF THE DISCOUNTED CASH FLOWS PER ACRE FOR THE CONDITIONS BELOW

1	2	3	4	5	6	7	8	9	10
YEAR	TOTAL LOAN END PAID	LOAN BALANCE	INTEREST	CASH INFLOW	TAXABLE INCOME 5-4	INCOME TAX 6 X .3	NET CASH FLOW 5-2-7	11% DISCOUNT FACTOR	PRESENT VALUE OF NET CASH FLOWS 9 X 8
1	362.33	3134.	346.50	161.25	-185.25	-55.57	-145.50	.901	-131.08
2	362.33	3117.	344.76	173.34	-171.42	-51.42	-137.56	.812	-111.65
3	362.33	3097.	342.83	186.34	-156.48	-46.94	-129.04	.731	-94.35
4	362.33	3075.	340.68	200.32	-140.36	-42.11	-119.90	.659	-78.98
5	362.33	3051.	338.30	215.34	-122.96	-36.89	-110.10	.593	-65.34
6	362.33	3025.	335.66	231.49	-104.16	-31.25	-99.58	.535	-53.24
7	362.33	2995.	332.72	248.86	-83.87	-25.16	-88.31	.482	-42.54
8	362.33	2962.	329.47	267.52	-61.95	-18.58	-76.22	.434	-33.07
9	362.33	2926.	325.85	287.59	-38.27	-11.48	-63.26	.391	-24.73
10	362.33	2885.	321.84	309.15	-12.69	-3.81	-49.37	.352	-17.39
11	362.33	2840.	317.39	332.34	14.95	4.49	-34.47	.317	-10.94
12	362.33	2791.	312.44	357.27	44.82	13.45	-18.51	.286	-5.29
13	362.33	2735.	306.96	384.06	77.10	23.13	-1.40	.258	-0.36
14	362.33	2674.	300.86	412.87	112.00	33.60	16.94	.232	3.93
15	362.33	2605.	294.10	443.83	149.73	44.92	36.59	.209	7.65
16	362.33	2530.	286.60	477.12	190.52	57.16	57.63	.188	10.85
17	362.33	2446.	278.27	512.90	234.63	70.39	80.18	.170	13.60
18	362.33	2352.	269.02	551.37	282.35	84.70	104.34	.153	15.95
19	362.33	2249.	258.76	592.72	333.96	100.19	130.21	.138	17.93
20	362.33	2134.	247.37	637.18	389.81	116.94	157.91	.124	19.59
21	362.33	2006.	234.72	684.96	450.24	135.07	187.56	.112	20.96
22	362.33	1865.	220.69	736.34	515.65	154.69	219.31	.101	22.08
23	362.33	1707.	205.10	791.56	586.46	175.94	253.30	.091	22.97
24	362.33	1533.	187.81	850.93	663.12	198.94	289.66	.082	23.67
25	362.33	1339.	168.61	914.75	746.13	223.84	328.58	.074	24.19
26	362.33	1124.	147.30	983.35	836.05	250.81	370.21	.066	24.55
27	362.33	885.	123.65	1057.10	933.45	280.04	414.74	.060	24.78
28	362.33	621.	97.40	1136.39	1038.99	311.70	462.36	.054	24.89
29	362.33	326.	68.26	1221.62	1153.36	346.01	513.28	.048	24.89
30	362.33	0.	35.91	1313.24	1277.33	383.20	567.71	.044	24.80

NET PRESENT VALUE FOR THIS THIRTY YEAR PERIOD IS -341.70

*** BASE CONDITIONS ***

PRICE PER ACRE = \$3500
 EXPECTED RETURN PER ACRE IN YEAR 1 = \$150.
 EXPECTED INFLATION ON RETURNS PER ACRE = 7.5 PERCENT/YEAR
 EXPECTED MARGINAL TAX BRACKET OVER THE PERIOD = .3
 LOAN = \$3500 X (1-.1[DOWNPAYMENT]) = \$3150
 LOAN LIFE = 30 YEARS
 LOAN INTEREST RATE = 11 PERCENT

It is only the relatively high inflation rate on returns that prevents the farmer with the higher tax bracket from having a lower expected cash flow. Tables 4.3 and 4.4 demonstrate these properties. (If the expected inflation rate on returns is reduced to six percent, the farmer with the highest marginal tax bracket has a higher cash flow under the conditions in Table 4.3.) Expected returns influence the cash flow in the expected manner (i.e., A higher expected return results in a higher cash flow).

This study uses the expected cash flow (over a thirty year period) to allocate 75 percent of the purchase land to the farmer with the highest expected cash flow. The other 25 percent is allocated randomly to those that are able to place a competitive bid.¹ All land is obtained at the average selling price which is calculated from the Almon lag model.

Table 4.3 can be extended to demonstrate how the Lee-Rask model develops a bid price on land. When the \$350 down payment is added to the negative \$366 cash flow, the net cash flow before considering the land sale is negative \$716. If expected land inflation is 7 percent per year, and it is assumed that the land will be sold at the end of the thirty year period, the ending nominal value of land will be \$26,643. The capital gains is $\$26,643 - 3,500 = \$23,143$. Charging the maximum possible capital gains tax of 28 percent leaves a net gain of \$16,663. When this is discounted by the 30th year, 11 percent discount factor, the present value is \$728. Adding this to the

¹ This represents the estimated proportion of land being sold between relatives. It is assumed that this land only has one bidder (i.e., the relative who purchases it). This study does not allow for inheritance.

TABLE 4.4

SENSITIVITY ON CONDITIONS IN TABLE 4.3 - INCREASE MARGINAL TAX TO .5

1	2	3	4	5	6	7	8	9	10
YEAR END	TOTAL LOAN PAID	LOAN BALANCE	INTEREST	CASH INFLOW	TAXABLE INCOME 5-4	INCOME TAX 6 X .5	NET CASH FLOW 5-2-7	11% DISCOUNT FACTOR	PRESENT VALUE OF NET CASH FLOWS 9 X 8
1	362.33	3134.	346.50	161.25	-185.25	-92.62	-108.45	.901	-97.70
2	362.33	3117.	344.76	173.34	-171.42	-85.71	-103.28	.812	-83.82
3	362.33	3097.	342.83	186.34	-156.48	-78.24	-97.74	.731	-71.47
4	362.33	3075.	340.68	200.32	-140.36	-70.18	-91.83	.659	-60.49
5	362.33	3051.	338.30	215.34	-122.96	-61.48	-85.51	.593	-50.74
6	362.33	3025.	335.66	231.49	-104.16	-52.08	-78.75	.535	-42.10
7	362.33	2995.	332.72	248.86	-83.87	-41.93	-71.54	.482	-34.46
8	362.33	2962.	329.47	267.52	-61.95	-30.97	-63.83	.434	-27.70
9	362.33	2926.	325.85	287.59	-38.27	-19.13	-55.61	.391	-21.74
10	362.33	2885.	321.84	309.15	-12.69	-6.34	-46.83	.352	-16.49
11	362.33	2840.	317.39	332.34	14.95	7.48	-37.46	.317	-11.89
12	362.33	2791.	312.44	357.27	44.82	22.41	-27.47	.286	-7.85
13	362.33	2735.	306.96	384.06	77.10	38.55	-16.82	.258	-4.33
14	362.33	2674.	300.86	412.87	112.00	56.00	-5.46	.232	-1.27
15	362.33	2605.	294.10	443.83	149.73	74.86	6.64	.209	1.39
16	362.33	2530.	286.60	477.12	190.52	95.26	19.53	.188	3.68
17	362.33	2446.	278.27	512.90	234.63	117.32	33.26	.170	5.64
18	362.33	2352.	269.02	551.37	282.35	141.17	47.87	.153	7.32
19	362.33	2249.	258.76	592.72	333.96	166.98	63.41	.138	8.73
20	362.33	2134.	247.37	637.18	389.81	194.90	79.94	.124	9.92
21	362.33	2006.	234.72	684.96	450.24	225.12	97.52	.112	10.90
22	362.33	1865.	220.69	736.34	515.65	257.82	116.18	.101	11.70
23	362.33	1707.	205.10	791.56	586.46	293.23	136.01	.091	12.33
24	362.33	1533.	187.81	850.93	663.12	331.56	157.04	.082	12.83
25	362.33	1339.	168.61	914.75	746.13	373.07	179.35	.074	13.20
26	362.33	1124.	147.30	983.35	836.05	418.02	203.00	.066	13.46
27	362.33	885.	123.65	1057.10	933.45	466.73	228.05	.060	13.62
28	362.33	621.	97.40	1136.39	1038.99	519.49	254.57	.054	13.70
29	362.33	326.	68.26	1221.62	1153.36	576.68	282.61	.048	13.70
30	362.33	0.	35.91	1313.24	1277.33	638.66	312.25	.044	13.64

NET PRESENT VALUE FOR THIS THIRTY YEAR PERIOD IS -366.29

negative \$716 yields \$12. Therefore, the maximum bid price could be slightly higher than the selling price of \$3500. The Lee-Rask model solves for the maximum bid price by forcing the net present value of all cash flows to zero. Clearly, the many assumptions that must be made drastically influence the maximum bid price.

Section 7--Subroutine LANALC

After all bids have been received from the Lee-Rask model and evaluation of expected cash flows are received from LANBID, all farms converge in subroutine LANALC (land allocation). As long as the bid price is not less than 5 percent below the average selling price of land, the farmer with the highest expected net present value cash flow receives the land at the average selling price, unless the current year's land involves a family transaction. Since roughly 25 percent of all land that is sold involves a family transaction, provisions were made to allow for randomly allocating land 25 percent of the time between farmers that are able to place a competitive bid. The user can specify the proportion of the total land to be allocated randomly. A random number is used to allocate the purchase land among those eligible.

Allocation of lease land proceeds from the viewpoint of the landlord. There are a number of reasons for taking this approach. The primary reason is that a true market for lease land does not exist. The predominant leasing practice in Central Illinois involves share leasing under established standard agreements (i.e., For better soils, a 50/50 sharing arrangement is most common). Therefore, farmers are not participating in a bidding market as with purchase

land. Under the assumption that all farmers in the model have similar managerial skills, the landlord uses the most readily available information to determine which farmer will receive the lease land. A major concern involves which farmer is best equipped to handle new land. The landlord is also interested in return above the variable costs he/she must share in. Therefore, a combination of criteria is used to allocate lease land. First, any farmer that has just purchased land is precluded from consideration. It is assumed that the landlord would prefer to lease his land to a farmer that has not made a recent expansion. It is also assumed that the landlord is familiar with the type of machinery complement that each farmer has had in recent years. (The landlord can distinguish between farmers in terms of which ones are best able to plant and harvest their crops in a timely fashion.) The feedback mechanism used here is a heavily weighted (.7 for the most recent year) exponential average on the ratio of actual to average machinery complement. (All machinery will be within 10 percent of the average requirement - 1.1 for the maximum and .9 for the minimum ratio.) This ratio is used to adjust the expected return above the variable costs shared by the landlord developing a proxy for a bid price on lease land. (Each farmer's average ratio is multiplied by the profits the landlord can expect from the different farmers.) Finally, the landlord has all proxy bids from perspective tenants. The user can use this value alone to allocate lease land. However, the economies of size built into the model will usually result in the larger farmers receiving an inordinate proportion of the lease land. Since there is evidence of smaller farmers receiving lease land for a variety of reasons (friendships

with landlords, nepotism, or the landlord's limited ability to distinguish between perspective tenants at the level described above) an allowance is made for considering all farmers that fall within a certain range of the proxy bid. For this study, a random number is used to choose one farmer from among all farmers that have a proxy bid that is within 96 percent of the maximum proxy bid. (It is assumed that any farmer that does not fall within this range is considered an unacceptable tenant, regardless of friendships or nepotism.¹ Finally, lease land contracts are assumed to be long-term in the sense that they are always renewed unless the farmer is in an extremely tight cash flow position and/or if his machinery complement is consistently below average.

Section 8--Subroutine INVEST

Once determination of which farms obtain new purchase and lease land is made, the production year begins by first purchasing new machinery and buildings (both for replacement and to accompany new land). Subroutine INVEST accounts for any new land when evaluating the average machinery and building complement required per acre. New purchases of land are assumed to contain no building complement. Machinery and building replacement is inflated at a constant rate over the planning horizon. The level of investment for replacement and/or new land machinery and buildings is determined by a number of criteria

¹ Prospective users should pay particular attention to this allocative procedure. It is much more reasonable when developing a number of stochastic iterations for Monte Carlo analysis than when performing only one deterministic run.

designed to reflect farmer behavior as a function of credit availability and desired reserves and most recent cash flow position.

There are five discrete levels of machinery investment allowed:

1) excellent - 110 percent of average, 2) above average - 105 percent of average, 3) average - 100 percent of average, 4) below average - 95 percent of average, and 5) poor - 90 percent of average. (The reason for using discrete levels will be made clear in the discussion on subroutine MIX.) Each farmer is constrained to no better than average in the first year that a new parcel of land has been purchased and/or when the internal financing (as measured by the average cost basis owner equity) has been below acceptable levels. Under other conditions, the level of investment is generally determined by the relationship between credit availability and desired cash and credit reserves. Cash and credit are updated to reflect debt service associated with any expansion. When there is excess credit available to cover desired cash and credit reserves, investment in machinery will be either excellent or above average. Likewise, if the available credit will not cover the desired credit and cash reserves, below average complements are purchased. The same type of criteria is used to determine building investment, with the exception that a poor complement is purchased in any year that land is purchased and above average or excellent building complements are never purchased. (Section 8.6 of Appendix B presents the explicit criteria for making machinery and building investments.)

Once the appropriate level of investment has been determined, INVEST uses subroutines REPL, DEPC, and BOR (as described below) to determine the extent of investment needed to bring existing levels up

to the desired level, set up new and update old depreciation schedules, and set up new and update old intermediate and fixed loans. Once investments are made, INVEST estimates the cash flow needs for the current year. The estimate includes down payments on machinery and buildings, the expected variable costs of growing corn and soybeans, and the expected family living expenses. If current assets (which include grain inventories) will not cover these expected cash flow needs, short term credit for some user supplied fraction of a year ($2/3$ is a reasonable fraction) will be borrowed to balance within year cash flows. There is no constraint on this type of borrowing. If the levels are unreasonable, the constraints will be imposed when cash flow is balanced at the end of the year.

Section 9--Subroutine REPL

Machinery and building complements are handled as dollars invested per acre. A machinery complement is required for all acres (both owned and leased) and a building complement is required for owned acres and twenty percent of the leased acres.¹ The alternative is to develop specific complements, tracking each item over time. There are distinct advantages and disadvantages associated with the approach used here. The primary advantage is its simplicity. Lumping the complements into a dollar invested per acre value reduces both the cost of running large simulation models and the amount of user input in terms of developing a full machinery and building complement in the

¹ Enough building complement to match 20 percent of the leased acreage represents the typical lease arrangement.

initial year. (Such a complement would need age, expected life, and replacement cost on each item.) The aspect that is lost with the approach used here is the lumpiness in the year-to-year expenditures on machinery and buildings due to replacement of major items such as combines or grain storage. Using investment per acre requires the simplifying assumption that the entire complement wears out at a constant rate. This results in a much smoother year-to-year expenditure than what occurs in reality. The seriousness of this problem is reduced by the manner in which this model allows for investing in different levels of both machinery and buildings.

The important issue for this study centers around how the method of replacement of machinery and buildings used here may distort the well being of different size farms. First, since each farm's replacement schedule is calculated in the same manner, there should be no distortion across farms. This study also assumes the same useful life on machinery on farms of different size. A distortion may be introduced here, since there is some evidence to suggest that smaller farmers use machinery longer than larger farmers. (Users have the option to change the useful life for each farm.) Another problem that is more serious involves the unique replacement problems a farmer faces when rapidly expanding the land base. Major expansion may require a total retooling in order to develop an appropriate complement for the larger operation. A major goal may be to minimize hired labor requirements. Thus, when the farm grows (in acres), adding on to an existing complement may be undesirable due to the labor efficiency of such a strategy. The common practice may be a total retooling in order to develop a labor efficient complement that

will allow for timely planting and harvest. This may involve trading in the existing complement before much of it has outlived its useful life. Such a practice is costly both in terms of trade in value being less than the replacement cost and the tax repercussions (i.e., recapturing investment credits and any accelerated depreciation). Therefore, the procedure used here may be underestimating the costs of machinery expansion when large parcels of land are acquired through leasing and/or purchase. The structure of this model minimizes the occurrences of large expansion of land in any given year and thus the seriousness of this problem is minimized. Recall that the model only allows for expansion of one parcel of lease or purchase land in any given year. Further, the frequency data on parcel sizes results in many more smaller parcels becoming available than larger parcels.

Since inflation on replacement buildings and machinery is allowed, a special approach is required to ensure that similar complements are being compared through time. First the simplifying assumptions that the total package has an average useful life and that replacement occurs at a constant equal rate with a 20 percent salvage value are made. (These values were developed using work done by Bowers.) Under conditions of no inflation, the solution to maintaining the same complement is simple - replace at the same dollar rate each year. Calculations presented in Table 4.5 demonstrate the method of keeping track of complements - with and without inflation. Under the example without inflation, one needs to merely spend \$800 per year to maintain a \$10,000 complement. When inflation is introduced, it is necessary to track each year's investments separately. The total current value in any particular year becomes the sum of each of the previous years'

TABLE 4.5
 CAUSE OF PHYSICAL DEPRECIATION SCHEDULE FOR A \$10,000 INVESTMENT (1979 DOLLARS)¹

TABLE 4.5

SAMPLE PHYSICAL DEPRECIATION SCHEDULE FOR A \$10,000 INVESTMENT (1979 DOLLARS)¹

Year	Calculating Current Value Without Inflation		Calculating Current Value With 10% Inflation		Current Value of Similar Complements (\$10,000 Compounded at 10%)
	Current Value - Wear Out Value	Current Value	Current Value = (Previous Year - Compounded Wear Out Value) X Inflation Rate	Current Value	
1980	\$10000-800 = 9200		(\$10000-(800X1.1 ⁰)) X 1.1 = 10120		11000
1981	9200-800 = 8400		(10120-(800X1.1 ¹)) X 1.1 = 10164		12100
1982	8400-800 = 7600		(10164-(800X1.1 ²)) X 1.1 = 10116		13310
1983	7600-800 = 6800		(10116-(800X1.1 ³)) X 1.1 = 9956		14641
1984	6800-800 = 6000		(9956-(800X1.1 ⁴)) X 1.1 = 9663		16105
1985	6000-800 = 5200		(9663-(800X1.1 ⁵)) X 1.1 = 9212		17716
1986	5200-800 = 4400		(9212-(800X1.1 ⁶)) X 1.1 = 8574		19487
1987	4400-800 = 3600		(8574-(800X1.1 ⁷)) X 1.1 = 7717		21436
1988	3600-800 = 2800		(7717-(800X1.1 ⁸)) X 1.1 = 6602		23579
1989	Salvage Value: 2800-800 = 2000		(6602-(800X1.1 ⁹)) X 1.1 = 5187		25937

¹ Assume a 20 percent salvage value and a 10-year useful life. The wear out rate (before inflation) = $(10000-(10000 \times 0.2))/10 = 800$.

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current values after allowances have been made for physical depreciation and inflation. New investments are made to bring the total current value up to the desired level. Other simplifying assumptions are: 1) The average useful life is always longer than depreciation life (This avoids depreciation recapture); 2) Machinery and buildings are kept throughout the useful life (This avoids recapture of investment tax credit); 3) Old machinery is traded in on new machinery so that the cost basis is the new value minus the salvage value; 4) Salvage values inflate at the same rate as replacement values; and 5) Buildings are not traded (They are considered lumpy assets and remain on the farm past their useful life).

Section 10--Subroutine DEPR

Depreciation schedules for new purchases are developed in subroutine DEPR. Previous years are also updated on the basis of previous schedules and remaining book value. A total of six depreciation methods are available: 1) straight line only, 2) straight line plus additional first year accelerated depreciation; 3) double declining balance only, 4) double declining balance converted to straight line half-way through the life, 5) double declining balance plus additional first year accelerated depreciation, and 6) the same as 5 with conversion to straight line half-way through the life. The current study uses option 6, with first year accelerated depreciation not being used in years when gross return per acres is substantially below average. It also depreciates the initial complements using straight line plus first year accelerated. This smooths out the depreciation when no growth occurs.

Previous studies indicate that farmers do not use rapid depreciation techniques as commonly as the more simple, less rapid techniques. However, recall that this study is concerned with the potential impact of existing and alternative policies on the opportunity sets of farms of different size. The rapid depreciation techniques are within the current set of options, and they should enhance the opportunity sets of farms that are attempting to grow (i.e., They allow for more tax write-offs in early years, thus providing for internal funds that can be used for expansion).

Subroutine DEPR is also used to calculate a depreciation value used in evaluating accrual farm income. The most important aspect in the selection of the depreciation technique is consistency throughout this study. Once again, the absolute values of measurement variables such as accrual farm income are not nearly as important as the relative position of the variables across farms of different size. In discussing how assets should be depreciated for the income statement, Hopkin, Barry, and Baker point out that: "Appealing arguments can be made for charging depreciation according to the cost of replacing an asset rather than to its original costs" (p. 101). They go on to discuss how traditional accounting techniques that use the original cost and a stable dollar (i.e., purchase price) overstate accrual income during inflationary times. The model accounts for some of the effects of inflation when calculating depreciation charges. This is done by inflating each of the previous year's book values before the individual year's depreciation values are calculated in any given year. The initial complement uses straight line depreciation on the useful life in order to offset the simplification that the total

complement in the initial year is assumed to be at total current value. (A more acceptable approach would be to segment the complement so that there are portions of it in years prior to the initial year.) All purchases made after the initial year are depreciated using double declining balance on the useful life of buildings and machinery in order to approximate the physical depreciation of machinery (Bower's work demonstrates that machinery deteriorates in a geometric fashion). Any salvage value that remains when using this method is unimportant for developing a depreciation charge. Salvage values are tracked in REPL and used here to develop the book value for new machinery purchases.

Section 11--Subroutine LOAN

Every year's purchase of machinery and buildings are added together and allowances are made for down payments. This value is assumed to be the amount of the current year's intermediate loan. A similar procedure is used for any purchase loan to obtain the current year's fixed loan. Subroutine LOAN uses these values to set up an amortization schedule that allows for equal payments over the life of the land. Although there are a number of types of loans to choose from (simple interest, balloon, add-on-interest, single payment, etc.), the amortization technique was chosen because: 1) It provides more stability in cash flow; 2) It is the most common type of loan for land payments, and 3) It is used in intermediate loans. Subroutine LOAN also separates the first year's payment for principal and interest.

Section 12--Subroutine BOR

This subroutine uses the amortization schedules developed in LOAN to retire each year's intermediate and fixed loans. It keeps track of expenditures on interest and principal for each year's loans, accumulating these charges for the current year (Interest charges are very important for income taxes). Allowances are also made for any loans that have been reduced with excess cash flows.

Section 13--Subroutine COSTS

Since this study is concerned with growth of farms of different size, capturing the production costs of corn and soybeans on farms of different size was essential. Data from Illinois farm records were used to develop quadratic cost curves of the general form:

$$\text{COST} = c + b_1 \times \text{tillable acres} + b_2 \times \text{tillable acres}^2$$

These cost curves were separated for corn and soybeans.¹ Introducing random yield variation also made it necessary to adjust specific cost items when yields changed. Those cost items that are most sensitive to yields are separated from the general equations and added back in after the yield has been determined. Adjustments are also made to reflect changes in crop mix (i.e., Labor requirements are not as high when more soybeans are grown.) Variable costs are calculated for corn

¹ The procedure for developing these costs curves is developed in Chapter V. Appendix B 13.3-13.4 explicitly present the equations used.

and soybeans under four incurred costs categories (fertilizer, hired labor, seed and crop, and machinery repairs) and two opportunity costs categories (charges for operator and family labor and management). Fixed costs are broken down into property taxes, building repairs, insurance, and miscellaneous. All of these costs are developed as a function of total tillable acres operated. Due to data limitations on larger farms, the quadratic cost curves on most items are not extended beyond 1600 acres (This is the general region where the curves flatten out). All costs are inflated at the same annual rate for simplicity (9 percent in this study). The most severe limitation of the cost calculations centers on charges for storage of grain. The cost curves are developed using historic data and, therefore, these costs are included at their average rates. However, the model allows for a good deal of adjustment in the amount of grain stored with no corresponding adjustment in cost. In reality, larger farms probably store proportionally more grain than smaller farms; therefore, this distortion will benefit smaller farms relatively more than larger farms, since the cost data for larger farms reflect more storage charges. Data also indicate that farmers who own proportionally more land than they lease will have more storage than those that lease proportionally more than they own. This study allows for the same behavior in storage of grain across farms of different size. There are two reasons for this: 1) the difficulty of allowing for proper changes in this behavior as farms grow in size, and 2) to provide smaller farms with the same opportunities to manage cash flows and income taxes as larger farms. Also, all farms receive the same price for stored grain; this price is always higher than the harvest price. Again, this probably does

not occur in reality, but each farmer should have similar opportunities (except in special cases, such as providing premiums to fill a special order). The opportunity cost of holding grain will differ between farmers due to the design of the model. Any farmer who chooses to hold grain at the end of the year when there are not adequate funds to cover cash flows will be forced to either obtain a short-term loan (one year) and/or refinance land. This can occur even if selling all grain would cover end of year cash flows.

Labor requirements are also developed using quadratic curves. Hired labor requirements are estimated using the residual between the total labor requirement and the operator and family labor usage. Even the smallest farmers hire labor since these equations reflect some of the timeliness impact associated with planting and harvest. Two simplifying assumptions that are made to provide for consistency in comparing across farms of different size are: 1) Only one farm family is being supported by the farms with an upper limit of 1.5 man-years of labor available for each family of four, and 2) Any excess operator and family labor is sold off the farm at the prevailing wage. This provides each farm with an equal opportunity to benefit from an equivalent labor complement.

Subroutine COSTS also allows for adjustments in the farm's share of expenses and revenues as a result of any share leased land. The assumption is made that leased land is used in the same fashion as owned land (i.e., Inputs are used at the same level and crop mix is the same). Under this assumption, a discount factor is developed (using owned and leased acres) to obtain the farmer's share. The most common lease agreement for Central Illinois farms with better soils is

a 50/50 arrangement whereby the farmer and landlord share equally in fertilizer and seed and crop expenses and in gross returns. It is also common for the landlord to provide approximately 20 percent of the expense for insurance, building repairs, and miscellaneous.

The flexibility provided by the cost relationships in this subroutine and the crop mix determination provided by subroutine MIX add many dimensions to this model. Not only are these subroutines used to determine year-to-year costs and production, but they are also used to aid in expansion decisions. When a farmer is considering purchasing a new parcel of land, this parcel is added to existing acres and the series of cost equations are used in conjunction with long-run price expectations and subroutine MIX to determine the expected returns per acre that may occur if the land is purchased. This assumes that the farmer is aware of how the new land may move his operation along the long-run average cost curve. It also is assumed that adjustment to new land occurs with little or no adjustment period. The only forced adjustment is the assumption that no better than an average machinery complement is purchased in the same year new land is purchased (i.e., This will reduce the yields for farmers that have been able to maintain above average complements). The expected costs per acre that are estimated when considering expansion include all of the variable costs items as well as charges for operator and family labor and management. The expected returns per acre are estimated using an average machinery complement and the expected yields that are associated with the crop mix that is derived from subroutine MIX. After the returns above non-land costs are obtained, the rest of the calculations in COSTS are made to estimate the cash

flow and income tax repercussions associated with purchase of the new land parcel. (These values are used in the manner described in Section 5.)

The expected yields that are derived from subroutine YIELD are used without adjustment when a deterministic run is being made or when decisions on land purchases are being considered. Most of the analysis here involves the introduction of stochastic events that will cause deviations around the expected yield. (Chapter V will explain how random deviations were developed.) When a stochastic run is being made, the expected yields are adjusted (upward or downward) by the random draw for that particular year. All farms receive the same adjustment in their individual expected yields to maintain equal treatment across farms of different size. Actual yields are then adjusted by a trend in the productivity factor.

Section 14--Subroutines MIX, FERTI, and YIELD¹

A major function performed by the farm manager involves decisions concerning the appropriate crop mix given the existing resources. Farm management specialists have made use of techniques such as linear programming to aid farmers in these decisions. Previous studies have combined simulation models such as the one in this study and linear programming. Such an approach increases both the computational costs and the amount of detail required by farm firm models. This study

¹ These subroutines were adapted from TELPLAN 41 developed by J. Roy Black, Agricultural Economist, and Maurice Vitosh, Crop and Soil Science, Michigan State University. For more detail on their operation, see "Michigan Farm Economics", No. 385, February 1975.

uses an approach that involves the same theory as the linear programming approach and the same type of detail in an aggregated form. The sacrifices in accuracy associated with the approach chosen here are probably offset by the cost savings and the simplicity. In fact, the approach used here may model farmer behavior more closely than an optimization technique such as linear programming.

Before making planting decisions, farmers develop expectations on prices for the coming season. The relative position of the price expectations of corn and soybeans is an important factor, as are the variable costs associated with production of corn versus soybeans. The decision is complicated by the differences in the impact of timely planting and harvest for corn versus soybeans. Production data on the percent of optimum corn and soybean yield related to date of planting and harvest illustrate that timely planting of corn is more crucial than timely planting of soybeans (Telplan 18, Corn-Soybeans Planning Guide). Since the level of machinery complements influences timeliness, farmers may be expected to plant proportionally more corn than soybeans as their machinery complement improves. Therefore, since the objective is to maximize returns, the ultimate decision will not only be based on expected prices and costs but also on expected yields which are influenced by the level of machinery and the crop mix. This study uses discounts to adjust potential yields, given the current level of machinery complement (recall that five distinct levels are possible) and different crop mixes.¹ After the optimal level of

¹ These discounts were developed using more detail in a linear program (Telplan 18). Although they were developed by J. Roy Black for use in Telplan 41, the basic relationships are sound for use in this study.

nitrogen application for corn is determined, the net returns above land costs are calculated for eleven possible crop mixes (i.e., 0, 10, 20, ..., 100 percent of tillable acres planted in corn with the remaining percentage planted in soybeans). The variable costs are adjusted by yields and include a charge for operator and family labor and management. The crop yield that maximizes returns above land cost is chosen. (The mix remains between 30 and 70 percent.) The model allows for total adjustments; however, this study assumes that farmers will always plant a minimum percent (30) of their acreage to corn and/or soybeans as a risk strategy. The yields that correspond with the ultimate crop mix that is chosen become the expected yields that are used in subroutine COSTS.

Section 15--Subroutine CASHFO

Managing cash flows is an extremely important function to be performed by cash grain farmers. Simulation models that make use of average prices and yields (i.e., deterministic analyses) greatly oversimplify the impact of cash flow on growth and/or viability. Introducing random prices and yields and allowing for major cash expenditures associated with farm growth creates increased year-to-year variability in income, taxes, family living, and cash flows. Developing techniques to control this variability was considered essential since this study attempts to capture real world variability by using random prices, yields, and land availability. Feedback mechanisms that reflect farmer behavior were necessary. The problem was simplified by assuming that farmers attempt to store a fixed percent of their production each year. (This is the only marketing

strategy assumed in this study.) The fact that the model aggregates the entire year (i.e., It does not analyze months or quarters) also simplifies the problem. Two assumptions were made to reflect farmer behavior in managing grain inventories and, thus, cash flow: 1) When negative cash flows are encountered, the farmer would rather sell extra grain than obtain outside financing to balance cash flows; and 2) Attempts are made to even out tax payments by storing less grain (and thus selling more grain) in poorer years and storing more grain in better years.

The first step involves estimating the current year's cash inflow and cash outflow.

Cash inflows include:

- 1) Grain sales:
 - The grain inventory is valued at the past January 1 prices.
 - The current year's production is sold at the average rate (This uses the average storage percentage).
- 2) Custom work
- 3) Outside income:
 - Wages earned off the farm
 - Interest from outside investments
- 4) Any short-run operating loans (2/3 of the year)

Cash outflows include:

- 1) Variable costs:
 - Corn (fertilizer, seed and crop, and machinery repair)
 - Soybeans (fertilizer, seed and crop, and machinery repair)

- Hired labor
- Interest on all short-term loans
- 2) Fixed costs:
 - Property tax
 - Building repair
 - Insurance and miscellaneous
 - Interest on fixed and intermediate loans
- 3) Principal payments:
 - Total short-run operating loan
 - Principal portion of amortized payments for fixed and intermediate loans
- 4) Down payments:
 - Machinery and buildings purchases
 - Land purchases
- 5) Tax payments (on previous year's income):
 - State and federal income taxes
 - Social security tax
- 6) Estimated family living charge

It should be noted that this estimate does not include any of the previous cash on hand or savings nor any of the one-year current loans. The attempt is to capture the actual year's cash flow. A rate feedback is developed using the ratio of cash inflows to cash outflows. When this ratio is greater than one, it indicates a positive cash flow position would occur if the average proportion of grain were stored. (Similarly, a negative cash flow is likely when the ratio is less than one.) The average percent of storage is multiplied by the ratio to obtain a first evaluation of the amount of grain to store

(i.e., Multiplying a ratio of greater than one by the average ratio of storage increases the ratio of storage when cash flows are going to be positive). This study also places upper and lower bounds on the ratio to adjust to the average percent of storage (i.e., no more than 120 percent of average and no less than 50 percent of average in the first evaluation). When these bounds are multiplied by the 70 percent average storage, the upper bound on storage becomes 84 percent of the current year's production and the lower bound is 35 percent. (These values were developed in an iterative fashion given the farmer goal to smooth out variability.)

Once the first level of storage has been determined on the basis of cash flow, the model then investigates the taxable farm income that would result if this amount of grain were stored. The farmer always attempts to avoid a negative taxable income. When taxable income is negative, the percent of storage is adjusted downward to yield some minimum level of taxable income or until the lowest amount of storage allowed is reached. (This study attempts to have taxable income at a level of \$10 per tillable acre as long as storage does not go below 17 percent of the current year's production.) If the first evaluation of storage yields a taxable income that is greater than 150 percent of an exponentially smoothed taxable income, then storage is increased until taxable income is no greater than the 150 percent or until the maximum level of storage is obtained.

Once the preferred level of storage is established, the actual taxable income is used to calculate tax commitments, which are paid in the following year. Accrual farm income is calculated and used to determine actual family living expenses for the current year. At this

stage, the actual cash inflows and outflows are updated and the cash position is evaluated by adding in any cash on hand and savings and subtracting an allowance for desired cash on hand (50 percent of family living) and any current loan that was borrowed at the end of the previous year. If the cash position is positive, the first step involves setting aside enough to cover the coming year's operating expenses that will not be covered by existing liquid assets. In most cases, grain inventories will cover these expenses. If there is an excess cash inflow, it is used to reduce outstanding intermediate loans and, ultimately, fixed loans, when all intermediate loans have been paid off. (Since this study focuses on growth, excess cash flows are not common.) When the cash position is negative, each farmer first borrows current loans (one year) up to the maximum allowed. Three constraints are placed on the level of this borrowing: 1) The amount is no more than that needed to cover the negative cash flow, 2) Current liabilities (This includes the one-year loans and contingent tax payments) cannot be more than 1.5 times current assets, and 3) Current liabilities cannot be greater than half of the expected gross returns. (The user can alter these assumptions.) In the event adequate short-run credit cannot be obtained, the farmer will then rely on the equity in land to cover any deficits by refinancing land loans. The primary constraint on refinancing of land is the fixed ratio. In this study, refinancing land beyond the point where all land loans would be seventy-five percent of the value of land is not allowed. The issue of insolvency becomes important if negative cash flow cannot be rectified through refinancing land. It may be logical to assume some disinvestment would occur to cover the cash deficits.

This study simplifies the problem with provisions to relinquish forty acres of lease land and allow for new short-run credit considerations due to associated reduction in machinery replacement. It is assumed that creditors will extend enough short-run credit (with a 5 percent additional charge) to equal the value of the machinery complement that would have been needed in the following year had the farmer retained the forty acres of land. If there is still not enough financing available to cover cash deficits, the farmer becomes insolvent.

Another mechanism that is used to aid in avoiding serious cash flow problems also involves giving up lease land in order to reduce cash requirements in machinery replacement. An indication that there are serious cash flow problems is the frequency and level of refinancing land. This study uses an exponential average of refinancing land as a feedback mechanism that indicates both degree and frequency. If this average is greater than 200 dollars per acre, then the farmer will give up forty acres of lease land - unless the current year's refinancing of land is less than 100 dollars per acre. Again, these values are somewhat arbitrary, but the logic of the selection of these feedback mechanisms is sound. One would expect good farm managers to react to a situation where it was continually necessary to refinance land to cover cash deficits. And if the farmer was not working toward rectifying the problem, creditors would very likely pressure him to take action.

Section 16--Subroutines TAXES, INCAV, TAXCOM, MINTAX¹

Capturing the many tax laws in a model of this nature is a demanding task. This study focuses on those provisions considered the most basic, attempting to account for tax regulations that may be beneficial to farmers that are growing, while providing for the imposed limits on such regulations. The various depreciation techniques available have been discussed above. These subroutines provide for income averaging, investment tax credits (with carry-over of credits), excess deductions, and standard deductions. Provisions that limit the tax benefits include consideration of the alternative minimum tax and constraints in the allowed investment tax credit.

Tax laws, in existence as of 1980, are used to develop federal income and social security taxes. This study evaluates only sole proprietorships and families of four filing a joint return. Each taxable exemption is allowed \$1000, and it is assumed that itemized deductions in excess of the appropriate zero bracket (\$3400 for joint returns) will be 10 percent of the current year's family living expenses. Capital gains tax considerations are not made since there are no livestock, and it is assumed that old machinery is traded for new machinery.

Taxable farm income is defined as follows:

- 1) Current year's grain sales

¹ These subroutines are a modified version of Telplan 05, developed by M. P. Kelsey and S. B. Harsh, Department of Agricultural Economics, Michigan State University.

plus

2) Custom work

less

3) Taxable costs items

- Variable costs
- Fixed costs
- Depreciation costs

Outside income and earnings on investments are added; then this value is adjusted by family exemptions and excess itemized deductions, to obtain the current year's taxable income. The previous four years of taxable income are then used in conjunction with the current year's taxable income to calculate the tax commitment under income averaging. Illinois farm data is used to establish the previous four years of income for income averaging in the first years of the planning horizon. After the model has established a history of taxable income, these values are updated. Since the model does not provide for carry over or carry back of net operating losses (Tax refunds can be obtained in years of a net operating loss), negative taxable income values are maintained in the income averaging values. Although this is not technically correct, the intent is to offset the effect of ignoring the carry over and carry back provisions. It must also be recognized that due to the design of this study (i.e., forcing some positive taxable income in each year), there should be few years where a net operating loss is encountered. If they are encountered, the farm will likely be in a position where income tax payments will be very low for several consecutive years. These factors prevent serious distortions from occurring when using negative income in income

averaging. Another precaution involves limiting the income to no more than a negative \$10,000.

Once the federal tax liability under income averaging and the standard procedure (Schedule Y, 1980) has been computed, the method that minimizes taxes is chosen. Investment tax credits are calculated on 10 percent of the current year's investment on machinery and buildings. (Any unused investment credits from previous years is also added in.) The tax commitment is reduced by the allowed investment tax credit. Investment tax credits cannot exceed the tax liability or a value that would reduce taxes below the alternative minimum tax level. Finally, the maximum allowed investment tax credit becomes effective when both taxable income and tax credits exceed \$25,000.¹ Any investment credit that is not used is carried over to the next year.

Social security taxes are calculated as 9.3 percent of the taxable farm income with an upper limit of \$2762 (the 1981 levels). State taxes are set at 2.5 percent of the total taxable income (the current Illinois tax rate). The total tax liability is then the sum of state and federal income taxes and federal social security taxes.

Section 17--Subroutine FAMILY

Developing an appropriate relationship between family living expenditures and income is complicated by the differences in taxable income and accrual income due to cash accounting. Two possible

¹ The details of these limitations are from the Tax Code sections 46 and 55. They appear in sections 16.8-16.11 in Appendix B.

consumption functions were available: 1) a Cobb-Douglas type function developed by Richardson using the 1973 USDA Family Farm survey for the Midwest, and 2) a more general function developed by Dunn.¹ Both functions provide very similar patterns in consumption. The Dunn equation was selected because it provided the flexibility of adding a poverty level or a minimal acceptable level of consumption. The portion of consumption that is sensitive to income is added to this base level. It was not considered necessary to replicate the exact consumption behavior. Rather, the criteria for selection were that it be consistent across farms and provide for the primary goal of maintaining a minimum standard of living. The estimated Dunn function is:

$$\text{Consumption} = 10000 + 61 \times \text{After Tax Accrual Income}^{.5}$$

The minimum \$10,000 of consumption is allowed to compound at a 9 percent inflation rate over the planning horizon. Since there is a good deal of variability in year-to-year accrual income, consumption is bounded to maintain some stability. It was considered unacceptable to allow consumption to deviate greatly from one year to the next. This study uses an exponentially smoothed average family consumption to place an upper bound that is no more than 130 percent of the average and a lower bound that is no less than 80 percent of the average on each year's consumption. Again, potential users of the model have the flexibility to change these assumptions.

¹ Both of these functions were obtained through conversations with James Richardson, Department of Agricultural Economics, Texas A&M University.

Summary

The model uses the annual sequence presented above for each year and each farm that is developed. At the end of the desired planning horizon, measurement variables are retained and a new simulation is developed. This process continues until the desired number of Monte Carlo simulations are completed. At this point, the model uses subroutine ACC to calculate important measurement variables (See Section 18 in Appendix B).

CHAPTER V

DEVELOPING DATA FOR THE SIMULATION MODEL

Many have argued that the data requirements for a simulation model, such as the one developed for this study, are prohibitive. Although acquiring and synthesizing the data for this study was a formidable task, it did not prove to be insurmountable. This was largely due to a high-quality data base available from the University of Illinois. However, there are data gaps where heroic leaps of faith were required. This was particularly true in regard to land availability data and assumptions concerning the manner in which alternative commodity policies impact probability density functions for prices. Moreover, the difficulty of depending on historic data for a 10 year planning horizon cannot be overlooked. The tremendous changes in the U.S. and world economies over the last several years (largely due to the world energy situation) have cast a shadow on the forecasting ability of economists. And, the agricultural sector is certainly not isolated from an inflationary economy.

This chapter first examines the development of production relationships. Since this study focuses on growth, a primary concern is to develop production relationships with respect to farm size. After discussing production relationships, this chapter turns to the development of an Almon lag model for estimating land prices as a function of returns above non-land costs. From there, the focus turns to the land

market and the estimates of land availability for purchase or lease. Next, development of random price and yield data is presented. Finally, the development of "general equilibrium" economic assumptions is discussed.

Production Data

Several factors were considered essential in development of appropriate production relationships: 1) Since isolating the impact of farm size on cost was desirable, soil productivity and management needed to be controlled; 2) Cost items needed to be disaggregated in such a way to as allow for adjustments when yields deviated from the average; and 3) Cost items needed to be allocated to corn and soybeans in order to develop production decisions. Two sources of information provided the needed data: 1) the 1974-79 annual "Summary(s) of Illinois Farm Business Records" and, 2) the 1979 "Farm Earnings and Production Cost Summary."¹ Data from the first source provided total farm expenditures for various cost items and data from the second source provided budgets allowing for allocation of cost to corn versus soybeans. The total farm expenditure data were aggregated by farm size. There were six farm size classes for the 1974-77 record summaries and eight classes for the 1978-79 records. Although the preferred method of developing cost curves would use individual data, rather than grouped data, this is not considered a serious problem

¹ Table C.1 in Appendix C provides the actual 1978 data from the "Summary of Illinois Farm Business Records" in order to familiarize the reader with the presentation of the data. Tables C.2 and C.3 in Appendix C provide the University of Illinois' budget data for corn and soybeans, respectively.

since the averages in these classifications capture the important cost relationships. However, since most of the variability is lost when data are aggregated in this fashion, reporting the statistical properties of the cost equations would be meaningless. Therefore, this discussion presents only the procedure for developing the production relationships and the values that result from the equations used. (Specific cost equations appear in Appendix B, Sections 13.3, 13.4, and 13.15).

The first requirement involved the selection of the data set to be used. As noted, a major concern was to isolate the impact of farm size. As Miller summarizes the problem: "There is a surprising variation in costs among farms - a variation that is, except for the smallest units, not related to size. In fact, there is much more variation within than between size groups. Martin has observed that such variation is due to differences in technology, in management ability, and in resource productivity....Such factors appear to be much more important than size in causing cost differences among commercial farms" (p. 111). Selecting data from a group of farmers participating in the Illinois Farm Business Farm Management Association provided some degree of homogeneity. It is likely that such farmers have similar managerial skills and use similar technology. Another control was introduced by using only data from farms with soil productivity ratings of 85-100. (The University of Illinois defines these soils as being "nearly level well-drained prairie soils.") These farms are also highly specialized with over 95 percent of the tillable acres planted to corn and soybeans.

Adjusting the total farm cost to allow only for costs that were incurred in growing corn versus soybeans was a complicated task. The first step involved adjusting acres to obtain an actual acres planted to corn versus soybeans. Then each cost item was allocated to corn versus soybeans on a per acre basis. Finally, since six years of data are used, each year is placed in 1979 dollars, using the annual budgets on each item to calculate the year-to-year inflation factor. Figure 5.1 illustrates the development of 1978 fertility cost for the farm class of 260-339 tillable acres. An identical procedure is used for each of the variable cost items: 1) soil fertility, 2) machinery fuel and repair, and 3) seed and crop. A similar procedure is used to develop per acre values for items that are not allocated to corn and soybeans (those that are whole farm values): 1) book value for machinery, 2) book value for buildings, 3) building repair, 4) insurance and miscellaneous expenses, 5) total labor used, 6) family labor used, 7) corn yields, and 8) soybean yields. All of these adjusted data were examined to identify consistent patterns (i.e., economies of size). For those data where such a relationship appeared to exist, quadratic curves were fit using ordinary least squares on the 40 observations (six classes times the four years 1974-77 and eight classes times the two years 1978-79). For data that appeared to have more diffuse patterns (such as yield data and machinery and building data), the data were averaged across years to obtain a value to correspond with tillable acres. These raw data are used in conjunction with a table look-up function to develop values for which there are no data points available (i.e., A linear extrapolation is used between data points). Since reliable data was not available for

FIGURE 5.1
EXPOSITION OF COST DATA DEVELOPMENT

Using 1978 Fertility Cost for Farms with 260-339 Tillable Acres

Step 1 - Calculate the total percent of tillable acres in production:

$$\begin{aligned}\text{Percent} &= \text{Corn Percent} + \text{Soybean Percent} + \text{Other Crops} \\ .97 &= .51 + .45 + .01\end{aligned}$$

Step 2 - Calculate the total tillable acres in production:

$$\begin{aligned}\text{Productive Acres} &= \text{Percent} \times \text{Average Tillable Acres for Class} \\ 280 &= .97 \times 289\end{aligned}$$

Step 3 - Calculate the actual percent of productive acres in corn versus soybeans:

$$\begin{aligned}\text{Percent Corn} &= \text{Corn Percent} \div \text{Percent} \\ .526 &= .51 \div .97\end{aligned}$$

$$\begin{aligned}\text{Percent Soybean} &= \text{Soybean Percent} \div \text{Percent} \\ .464 &= .45 \div .97\end{aligned}$$

Step 4 - Calculate an allocation factor that breaks down one acre of land for corn versus soybeans (this accounts for land in other production):

$$\begin{aligned}\text{Budget Factor Corn} &= 1978 \text{ Fertility Cost Soybeans} \div 1978 \text{ Fertility Cost Corn} \\ .32 &= 13 \div 41\end{aligned}$$

$$\begin{aligned}\text{Budget Factor Soybeans} &= 1978 \text{ Fertility Cost Corn} \div 1978 \text{ Fertility Cost Soybean} \\ 3.15 &= 41 \div 13\end{aligned}$$

$$\begin{aligned}\text{Acre Factor Corn} &= 1 \div (\text{Percent Soybean} \times \text{Budget Factor Corn} + \text{Percent Corn}) \\ 1.48 &= 1 \div (.46 \times .32 + .53)\end{aligned}$$

$$\begin{aligned}\text{Acre Factor Soybean} &= 1 \div (\text{Percent Corn} \times \text{Budget Factor Soybean} + \text{Percent Soybean}) \\ .47 &= 1 \div (.53 \times 3.15 + .46)\end{aligned}$$

Step 5 - The final step involves development of a per acre cost for both corn and soybeans and placing this cost into 1979 dollars:

$$\begin{aligned}\$ \text{ Per Acre Corn} &= \text{Total Fertility Expenditures} \div \text{Productive Acres} \times \text{Acre Factor Corn} \\ 41.95 &= 7937 \div 280 \times 1.48\end{aligned}$$

$$\begin{aligned}\$ \text{ Per Acre Soybean} &= \text{Total Fertility Expenditures} \div \text{Productive Acres} \times \text{Acre Factor Soybean} \\ 13.32 &= 7937 \div 280 \times .47\end{aligned}$$

$$\begin{aligned}\text{Corn Fertility Cost (1979 \$ / Acre)} &= \$ \text{ Per Acre Corn} \times \text{Fertility Inflation Factor} \\ \$52.02 &= 41.95 \times 1.24\end{aligned}$$

$$\begin{aligned}\text{Soybean Fertility Cost (1979 \$ / Acre)} &= \$ \text{ Per Acre Soybean} \times \text{Fertility Inflation Factor} \\ \$16.52 &= 13.32 \times 1.24\end{aligned}$$

Note: The 1979 Illinois budget data for Central Illinois allocates \$50/acre for corn fertility and \$16/acre for soybean fertility. The average size of the farm for these budgets is 525 acres.

farms larger than 1600 acres, production relationships beyond 1600 acres use the per acre value at 1600 acres. Tables 5.1-5.3 demonstrate the properties of the production relationships under average yield and average machinery investment conditions. (Recall that costs and yields are adjusted to reflect machinery complements and the random deviation from the average yield.)

The Almon Lag Land Model

Hauschen and Herr (1980) developed an Almon (polynomial lag) model to explain U.S. farm real estate prices as a function of the previous year's net earnings (above land costs) and a capitalization rate. They found that a second degree, eight year lag model had the most desirable statistical properties of eighteen alternative models tested. This study uses a similar lag model to allow for differences in land prices as a function of the random draws on prices and yields and the general economy's inflation rate.

Data for development of the Almon lag used in this study were compiled from a number of sources, including the Illinois budget data and Scott's article "Forecasting the Prices of (Illinois) Farmland for 1990". A budgeted return above land costs was calculated for years 1959-79, using the prices and yields over this time period and the non-land cost estimates. Percent of acres planted to corn versus soybeans was based on the trends over this period (65 percent corn in 1959-65, 60 percent corn in 1966-69, and 55 percent corn in 1970-79). Using these percentages, a budgeted return to one acre was estimated. In addition to the budgeted returns to land, it was hypothesized that interest rates on land loans and the inflation rate in the general

TABLE 5.1

VARIABLE COSTS RELATIONSHIPS FOR CORN BY FARM SIZE

TILLABLE ACRES	YIELD BU/ACRE	SOIL FERTILITY COSTS [--- DOLLARS PER ACRE ---]	MCHY. FUEL & REPAIR COSTS	SEED & CROP COSTS	VARIABLE COSTS \$/BU
100	137.3	51.58	24.18	37.39	0.82
200	137.3	52.15	23.91	37.08	0.82
300	139.1	52.62	23.68	36.74	0.81
400	140.2	52.97	23.49	36.36	0.80
500	140.7	53.21	23.33	35.95	0.80
600	141.0	53.33	23.21	35.50	0.79
700	141.1	53.34	23.12	35.01	0.79
800	141.0	53.23	23.07	34.49	0.79
900	141.0	53.02	23.06	33.92	0.78
1000	141.0	52.68	23.08	33.32	0.77
1100	141.2	52.24	23.13	32.69	0.76
1200	141.5	51.67	23.22	32.02	0.76
1300	141.7	51.00	23.35	31.31	0.75
1400	141.4	50.21	23.51	30.56	0.74
1500	140.8	49.31	23.71	29.78	0.73
1600	140.2	48.29	23.94	28.96	0.72
1700	140.2	48.29	23.94	28.96	0.72

NOTE - THESE RELATIONSHIPS REPRESENT AVERAGE VALUES FOR YIELDS AND MACHINERY COMPLEMENT. DEVIATIONS FROM THE AVERAGE YIELDS AND THE AVERAGE MACHINERY COMPLEMENT WILL INFLUENCE THE COSTS PER BUSHEL. IT SHOULD ALSO BE NOTED THAT ALL FACTORS REMAIN AT A CONSTANT RATE PER ACRE AFTER REACHING 1600 ACRES. ALL COSTS ARE IN 1979 DOLLARS.

TABLE 5.2

VARIABLE COSTS RELATIONSHIPS FOR SOYBEANS BY FARM SIZE

TILLABLE ACRES	YIELD BU/ACRE	SOIL FERTILITY COSTS [--- DOLLARS PER ACRE ---]	MCHY. FUEL & REPAIR COSTS	SEED & CROP COSTS	VARIABLE COSTS \$/BU
100	42.5	15.96	20.73	24.78	1.45
200	42.5	15.95	20.57	25.11	1.45
300	43.6	15.93	20.43	25.38	1.42
400	43.6	15.91	20.30	25.60	1.42
500	44.0	15.90	20.20	25.76	1.40
600	44.2	15.87	20.11	25.88	1.40
700	44.4	15.85	20.05	25.94	1.39
800	44.4	15.82	20.00	25.95	1.39
900	44.5	15.80	19.97	25.90	1.39
1000	44.5	15.77	19.96	25.80	1.38
1100	44.4	15.74	19.97	25.65	1.38
1200	44.3	15.70	19.99	25.45	1.38
1300	44.2	15.67	20.04	25.19	1.38
1400	44.1	15.63	20.11	24.88	1.37
1500	44.0	15.59	20.19	24.52	1.37
1600	43.5	15.55	20.29	24.10	1.38
1700	43.5	15.55	20.29	24.10	1.38

NOTE - THESE RELATIONSHIPS REPRESENT AVERAGE VALUES FOR YIELDS AND MACHINERY COMPLEMENT. DEVIATIONS FROM THE AVERAGE YIELDS AND THE AVERAGE MACHINERY COMPLEMENT WILL INFLUENCE THE COSTS PER BUSHEL. IT SHOULD ALSO BE NOTED THAT ALL FACTORS REMAIN AT A CONSTANT RATE PER ACRE AFTER REACHING 1600 ACRES. ALL COSTS ARE IN 1979 DOLLARS.

TABLE 5.3

VARIOUS PRODUCTION AND COSTS RELATIONSHIPS RELATED TO FARM SIZE						
TILLABLE ACRES	MACHINERY \$/AC	BUILDING \$/AC	BUILDING REPIAR \$/AC	INSURANCE MISC \$/AC	TOTAL LABOR MONTHS	FAMILY LABOR MONTHS
100	204.80	131.40	3.39	8.27	9.9	9.9
200	204.80	131.40	3.09	7.81	11.3	10.7
300	201.10	99.00	2.82	7.40	12.8	11.4
400	206.41	98.88	2.59	7.04	14.5	12.1
500	202.55	97.68	2.41	6.73	16.3	12.9
600	197.71	97.20	2.25	6.47	18.2	13.6
700	195.32	93.60	2.14	6.27	20.3	14.3
800	202.20	79.20	2.07	6.12	22.5	15.1
900	203.96	75.69	2.03	6.02	24.8	15.9
1000	205.71	72.18	2.03	5.97	27.2	16.6
1100	202.64	73.05	2.07	5.97	29.8	17.4
1200	199.32	74.16	2.15	6.03	32.5	18.0
1300	196.00	75.27	2.26	6.13	35.4	18.0
1400	194.22	74.67	2.42	6.29	38.3	18.0
1500	193.11	73.33	2.61	6.51	41.4	18.0
1600	192.00	72.00	2.84	6.77	44.6	18.0
1700	192.00	72.00	2.84	6.77	48.0	18.0
1800	192.00	72.00	2.84	6.77	51.5	18.0
1900	192.00	72.00	2.84	6.77	55.1	18.0
2000	192.00	72.00	2.84	6.77	58.9	18.0

NOTE - MANY OF THE COSTS REMAIN AT A CONSTANT RATE PER ACRE AFTER REACHING 1600 ACRES. ALSO, FAMILY LABOR IS RESTRICTED TO A MAXIMUM OF 18 MONTHS FOR THIS STUDY. ALL COSTS ARE IN 1979 DOLLARS.

economy are factors influencing the price of land (Table 5.4 presents the data used for the model). A number of lag models were developed using the polynomial lag routine in the time series processor package. These models were compared and a second degree, six year lag model was chosen based on predictive properties (R^2) and the behavior of the lagged relationships (i.e., It is believed that recent years have a progressively greater influence on the price of land until reaching a peak and declining for the latest years in the lag model). The general form of the model is expressed as follows:

$$V_t = C + b_1 \text{LAGFLB} + b_2 \text{CPI} + b_3 \text{BRET} + U_t$$

where:

V_t = the index for Illinois farm land (1979 = 100)

C = the constant term

LAGFLB = the annual federal land bank interest rate, lagged one year

CPI = the consumer price index (1979 = 100)

$\text{BRET} = (w_0 \text{BRET} + w_1 \text{BRET}_{t-1} + \dots + w_n \text{BRET}_{t-n})$
 where the "w" terms represent weights placed on previous returns that follow a second degree polynomial

U_t = the disturbance term in period t

All observations are in nominal terms. Using the consumer price index converts the values into real terms. The results of the second degree, six year lag appear in Table 5.5. All signs are as expected, and the lag structure follows an acceptable pattern.

TABLE 5.4
DATA USED FOR ALMON LAG¹

Year	Budgeted Return	Federal Land Bank Mortgage Interest Rate	Illinois Land Index	Consumer Price Index
1959	\$ 37.83	5.51	16.10	42.03
1960	42.42	6.00	16.10	42.71
1961	45.58	5.64	15.65	43.14
1962	48.99	5.60	16.10	43.62
1963	52.35	5.60	17.00	44.15
1964	51.40	5.60	17.69	44.73
1965	59.60	5.60	19.05	45.50
1966	53.20	5.82	21.32	46.80
1967	59.20	6.02	22.68	48.15
1968	33.20	6.84	23.58	50.17
1969	56.00	7.82	24.72	52.86
1970	35.40	8.68	24.26	55.99
1971	70.80	7.86	24.49	58.40
1972	63.60	7.42	26.30	60.33
1973	161.70	7.48	29.25	64.08
1974	130.90	8.14	39.23	71.11
1975	180.30	8.69	47.39	77.61
1976	145.00	8.66	58.96	82.09
1977	120.30	8.50	80.04	85.36
1978	107.70	8.50	88.43	90.90
1979	141.10	9.25	100.00	100.00

¹ Data compiled from a variety of sources from the University of Illinois.

TABLE 5.5
RESULTS OF ALMON LAG, ILLINOIS LAND MODEL, 1959-79

<u>Variable</u>	<u>Coefficient</u>	<u>Standard Error</u>	<u>t-statistic</u>
C	-23.82	3.39	-7.02
LAGFLB	-210.06	79.12	-2.65
CPI	.723	.119	6.09
<u>Distributed Lags on Return</u>			
$w_0(t)$	.0068	.012	.58
$w_1(t-1)$	.069	.0094	7.30
$w_2(t-2)$	.105	.0092	11.41
$w_3(t-3)$	.117	.0091	12.82
$w_4(t-4)$	.103	.0078	13.21
$w_5(t-5)$	.064	.0048	13.28
<u>R²</u>	<u>F-statistic</u>	<u>Durbin-Watson</u>	
.997	764.03	2.75	

Land Availability Data

Discussion of subroutine LANEXP in Chapter IV briefly introduced the assumptions concerning land availability. This section develops the empirical foundation for these assumptions. Frequency data by parcel size for farm land transfers from 1975-80 were obtained from the Illinois State Statistical Office of the Economics and Statistics Service. These data were used in conjunction with estimates from the "Farm Real Estate Market Developments" on transfers per 1000 farms from 1977-80 to develop annual availability of land for the general area being studied. Districts four and five (East and Central Illinois) were analyzed. By assuming that the relevant land market (for the farms in this study) is a circle with a 10-mile radius, there are roughly 201,050 acres in the market domain. This is roughly 6.2 percent of the total land base in both Districts four or five (or 3.1 percent of the combined 6,457,000 total acres in these Districts). Using the 1977 estimate of total farms in these two districts (18,212), the estimated annual transfers in a 10-mile radius (There are approximately 567 farms in this market) are 22.9. Recognizing that roughly 15 percent of the farm transfers involve estate settlements, this number is adjusted to reflect only sales. This gives an estimated transfer of 19.5 parcels per year. Using the frequency data by size parcel, these 19.5 parcels were distributed among eight discrete size parcels as presented in Table 5.6.

Johnson uses a similar approach to develop the annual probability of farm land becoming available for leasing in the general area of this study (more specifically, Champaign County, Illinois). Again,

TABLE 5.6

ANNUAL LAND AVAILABILITY PROBABILITIES AND FREQUENCY FOR
AN EFFECTIVE MARKET WITH A 10 MILE RADIUS

Purchase Land			
<u>Size (acres)</u>	<u>Probability by Size</u>	<u>Number of Parcels</u>	
40	.21	4.1	
80	.296	5.8	
120	.117	2.2	
160	.143	2.8	
200	.080	1.6	
240	.054	1.0	
360	.079	1.5	
640	.024	<u>.5</u>	
Total Parcels		19.5	
Total acres		2,765	
1.4% turnover rate			
Lease Land ¹			
<u>Size (acres)</u>	<u>Probability by Size</u>	<u>5% Turnover Rate Number of Parcels</u>	<u>10% Turnover Rate Number of Parcels</u>
40	.20	32.7	65.3
80	.35	28.6	57.2
120	.15	8.2	16.3
160	.20	8.2	16.3
200	.05	1.7	3.3
240	.05	<u>1.4</u>	<u>2.7</u>
Total Parcels		80.4	160.8
Total acres		6,535	13,069

¹ Reliable estimates on the annual turnover rate of lease land were not available. However, it is likely to be closer to 5 percent than 10 percent.

assuming that the effective market is a 10-mile radius and assuming that roughly 65 percent of the land is rented, Table 5.6 also includes the number of discrete size parcels available for lease under two conditions - an annual turnover rate of 5 and, also, 10 percent.

Johnson's survey revealed that rental land was allocated with the following frequency: 40 acres, 22%; 80 acres, 42%; 120 acres, 15%; and 160 acres, 21%. Since the Johnson study is nearly ten years old and during this time farms have become larger, this study modified these frequencies in the following manner: 40 acres, 20%; 80 acres, 35%; 120 acres, 15%; 160 acres, 20%; 200 acres, 5%; and 240 acres, 5%.

Once the total number of parcels of lease and purchase land have been determined, the next issue to be determined is the number of farms which will be competing for the available land. Illinois census data indicate that there are approximately 567 farmers in the specified market. Since the financial requirements for purchasing Illinois farm land are restrictive, it is assumed that only commercial farms with sales of \$100,000 or more will be able to compete for the land. (This assumption may be too restrictive; however, the intent here is to allow the most available land possible - within reason). Census data indicate that 11 percent of Illinois farms have yearly gross sales of \$100,000 and greater. This leaves approximately 66 farms to compete for roughly 19 parcels of purchase land in any given year; that is, 3.5 farms for each parcel of land. This study uses four farms to compete for the same parcel of purchase land each year.¹

¹ Since development of these estimates is highly questionable, the impact of allowing for two times as much land availability is tested in Chapter VI under sensitivity analyses.

(Random size parcels are created in the manner specified below.) A similar procedure can be used to determine the number of farmers competing for a parcel of lease land. The financial restrictions on obtaining lease land are not as restrictive as on purchase land. If qualified farms are limited to those with 180 acres or more, this leaves roughly 58% of the 567 farmers in contention for lease land (or 329 farmers). Since the purchase land was used to determine how many farmers would be modeled in this study, the question now becomes how many parcels of lease land are available for 82 groups of four farmers (329 divided by 4)? Under the 5 percent turnover assumption, there are approximately 80 parcels of lease land available per year. Therefore, one parcel of lease land would be available each year for the four farmers in this study. If the turnover rate for lease land is closer to 10 percent, this provides for roughly two parcels of lease land for the four farms (i.e., 160 parcels for 80 groups of four farms). Under most analyses, this study assumes that the turnover rate is closer to 5 percent, thus allowing for only one parcel of lease land per year to be allocated to a group of four farms. However, sensitivity is performed to demonstrate the impact of a 10% turnover rate.

Admittedly, the assumptions made here are tenuous. The intent is to provide for availability of land that is reasonable. Many farmers may be unwilling to consider an area as large as a 10-mile radius circle when making land expansion decisions. Even though these assumptions concerning land availability may be considered too optimistic by many, it should be stressed that they are considerably more realistic (restrictive) than most previous growth studies that have

used simulation models.

Finally, a few comments addressing the determination of the particular size parcel of lease and/or purchase land in any given year is in order. A uniform random number (0 thru 1) determines the size of the parcel. Values of the random number correspond to the probability of discreet size parcels of land becoming available in any given year. For example, since there is only a 2.4 percent chance that the purchase parcel will be 640 acres, if the random number is equal to or greater than .976, then a 640 acre parcel becomes available. Likewise, since the odds of a 360 acre parcel becoming available are 7.9 percent, if the random number is between .976 and .897, a 320 acre parcel becomes available, etc. The same procedure is used to determine the size of the lease parcel. (Any sensitivity to allow for two parcels of lease and/or purchase land in a given year duplicates the size of the first draw.) All random size parcels selected are stored on a data file in order to insure the same sequence when performing sensitivity analyses. This is especially important when only a few (i.e., 20 or less) simulations are analyzed.

Random Prices and Yields

This section shall first describe the procedure for developing random prices and yields, emphasizing the data requirements and the procedure used to develop the data. Next, the data that were used to develop random prices and yields is presented. Finally, the statistical properties of the random data sets are presented.

Procedure for Developing the Data

Since one of the objectives of this study is to examine the impact of more stable versus less stable commodity policies (and resulting prices) on farms of different size, generating reasonable data sets of up to 15 years of random national prices and farm level yields was considered essential. In order to accomplish this task, the probability density functions (probability distributions) for national corn and soybean prices and for farm level corn and soybean yields have to be developed. It is unacceptable to develop random prices and yields in isolation. There are also many relationships within and between years that must be accounted for. The price of corn in the current year is correlated with the price of soybeans in the current year and with the price of corn and soybeans in the previous year. If there is a good crop year and corn yields are high, it is reasonable to expect soybean yields to be high. In most regions, accounting for price correlations and within-year yield correlations would be sufficient. It is generally acceptable to assume that national prices are not correlated with farm level yields. However, due to the national importance of the region being studied, there is a negative relationship between yields and national prices. If farmers in Central Illinois have a bad crop year, there is a high probability that national prices will be above average. This increases the amount of correlation to be accounted for.

In order to develop random yields and prices that reflect the appropriate correlations and the properties of their individual density functions, it is necessary to develop multivariate

distributions. Previous studies have generally used univariate process generators or multivariate normal process generators to develop stochastic factors for Monte Carlo analysis.¹ There are two reasons why forcing the stochastic values in this study into normal distributions was considered unacceptable: 1) The commodity programs place upper and lower bounds on prices that cannot be properly accounted for by a normal distribution, and 2) A normal distribution is symmetrical around the mean, and there is reason to believe that prices are skewed to the right and yields are skewed to the left. Therefore, the process generator should allow for upper and lower bounds as well as abnormally shaped distributions. The beta distribution has these desired properties. A multivariate beta process generator (developed by King and modified by Hoskin) met all of the requirements outlined above.² The data requirements for this generator are: 1) the means, 2) the variances, 3) a lower bound, and 4) an upper bound of each distribution; and 5) the correlation matrix between each stochastic variable. The discussion now turns to development of these data.

Individual farm yield data were obtained from the University of Illinois. These 1972-79 data were carefully selected by personnel (from the Illinois Farm Business Farm Management Association) at the University of Illinois. Effects of farm growth on yields (and their

¹ King defines a process generator as being "a procedure, usually programmed for implementation on a computer, which generates pseudo-random sample observations from a specified probability distribution" (p. 208).

² The reader is referred to King (1979) and Hoskin (1980) for details on the operation of this process generator.

distributions) were isolated by selecting a sample of farms that had not grown over this period. The data were also sorted by soil type, leaving only those farms with an average soil rating of 85 and above.¹ (This left 43 usable observations.) Recall that the intent here is to develop representative farm level yield distributions; thus, the need exists for controlling the impact of growth and soil type on yields. Naturally, this is an abstraction from reality. But again, the only way to run controlled experiments is to provide for the same yield distributions (and random deviations around the average yield) across the farms in this study.

Once a usable sample was developed, the next step was to normalize the data across farms. This was necessary in order to control for variability in average yields across farms. The desire was to obtain deviations around the mean.² Therefore, the mean yield was calculated for each farm and subtracted from each year's actual yield in order to obtain deviations around the mean. These data were analyzed individually (for each farm across the eight years) and

¹ Only farms with soil ratings of 85 and above are used in this study. However, in sorting through the yield data, some interesting questions regarding the relationship between farm size and soil type arose. These data suggest that larger farmers may be better able to obtain better soils (i.e., There was a positive correlation between farm size and soil type). Since there is also more yield variability with poorer soils, this places smaller farmers in a more risky environment than larger farmers (assuming there is a relationship between soil quality and farm size). Since yields could be expected to be lower more often for smaller farmers, this would explain some of the apparent economies of size.

² Recall that the model allows for expected yields to vary based on farm size, machinery complement, and nitrogen application (for corn). Therefore, distributions that reflect deviations from the mean were required. Under this approach, the means are zero.

collectively (for all farms across the eight years). Although there was variability in distributions across farms (indicating that all factors were not controlled), it was still necessary to select the appropriate parameters to develop one distribution for corn and one for soybeans.¹ This involved both empirical analysis and researcher insight. It was determined that the variances from the collective data captured individual farm yield variability in an acceptable manner. (Frequency tables for individual farm data were developed and compared to the collective estimates to determine how representative the collective estimates were.) Moreover, since there were only eight years of data, upper and lower bounds were selected on the basis of the highest and lowest yields in the entire data set. These values were not from the same farms and it could be argued that they are extremes. Had there been more years of data available, the likelihood that these extremes would appear across several farms would increase. Next, the within-year correlation between corn and soybeans was calculated individually and collectively. Again, the collective estimate was selected since individual data indicated that it was a value that appeared for many individual farms. No consistent patterns of between-year yield correlation were found (i.e., Frequency data indicated a relatively equal mix of positive and negative correlations). Therefore, this study assumes yield correlations between years is zero. Finally, individual farm level yields were correlated with national prices. Again, frequency data were used in conjunction

¹ Parameters for all distributions are presented in Table 5.7 in the next section.

with the collective estimate to select a reasonable estimate. Of the forty-three farms, less than ten percent had positive correlations between yields and prices. Well over half had negative correlations in excess of $-.3$ for both corn and soybeans.

Turning to the development of parameters for price distributions, use of only historical data to generate distributions was considered unacceptable.¹ Institutional changes (i.e., commodity policy changes) have occurred approximately every four years as major farm legislation was modified throughout the 1960s and 70s. Such policies have likely altered both the shape and the expected values of price distributions.

The problems associated with selecting one price distribution for each commodity to be used over a relatively long planning period should not be taken lightly. First, there is the pervasive issue of how institutional changes during a 10-15 year period (as used in this study) may alter the distributions. In addition, there is no such thing as a stable price distribution. World yields from season to season will alter the slope of the next season's distribution. Stocks (carryovers), livestock numbers, export policies, import policies, macroeconomic policies, and a host of other factors will alter each year's price distribution. Capturing these transitions is beyond the scope of this study and likely beyond the current state of the arts in the economics profession. The best that can be hoped for,

¹ Use of historical data to generate the distributions for yield was not a problem. Over the 1972-79 period there were few technological and/or institutional changes which would be expected to change the distributional shapes. It is assumed that the shape of the distributions will remain nearly the same over the time period of this study. This means that as the averages increase through time, the distributions move along with them.

at this stage, is to develop distributions that represent long run trends under one set of institutional arrangements. (Chapter II discusses the necessity of fixing policies over the planning period.) This, also, is no trivial task.

Since commodity policies will influence the distributions, a technique that made use of both historical data and commodity programs was needed. Gardner, in his article entitled "The Farmer's Risk and Financial Environment Under the Food and Agriculture Act of 1977", presented his views on how the 1977 legislation would alter the probability distributions of commodity prices received by farmers. He concluded that the 1977 act would reduce the price variability, mainly due to the manner in which the loan rate reduces the probability of prices falling below that level (i.e., The distributions are truncated at the loan rate). In addition, providing for a farmer-held reserve program that has built-in incentives (i.e., release and call levels) for releasing grain when prices rise above specified levels also reduces the probability of prices being above those levels. Such a "stability policy" reduces a major source of risk in cash grain farming - variability in prices.

This study makes use of a Monte Carlo technique developed by Armstrong which uses an international agricultural commodity econometric model (the MSU-AG model).¹ Basically, this technique uses random yields from several global regions to develop a number of world

¹ The technique is developed in Armstrong's forthcoming Master thesis at Michigan State University. Details on the policy assumptions and the supply and demand equations can be found in Eric Wailes' forthcoming Ph.D. dissertation.

supply scenarios (300 Monte Carlo iterations are generally used). These supply conditions are subjected to the series of supply and demand relationships in the MSU-AG model, given the initial stock levels and market conditions. This allows for development of frequency data on prices which can be used to develop important parameters for national annual average price distributions. Naturally, the distributions that are developed are only for the upcoming season (i.e., They are contingent upon the current market conditions and policies). Therefore, it was determined that the market conditions in the fall of 1980 were fairly representative of long-run trends, and density functions were developed using these market conditions. These distributions provide a base line for current (1980) commodity policies. Historical data and heroic assumptions are used to develop distributions that deviate from this base line. First, a relatively free market with lower loan rates and higher release levels for reserves (or no reserves at all) is developed by changing the upper and lower bounds, increasing the variation, and slightly increasing the average prices. A more restrictive market is developed by increasing the lower bounds (the loan levels), decreasing the upper bounds (the call levels), decreasing the variation, and slightly decreasing the average prices. Admittedly, the procedures used to develop the base distributions are somewhat subjective. However, developing these three scenarios, from which to draw prices, serves the objectives of this study. The exact relationships are not essential for this first analysis to investigate the impact of alternative commodity policies on farms of different size. If this study finds important relationships, then it would be more important for future

research to use some of the techniques described above to develop more accurate price distributions under specific commodity policy scenarios or, possibly, to attempt to capture transitional distributions.

Parameters for corn and soybean price distributions are developed as discussed above. In addition to these parameters, recall that within and between year price correlations are required. Again, there are problems associated with using historical data to develop these correlations; however, there is no alternative. Further, the issue of whether to use the same correlations across the three commodity (and price distributions) scenarios is unclear. Basically, this study examines correlations over different spans of time to identify changes through time. Then, on the basis of these empirical estimates, the values that are believed to be most likely for the future are selected. (It should be emphasized that, for the most part, the several time periods analyzed did not produce drastically different correlations.) Finally, since knowledge concerning just how the different price distributions may alter within and between year correlations is not available, the same correlations are used under all three scenarios.

Parameters Used to Develop Random Prices and Yields

As the discussion above indicates, the data requirements for the Multivariate Beta processor are: 1) means, 2) variances, 3) lower bounds, 4) upper bounds, and 5) correlations. This study requires up to fifteen years of data for analysis. Therefore, there are four variables across fifteen years to be generated. In addition, the study allows for up to one hundred iterations (or random draws) when performing analyses. This results in 6,000 random numbers for each

data set (i.e., 4 variables x 15 years x 100 set-iterations). Table 5.7 presents the parameters for all distributions under the three policy scenarios outlined above. The correlation matrix is a 60 x 60 (i.e., 4 variables x 15 years). Because all correlations beyond two years are set at zero, only the values near the diagonal are relevant and only two years of correlation values need be presented. Table 5.8 presents two years of correlation values in an 8 x 8 matrix and in a summary form for easy viewing.

Properties of Actual Random Prices and Yields Used

Using the parameters and correlations presented in Tables 5.7 and 5.8, in conjunction with the Multivariate Beta generator, yields the data sets used in the analyses in the following chapters. This section presents the basic statistics for the fifteen year planning periods under each of the three commodity policy scenarios. In addition, each set of data is analyzed in order to present frequency tables and cumulative distributions for a better understanding of the properties of the distributions used. Finally, the random prices and yields are used to generate a budgeted return above land cost; and, in turn, these returns are used in the Almon lag land model to demonstrate how the three sets of data may be expected to impact returns, risk, and land prices.

First, Table 5.9 presents the means, variances, and skewness for each of the fifteen years of random corn and soybean yields. These draws are precisely the same for each of the commodity policy scenarios. Table 5.10 presents similar statistics for corn prices under the three scenarios and Table 5.11 presents these statistics for

TABLE 5.7

PARAMETERS FOR PROBABILITY DISTRIBUTIONS - USED TO GENERATE
MULTIVARIATE BETA DISTRIBUTIONS¹

<u>Yield Parameters (remain the same for all policy scenarios)</u>							
<u>Corn Yields</u>				<u>Soybean Yields</u>			
<u>Mean</u>	<u>Std. Deviations</u>	<u>Upper Bound</u>	<u>Lower Bound</u>	<u>Mean</u>	<u>Std. Deviations</u>	<u>Upper Bound</u>	<u>Lower Bound</u>
0	19.0	44.9	-57.4	0	6.12	14.8	-22.4
<u>Price Parameters - Current Policy (1980)</u>							
<u>Corn Price</u>				<u>Soybean Price</u>			
<u>Mean</u>	<u>Std. Deviations</u>	<u>Upper Bound</u>	<u>Lower Bound</u>	<u>Mean</u>	<u>Std. Deviations</u>	<u>Upper Bound</u>	<u>Lower Bound</u>
\$2.67	.33	\$3.60	\$2.25	\$6.95	.843	\$10.04	\$5.90
<u>Price Parameters - Quasi-Free Market</u>							
<u>Corn Price</u>				<u>Soybean Price</u>			
<u>Mean</u>	<u>Std. Deviations</u>	<u>Upper Bound</u>	<u>Lower Bound</u>	<u>Mean</u>	<u>Std. Deviations</u>	<u>Upper Bound</u>	<u>Lower Bound</u>
\$2.72	.63	\$4.26	\$1.90	\$7.00	.949	\$12.00	\$4.80
<u>Price Parameters - Restrictive Market</u>							
<u>Corn Price</u>				<u>Soybean Price</u>			
<u>Mean</u>	<u>Std. Deviations</u>	<u>Upper Bound</u>	<u>Lower Bound</u>	<u>Mean</u>	<u>Std. Deviations</u>	<u>Upper Bound</u>	<u>Lower Bound</u>
\$2.63	.28	\$3.50	\$2.33	\$6.92	.775	\$9.30	\$6.20

¹ These parameters are in 1980 values and are used across the fifteen years. Recall that the model allows for user assumptions to vary trends on yields and prices. Also, recall that yields are presented as deviations around the mean.

TABLE 5.8

CORRELATIONS - WITHIN AND BETWEEN YEARS FOR CORN AND SOYBEAN PRICES
AND YIELDS - USED TO GENERATE MULTIVARIATE BETA RANDOM VALUES.¹

	CP _{t=1}	SP _{t=1}	CY _{t=1}	SY _{t=1}	CP _{t=2}	SP _{t=2}	CY _{t=2}	SY _{t=2}
CP _{t=1}	1.0	.5	-.27	.0	.5	.3	.0	.0
SP _{t=1}	.5	1.0	.0	-.27	.2	.35	.0	.0
CY _{t=1}	-.27	.0	1.0	.55	.0	.0	.0	.0
SY _{t=1}	.0	-.27	.55	1.0	.0	.0	.0	.0
CP _{t=2}	.5	.2	.0	.0	1.0	.0	-.27	.0
SP _{t=2}	.3	.35	.0	.0	.0	1.0	.0	-.27
CY _{t=2}	.0	.0	.0	.0	-.27	.0	1.0	.55
SY _{t=2}	.0	.0	.0	.0	.0	-.27	.55	1.0

¹ This 8 x 8 matrix is expanded to a 60 x 60 for 15 years.

CP = Corn Price
SP = Soybean Price
CY = Corn Yield
SY = Soybean Yield

Summary of Within Year Correlations

Corn and Soybean Price	=	.5
Corn Yield and Corn Prices	=	-.27
Soybean Yield and Soybean Prices	=	-.27
Corn Yield and Soybean Yields	=	.55

Summary of Between Year Correlations

Corn Prices Between Years	=	.5
Corn Price _t and Soybean Price _{t+1}	=	.3
Soybean Prices Between Years	=	.35
Soybean Price _t and Corn Price _{t+1}	=	.2

TABLE 5.9
STATISTICS FOR RANDOM CORN AND SOYBEAN YIELDS¹

	Corn Yields			Soybean Yields		
	Means	Std. Deviations	Skewness	Means	Std. Deviations	Skewness
1980	-1.4	17.9	-24.9	-.3	5.7	-1.1
1981	1.6	19.8	-78.8	.5	6.8	-23.2
1982	-1.3	19.8	78.3	-.2	6.8	.4
1983	1.8	19.5	-133.1	-.1	6.5	-20.4
1984	1.2	19.8	-13.9	.7	5.6	-15.0
1985	2.2	17.9	-150.1	-.2	5.5	4.6
1986	.9	19.2	-71.7	.8	6.0	-16.5
1987	1.3	18.7	-5.0	.3	6.3	5.3
1988	-.3	19.0	-43.9	.8	6.9	-20.2
1989	.5	17.3	-21.0	.2	6.0	-10.9
1990	1.4	20.8	-80.5	.6	6.9	-11.2
1991	-2.8	18.2	-50.3	-1.0	6.2	.1
1992	-1.2	20.0	52.9	-.7	6.5	-15.8
1993	-1.6	20.2	32.1	-.4	6.8	-4.5
1994	.6	17.6	-52.0	.2	5.5	-4.2

¹ Yields are expected to be skewed to the left (i.e., Negative values for skewness indicate distributions that are skewed to the left).

TABLE 5.10
STATISTICS FOR RANDOM CORN PRICES UNDER THREE COMMODITY POLICY SCENARIOS¹

Year	Current Policy (1980)			Quasi-Free Market Policy			Restrictive Market Policy		
	Means	Std. Deviations	Skewness	Means	Std. Deviations	Skewness	Means	Std. Deviations	Skewness
1980	2.72	.36	.078	2.82	.68	.227	2.68	.32	.079
1981	2.72	.33	.037	2.80	.63	.101	2.66	.28	.043
1982	2.69	.32	.054	2.77	.62	.157	2.65	.28	.059
1983	2.68	.34	.054	2.75	.65	.157	2.64	.29	.058
1984	2.68	.43	.132	2.72	.80	.373	2.65	.37	.124
1985	2.66	.32	.077	2.70	.62	.238	2.62	.28	.075
1986	2.63	.29	.053	2.64	.57	.170	2.59	.24	.051
1987	2.65	.32	.065	2.68	.62	.197	2.61	.27	.066
1988	2.66	.33	.086	2.71	.63	.251	2.62	.28	.087
1989	2.69	.45	.150	2.74	.84	.422	2.67	.40	.141
1990	2.61	.33	.090	2.60	.62	.290	2.58	.27	.083
1991	2.66	.31	.039	2.70	.60	.110	2.62	.26	.044
1992	2.67	.34	.084	2.71	.64	.258	2.63	.29	.083
1993	2.68	.35	.073	2.73	.66	.208	2.64	.30	.075
1994	2.70	.46	.139	2.75	.84	.387	2.68	.40	.130

¹ Prices are expected to be skewed to the right since government programs (loan rates) support prices on the lower end of the distributions. All prices are expressed in 1980 dollars.

TABLE 5.11
STATISTICS FOR RANDOM SOYBEAN PRICES UNDER THREE COMMODITY POLICY SCENARIOS¹

Year	Current Policy (1980)			Quasi-Free Market Policy			Restrictive Market Policy		
	Means	Std. Deviations	Skewness	Means	Std. Deviations	Skewness	Means	Std. Deviations	Skewness
1980	6.97	.86	.69	7.04	.95	.49	6.93	.79	.74
1981	6.96	.81	.55	7.02	.90	.29	6.92	.75	.64
1982	6.89	.75	.36	6.93	.88	.03	6.86	.67	.47
1983	6.85	.75	.41	6.89	.86	.19	6.83	.69	.49
1984	6.83	.75	.43	6.86	.88	.18	6.81	.68	.52
1985	7.03	.84	.68	7.12	.94	.74	6.97	.77	.66
1986	6.83	.77	.58	6.88	.88	.36	6.81	.71	.66
1987	6.93	.92	.68	6.95	1.04	.53	6.93	.84	.72
1988	7.03	.95	.63	7.07	1.06	.49	7.01	.88	.66
1989	6.89	.89	.87	6.92	1.03	.69	6.87	.80	.87
1990	6.82	.77	.56	6.86	.87	.39	6.80	.71	.62
1991	7.00	.88	.52	7.05	1.00	.28	6.98	.80	.58
1992	6.91	.87	.68	6.94	1.00	.52	6.89	.78	.68
1993	6.82	.77	.51	6.85	.90	.27	6.81	.70	.58
1994	6.86	.82	.71	6.90	.94	.53	6.84	.75	.75

¹ Prices are expected to be skewed to the right since government programs (loan rates) support prices on the lower end of the distributions. All prices are expressed in 1980 dollars.

soybean prices under the three scenarios. The statistical properties of the data sets developed for this study correspond with the desired properties presented in Table 5.7.

In order to provide more insight into the properties of the random data sets used in this study, Tables 5.12-5.16 present frequency and cumulative probabilities for the most important relationships that result from the random values. Table 5.12 contains the statistical properties for corn and soybean yields. Examination of the cumulative probabilities clearly demonstrates the relatively small amount of variability in yields for this region. For example, there is nearly an 89 percent chance that corn yields will not be more than 25 bushels below the average yield. Similarly, 89 percent of the time soybean yields will not be more than 8 bushels below the average yield. The cumulative probabilities can also be used to make statements concerning the odds of extraordinarily high yields. Only 20 percent of the corn yields will be greater than 17.5 bushels above average and only 20 percent of the soybean yields will be greater than 6 bushels above the average. It is important to recognize that precisely the same sequence of random yields is used for all three commodity policy scenarios. This was done in order to provide control between policy scenarios.

The impact of alternative assumptions concerning commodity programs is clearly visible in the frequency and cumulative probability data on corn prices displayed in Table 5.13. Under each policy scenario, the greatest frequency occurs at or near the loan level. In the case of the current market scenario, 16 percent of all corn prices are between the loan level (\$2.25) and \$2.31. Even the quasi-free

TABLE 5.12

STATISTICAL PROPERTIES OF RANDOM CORN AND SOYBEAN YIELDS
(SAME DRAWS UNDER EACH POLICY SCENARIO)

CORN YIELD	FREQUENCY	CUMMULATIVE PROBABILITY	SOYBEAN YIELD	FREQUENCY	CUMMULATIVE PROBABILITY
-52.5	0	0	-22	1	0.001
-50.0	0	0	-21	0	0.001
-47.5	1	0.001	-20	2	0.002
-45.0	2	0.002	-19	1	0.003
-42.5	9	0.008	-18	1	0.003
-40.0	7	0.013	-17	0	0.003
-37.5	7	0.017	-16	4	0.006
-35.0	20	0.031	-15	9	0.012
-32.5	24	0.047	-14	7	0.017
-30.0	32	0.068	-13	10	0.023
-27.5	31	0.089	-12	13	0.032
-25.0	38	0.114	-11	15	0.042
-22.5	33	0.136	-10	38	0.067
-20.0	40	0.163	-9	21	0.081
-17.5	50	0.196	-8	46	0.112
-15.0	61	0.237	-7	58	0.151
-12.5	47	0.268	-6	67	0.195
-10.0	58	0.307	-5	62	0.237
-7.5	57	0.345	-4	55	0.273
-5.0	79	0.397	-3	67	0.318
-2.5	60	0.437	-2	66	0.362
0.0	75	0.487	-1	87	0.420
2.5	77	0.539	0	88	0.479
5.0	64	0.581	1	96	0.543
7.5	73	0.630	2	78	0.595
10.0	71	0.677	3	110	0.668
12.5	67	0.722	4	57	0.706
15.0	58	0.761	5	75	0.756
17.5	61	0.801	6	85	0.813
20.0	49	0.834	7	68	0.858
22.5	42	0.862	8	60	0.898
25.0	42	0.890	9	53	0.933
27.5	42	0.918	10	43	0.962
30.0	38	0.943	11	29	0.981
32.5	30	0.963	12	17	0.993
35.0	20	0.977	13	9	0.999
37.5	23	0.992	14	2	1
40.0	10	0.999	15	0	1
42.5	0	0.999	16	0	1
45.0	2	1	17	0	1
BASIC STATISTICS					
MEAN		.192			-.04
STD. DEVIATION		19.02			6.27
SKEWNESS		-35.87			-11.26

TABLE 5.13

STATISTICAL PROPERTIES OF RANDOM CORN. PRICES UNDER THREE ALTERNATIVE COMMODITY POLICY SCENARIOS

CURRENT POLICY			QUASAI-FREE MARKET		RESTRICTIVE MARKET	
CORN PRICE \$/BU	FREQUENCY	CUMMULATIVE PROBABILITY	FREQUENCY	CUMMULATIVE PROBABILITY	FREQUENCY	CUMMULATIVE PROBABILITY
1.89	0	0.0	0	0.0	0	0.0
1.95	0	0.0	143	0.095	0	0.0
2.01	0	0.0	101	0.163	0	0.0
2.07	0	0.0	72	0.211	0	0.0
2.13	0	0.0	64	0.253	0	0.0
2.19	0	0.0	62	0.295	0	0.0
2.25	0	0.0	62	0.336	0	0.0
2.31	240	0.160	37	0.361	0	0.0
2.37	139	0.253	63	0.403	324	0.216
2.43	125	0.336	40	0.429	196	0.347
2.49	104	0.405	48	0.461	138	0.439
2.55	87	0.463	46	0.492	112	0.513
2.61	82	0.518	33	0.514	88	0.572
2.67	72	0.566	40	0.541	81	0.626
2.73	67	0.611	37	0.565	64	0.669
2.79	58	0.649	34	0.588	74	0.718
2.85	73	0.698	32	0.609	72	0.766
2.91	62	0.739	29	0.629	59	0.805
2.97	55	0.776	30	0.649	50	0.839
3.03	59	0.815	35	0.672	36	0.863
3.09	47	0.847	39	0.698	36	0.887
3.15	33	0.869	30	0.718	29	0.906
3.21	37	0.893	36	0.742	46	0.937
3.27	30	0.913	34	0.765	16	0.947
3.33	42	0.941	24	0.781	26	0.965
3.39	20	0.955	37	0.805	19	0.977
3.45	21	0.969	25	0.822	20	0.991
3.51	21	0.983	28	0.841	14	1.000
3.57	18	0.995	17	0.852	0	1.000
3.63	8	1.000	19	0.865	0	1.000
3.69	0	1.000	26	0.882	0	1.000
3.75	0	1.000	20	0.895	0	1.000
3.81	0	1.000	16	0.906	0	1.000
3.87	0	1.000	29	0.925	0	1.000
3.93	0	1.000	24	0.941	0	1.000
3.99	0	1.000	9	0.947	0	1.000
4.05	0	1.000	22	0.962	0	1.000
4.11	0	1.000	13	0.971	0	1.000
4.17	0	1.000	17	0.982	0	1.000
4.23	0	1.000	19	0.995	0	1.000
4.29	0	1.000	8	1.000	0	1.000
BASIC STATISTICS						
MEAN		\$2.67		\$2.72		\$2.64
STD. DEVIATION		.36		.67		.30
SKEWNESS		.089		.252		.089

TABLE 5.14

STATISTICAL PROPERTIES OF RANDOM SOYBEAN PRICES UNDER
THREE ALTERNATIVE COMMODITY POLICY SCENARIOS

SOYBEAN PRICE \$/BU	CURRENT POLICY		QUSAI-FREE MARKET		RESTRICTIVE MARKET	
	FREQUENCY	CUMMULATIVE PROBABILITY	FREQUENCY	CUMMULATIVE PROBABILITY	FREQUENCY	CUMMULATIVE PROBABILITY
4.92	0	0.0	0	0.0	0	0.0
5.08	0	0.0	3	0.002	0	0.0
5.24	0	0.0	12	0.010	0	0.0
5.40	0	0.0	20	0.023	0	0.0
5.56	0	0.0	35	0.047	0	0.0
5.72	0	0.0	50	0.080	0	0.0
5.88	0	0.0	63	0.122	0	0.0
6.04	178	0.119	77	0.173	0	0.0
6.20	171	0.233	93	0.235	0	0.0
6.36	153	0.335	104	0.305	538	0.359
6.52	118	0.413	96	0.369	151	0.459
6.68	106	0.484	80	0.422	124	0.542
6.84	108	0.556	96	0.486	98	0.607
7.00	86	0.613	99	0.552	81	0.661
7.16	81	0.667	84	0.608	78	0.713
7.32	79	0.720	82	0.663	64	0.756
7.48	74	0.769	86	0.720	54	0.792
7.64	49	0.802	78	0.772	47	0.823
7.80	54	0.838	55	0.809	42	0.851
7.96	43	0.867	54	0.845	39	0.877
8.12	46	0.897	51	0.879	40	0.904
8.28	35	0.921	46	0.909	33	0.926
8.44	29	0.940	35	0.933	25	0.943
8.60	19	0.953	24	0.949	17	0.954
8.76	19	0.965	13	0.957	23	0.969
8.92	15	0.975	17	0.969	20	0.983
9.08	13	0.984	14	0.978	16	0.993
9.24	10	0.991	11	0.985	10	1.000
9.40	8	0.996	8	0.991	0	1.000
9.56	5	0.999	4	0.993	0	1.000
9.72	0	0.999	3	0.995	0	1.000
9.88	1	1.000	4	0.998	0	1.000
10.04	0	1.000	2	0.999	0	1.000
10.20	0	1.000	0	0.999	0	1.000
10.36	0	1.000	0	0.999	0	1.000
10.52	0	1.000	0	0.999	0	1.000
10.68	0	1.000	1	1.000	0	1.000
BASIC STATISTICS						
MEAN		\$6.91		\$6.95		\$6.88
STD. DEVIATION		.83		.94		.76
SKEVNESS		.62		.42		.67

TABLE 5.15

STATISTICAL PROPERTIES OF BUDGETED RETURN ABOVE LAND COSTS UNDER THREE ALTERNATIVE COMMODITY POLICY SCENARIOS

CURRENT POLICY			QUSAI-FREE MARKET		RESTRICTIVE MARKET	
BUDGETED RETURN \$/ACRE	FREQUENCY	CUMMULATIVE PROBABILITY	FREQUENCY	CUMMULATIVE PROBABILITY	FREQUENCY	CUMMULATIVE PROBABILITY
-31	0	0.0	1	0.001	0	0.0
-19	0	0.0	0	0.001	0	0.0
-7	2	0.001	8	0.006	2	0.001
5	1	0.002	11	0.013	2	0.003
17	7	0.007	29	0.033	3	0.005
29	16	0.018	29	0.053	15	0.015
41	30	0.038	43	0.081	29	0.034
53	36	0.062	78	0.134	39	0.061
65	76	0.113	77	0.186	73	0.110
77	86	0.171	95	0.250	90	0.170
89	99	0.238	92	0.312	106	0.242
101	107	0.310	108	0.385	120	0.323
113	144	0.407	115	0.462	136	0.414
125	145	0.504	91	0.523	159	0.521
137	125	0.589	75	0.574	132	0.610
149	111	0.663	76	0.625	102	0.679
161	93	0.726	73	0.674	99	0.745
173	75	0.776	56	0.712	104	0.815
185	72	0.825	57	0.750	68	0.861
197	65	0.869	45	0.780	51	0.896
209	46	0.900	45	0.811	47	0.927
221	46	0.931	48	0.843	33	0.949
233	33	0.953	47	0.875	28	0.968
245	22	0.968	27	0.893	14	0.978
257	15	0.978	21	0.907	13	0.987
269	13	0.987	37	0.932	4	0.989
281	3	0.989	23	0.947	9	0.995
293	12	0.997	21	0.962	2	0.997
305	0	0.997	20	0.975	2	0.998
317	2	0.998	6	0.979	1	0.999
329	1	0.999	11	0.987	1	0.999
341	0	0.999	6	0.991	1	1.000
353	2	1.000	7	0.995	0	1.000
365	0	1.000	2	0.997	0	1.000
377	0	1.000	1	0.997	0	1.000
389	0	1.000	2	0.999	0	1.000
401	0	1.000	0	0.999	0	1.000
413	0	1.000	0	0.999	0	1.000
425	0	1.000	2	1.000	0	1.000
425	0	1.000	2	1.000	0	1.000

BASIC STATISTICS			
MEAN	\$130.92	\$135.27	\$127.50
STD. DEVIATION	56.21	78.15	52.51
SKEWNESS	1485.75	3870.28	1222.40

TABLE 5.16

STATISTICAL PROPERTIES OF ALMON LAG LAND PRICE ESTIMATES UNDER
THREE ALTERNATIVE COMMODITY POLICY SCENARIOS

LAND PRICE \$/ACRE	CURRENT POLICY		QUSAI-FREE MARKET		RESTRICTIVE MARKET	
	FREQUENCY	CUMMULATIVE PROBABILITY	FREQUENCY	CUMMULATIVE PROBABILITY	FREQUENCY	CUMMULATIVE PROBABILITY
1600	0	0.0	2	0.001	0	0.0
1700	0	0.0	4	0.004	0	0.0
1800	0	0.0	3	0.006	0	0.0
1900	1	0.001	3	0.008	0	0.0
2000	4	0.003	14	0.018	2	0.001
2100	2	0.005	20	0.031	6	0.005
2200	9	0.011	24	0.047	9	0.011
2300	20	0.024	28	0.066	14	0.021
2400	26	0.042	36	0.090	29	0.040
2500	43	0.071	45	0.121	48	0.073
2600	40	0.098	54	0.157	46	0.104
2700	66	0.142	57	0.195	67	0.149
2800	74	0.192	61	0.236	88	0.208
2900	92	0.254	61	0.277	94	0.271
3000	98	0.320	62	0.319	112	0.347
3100	117	0.399	79	0.372	127	0.432
3200	110	0.473	93	0.435	135	0.523
3300	133	0.562	100	0.502	129	0.610
3400	106	0.634	73	0.552	95	0.674
3500	288	0.828	275	0.737	293	0.871
3600	77	0.879	66	0.781	63	0.914
3700	55	0.916	49	0.814	39	0.940
3800	38	0.942	62	0.856	32	0.962
3900	24	0.958	38	0.881	13	0.970
4000	15	0.968	42	0.910	12	0.978
4100	14	0.978	31	0.931	13	0.987
4200	13	0.987	13	0.939	11	0.995
4300	7	0.991	20	0.953	3	0.997
4400	7	0.996	18	0.965	1	0.997
4500	2	0.997	13	0.974	4	1.000
4600	2	0.999	7	0.978	0	1.000
4700	2	1.000	13	0.987	0	1.000
4800	0	1.000	4	0.990	0	1.000
4900	0	1.000	5	0.993	0	1.000
5000	0	1.000	3	0.995	0	1.000
5100	0	1.000	3	0.997	0	1.000
5200	0	1.000	1	0.998	0	1.000
5300	0	1.000	1	0.999	0	1.000
5400	0	1.000	0	0.999	0	1.000
5500	0	1.000	2	1.000	0	1.000
BASIC STATISTICS						
MEAN		\$3179.90		\$3232.83		\$3138.12
STD. DEVIATION		426.57		600.15		401.68
SKEWNESS		-9579.90		51164.88		-18108.50

market scenario has a relatively high concentration of prices near the loan level (\$1.90). As expected, although the mean for the quasi-free market is higher than either of the other two scenarios, there is also a greater probability that prices will be concentrated at the lower and upper end of the price scale. For example, 40 percent of all corn prices are below \$2.37 in the quasi-free market; whereas, 25 percent are below this level under the current policy, and 22 percent are below this level with a more restrictive market. Table 5.14 can be interpreted similarly to Table 5.13. The most noteworthy aspect of the results in this table, regarding soybean prices, is that the quasi-free market presented here comes closer to a truly free market than the one for corn prices. The concentration of prices at the loan rate is absent. On the other hand, the restrictive market created for soybean prices is more restrictive than the one created for corn prices (i.e., 36 percent of the soybean prices in the restrictive market are stacked near the \$6.20 loan rate).

Since a set of random prices and yields occur in any given year, presenting the random prices and yields in isolation was not adequate. The crop mix and the set of random draws will determine financial success under alternative policies. A budget simulator was developed to provide more information concerning the collective set of random data. This was done by fixing the crop mix at 60 percent corn and 40 percent soybeans and calculating a gross return per acre given each set of random price and yield data (a total of 1500 sets). The Illinois non-land cost data was used in conjunction with these values to obtain a distribution of budgeted returns above land cost for each data set. Results are presented in Table 5.15. The most striking

aspect is that the differences between the three scenarios are no longer as pronounced as they appeared to be when examining the price data in isolation. The current policy returns are nearly identical to the returns under a more restrictive market. However, there are differences between the quasi-free market and the other policies. Under the free market returns are below \$77 per acre 25 percent of the time. This contrasts to 17 percent under the other policies. Likewise, 19 percent of the returns will be greater than \$209 under the quasi-free market; whereas, less than 10 percent will be above this level under the other two scenarios. Table 5.15 also reports the means, standard deviations, and skewness of the 1500 observations. Clearly, the quasi-free market has a greater variance.

Finally, Table 5.16 presents the results of using the budgeted returns calculated for Table 5.15 in conjunction with the Almon lag land price model. This demonstrates how the alternative data sets (and policies) influence the variability in land prices. It must be stressed that these calculations were performed with no trends on prices and/or yields. The actual draws were used in sequence so that one set of fifteen years of price data are used to develop land prices for that fifteen year period. Since a six year lag is involved, the initial six years (i.e., the six years prior to year one of the data set) influence the price of land in the first several years. Therefore, Table 5.16 reveals a heavy concentration around \$3500 per acre (i.e., the initial land value for each fifteen year period performed 100 times). The actual 1974-79 returns above land cost are used to calculate the first year's land price. The fact that the initial land value (\$3500/acre) is in the upper percentile reflects the fact that

the average returns for 1974-79 were above the average returns that are generated from the random data sets used in this study.

Developing General Equilibrium Conditions

Developing relationships between the general economy and the agricultural economy was a major aspect of developing assumptions concerning a "general equilibrium" economy for this study. Events of the 1970's clearly demonstrate that important macroeconomic parameters such as inflation and interest rates are in a state of disequilibrium. The agricultural economy has not been isolated from this instability. Inflation and the uncertainty associated with changes in the rate of inflation have become an important risk component for individual farmers making long-run investment decisions. This study abstracts from the instability created by changing rates of inflation by creating long-run "general equilibrium" inflation rates and tying other important variables to those rates. At this stage, controlling for this instability was considered an important aspect of developing controlled experiments.¹

Developing a general equilibrium economy was proceeded by examining the historical relationships between inflation rates and interest rates. Table 5.17 presents the relationship between the Consumer Price Index, the Federal Land Bank Mortgage rate of interest, and the Illinois Land Price Index. Examination of this table illustrates the difficulty associated with developing long-run equilibrium conditions.

¹ One of the major modifications of the model developed in this study should be allowances for random and changing rates of inflation and interest.

TABLE 5.17

RELATIONSHIP BETWEEN THE FEDERAL LAND BANK MORTGAGE
INTEREST RATE, THE CONSUMER PRICE INDEX, AND
THE ILLINOIS LAND PRICE INDEX

Year	1 Federal Land Bank Mortgage Rate of Int.	2 % Change in CPI	3 Col (1)- Col (2)	4 % Change in Illinois Land Price Index	5 Col (4)- Col (1)
1979	9.25	10.0	-.75	13.1	3.1
78	8.50	6.5	2.0	10.5	4.0
77	8.50	5.5	3.0	35.8	30.3
76	8.66	5.7	2.96	24.4	18.7
75	8.69	9.1	-.41	20.8	11.7
74	8.14	10.9	-2.76	34.1	23.2
73	7.48	6.2	1.28	11.2	5.0
72	7.42	3.3	4.12	7.4	4.1
71	7.86	4.3	3.56	.9	-3.8
70	8.68	6.5	2.18	-1.8	-8.3
69	7.82	5.4	2.42	4.8	-.6
68	6.84	4.2	1.44	4.0	-.2
67	6.02	2.9	1.82	6.4	3.5
66	5.82	2.8	2.92	11.9	9.1
65	5.60	1.7	2.80	7.7	6.0
64	5.60	1.3	2.49	4.0	2.7
63	5.60	1.2	4.30	5.6	4.4
62	5.60	1.1	4.40	2.9	1.8
61	5.64	1.0	4.54	-2.8	-3.8
60	6.00	1.6	4.40	.0	-1.6
Average (1960-69)			2.6		5.75
Average (1970-79)			1.5		8.80

Compiled from Scott, "Forecasting the Price of Illinois Land".

This study assumes that the annual rate of inflation will be 9 percent. The Federal Land Bank interest rate is then set at 11 percent (i.e., assuming a real rate of interest of 2 percent). Next, the desired long-run average rate of inflation on land prices was set at 12 percent. (This is the land price inflation that should be developed by the Almon lag model.) This assumes that land will inflate at approximately 3 percent above the general economy. Clearly, this is an important relationship. If land prices inflate at rates above the general economy, those with land will not only benefit by the increase in wealth, but also by the increased leverage and ability to buy more land. On the other hand, if the trends in land prices reverse (as the values presented in Table 5.17 indicate they may), farmers may find other investments more attractive; and they will not be able to use existing land in the same manner (as under high land inflation), to gain control over more land.

Given these assumptions, the next step involved developing inflation rates for corn and soybean prices and costs of production that would account for trends in yields and also produce a return that was roughly equivalent to the general inflation rate. Allowing for a return that keeps pace with the general economy was considered important since the general inflation rate is used to convert each year's nominal dollars into real (1979) dollars when developing important measurement variables. It was also necessary to establish the parameters for the Almon lag model in order to obtain a long run inflation rate of 12 percent for land, given the inflation on returns above land cost. Values for these parameters were developed in an iterative fashion using a simple budget simulator and alternative

rates of inflation for corn and soybean prices, costs of production, and for the inflation factor in the Almon lag model. Table 5.18 presents the assumed values for the important variables used by the simple budget generator (and in most of the analyses in this study). The generator was used to obtain an inflation rate on land of 12 percent and an inflation rate on returns above land of 9 percent. The values that were iteratively altered to obtain these rates were the inflation on corn and soybean prices and the inflation index used in the Almon lag model.¹ Table 5.18 also presents the deterministic values (Note that these will change with random prices and yields) for land prices and returns above land for one acre of corn and soybeans (i.e., 0.6 acre is corn and 0.4 is soybeans).

The importance of providing for consistent relationships between various inflation rates cannot be overstated. Serious distortions can be created when compounding high inflation rates (i.e., 9-12 percent) over ten years. If the values are not in concert at the beginning of the period, there will certainly be more distortion at the end of the period. Admittedly, the procedure used here is oversimplified. Ideally, estimates and relationships should be developed by a macro-economic model. However, the procedure here does provide for a consistent method of changing the basic inflation rates (i.e., the general economy and the land price inflation) in order to perform sensitivity on alternative assumptions. Without such a consistent method, little could be said about the influence of different

¹ Note that the Almon lag model is being used to obtain the desired inflation rate on land prices. This does not lessen its ability to adjust land price as a result of the random prices and yields.

TABLE 5.18

ASSUMPTIONS AND DEVELOPMENT OF SPECIFIC VALUES
TO OBTAIN A GENERAL EQUILIBRIUM DETERMINISTIC ECONOMY

Approach - Given assumptions and initial (1979) values 1-19 below, the budget simulator was used in conjunction with the Almon lag model to obtain values for 22 and 23 below that would yield the desired levels for 20 and 21.

Given Values

1. General Inflation Rate (annual %)	9
2. Federal Land Bank Mortgage Interest Rate (annual %)	11
3. Trend on Corn Yields (annual %)	1.8
4. Trend on Soybean Yields (annual %)	.5
5. Corn Yield (Bu/Ac)	145
6. Soybean Yield (Bu/Ac)	45
7. Corn Price (\$/Bu)	2.53
8. Soybean Price (\$/Bu)	6.47
9. Nonland Cost for Corn Production (\$/Ac)	255
10. Nonland Cost for Soybean Production (\$/Ac)	180
11. Percent of Corn Planted (% of one Acre)	60
12. Percent of Soybeans Planted (% of one Acre)	40
13. Land Price (\$/Ac)	3500
14. 1973 Return Above Land Costs (\$/Ac - for Almon Lag)	131
15. 1974 Return Above Land Costs (\$/Ac - for Almon Lag)	180
16. 1975 Return Above Land Costs (\$/Ac - for Almon Lag)	145
17. 1976 Return Above Land Costs (\$/Ac - for Almon Lag)	140
18. 1977 Return Above Land Costs (\$/Ac - for Almon Lag)	145
19. 1978 Return Above Land Costs (\$/Ac - for Almon Lag)	150

Desired Values

20. Inflation on Returns (annual %)	9
21. Inflation on Land Prices (annual %)	12

Derived Values

22. Inflation on Corn and Soybean Prices (annual %)	7.5
23. Inflation for Almon Lag Model (annual %)	14.0

TABLE 5.18 (Continued)

Values - Given the Above Conditions

<u>Year</u>	<u>Return Above Land Cost (Nominal \$/Ac)</u>	<u>Land Price (Nominal \$/Ac)</u>
1980	122	3707
1981	132	4121
1982	144	4467
1983	157	4947
1984	171	5529
1985	186	6251
1986	202	7160
1987	221	8286
1988	240	9562
1989	<u>262</u>	<u>11007</u>
Actual % on Inflation	8.9	12.1

These conditions are also used in the main simulation model with the exception of the adjustment in crop mix provided by the main model. Also, the general inflation rate is used to inflate cost of production, replacement costs of machinery and buildings, outside income, and family living requirements. The model allows for different values for these rates. However, this study uses the same rates to provide for more control.

inflation rates on land and the general economy.

Summary

Regional farm firm data comprises the bulk of the data requirements for this model. It should be clear that any attempt to use this model for analysis in another region would require an investment in obtaining and synthesizing new data. This is particularly true for the cost data and the development of a local land market. Random price data and the general equilibrium assumptions could be transferred to another region; provided that random yield data were developed separately.

The attempt to develop random prices which would reflect alternative commodity policies involved researcher subjectivity. Ideally, explicit commodity policies should have been developed and used in conjunction with the MSUAG model to develop different price distributions.

The approach used to develop general equilibrium assumptions was also oversimplified. Here, use of a macroeconomic model to generate appropriate relationships would have been preferred. However, as with all cases of simplification, the primary issue is how will it impact the intended use of the model? It was the researcher's judgement that the additional effort required to develop equilibrium conditions using a macroeconomic model would have been greater than the value gained. The reader must recognize that this is the basis for many decisions that are made when developing a large simulation model.

CHAPTER VI
PROPERTIES OF THE MODEL - DEVELOPING DESIGN PARAMETERS
AND PERFORMING SENSITIVITY ANALYSES

One of the best ways to demonstrate the properties of a simulation model is to perform sensitivity analyses. Further, one of the only ways to perform sensitivity analyses is to develop a control (i.e., what is termed the "base run" here) and compare other results (when only a few variables are changed) with the control. The number of possible sensitivity analyses that can be performed are staggering. There are nearly 100 general input values and 48 values that can be altered across the four farms developed for this study. Chapter V discussed the development of some of the most essential environmental variables used in this study. Other assumptions have also been discussed in Chapters IV and V.

This chapter begins by developing the logic behind the manner in which the model is used and the results are reported. From there, a primary objective of this chapter - the evolutionary development of the base run - is discussed, concentrating on the concept of systems design. Recall (from Chapter II) that systems design involves use of the performance criteria (i.e., the specified goals of farmers) in conjunction with the structure (or environment) of the system to develop design (or management) parameters that will aid in reaching

multiple goals.¹ Once the evolutionary development of the basic behavioral assumptions has been discussed, the next section demonstrates the sensitivity of the model with respect to some of the most basic (general environment) assumptions. Finally, the last section demonstrates the impact (and possible use of the model) when the initial structure of the farms is changed.

Proper Use of the Model

Before beginning the sensitivity analyses, it is necessary to develop some of the logic behind the manner in which the model is used in this study. First and foremost, model development is viewed as long-run research. Many of the techniques used here have not been used before. Many of the assumptions are made with limited empirical foundation. (This model can be used to identify areas where more empirical work is needed.) In addition, the lack of knowledge concerning behavior and the inability to create truly representative farms makes it nearly impossible to use a model such as this to statistically predict the future. This should not be the purpose of this type of simulation model. Rather, the model should be used to provide insights by identifying the most important relationships and possible responses. Conditional statements can then be made regarding

¹ Sensitivity analyses will not be performed on the production relationships since they are empirically based. Further, the assumptions concerning credit and lender behavior were developed in consultation with individuals familiar with this behavior and are believed to be reasonable. The use of farmer constraints on borrowing usually preempt credit constraints. Therefore, sensitivity on these parameters is not performed. This chapter also does not deal with the institutional assumptions (i.e., income taxes and commodity programs) since they are taken as given.

the implications of different behavior (in a management sense) and/or different environments (this includes policy, general economy, initial structure, etc.). Therefore, it was considered more important to perform a large number of sensitivity analyses in order to develop an understanding of not only the model properties but, more importantly, the system relationships. This determination influenced the manner in which the analyses were performed and the summary statistics are reported. Costs of the computer analyses became a constraint. Normally, Monte Carlo analyses should be performed using a large number of simulations (Recall that one simulation involves a ten-year period with random prices, yields, land availability, and some land allocation). However, the cost of performing sensitivity analyses using a large number of simulations was prohibitive. Moreover, preliminary analyses (using the same random data sets) revealed that the results were very similar when using 25, 50, or 100 simulations.¹ Therefore, the sensitivity analyses developed for this study use only 25 simulations. Clearly, this number would not be adequate if random events varied between analyses.

The determination that it was premature or possibly impossible to use the model to predict the future (and thus limiting the use of the model to diagnostic analyses) influenced the presentation of the basic measurement variables of the model. The discussion turns to the reasons for presenting the measurement variables as they are here, with emphasis on the manner in which the results can be interpreted.

¹ Appendix D includes results of the base analysis (Table 6.1) using 50 (Table D.1) and 100 (Table D.2) simulations.

Possibly the most important function to be performed by a simulation model involves developing and reporting important measurement statistics. This model can evaluate up to four farms simultaneously, providing for analysis of up to 100 fifteen-year planning horizons for each farm. (That is, 100 sets of random prices, yields, and land availability.) The decision to use only 25 iterations has been discussed. Some of the same reasons prompted the use of only a ten-year planning horizon. Besides the cost consideration, the problems associated with making fifteen-year projections on land prices influenced this decision.¹ This type of analysis presents a number of dimensions that can be evaluated. The two most important performance dimensions are: 1) the performance across farms under the same set of conditions, and 2) the performance of the same farm under a different set of conditions. When these dimensions are combined, the third (and possibly the most important) dimension becomes a comparison of the relative position of farms of different size under different assumptions. The problem of evaluating performance over the planning horizon is complicated by the presence of different inflation rates. Chapter V discussed the selection of approximately the same inflation rate on returns, family living, production cost, and the general economy, with the reason being to provide for similar comparisons when using the family living inflation rate to adjust each year's nominal

¹ One of the findings, under the general equilibrium conditions outlined at the end of Chapter V, was that returns did not inflate at a high enough rate to merit purchase of new land after 10 or 11 years (i.e., The decision rule that new land would not be purchased if the debt service associated with it surpassed the net returns, above land costs, associated with four existing acres was violated after 10 or 11 years).

dollars to present value (1979) dollars. Therefore, all values that present an average of a stream of dollar values across the planning period use the 9 percent family living inflation rate as the common denominator.

Eleven measurement variables are reported in this study. Five of these variables involve the average value over each planning period and the other six involve the ending value for each planning period.¹

Those evaluating averaged values over each planning period include:

1) the accrual farm income, 2) the taxable farm income, 3) the tax and social security payments, 4) the annual family living expenditures, and 5) the number of times for refinancing land (at levels greater than \$10 per tillable acre) over each period. The values that evaluate end-of-period variables are: 1) ending net worth (reported in nominal dollars), 2) annual growth in net worth (adjusted to 1979 dollars), 3) the debt/asset ratio, 4) the increase in owned acres, 5) the increase in leased acres, and 6) the increase in total acres controlled. Other values that are reported to provide insight into the land purchase market are the total number of bids placed on land by each farm, the percent of possible bids made, and the total number of land parcels purchased. (For 25 ten-year planning periods there are 250 opportunities to purchase land.)

Table 6.1 is the ultimate base run selected. (The next section will discuss how the base behavioral parameters were developed.) In

¹ It must be recognized that taking the average present values for measurement variables over the period does not reveal the within period variability of these values. Although these values are considered important, the bulk of their impact on growth should be captured in the summary statistics reported here.

addition to the mean values for each measurement variable, there are also measures of dispersion presented. The value labeled "DISPERSION" is calculated just as a standard deviation and, therefore, represents the variability in the measurement variable for the 25 (in most cases) observations. The value labeled "MEASURE OF VAR" is calculated just as a coefficient of variation (i.e., standard deviation ÷ mean) and it is reported to allow for easy comparisons of the degree of variability between measurement variables with different means (i.e., the relative variability across farms). The use of conventional statistical jargon (i.e., standard deviation and coefficient of variation) is avoided since there are legitimate concerns regarding the appropriate number of simulations (observations) and since the analysis is controlled.¹ If more simulations were developed and/or a different set of random variables were being used (with all control variables fixed) to analyze the underlying distributions or to perform Monte Carlo analyses to determine how many simulations were required to capture the underlying distributions, then conventional statistics would be more appropriate.

Recognizing that there are problems associated with the conventional use of the values of dispersion reported here creates technical problems in the ability to interpret results across analyses. Although some simplifying assumptions could be made (i.e., that the Central Limit Theorem is applicable and confidence intervals could be created to test statistical hypotheses concerning the difference in estimated

¹ Each analysis uses the same sequence (set of random data). The only change is the variable(s) on which sensitivity is being performed.

means), such assumptions are extremely questionable (especially in light of the above discussion). Therefore, this study reports the values and narratively interprets those values for analyses that appear to reveal important relationships. Since such reporting is subject to individual interpretation, each summary table is presented (to allow the reader an opportunity to interpret the results) either in this chapter or in Appendix D. (Those sensitivity analyses that are judged as being unrevealing are placed in the Appendix.) Finally, there is the pervasive issue of interpreting multiple measurement variables that involve tradeoffs. At this stage, it was considered unacceptable to develop any type of scheme to aggregate the multiple measurement variables. First, there is not enough knowledge concerning the weights that a representative farmer may assign to the alternative measurement variables. And, second, such a scheme would involve even more assumptions and possible researcher biases than a narrative interpretation. Finally, there is the danger of the abuse of such a scheme. Rather than explicitly introduce the researcher's subjective weighting index, it is left to the reader to assess the relative value associated with the different measurement variables.

Developing Behavioral Parameters for a Base Run

Table 6.1 presents the results from the base run and Appendix A presents the input parameters used for this base analysis. This discussion traces the process of the selection of these behavioral parameters by presenting sensitivity performed on the most essential control parameters in the model. Again, the selection of the base run is based on concepts of system design, given the farmer goals at the

TABLE 6.1

BASE ANALYSIS (SEE APPENDIX A FOR BASE ASSUMPTIONS
AND TABLE A.1 FOR A SUMMARY OF YEAR 1)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES	
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18301.	28070.	31197.	29575.
DISPERSION=	6192.	13379.	16224.	21459.
MEASURE OF VAR=	.34	.48	.52	.73
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8937.	15768.	17285.	14156.
DISPERSION=	3649.	9374.	12582.	13650.
MEASURE OF VAR=	.41	.59	.73	.96
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1710.	3415.	3998.	3491.
DISPERSION=	1019.	3248.	2880.	2497.
MEASURE OF VAR=	.60	.95	.72	.72
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16989.	17390.	17831.	17280.
DISPERSION=	721.	1607.	1750.	2188.
MEASURE OF VAR=	.04	.09	.10	.13
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1091223.	2383559.	3616492.	5005683.
DISPERSION=	148707.	296658.	504100.	714594.
MEASURE OF VAR=	.14	.12	.14	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1600	.2000	.5200	.6800
DISPERSION=	.6245	.6455	1.1225	1.2152
MEASURE OF VAR=	3.9031	3.2275	2.1586	1.7870
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0293	.0403	.0426	.0473
DISPERSION=	.0126	.0117	.0127	.0134
MEASURE OF VAR=	.4300	.2900	.2982	.2835
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2043	.2685	.3048	.2721
DISPERSION=	.0946	.0767	.0704	.0418
MEASURE OF VAR=	.4630	.2858	.2309	.1537
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	19.	128.	253.	338.
DISPERSION=	29.	43.	86.	75.
MEASURE OF VAR=	1.49	.34	.34	.22
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	322.	269.	262.	208.
DISPERSION=	242.	167.	172.	155.
MEASURE OF VAR=	.75	.62	.66	.75
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	641.	997.	1415.	1746.
DISPERSION=	235.	164.	177.	129.
MEASURE OF VAR=	.37	.16	.12	.07

NUMBER OF BIDS ON LAND	58	131	156	143
PERCENT OF POSSIBLE BIDS	23	52	62	57
TOTAL PARCELS PURCHASED	9	37	66	77

end of Chapter II.

The development of the important control variables began at an early stage of the model development. Much of the process of developing parameters for the control variables need not be reported. Many of the values were developed using the model to simulate 1-10 ten-year planning horizons. Under these conditions, many more measurement variables were examined. Annual data was observed to develop an understanding of how the control variables influenced year-to-year variability and well-being. This process aided in placing feasible bounds on control variables. This discussion identifies those feasible bounds and demonstrates the process of selecting the ultimate values within those bounds. It must be recognized that this is an iterative process that required a great deal of intermediate evaluation on the part of the researcher. It would be unreasonable to present all intermediate evaluations. One way this is avoided is by presenting the range of what were considered to be reasonable assumptions, given the goals of farmers. Four divisions of farmer behavior are made: 1) credit control, 2) cash flow management, 3) family living, and 4) production. These divisions are not totally independent, as the following discussion reveals.

The Influence of Credit Control Behavior

Probably the most important factors that influence growth and variability are the constraints placed on credit. The assumptions concerning the external (lenders) constraints on credit have been reviewed. This study allows for rather liberal constraints from the creditors viewpoint, thus, forcing the farmer to practice judicial use

of credit (recall that a major goal is to insure survivability). Six control parameters that have the greatest influence on credit use and growth are identified. (The reader should refer to Chapter IV and Appendix B for in-depth discussion of how the model uses these variables.) Table 6.2 presents the six farmer credit parameters that are most sensitive with the feasible bounds and ultimate base values selected.

Performing sensitivity analyses on this set of parameters demonstrates the tradeoffs between growth, income, variability in income, and family living. Further, performing these types of sensitivity analyses provides a rigorous test of the consistency of the simulation model. Tables 6.3 and 6.5 demonstrate the impact of changing the internal credit rationing assumption. (From this point on, all variables, except those mentioned, remain as in Appendix A.) The discussion of these tables will be the most detailed, laying the groundwork for understanding differences in other tables. Unless the discussion specifies where comparisons are being made, all references (such as increases, decreases, etc.) will be relative to the table being discussed and Table 6.1 - the base run.

Table 6.3 increases the maximum allowed leverage ratio from 1.3 to 1.8. All farms show an increase in the purchased acres. This is accompanied by corresponding decreases in accrual farm income and family living expenses and increases in the frequency of refinancing land and the variability of income. The frequency of refinancing land doubles for every farm except the largest farm. Some of the most revealing information supplied by this analysis involves the impact of a more aggressive land purchase strategy on the smallest farm. This

TABLE 6.2
FEASIBLE BOUNDS AND BASE VALUES
FOR FARMER CREDIT BEHAVIORAL PARAMETERS¹

Parameter	Feasible Bounds	Base Value
1. Internal leverage ratio (Market Value Net Worth x Leverage Ratio = Credit Reserves)	1-1.8	1.3
2. Required credit and cash reserves (Years to meet debt service)	1-3	2
3. Existing acres needed to support one new acre	4-5	4
4. Acceptable negative cash flow (\$/after purchase tillable acre)	0-200	50
5. Acceptable negative cost basis owner equity (\$/existing tillable acre)	10-60	40
6. Inflation rate on nominal values in 4 and 5 (Annual percent)	0-9	4

¹ These values represent the identified feasible set of these parameters given the farmer goals at the end of Chapter II.

TABLE 6.3

MORE AGGRESSIVE GROWTH
(I.E., INTERNAL LEVERAGE RATIO = 1.8)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	16225.	25753.	21462.	23416.
DISPERSION=	5776.	14514.	24164.	23981.
MEASURE OF VAR=	.36	.56	1.13	1.02

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	9167.	14250.	7674.	8540.
DISPERSION=	4048.	10191.	18012.	19276.
MEASURE OF VAR=	.44	.72	2.35	2.26

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	2059.	3118.	2965.	2965.
DISPERSION=	1389.	3099.	3114.	1607.
MEASURE OF VAR=	.67	.99	1.05	.54

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16690.	17049.	17132.	16983.
DISPERSION=	1045.	1747.	1983.	1741.
MEASURE OF VAR=	.06	.10	.12	.10

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1064428.	2382711.	3739899.	5045007.
DISPERSION=	147015.	302552.	515058.	765779.
MEASURE OF VAR=	.14	.13	.14	.15

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.3200	.4000	1.4800	1.1600
DISPERSION=	.7483	1.1547	2.1432	1.8637
MEASURE OF VAR=	2.3385	2.8868	1.4481	1.6066

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0270	.0403	.0457	.0479
DISPERSION=	.0124	.0118	.0129	.0142
MEASURE OF VAR=	.4598	.2918	.2822	.2972

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1992	.2812	.3076	.2796
DISPERSION=	.1133	.0788	.0803	.0544
MEASURE OF VAR=	.5688	.2803	.2612	.1947

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	26.	136.	286.	358.
DISPERSION=	32.	58.	100.	93.
MEASURE OF VAR=	1.27	.42	.35	.26

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	163.	358.	299.	240.
DISPERSION=	140.	181.	177.	204.
MEASURE OF VAR=	.86	.50	.59	.85

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	489.	1094.	1486.	1798.
DISPERSION=	151.	185.	180.	201.
MEASURE OF VAR=	.31	.17	.12	.11

NUMBER OF BIDS ON LAND	90	146	151	140
PERCENT OF POSSIBLE BIDS	36	58	60	55
TOTAL PARCELS PURCHASED	12	37	55	84

is the only farm that experiences less growth in net worth despite an increase in purchased acres. The decrease in leased acres is responsible for this phenomenon. The smallest farmer is not as competitive in the lease market because he is unable to purchase above average machinery complements as often, since he is using his financial resources to purchase more land. Further, the lack of growth in controlled acres reduces tax write-offs associated with purchase of machinery to accompany new acres. This results in a higher taxable farm income (and higher taxes) despite a lower accrual farm income.¹ These results demonstrate the tradeoffs associated with expansion through purchasing versus leasing for the smallest farm. It must be recognized that these results are a function of the assumption that the landlord places a good deal of weight on the tenant's machinery complement when making decisions on potential tenants.

The values on the number of bids placed on land and the number of parcels purchased can also be used to understand many of the results and to illustrate the importance of farmer behavior on a local land market. Increasing the leverage ratio to 1.8 had the largest impact on the ability of the smallest farm to place bids on new land (i.e., The smallest farmer places bids on 36 percent versus 23 percent of the available parcels due to this change). The summary statistics on land purchase can also be used to calculate the average size of the parcel of purchase land. Recall that one parcel is available for the four farms each year. There are 25 simulations for 10 years; thus, each

¹ Part of the increase in taxes must also be attributed to higher outside income when less acres are operated. These numbers are not reported but tax payments reflect outside income.

analysis has 250 available parcels of purchase land. If the number of parcels purchased is divided by the number of simulations, this provides an estimate of the average number of parcels purchased over a 10 year horizon. This number can then be used in conjunction with the average acres purchased by each farm to reveal a good deal of information about the local land market. Table 6.4 develops the type of information that can be obtained using the base run and the sensitivity analyses appearing in Tables 6.3 and 6.5. Clearly, the size of the parcel purchased is influenced by the farmer's internal credit rationing. Further, internal credit rationing also influences the amount of available land that they obtain. For example, these four farmers purchase approximately 75 percent of the available parcels when using a leverage ratio of 1.3 and 1.8. However, less than 75 percent of the total acres available is purchased. The percentage of available acres increases as farmers make more use of credit. This is evidence that the farmers are rarely purchasing the largest parcels of land (i.e., the 640 acre and 360 acre parcels). Questions can be raised in regard to how representative these results are. Behavior is not likely to remain the same over a ten-year period. It will be influenced by how recently purchase land was available in the relevant market. If it has been several years since a growth-oriented farmer has been able to obtain land, he may be more willing to take the risk when a parcel becomes available. Although data were not available, it is likely that the larger parcels are being transferred either through inheritance or through such mechanisms as land contracts. If this is the case, then the results here are reasonable, since these farmers are forced to finance the land at market prices and with conventional

TABLE 6.4
DEVELOPMENT OF LOCAL LAND MARKET CHARACTERISTICS UNDER DIFFERENT LEVERAGE ASSUMPTIONS

	Farm 1	Farm 2	Farm 3	Farm 4	% of Total Available Parcels Purchased by 4 Farms	% of Total Available Acres Purchased by 4 Farms
Leverage Ratio = 1.3 ¹						
Average Size of Purchase Parcel	53	86	96	110	75.6	52.0
Frequency of Parcels Purchased Over 10 Years	.36	1.48	2.64	3.08		
Leverage Ratio = 1.8 ²						
Average Size of Purchase Parcel	54	92	130	107	75.2	56.8
Frequency of Parcels Purchased Over 10 Years	.48	1.48	2.2	3.36		
Leverage Ratio = 1.0 ³						
Average Size of Purchase Parcel	42	70	78	96	66.4	39.1
Frequency of Parcels Purchased Over 10 Years	.12	1.32	2.16	3.04		

1 - Table 6.1 presents the detail of the base run which has a leverage ratio of 1.3

2 - Table 6.3 presents the detail of changing the leverage ratio to 1.8

3 - Table 6.5 presents the detail of changing the leverage ratio to 1.0

4 - There are 250 available parcels in these analyses with an average of 1418 acres available in a 10 year period

TABLE 6.5

LESS AGGRESSIVE GROWTH
(I.E., INTERNAL LEVERAGE RATIO = 1.0)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	19968.	33820.	44241.	41623.
DISPERSION=	6376.	11656.	16480.	16803.
MEASURE OF VAR=	.32	.34	.37	.40

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	10519.	20487.	24664.	22803.
DISPERSION=	4283.	8759.	11619.	10835.
MEASURE OF VAR=	.41	.43	.47	.48

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	2270.	4810.	5643.	4768.
DISPERSION=	1368.	3593.	5140.	4139.
MEASURE OF VAR=	.60	.75	.91	.87

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	17121.	18073.	18542.	18200.
DISPERSION=	888.	1158.	1605.	1599.
MEASURE OF VAR=	.05	.06	.09	.09

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1068706.	2308404.	3587405.	4919984.
DISPERSION=	127513.	253530.	404988.	580588.
MEASURE OF VAR=	.12	.11	.11	.12

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.0000	.0000	.0000	.0800
DISPERSION=	0.0000	0.0000	0.0000	.2769
MEASURE OF VAR=	0.0000	0.0000	0.0000	3.4611

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0275	.0374	.0420	.0459
DISPERSION=	.0109	.0103	.0106	.0111
MEASURE OF VAR=	.3941	.2739	.2520	.2430

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1558	.2298	.2306	.2511
DISPERSION=	.0722	.0820	.0696	.0449
MEASURE OF VAR=	.4636	.3570	.3019	.1786

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	5.	93.	166.	291.
DISPERSION=	13.	40.	68.	79.
MEASURE OF VAR=	2.76	.43	.41	.27

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	315.	248.	315.	182.
DISPERSION=	211.	167.	180.	183.
MEASURE OF VAR=	.67	.67	.57	1.01

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	620.	941.	1382.	1674.
DISPERSION=	213.	155.	163.	154.
MEASURE OF VAR=	.34	.16	.12	.09

NUMBER OF BIDS ON LAND	46	118	140	141
PERCENT OF POSSIBLE BIDS	18	47	55	56
TOTAL PARCELS PURCHASED	3	33	54	76

credit sources.

There is one value in Table 6.4 that is perplexing. All values on the average size of parcels purchased by each size farm under the three leverage ratios are consistent, except for the third largest farmer who purchased a larger average parcel than the largest farm under the most liberal credit rationing behavior (i.e., a leverage ratio of 1.8). A possible explanation may be that this practice enables the largest farmer to bid on more parcels, and he is more competitive than the third largest farmer. This leaves the third farmer the larger parcels after the largest farmer obtains more small parcels.

Finally, some comments should be made about the small amount of variability in family living expenses and the great variability in the frequency of refinancing land. Recall that family living is forced in at a minimum plus an allowance reflecting the level of accrual farm income. Once the initial level is established, the upper and lower bounds (for year-to-year adjustments) maintain stability in family living. In the case of refinancing land, farmers have some periods where they are able to gain control of more purchase land and the resulting cash flow problems force a sequence of refinancing land. In other periods (simulations), they may never have to refinance land either because of less purchasing of land and/or a better set of random prices and yields.

Turning to the case of using a leverage ratio of 1 (Table 6.5), the relationships are consistent. There is more income, taxes, and family living expenditures associated with less growth. Likewise, the growth in net worth is less and the need to refinance land is

practically eliminated. When the relative impact on purchased acres is compared across farms, it is the largest farmer that maintains the most ability to purchase more acres under this leverage control system. When Tables 6.5 and 6.1 are compared, the largest farmer purchases 87 percent of the acres in the base run, the third farmer purchases 66 percent, the second farmer purchases 73 percent, and the smallest farmer purchases only 26 percent as much as in the base run. These values reflect the power of current ownership in obtaining more land. That is, the leverage ratio of 1 did not have as serious an impact on that farmer's purchasing power who owned relatively more land which could be leveraged. It is also interesting to compare the accrual income and tax payments for the third farmer and the largest farmer. Although the third farmer has only a 6 percent higher accrual income, his tax payments are 18 percent higher than the largest farmer. This demonstrates the tax write-offs associated with purchasing more land. (That is, the largest farmer pays proportionally less taxes due to the fact that he purchases more land.)

Credit and Cash Reserves

Tables 6.6 and 6.7 demonstrate the impact of altering the required credit and cash reserve years. Recall the relationship between machinery purchases and the amount of credit and cash reserves. When reserves will not cover specified percentages (see Appendix B, Section 7.6) of the debt service, less machinery is purchased. Likewise, when the farmer has excess reserves to cover the specified years of debt service, then, above average machinery is purchased. First, Table 6.6 demonstrates that going from a two year reserve requirement to a

TABLE 6.6

LESS AGGRESSIVE GROWTH
(I.E., REQUIRED RESERVE YEARS = 3)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	18525.	27838.	31217.	29354.
DISPERSION=	6198.	13187.	16003.	21462.
MEASURE OF VAR=	.33	.47	.51	.73

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	8934.	15452.	17474.	13934.
DISPERSION=	3648.	9267.	12263.	13113.
MEASURE OF VAR=	.41	.60	.70	.94

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1700.	3312.	3997.	3359.
DISPERSION=	1012.	3155.	2881.	2376.
MEASURE OF VAR=	.60	.95	.72	.71

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16988.	17391.	17836.	17249.
DISPERSION=	731.	1589.	1693.	2189.
MEASURE OF VAR=	.04	.09	.09	.13

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1095374.	2377752.	3613136.	5007626.
DISPERSION=	150154.	287657.	498025.	711267.
MEASURE OF VAR=	.14	.12	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.1600	.1600	.5200	.6800
DISPERSION=	.6245	.6245	1.0847	1.2152
MEASURE OF VAR=	3.9031	3.9031	2.0860	1.7870

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0296	.0401	.0425	.0473
DISPERSION=	.0127	.0114	.0126	.0133
MEASURE OF VAR=	.4287	.2833	.2959	.2809

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1976	.2723	.3079	.2693
DISPERSION=	.0919	.0768	.0710	.0402
MEASURE OF VAR=	.4650	.2820	.2306	.1493

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	18.	130.	256.	336.
DISPERSION=	28.	53.	92.	67.
MEASURE OF VAR=	1.62	.41	.36	.20

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	338.	302.	266.	155.
DISPERSION=	251.	173.	185.	133.
MEASURE OF VAR=	.74	.57	.70	.86

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	655.	1032.	1422.	1691.
DISPERSION=	246.	165.	187.	124.
MEASURE OF VAR=	.37	.16	.13	.07

NUMBER OF BIDS ON LAND	58	131	157	143
PERCENT OF POSSIBLE BIDS	23	52	62	57
TOTAL PARCELS PURCHASED	8	38	66	77

TABLE 6.7

MORE AGGRESSIVE GROWTH
(I.E., REQUIRED RESERVE YEARS = 1)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	17946.	28403.	30047.	32286.
DISPERSION=	3787.	13546.	20795.	17928.
MEASURE OF VAR=	.21	.48	.69	.56

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	10659.	16107.	15904.	16534.
DISPERSION=	3516.	9635.	13196.	9777.
MEASURE OF VAR=	.33	.60	.83	.59

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	2543.	3601.	3924.	3398.
DISPERSION=	1434.	3309.	3451.	2322.
MEASURE OF VAR=	.56	.92	.88	.68

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16994.	17498.	17351.	17500.
DISPERSION=	509.	1392.	2164.	1706.
MEASURE OF VAR=	.03	.08	.12	.10

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1051338.	2345334.	3655369.	5004443.
DISPERSION=	145341.	254293.	520925.	731737.
MEASURE OF VAR=	.14	.11	.14	.15

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.0400	.2800	.5600	.3200
DISPERSION=	.2000	.7371	1.0440	.5568
MEASURE OF VAR=	5.0000	2.6325	1.8643	1.7399

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0258	.0390	.0435	.0472
DISPERSION=	.0123	.0101	.0132	.0135
MEASURE OF VAR=	.4771	.2601	.3028	.2868

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1515	.2847	.2820	.2831
DISPERSION=	.0936	.0779	.0580	.0649
MEASURE OF VAR=	.6179	.2736	.2056	.2292

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	13.	130.	235.	352.
DISPERSION=	28.	45.	75.	110.
MEASURE OF VAR=	2.16	.35	.32	.31

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	165.	336.	320.	240.
DISPERSION=	182.	205.	168.	158.
MEASURE OF VAR=	1.10	.61	.53	.66

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	478.	1066.	1455.	1792.
DISPERSION=	193.	206.	169.	133.
MEASURE OF VAR=	.40	.19	.12	.07

NUMBER OF BIDS ON LAND	57	132	146	156
PERCENT OF POSSIBLE BIDS	22	52	58	62
TOTAL PARCELS PURCHASED	5	39	57	86

three year requirement has very little impact on the base analysis. The only noteworthy difference here occurs with regard to the allocation of leased acres. The distribution shifts from the largest to the smallest farms. This is explained by the fact that the largest farms have relatively more debt service since they are purchasing more land and, therefore, they are unable to maintain comparable (to smaller farms) machinery complements. Therefore, since the allocation of lease land is partially determined by the level of machinery complement, the large farmers lose more lease land to the smaller farmers. The results associated with decreasing the required reserve years to one year are more striking. Table 6.7 reveals that under these conditions larger farmers do maintain above average machinery complements (despite their heavy debt service due to purchasing land) and are, therefore, more competitive in obtaining leased land. The impacts of this reallocation are also revealing. The largest farm is able to obtain more purchase land due to the ability to generate more income with leased land. Similarly, the smallest farmer does not purchase as many acres since his leased land (and income generating ability) is reduced from the base run. This also reveals some interesting relationships with respect to taxable income and income tax payments. Although the accrual farm income is lower than the base run, the taxable farm income is actually higher and the taxes are nearly 1.5 times higher. This reflects two factors: 1) The tax write-offs associated with growth are not as pronounced, and 2) The outside income due to selling excess labor (which is not reported here) is higher for the smallest farm (see Table 6.7).

Using Existing Acres to Support New Purchases

One of the control variables uses the number of existing acres required to support the debt service associated with the purchase of a new acre. Allowing for an inflation rate in land prices that is three percent above the inflation rate on returns causes the required existing acres to increase as time passes. In early years, 2 1/2 to 3 acres are sufficient. But, as the tenth year approaches, returns from four acres are required to support the debt service associated with one newly purchased acre. (Eventually returns inflate enough so that the new acre will be self supporting - see Table 4.3 and 4.4.) The important question was: "Under these conditions, will four acres be sufficient in the tenth year?" The answer was provided by increasing the control parameter to five acres and reviewing the results. As Table D.3 (Appendix D) demonstrates, this change had no impact on the largest two farms (i.e., Expected returns are higher for these farms) and only a slight impact on the two smallest farms (They purchased a couple of additional acres). Four acres are very seldom adequate for any of the farms after the tenth year.

Legitimate questions can be raised regarding how long inflation rates in land prices can remain above inflation rates in returns above land costs.¹ The March 1981 "Farm Real Estate Market Developments" reported that the 1980 land inflation rate was as great or greater than the general inflation rate in only 11 of 48 states. The conditions provided here increase the barriers to entry into cash grain

¹ This is why sensitivity analyses are performed to alter these conditions. (See "Alternative Inflation Rates".)

farming, especially if the leasing arrangements change in order to provide landlords with a greater share of the returns. (There is some evidence that share lease agreements may be changing to a 60-40 arrangement.) Many argue that land inflation will be forced to slow down as potential bidders demand a higher return to land (Scott, 1979). Although some may consider the discrepancy between rates of inflation in land prices and returns unreasonable, the important point to be made on the basis of this analysis is that established farmers can continue to purchase land under these conditions and still maintain a reasonable standard of living and a viable operation.

Changing Cash Flow Requirements

One of the more important control variables involves a whole farm (including family living) analysis of the impact of purchasing an available parcel of land. The presence of inflation (and the expectation that it will continue at comparable rates) enables the prospective buyer to accept expected negative cash flows in the early years after a purchase. The base run uses -\$50 per acre as an acceptable value.¹ For example, if a 400 acre operation is evaluating the purchase of 100 acres, any expected first year cash flow above -\$20,000 (i.e., 400×-50) would be acceptable. It must be recognized that the random prices and yields may result in either large deviations above or below the estimated cash flow. Recall that negative cash flows are financed with one-year loans first and then by the refinancing of land.

¹ This value is inflated at 4 percent per year. The section entitled "Alternative Inflation Rates on Important Control Variables" explains the logic of using 4 percent.

Table 6.8 reveals the impact of increasing the amount of acceptable negative cash flow from \$50 to \$150 per acre. All farms except farm 2 (the 600 acre farm) increased the owned acres. The general relationships associated with growth are present. This analysis emphasizes the importance of a local market and the behavior of the market participants. Although all farmers were willing to accept similar levels of negative cash flows (on a per acre basis), the largest two farmers increase their frequency of bids enough to outbid the second farmer more often (than in the base run). This results in the decrease in the purchased acres for the second farmer, even though he also increases the frequency of bidding. (It should be noted that the second farmer does acquire more lease land.) The largest farmer obtains 21 percent more owned land when he is willing to accept this higher level of negative cash flow. This 21 percent increase is also accompanied by a decrease in leased acres obtained and a significant increase in the frequency of refinancing land. It is also interesting to note that there is little difference in the growth in net worth, despite the increase in owned acres. This finding suggests that there may be an optimal level for refinancing land. (The increased refinancing of land is responsible for the net worth not growing at a higher rate.) However, it is more likely that the largest farmer (using the behavior reflected in Table 6.8) will have a greater increase in net worth after he has stopped growing. (This point emphasizes some of the problems associated with only focusing on the growth cycle.)

When farmers require a breakeven (zero \$ per acre) cash flow, all farmers reduce their purchasing of acres (see Table 6.9). Comparing

TABLE 6.8

MORE AGGRESSIVE GROWTH
(I.E., CASH FLOW REQUIREMENT = -\$150/AC)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	17679.	30992.	29494.	21574.
DISPERSION=	6084.	13965.	18797.	23021.
MEASURE OF VAR=	.34	.45	.64	1.07

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8390.	17849.	16092.	10018.
DISPERSION=	3475.	10298.	14341.	15530.
MEASURE OF VAR=	.41	.58	.89	1.55

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1519.	4163.	4159.	3337.
DISPERSION=	862.	3589.	3038.	2470.
MEASURE OF VAR=	.57	.86	.73	.74

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16842.	17637.	17799.	17009.
DISPERSION=	758.	1645.	1837.	2218.
MEASURE OF VAR=	.05	.09	.10	.13

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1098543.	2364067.	3616387.	4995308.
DISPERSION=	145485.	326934.	492617.	702202.
MEASURE OF VAR=	.13	.14	.14	.14

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1600	.1200	.7600	1.2400
DISPERSION=	.6245	.6000	1.4514	1.4224
MEASURE OF VAR=	3.9031	5.0000	1.9098	1.1471

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0300	.0394	.0426	.0471
DISPERSION=	.0123	.0126	.0125	.0132
MEASURE OF VAR=	.4088	.3195	.2948	.2809

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2140	.2390	.3119	.3166
DISPERSION=	.0866	.0934	.0813	.0509
MEASURE OF VAR=	.4046	.3908	.2607	.1609

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	21.	107.	266.	410.
DISPERSION=	29.	53.	91.	95.
MEASURE OF VAR=	1.37	.49	.34	.23

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	366.	310.	229.	155.
DISPERSION=	233.	174.	138.	125.
MEASURE OF VAR=	.64	.56	.60	.81

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	687.	1018.	1394.	1765.
DISPERSION=	226.	176.	157.	136.
MEASURE OF VAR=	.33	.17	.11	.08

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
NUMBER OF BIDS ON LAND	60	143	175	170
PERCENT OF POSSIBLE BIDS	23	57	70	68
TOTAL PARCELS PURCHASED	10	33	65	93

TABLE 6.9

LESS AGGRESSIVE GROWTH
(I.E., CASH FLOW REQUIREMENT = \$0/AC)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	18606.	34018.	39062.	45237.
DISPERSION=	3361.	10782.	17049.	19605.
MEASURE OF VAR=	.18	.32	.44	.43

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	11324.	18261.	20479.	22827.
DISPERSION=	3084.	8055.	11562.	11174.
MEASURE OF VAR=	.27	.44	.56	.49

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	2723.	3678.	4282.	4748.
DISPERSION=	1332.	3259.	4573.	3619.
MEASURE OF VAR=	.49	.89	1.07	.76

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	17135.	18075.	17938.	18561.
DISPERSION=	462.	1216.	1961.	1853.
MEASURE OF VAR=	.03	.07	.11	.10

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1035414.	2368159.	3636214.	4947377.
DISPERSION=	109212.	255958.	455959.	632258.
MEASURE OF VAR=	.11	.11	.13	.13

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.0000	.0000	.0400	.0800
DISPERSION=	0.0000	0.0000	.2000	.2769
MEASURE OF VAR=	0.0000	0.0000	5.0000	3.4611

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0247	.0399	.0432	.0463
DISPERSION=	.0097	.0102	.0118	.0120
MEASURE OF VAR=	.3920	.2555	.2744	.2594

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1296	.2064	.2315	.2124
DISPERSION=	.0575	.0782	.0517	.0422
MEASURE OF VAR=	.4440	.3791	.2233	.1985

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	6.	85.	176.	242.
DISPERSION=	15.	48.	66.	72.
MEASURE OF VAR=	2.34	.57	.38	.30

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	126.	339.	283.	312.
DISPERSION=	148.	217.	192.	198.
MEASURE OF VAR=	1.17	.64	.68	.64

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	433.	1024.	1359.	1754.
DISPERSION=	150.	215.	179.	185.
MEASURE OF VAR=	.35	.21	.13	.11

NUMBER OF BIDS ON LAND	29	99	108	103
PERCENT OF POSSIBLE BIDS	11	39	43	41
TOTAL PARCELS PURCHASED	4	30	49	64

this analysis with the base run reveals a positive increase in growth in net worth despite the decrease in purchased acres for the third farm (i.e., The third farmer's net worth grows at 4.32 versus 4.26 percent per year, while the purchased acres is 176 versus 253). Otherwise, all relationships are as expected. Using this policy practically eliminates the need for refinancing land for all farmers. Of 250 opportunities, the largest farmer refinanced land only two times or .8 of one percent of the time. This compares to a 6.8 percent chance of requiring refinancing of land under the base run. Clearly, the estimate of expected cash flow is reliable, if the farmer wants to avoid the need to refinance land because of negative cash flows. This does not eliminate negative cash flows. It only increases the chance that short-term financing will be adequate to cover such deficits. The frequency of negative cash flows could be practically eliminated by increasing the required cash flow to a positive value (i.e., \$20 per acre). However, the revealing aspect of Table 6.9 is that growth can occur without the need for refinancing land for these farmers under all of the conditions in Appendix A.

Once again, the reduced growth situation (presented in Table 6.9) reveals the importance of assumptions concerning the acquisition of lease land. Again, the smallest farmer's ability to obtain lease land is greatly reduced (All other farmers increase their lease land) due to the design of the model. As the larger farmers are able to purchase above average machinery complements (due to less resources being used for the purchase of land), they increase their competitive position in the lease market.

Changing Required Average Owner Equity

A control variable that is used to examine both the purchase of land and purchases of above average machinery complements is the exponentially averaged cost basis owner equity. Recall that this value reflects the firm's internal financing capacity and the general well-being of the firm. The base run assumes that as long as this value does not go below negative 50 (1979) dollars per acre, it will be unimportant in making expansion decisions.¹ Table 6.10 reflects the sensitivity of this value as it is made more restrictive (i.e., -\$10 per acre). This change has little impact on the purchasing of land. (All farmers do purchase slightly less land.) But, the impact on the allocation of lease land is noteworthy. The first and third farms lose lease acres to the second and fourth farms. This is attributed to relationships between machinery complement, owner equity, and the acquisition of lease land. The relatively unrestricted level of -\$50 per acre was selected since it allows for above-average machinery expansion despite owner equity changes. This causes less distortion in the allocation of lease land.

Inflating Control Variables at Different Rates

The two controls that are based on a per acre value (cash flow and owner equity) can be inflated at different rates with different results. The logic associated with allowing them to inflate at a rate lower than the inflation rate on returns is that this provides a rate

¹ This control variable also inflates at 4 percent per year.

TABLE 6.10

LESS AGGRESSIVE GROWTH
(I.E., OWNER EQUITY = -\$10/AC)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	17846.	30233.	30568.	36292.
DISPERSION=	5272.	13825.	16164.	22376.
MEASURE OF VAR=	.30	.46	.53	.62

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	9762.	16405.	17571.	18678.
DISPERSION=	3535.	9183.	10344.	13962.
MEASURE OF VAR=	.36	.56	.59	.75

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	2096.	3341.	3782.	4481.
DISPERSION=	1239.	3174.	2648.	4281.
MEASURE OF VAR=	.59	.95	.70	.96

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16953.	17571.	17589.	17606.
DISPERSION=	711.	1341.	1671.	2239.
MEASURE OF VAR=	.04	.08	.09	.13

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1056248.	2378302.	3665239.	4945855.
DISPERSION=	125018.	271915.	483709.	651647.
MEASURE OF VAR=	.12	.11	.13	.13

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.0800	.2400	.5200	.2800
DISPERSION=	.2769	.8307	1.0456	.6782
MEASURE OF VAR=	3.4611	3.4611	2.0108	2.4223

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0265	.0402	.0439	.0462
DISPERSION=	.0107	.0108	.0124	.0123
MEASURE OF VAR=	.4061	.2687	.2828	.2667

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1929	.2784	.2816	.2528
DISPERSION=	.0936	.0704	.0602	.0523
MEASURE OF VAR=	.4851	.2527	.2138	.2069

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	16.	126.	243.	302.
DISPERSION=	26.	44.	77.	79.
MEASURE OF VAR=	1.61	.35	.31	.26

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	253.	405.	176.	227.
DISPERSION=	194.	224.	146.	133.
MEASURE OF VAR=	.77	.55	.83	.58

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	569.	1131.	1319.	1730.
DISPERSION=	190.	212.	147.	155.
MEASURE OF VAR=	.33	.19	.11	.09

NUMBER OF BIDS ON LAND	52	124	144	135
PERCENT OF POSSIBLE BIDS	20	49	57	54
TOTAL PARCELS PURCHASED	8	37	57	76

control mechanism as growth occurs. That is, once growth begins, it may be reasonable to expect adjustments to occur in the amount of risk that a farmer wishes to take. Inflating the control variables at a lower rate than returns provides more restrictive controls as time passes and growth occurs. The ultimate level selected for the base run was 4 percent per year. Table 6.11 demonstrates the impact of allowing the cash flow and owner equity controls to inflate at 9 percent per year (the inflation rate on returns) and Table 6.12 demonstrates the impact of allowing for no inflation on these control variables. Allowing for inflation at the same rate as returns provides very similar results as the base analysis. Only the largest farmer is able to obtain more acres, and this is at the expense of nearly doubling the refinancing of land (see Table 6.11). When cash flow and owner equity values are not allowed to inflate, all farms purchase fewer acres and the smallest farmer is unable to remain competitive in the lease market. (Again, this is the heavy influence of owner equity on machinery expansion.) Inflation rates of 2 percent (Table D.4) and 5 percent (Table D.5) were also developed. The 4 percent inflation rate was selected because it was very similar to the analysis in Table 6.11 (an inflation rate equal to inflation on returns) with the exception of allowing for more control for the most aggressive farm. (The largest farmer did not need to refinance land as often.)

TABLE 6.11

MORE AGGRESSIVE GROWTH
(I.E., INFLATING CONTROL VARIABLES AT 9%)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18250.	27186.	31223.	25510.
DISPERSION=	6427.	13948.	16211.	22530.
MEASURE OF VAR=	.35	.51	.52	.88

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8814.	15060.	16669.	12181.
DISPERSION=	3638.	9665.	12516.	14758.
MEASURE OF VAR=	.41	.64	.75	1.21

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1675.	3326.	3909.	3507.
DISPERSION=	991.	3337.	2774.	2506.
MEASURE OF VAR=	.59	1.00	.71	.71

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16945.	17212.	17920.	17096.
DISPERSION=	771.	1677.	1716.	2295.
MEASURE OF VAR=	.05	.10	.10	.13

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1095009.	2393512.	3625976.	4979849.
DISPERSION=	147073.	322790.	498583.	697793.
MEASURE OF VAR=	.13	.13	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1600	.2400	.4800	1.1200
DISPERSION=	.6245	.7234	1.0847	1.4526
MEASURE OF VAR=	3.9031	3.0142	2.2599	1.2969

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0296	.0406	.0428	.0468
DISPERSION=	.0124	.0125	.0126	.0131
MEASURE OF VAR=	.4198	.3068	.2952	.2803

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2067	.2654	.3011	.2973
DISPERSION=	.0904	.0793	.0776	.0527
MEASURE OF VAR=	.4375	.2987	.2576	.1774

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	19.	128.	251.	373.
DISPERSION=	29.	42.	97.	85.
MEASURE OF VAR=	1.49	.33	.39	.23

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	339.	267.	258.	197.
DISPERSION=	242.	134.	163.	145.
MEASURE OF VAR=	.71	.50	.63	.73

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	658.	995.	1409.	1770.
DISPERSION=	232.	129.	181.	145.
MEASURE OF VAR=	.35	.13	.13	.08

NUMBER OF BIDS ON LAND	61	137	162	150
PERCENT OF POSSIBLE BIDS	24	54	64	59
TOTAL PARCELS PURCHASED	9	37	66	81

TABLE 6.12

LESS AGGRESSIVE GROWTH
(I.E., NO INFLATION ON CONTROL VARIABLES)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180
			1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	17577.	29111.	30050.
DISPERSION=	4734.	13039.	19657.
MEASURE OF VAR=	.27	.45	.65
			.58
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	9949.	15945.	15262.
DISPERSION=	3585.	9149.	11621.
MEASURE OF VAR=	.36	.57	.76
			.58
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-			
MEAN VALUES =	2218.	3372.	3546.
DISPERSION=	1341.	3137.	3006.
MEASURE OF VAR=	.60	.93	.85
			.69
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-			
MEAN VALUES =	16898.	17525.	17368.
DISPERSION=	647.	1335.	2111.
MEASURE OF VAR=	.04	.08	.12
			.11
ENDING NET WORTH -NOMINAL DOLLARS-			
MEAN VALUES =	1062333.	2372234.	3673639.
DISPERSION=	144575.	273730.	546999.
MEASURE OF VAR=	.14	.12	.15
			.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD			
MEAN VALUES =	.0800	.2400	.6000
DISPERSION=	.2769	.8794	1.1547
MEASURE OF VAR=	3.4611	3.6641	1.9245
			1.7399
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)			
MEAN VALUES =	.0268	.0400	.0439
DISPERSION=	.0122	.0108	.0138
MEASURE OF VAR=	.4558	.2713	.3144
			.2767
ENDING DEBT/ASSET RATIO			
MEAN VALUES =	.1712	.2637	.2704
DISPERSION=	.0916	.0710	.0618
MEASURE OF VAR=	.5352	.2693	.2285
			.1665
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	16.	120.	227.
DISPERSION=	28.	43.	81.
MEASURE OF VAR=	1.77	.36	.36
			.25
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	195.	338.	288.
DISPERSION=	174.	236.	206.
MEASURE OF VAR=	.89	.70	.71
			.73
ENDING TOTAL TILLABLE ACRES CONTROLLED			
MEAN VALUES =	511.	1058.	1415.
DISPERSION=	176.	233.	185.
MEASURE OF VAR=	.35	.22	.13
			.08

NUMBER OF BIDS ON LAND	56	124	137
PERCENT OF POSSIBLE BIDS	22	49	54
TOTAL PARCELS PURCHASED	7	38	52
			82

Combining Changes in Control Variables
to Provide for More Growth

Once a base run was established, sensitivity was performed to assess how much these farmers could grow without becoming insolvent. (Recall that refinancing land beyond the point where land loans are greater than 75 percent of the value of the land is not allowed.) The first test involved increasing the acceptable negative cash flow to -\$150 per acre and the leverage ratio to 1.6. Table 6.13 reveals that all farmers except the second one are able to increase their purchased acres under this behavior. The second farmer purchases as many parcels, but the average size is smaller. This indicates that the largest two farmers are able to outbid him on some of the larger parcels.

The most aggressive growth strategy (without high risk of becoming insolvent) is developed in Table 6.14. Under this strategy acceptable negative cash flow is increased to \$200 per acre, acceptable negative owner equity is increased to \$60 per acre, the leverage ratio is increased to 1.8, and the acres required to support a new acre are set at 5. This strategy did cause farm 2 to fail the test of solvency in years 8 and 10 for one of the 25 simulations. Therefore, it should represent the most aggressive growth strategy. Under this strategy, all farmers increase their purchased acres. (Farm 1 increases purchased acres 137 percent, Farm 2 - 34 percent, Farm 3 - 43 percent, and Farm 4 - 39 percent.) Each farmer also incurs a substantial increase in the frequency of refinancing land. The growth in net worth is similar for all farms except in the case of farm 2 where

TABLE 6.13

MORE AGGRESSIVE GROWTH (I.E., INTERNAL LEVERAGE RATIO = 1.6
AND CASH FLOW REQUIREMENT = -\$150/AC)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	14890.	30573.	23279.	19321.
DISPERSION=	8260.	13296.	22329.	28579.
MEASURE OF VAR=	.55	.43	.96	1.48

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	7186.	17677.	11602.	4335.
DISPERSION=	6382.	9048.	15513.	23475.
MEASURE OF VAR=	.89	.51	1.34	5.42

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1684.	4113.	3666.	3162.
DISPERSION=	1312.	2920.	2972.	2093.
MEASURE OF VAR=	.78	.71	.81	.66

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16370.	17683.	17543.	16981.
DISPERSION=	1506.	1384.	2062.	2261.
MEASURE OF VAR=	.09	.08	.12	.13

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1097283.	2334657.	3681060.	4998787.
DISPERSION=	163777.	276954.	500254.	761032.
MEASURE OF VAR=	.15	.12	.14	.15

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.7600	.2000	1.4400	1.6400
DISPERSION=	1.9425	.6455	1.6350	1.9765
MEASURE OF VAR=	2.5559	3.2275	1.1354	1.2052

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0297	.0384	.0443	.0470
DISPERSION=	.0134	.0111	.0126	.0142
MEASURE OF VAR=	.4527	.2888	.2852	.3022

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2223	.2777	.3249	.3180
DISPERSION=	.1056	.0829	.0943	.0803
MEASURE OF VAR=	.4752	.2985	.2903	.2526

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	30.	122.	302.	406.
DISPERSION=	33.	52.	116.	108.
MEASURE OF VAR=	1.09	.43	.38	.27

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	258.	341.	203.	259.
DISPERSION=	237.	160.	127.	193.
MEASURE OF VAR=	.92	.47	.63	.75

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	588.	1062.	1406.	1866.
DISPERSION=	233.	169.	171.	201.
MEASURE OF VAR=	.40	.16	.12	.11

NUMBER OF BIDS ON LAND	82	179	173	176
PERCENT OF POSSIBLE BIDS	32	71	69	70
TOTAL PARCELS PURCHASED	13	37	70	86

TABLE 6.14

MOST AGGRESSIVE GROWTH (I.E., INTERNAL LEVERAGE RATIO = 1.8,
OWNER EQUITY = -\$60/AC, AND CASH FLOW REQUIREMENT = -\$200/AC)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	13184.	25059.	13101.	14584.
DISPERSION=	7503.	19727.	22164.	29282.
MEASURE OF VAR=	.57	.79	1.69	2.01

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	5968.	13531.	1902.	-394.
DISPERSION=	5936.	14187.	19829.	24779.
MEASURE OF VAR=	.99	1.05	10.42	-62.93

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1457.	3990.	2976.	2891.
DISPERSION=	1127.	3319.	2286.	1622.
MEASURE OF VAR=	.77	.83	.77	.56

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16141.	17559.	16695.	16831.
DISPERSION=	1465.	1570.	1883.	2298.
MEASURE OF VAR=	.09	.09	.11	.14

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1095001.	2276885.	3711530.	4976128.
DISPERSION=	166943.	348673.	459840.	802352.
MEASURE OF VAR=	.15	.15	.12	.16

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.9600	.9600	2.3200	1.9200
DISPERSION=	2.0100	1.4572	2.1741	2.1393
MEASURE OF VAR=	2.0937	1.5179	.9371	1.1142

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0295	.0356	.0451	.0465
DISPERSION=	.0138	.0147	.0118	.0148
MEASURE OF VAR=	.4683	.4112	.2605	.3189

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2674	.3463	.3728	.3609
DISPERSION=	.1282	.1295	.0707	.0768
MEASURE OF VAR=	.4794	.3740	.1897	.2128

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	45.	171.	363.	469.
DISPERSION=	44.	86.	94.	133.
MEASURE OF VAR=	.98	.50	.26	.28

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	261.	293.	246.	254.
DISPERSION=	203.	181.	181.	187.
MEASURE OF VAR=	.78	.62	.73	.73

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	606.	1069.	1511.	1923.
DISPERSION=	213.	190.	186.	189.
MEASURE OF VAR=	.35	.18	.12	.10

NUMBER OF BIDS ON LAND	112	193	180	194
PERCENT OF POSSIBLE BIDS	44	77	72	77
TOTAL PARCELS PURCHASED	16	45	68	97

there is a substantial decline. This is associated with the fact that this farm became insolvent during one of the 25 simulations. Even under this aggressive set of strategies, the four farms are still unable to obtain all available parcels. They do obtain 90 percent (versus 76 percent in the base run) of the parcels and 74 percent (versus 52 percent) of the total available acreage. Again, this emphasizes how difficult it is for even the largest farmers in this study to obtain the large parcels (i.e., the 360 and 640 acre parcels). Finally, the distribution of lease land under this set of strategies is nearly uniform. (All farmers obtain around the same number of lease acres.)

The Impact of Changing Assumptions Concerning

Family Living Expenditures

Decreasing Family Living Expenditures

Changing assumptions concerning the minimum acceptable level of family living has the most impact on the smallest farmer. Table 6.15 illustrates the impact of reducing the minimum (1979) level from \$10,000 to \$7000. The three larger farmers are not significantly impacted by this change. However, the smallest farmer does purchase 15 more acres (a 79 percent increase) and the growth in net worth goes from 2.93 percent per year to 3.71 percent per year. (All other farmers experience less increase in the growth in net worth.)

TABLE 6.15

DECREASING FAMILY LIVING REQUIREMENTS
(MINIMUM FAMILY LIVING = \$7,000)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	17463.	30271.	33133.	28256.
DISPERSION=	7818.	13864.	17464.	22976.
MEASURE OF VAR=	.45	.46	.53	.81

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8380.	16956.	18380.	12455.
DISPERSION=	4413.	10170.	12929.	17542.
MEASURE OF VAR=	.53	.60	.70	1.41

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1710.	3973.	4411.	3490.
DISPERSION=	1179.	3473.	3043.	2745.
MEASURE OF VAR=	.69	.87	.69	.79

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	13777.	14692.	15252.	14694.
DISPERSION=	1018.	1609.	1697.	2159.
MEASURE OF VAR=	.07	.11	.11	.15

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1196435.	2434338.	3700679.	5103921.
DISPERSION=	170707.	285550.	491027.	727061.
MEASURE OF VAR=	.14	.12	.13	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.2000	.2400	.4400	.7600
DISPERSION=	.8165	.7234	.8699	1.5078
MEASURE OF VAR=	4.0825	3.0142	1.9770	1.9839

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0371	.0420	.0445	.0489
DISPERSION=	.0130	.0109	.0122	.0135
MEASURE OF VAR=	.3514	.2607	.2745	.2752

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1967	.2567	.2951	.2758
DISPERSION=	.1065	.0866	.0607	.0542
MEASURE OF VAR=	.5414	.3375	.2059	.1967

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	34.	126.	253.	358.
DISPERSION=	34.	59.	67.	80.
MEASURE OF VAR=	1.01	.46	.27	.22

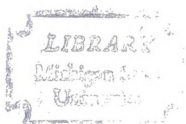
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	314.	291.	219.	237.
DISPERSION=	253.	159.	131.	170.
MEASURE OF VAR=	.81	.55	.60	.72

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	647.	1018.	1372.	1795.
DISPERSION=	244.	141.	134.	154.
MEASURE OF VAR=	.38	.14	.10	.09

NUMBER OF BIDS ON LAND	68	134	167	145
PERCENT OF POSSIBLE BIDS	27	53	66	57
TOTAL PARCELS PURCHASED	14	35	68	79



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Increasing Family Living Requirements

Consistent results are obtained when increasing the minimum family consumption to \$15,000 (Table 6.16). Again, the smallest farmer is impacted the most. All farmers acquire less owned acres, but the smallest farm loses proportionally more. The smallest farmer also experiences the largest decline in the growth in net worth (i.e., 96 percent for the smallest farm, 20 percent for farm 2, 4 percent for farm 3, and 5 percent for farm 4). The increase in family living also has a dramatic impact on the frequency of refinancing land for the smallest farm. This occurs even though the smallest farm is unable to purchase land. The second farm also suffers more than the larger farms from this increase in family living expenditures. This farm purchases proportionally less land and experiences more decline in growth in net worth than the two larger farms. Farm 2 also requires more refinancing of land (compared to the base run) even though the purchase of new land is reduced.

Allowing More Variability in Family Living Expenditures

Finally, the year-to-year variability in family living expenditures was allowed to increase (i.e., The upper bound on family living was set at two times the moving average and the lower bound was set at one half of the moving average). This analysis did not prove to be revealing. (There was little change from the base run.) Therefore, the results appear in Table D.6.

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TABLE 6.16

INCREASING FAMILY LIVING REQUIREMENTS
(MINIMUM FAMILY LIVING = \$15,000)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES	
INITIAL NET WORTH-	332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	15970.	27975.	28647.	30066.
DISPERSION=	4766.	13176.	14233.	19439.
MEASURE OF VAR=	.30	.47	.50	.65
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8956.	16738.	15606.	15081.
DISPERSION=	2948.	8555.	8336.	10239.
MEASURE OF VAR=	.33	.51	.53	.68
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1694.	3419.	3025.	3099.
DISPERSION=	871.	2860.	2120.	1916.
MEASURE OF VAR=	.51	.84	.70	.62
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	21701.	22324.	22021.	21964.
DISPERSION=	669.	1513.	1952.	1816.
MEASURE OF VAR=	.03	.07	.09	.08
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	921888.	2191381.	3541775.	4868622.
DISPERSION=	132542.	236705.	548700.	730626.
MEASURE OF VAR=	.14	.11	.15	.15
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	1.4000	.2400	.5600	.7200
DISPERSION=	1.5811	.5228	.9165	.8907
MEASURE OF VAR=	1.1294	2.1784	1.6366	1.2371
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0150	.0333	.0408	.0449
DISPERSION=	.0129	.0101	.0144	.0140
MEASURE OF VAR=	.8610	.3025	.3528	.3109
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2086	.2724	.2933	.2704
DISPERSION=	.0399	.0753	.0621	.0469
MEASURE OF VAR=	.1913	.2764	.2118	.1733
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	3.	102.	232.	315.
DISPERSION=	11.	45.	77.	87.
MEASURE OF VAR=	3.46	.44	.33	.27
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	206.	347.	243.	264.
DISPERSION=	178.	221.	189.	208.
MEASURE OF VAR=	.86	.64	.78	.79
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	510.	1050.	1375.	1779.
DISPERSION=	177.	221.	210.	183.
MEASURE OF VAR=	.35	.21	.15	.10
NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	36	125	135	147
TOTAL PARCELS PURCHASED	14	50	54	58
	2	36	56	79

Eliminating Off-Farm Employment

Recall that all farmers use 1.5 man years of family labor. Any labor that is not used on the farm is assumed to be sold off the farm. Naturally the smallest farmers sell the most off-farm labor. Table 6.17 presents the results of disallowing off-farm employment. The smallest farmer is nearly eliminated from purchasing land when he does not supplement his operation with off-farm income. Of 250 possible purchases, he purchases only one parcel of land. The growth in net worth for the smallest farmer is also adversely affected by eliminating off-farm income. (The average growth in net worth goes from 2.93 to 1.93 percent per year.) This decline in the growth rate reflects the need to use the equity in order to maintain an adequate standard of living. Further evidence for this conclusion is the fact that the need to refinance land increases even though only one parcel of land is purchased. Other farms are not as adversely affected by disallowing outside income.

Altering Cash Flow and Income Tax Management

Eliminating Cash Flow and Income Tax Management

The model used in this study is unique in the attempt to manage cash flow and stabilize income taxes through grain inventories. Recall that the model first goes through several steps to attempt to provide enough cash to meet the current year's needs and, then, to stabilize taxable income. The base analysis allows for a maximum of 84 percent storage of the current year's crop to a minimum of 18 percent. Allowing for no adjustments for cash flow and income tax

TABLE 6.17

ELIMINATING OFF-FARM EMPLOYMENT

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	17484.	28994.	28694.	31658.
DISPERSION=	5295.	12641.	16841.	18604.
MEASURE OF VAR=	.30	.44	.59	.59
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	9313.	15568.	15673.	16322.
DISPERSION=	3140.	9013.	12459.	11096.
MEASURE OF VAR=	.34	.58	.79	.68
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1092.	2808.	3378.	3551.
DISPERSION=	492.	2815.	2615.	2601.
MEASURE OF VAR=	.45	1.00	.77	.73
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	15548.	17059.	17373.	17383.
DISPERSION=	912.	1523.	1939.	2075.
MEASURE OF VAR=	.06	.09	.11	.12
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	966428.	2344193.	3622633.	4995291.
DISPERSION=	141659.	324571.	519365.	702700.
MEASURE OF VAR=	.15	.14	.14	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.2800	.3200	.5600	.3600
DISPERSION=	.6782	1.0693	1.1210	.5686
MEASURE OF VAR=	2.4223	3.3415	2.0018	1.5795
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0193	.0389	.0427	.0471
DISPERSION=	.0131	.0127	.0133	.0131
MEASURE OF VAR=	.6809	.3265	.3122	.2791
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1944	.2691	.2937	.2684
DISPERSION=	.0489	.0860	.0648	.0452
MEASURE OF VAR=	.2516	.3197	.2208	.1686
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	2.	122.	246.	331.
DISPERSION=	8.	57.	92.	74.
MEASURE OF VAR=	5.00	.47	.37	.22
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	294.	317.	243.	206.
DISPERSION=	235.	164.	189.	150.
MEASURE OF VAR=	.80	.52	.78	.72
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	596.	1038.	1390.	1738.
DISPERSION=	236.	179.	174.	123.
MEASURE OF VAR=	.40	.17	.12	.07

NUMBER OF BIDS ON LAND	36	124	142	144
PERCENT OF POSSIBLE BIDS	14	49	56	57
TOTAL PARCELS PURCHASED	1	39	59	81

management (i.e., fixing the percent of stored grain at 70 percent for every year) had two predictable impacts: 1) The frequency of refinancing land increased by 176 percent or more for every farm, and 2) The income tax commitment increased by 11 percent or more for every farm (See Table 6.18). Somewhat unpredictable growth in purchased acres occurred for the two largest farms. The two smallest farms' purchased acres remained essentially the same. Therefore, a net increase in purchased acres (including all four farms) was associated with the increased instability brought on by disallowing cash flow and income tax management. It is difficult to evaluate the precise reasons for this relationship.¹ However, given the manner in which expected cash flows are evaluated, it is probably the cash flow constraint that is less binding under this type of instability. The most significant aspect of the analysis in Table 6.18 involves the dramatic increase in the frequency of refinancing land and the increase in tax payments. The conclusion is that it is more reasonable to expect farmers to adjust the level of storage in order to manage cash flows and income taxes.

Maximum Cash Flow and Income Tax Management

Given the conclusion above, the next analysis allows for complete adjustments in storage (i.e., store as much as 100 percent or as little as 0 percent). Table 6.19 presents the results of this change. Income tax payments do decrease for the three largest farmers.

¹ Future research using this model should develop a counting system to determine which constraints prevent land purchases. This would provide more insights into these types of questions.

TABLE 6.18

ELIMINATING CASH FLOW AND INCOME TAX MANAGEMENT
NO STORAGE ADJUSTMENTS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	17820.	28408.	30075.	29095.
DISPERSION=	6287.	13610.	16296.	18836.
MEASURE OF VAR=	.35	.48	.54	.65
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	7534.	12571.	7282.	-1621.
DISPERSION=	5511.	13095.	16514.	18087.
MEASURE OF VAR=	.73	1.04	2.27	-11.16
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1925.	4232.	4441.	3874.
DISPERSION=	995.	3454.	2915.	3267.
MEASURE OF VAR=	.52	.82	.66	.84
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16754.	17334.	17605.	17269.
DISPERSION=	831.	1542.	1743.	1793.
MEASURE OF VAR=	.05	.09	.10	.10
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1097807.	2366062.	3634692.	5062378.
DISPERSION=	143411.	309619.	463432.	652272.
MEASURE OF VAR=	.13	.13	.13	.13
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.4400	.9200	1.4400	1.8800
DISPERSION=	1.2610	1.6310	1.6350	1.5631
MEASURE OF VAR=	2.8658	1.7728	1.1354	.8314
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0299	.0396	.0432	.0485
DISPERSION=	.0122	.0121	.0117	.0121
MEASURE OF VAR=	.4073	.3056	.2711	.2499
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2153	.2769	.3285	.3240
DISPERSION=	.0941	.0980	.0808	.0570
MEASURE OF VAR=	.4369	.3539	.2459	.1760
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	19.	125.	266.	390.
DISPERSION=	29.	55.	89.	83.
MEASURE OF VAR=	1.49	.44	.34	.21
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	366.	264.	221.	210.
DISPERSION=	215.	181.	190.	141.
MEASURE OF VAR=	.59	.69	.86	.67
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	686.	989.	1386.	1800.
DISPERSION=	206.	167.	190.	165.
MEASURE OF VAR=	.30	.17	.14	.09

NUMBER OF BIDS ON LAND	56	134	169	172
PERCENT OF POSSIBLE BIDS	22	53	67	68
TOTAL PARCELS PURCHASED	9	38	65	88

TABLE 6.19

MAXIMUM CASH FLOW AND INCOME TAX MANAGEMENT
COMPLETE STORAGE ADJUSTMENTS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	17790.	28486.	29991.	31822.
DISPERSION=	4947.	13966.	20732.	18228.
				.57

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	9341.	15626.	16169.	17861.
DISPERSION=	3302.	8261.	10007.	7672.
MEASURE OF VAR=	.35	.53	.62	.43

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1966.	3068.	3281.	3249.
DISPERSION=	1190.	2870.	2602.	1893.
MEASURE OF VAR=	.61	.94	.79	.58

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16990.	17622.	17476.	17503.
DISPERSION=	658.	1469.	2215.	1869.
MEASURE OF VAR=	.04	.08	.13	.11

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1074923.	2375398.	3658310.	4990394.
DISPERSION=	147848.	271270.	529133.	731506.
MEASURE OF VAR=	.14	.11	.14	.15

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.2000	.4800	.8000	.4000
DISPERSION=	.8165	1.0456	1.3844	.6455
MEASURE OF VAR=	4.0825	2.1784	1.7305	1.6137

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0279	.0401	.0436	.0469
DISPERSION=	.0125	.0107	.0134	.0136
MEASURE OF VAR=	.4490	.2675	.3070	.2896

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1737	.2832	.2748	.2823
DISPERSION=	.0875	.0729	.0620	.0642
MEASURE OF VAR=	.5034	.2575	.2256	.2274

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	16.	134.	232.	354.
DISPERSION=	31.	46.	79.	112.
MEASURE OF VAR=	1.91	.34	.34	.32

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	218.	301.	290.	248.
DISPERSION=	182.	199.	186.	194.
MEASURE OF VAR=	.84	.66	.64	.78

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	534.	1035.	1422.	1802.
DISPERSION=	182.	196.	176.	160.
MEASURE OF VAR=	.34	.19	.12	.09

NUMBER OF BIDS ON LAND	60	137	145	155
PERCENT OF POSSIBLE BIDS	23	54	57	61
TOTAL PARCELS PURCHASED	6	40	56	86

However, farmers 2 and 3 have a greater incidence of refinancing land, and farmer 3 actually purchases less acres. This is explained by the fact that farmer 3 purchases larger parcels of land and, thus, purchases fewer parcels under this analysis (i.e., average size is 104 acres versus 96 acres). It may also be that managing income taxes preempts the management of cash flows when complete adjustments are allowed. Finally, the most striking difference associated with this analysis involves the reallocation of lease land. The most likely explanation for this is that better management of cash flows and income taxes stabilizes cost basis owner equity. This influences the purchase of machinery complements which, in turn, influence the acquisition of lease land.

Altering Other Investment and Production Assumptions

Allowing Only Average Machinery Complements

This analysis assumes that there will be no adjustments in the level of investment in machinery (i.e., An average complement will always be purchased). Recall that all other analyses allow for five discrete levels of machinery investment. Table 6.20 presents the results of this analysis. Clearly, the acquisition of above-average machinery complements plays an important role in enabling the smallest farmer to obtain lease land. Under this analysis the smallest farmer obtains less than 7 percent of the total available lease land. This illustrates the difference in returns for this farmer versus the larger farmers. There are also some other interesting points to be made on the basis of this analysis. The important interaction of

TABLE 6.20

ALLOWING ONLY AVERAGE MACHINERY COMPLEMENTS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	17078.	27807.	27586.	26586.
DISPERSION=	6334.	13213.	17799.	22949.
MEASURE OF VAR=	.37	.48	.65	.86

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	11186.	15153.	14957.	11651.
DISPERSION=	4553.	9130.	11342.	16925.
MEASURE OF VAR=	.41	.60	.76	1.45

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	3070.	3362.	3512.	3578.
DISPERSION=	1495.	2762.	2585.	2600.
MEASURE OF VAR=	.49	.82	.74	.73

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16838.	17319.	17514.	17231.
DISPERSION=	1052.	1555.	1786.	2170.
MEASURE OF VAR=	.06	.09	.10	.13

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1029567.	2371539.	3635547.	4944065.
DISPERSION=	114009.	312285.	498260.	698349.
MEASURE OF VAR=	.11	.13	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.3600	.3200	.8400	.8800
DISPERSION=	1.0360	1.0296	1.1790	1.3013
MEASURE OF VAR=	2.8778	3.2174	1.4036	1.4787

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0241	.0398	.0431	.0461
DISPERSION=	.0103	.0122	.0125	.0131
MEASURE OF VAR=	.4251	.3058	.2897	.2839

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1320	.3004	.3062	.2875
DISPERSION=	.0800	.0767	.0657	.0645
MEASURE OF VAR=	.6060	.2554	.2146	.2242

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	13.	142.	262.	350.
DISPERSION=	28.	57.	78.	87.
MEASURE OF VAR=	2.16	.40	.30	.25

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	69.	395.	264.	333.
DISPERSION=	124.	187.	178.	149.
MEASURE OF VAR=	1.80	.47	.67	.45

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	382.	1138.	1426.	1883.
DISPERSION=	126.	195.	173.	162.
MEASURE OF VAR=	.33	.17	.12	.09

NUMBER OF BIDS ON LAND	64	133	158	144
PERCENT OF POSSIBLE BIDS	25	53	63	57
TOTAL PARCELS PURCHASED	5	40	64	84

obtaining lease land to aid in the purchase of other land is illustrated by the fact that the small farm had a decline (from the base run) in both leased and purchased acres, while the other farms had an increase in both types of land. This increase was not the result of reallocation of purchase land. The largest farmers were able to purchase land that was bypassed in the base analysis. It is also likely that the returns were adversely impacted by not providing an opportunity to have above average machinery complements. (Recall that yields are discounted by the level of machinery complement.)

Allowing Complete Adjustments in Crop Mix

Another production oriented question centered around the bounds placed on total crop adjustments. Recall that all other analyses assume that farmers will always plant some corn and some soybeans (i.e., at least 30 percent of one of these crops). Table 6.21 demonstrates the impact of allowing for complete adjustments in crop mix (0-100 percent). In general, the smallest farmer is relatively worse off when this change is made. This can be attributed to the expected returns increasing relatively more for the largest farmers who are able to use this to their advantage in the lease market.

Altering Development of Price Expectations

Another set of assumptions that were tested to determine their sensitivity were the weights on the exponentially weighted averages for short and long-run price expectations. Recall that the weights used for this study are .25 (for the most recent year) to develop long-run expectations and .4 to develop short-run expectations. Table 6.22

TABLE 6.21

ALLOWING COMPLETE ADJUSTMENTS IN CROP MIX

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	17937.	28544.	30278.	33939.
DISPERSION=	4446.	13864.	20157.	18797.
MEASURE OF VAR=	.25	.49	.67	.55
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	10427.	15824.	15497.	17295.
DISPERSION=	3497.	9332.	12321.	10442.
MEASURE OF VAR=	.34	.59	.80	.60
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	2380.	3395.	3738.	3631.
DISPERSION=	1330.	3231.	3181.	2551.
MEASURE OF VAR=	.56	.95	.85	.70
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16953.	17520.	17270.	17594.
DISPERSION=	601.	1391.	2119.	1748.
MEASURE OF VAR=	.04	.08	.12	.10
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1056573.	2371499.	3676893.	5023252.
DISPERSION=	140832.	284566.	545169.	757554.
MEASURE OF VAR=	.13	.12	.15	.15
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0800	.2800	.6000	.2800
DISPERSION=	.2769	.8907	1.1180	.5416
MEASURE OF VAR=	3.4611	3.1810	1.8634	1.9343
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0263	.0399	.0440	.0475
DISPERSION=	.0121	.0113	.0138	.0140
MEASURE OF VAR=	.4594	.2829	.3130	.2941
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1527	.2878	.2753	.2779
DISPERSION=	.0855	.0716	.0615	.0642
MEASURE OF VAR=	.5600	.2490	.2233	.2311
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	13.	134.	230.	344.
DISPERSION=	28.	43.	76.	109.
MEASURE OF VAR=	2.16	.32	.33	.32
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	163.	322.	301.	275.
DISPERSION=	165.	200.	171.	206.
MEASURE OF VAR=	1.01	.62	.57	.75
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	476.	1056.	1431.	1819.
DISPERSION=	165.	203.	161.	175.
MEASURE OF VAR=	.35	.19	.11	.10

NUMBER OF BIDS ON LAND	61	133	146	155
PERCENT OF POSSIBLE BIDS	24	53	58	61
TOTAL PARCELS PURCHASED	5	42	55	83

TABLE 6.22

ALTERING DEVELOPMENT OF PRICE EXPECTATIONS
EXPONENTIAL WEIGHT = .6

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18667.	29636.	33366.	32968.
DISPERSION=	5702.	12841.	15939.	23310.
MEASURE OF VAR=	.31	.43	.48	.71

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	10687.	17415.	18132.	17284.
DISPERSION=	3843.	9118.	10077.	13822.
MEASURE OF VAR=	.36	.52	.56	.80

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	2366.	4042.	3717.	4035.
DISPERSION=	1371.	3198.	3099.	3581.
MEASURE OF VAR=	.58	.79	.83	.89

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17062.	17670.	17636.	17508.
DISPERSION=	750.	1561.	1810.	2219.
MEASURE OF VAR=	.04	.09	.10	.13

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1071610.	2309415.	3704178.	4956012.
DISPERSION=	136022.	231443.	544200.	647953.
MEASURE OF VAR=	.13	.10	.15	.13

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0800	.2400	.1200	.4000
DISPERSION=	.2769	.8307	.3317	1.0408
MEASURE OF VAR=	3.4611	3.4611	2.7639	2.6021

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0277	.0376	.0447	.0464
DISPERSION=	.0118	.0096	.0136	.0123
MEASURE OF VAR=	.4242	.2547	.3046	.2654

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1595	.2847	.2573	.2686
DISPERSION=	.0887	.0902	.0572	.0633
MEASURE OF VAR=	.5563	.3169	.2225	.2357

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	14.	125.	219.	325.
DISPERSION=	28.	52.	81.	90.
MEASURE OF VAR=	1.94	.42	.37	.28

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	187.	341.	267.	266.
DISPERSION=	147.	230.	170.	176.
MEASURE OF VAR=	.79	.67	.63	.66

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	502.	1066.	1386.	1790.
DISPERSION=	142.	236.	180.	161.
MEASURE OF VAR=	.28	.22	.13	.09

NUMBER OF BIDS ON LAND	48	126	140	144
PERCENT OF POSSIBLE BIDS	19	50	55	57
TOTAL PARCELS PURCHASED	6	35	56	81

changes the long run weight to .6, thus placing more emphasis on the most recent past when making investment decisions. The impact of bad years (low prices) is emphasized under this weighting scheme as farmers become more reluctant to purchase additional acres. All four farmers purchase less land when this change is made. However, in general, the results are similar to the base run. The two most striking differences are the reallocation of lease land and the growth in net worth for the third farmer. Both of these results have been explained in other analyses where this farmer purchased less land.

Finally, analysis is performed under the assumption that farmers formulate short and long-run expectations entirely on the basis of the previous year's prices (i.e., The weights are set at one). The results are very similar to those in Table 6.22. Therefore, they appear in Table D.7 (Appendix D).

Purchase Land Randomly Allocated

Since one of the primary concerns of this study centers on the ability to obtain purchase land, the allocative scheme to determine which farmer is able to purchase the land is extremely important. Some of the problems associated with developing assumptions that influence the allocation of purchase land have been discussed. Chapter IV demonstrated the degree of sensitivity in evaluating expected present value of a stream of cash flows. The ranking of bids can be altered when farmers have different expectations on inflation rates, different planning horizons, different expected tax brackets, etc. The problem of making these extremely sensitive assumptions has been handled by assuming all farmers formulate the same expectations,

have the same planning horizon, and expect the same returns from selling the land. Only returns to land and marginal tax brackets differ. Serious questions can be raised regarding the restrictive nature of these assumptions. This section could have altered the many assumptions across farms to demonstrate their sensitive nature when placed in the context of a ten year planning horizon and competition for the same land as this model does. However, the most extreme test to determine the impact of alternative assumptions that influence the bids on land involves randomly allocating all purchase land to those farmers that are able to place a bid on land. Table 6.23 presents this test. The results clearly demonstrated that the bidding game is not nearly as important as the ability to play the game. As Table 6.23 demonstrates, the two smaller farmers were able to obtain more purchased acres (at the expense of the two larger farmers) when it was randomly allocated. However, the relative position of the farmers does not change and the amount of additional acres obtained by the smaller farms is small. (The largest gain made by the smallest farmer is 23 acres.) This demonstrates that even when the smaller farmers obtain more land, because they can place a competitive bid, the ability to leverage existing land and the judgement that inadequate cash flows will be associated with purchasing land prevent new purchases of land as much, or more, than the bidding process. The interactions here must be emphasized. When a farmer makes a purchase, it usually precludes him from making another purchase for several years. This is especially true for the smallest farmer who is only able to bid on approximately two parcels every ten years, with less than one (.8) successful bid in those ten years. Examining the

TABLE 6.23

PURCHASE LAND RANDOMLY ALLOCATED TO
THOSE ABLE TO PLACE A BID

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	13710.	23470.	29879.	34173.
DISPERSION=	8578.	11507.	20354.	19731.
MEASURE OF VAR=	.63	.49	.68	.58
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	6846.	12254.	16422.	18608.
DISPERSION=	5030.	7705.	14566.	12083.
MEASURE OF VAR=	.73	.63	.89	.65
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1383.	2760.	3968.	4597.
DISPERSION=	1132.	2495.	4240.	3468.
MEASURE OF VAR=	.82	.90	1.07	.75
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	15980.	16631.	17437.	18004.
DISPERSION=	1487.	1659.	2363.	1877.
MEASURE OF VAR=	.09	.10	.14	.10
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1108046.	2381274.	3665063.	4933870.
DISPERSION=	150133.	326588.	491262.	712506.
MEASURE OF VAR=	.14	.14	.13	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.7200	.4000	.5200	.4800
DISPERSION=	1.2083	.8660	.8718	.8226
MEASURE OF VAR=	1.6782	2.1651	1.6765	1.7137
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0308	.0401	.0439	.0459
DISPERSION=	.0124	.0124	.0126	.0132
MEASURE OF VAR=	.4038	.3087	.2869	.2881
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2467	.2738	.2898	.2721
DISPERSION=	.1004	.0885	.0698	.0511
MEASURE OF VAR=	.4072	.3232	.2409	.1879
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	42.	134.	250.	323.
DISPERSION=	32.	56.	88.	87.
MEASURE OF VAR=	.76	.42	.35	.27
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	224.	325.	262.	250.
DISPERSION=	189.	192.	162.	185.
MEASURE OF VAR=	.84	.59	.62	.74
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	566.	1059.	1412.	1773.
DISPERSION=	192.	198.	171.	137.
MEASURE OF VAR=	.34	.19	.12	.08

NUMBER OF BIDS ON LAND	46	108	148	147
PERCENT OF POSSIBLE BIDS	18	43	59	58
TOTAL PARCELS PURCHASED	20	39	64	65

percent of bids made with random allocation versus the base run demonstrates the impact that obtaining more land has on the ability to bid. Farm 1 placed bids on 23 percent of the available land in the base run and 18 percent in the analysis in Table 6.23. Similarly, the numbers for farm 2 are 52 percent and 43 percent respectively. These results would be expected to change as the behavioral assumptions which influence the ability to place a bid on land are changed. For example, with random allocation and a more aggressive growth policy, the smaller farmers would be expected to bid on and purchase more land (Although examining the smallest farm in Table 6.22 suggests that he could not purchase many more acres). Since this analysis was not extremely sensitive, this reduced the importance of the allocative assumptions that had to be made in developing a base run.

Concluding Comments on Developing Behavioral Assumptions

The foregoing discussion developed the process for deciding upon the ultimate behavioral assumptions to be used for the base analysis. Certainly, the feasible set is infinite. Nearly all of the analyses presented would satisfy the multiple goals at the end of Chapter II. The analyses above are generally considered consistent. The one area that proved to be the most sensitive involved the allocation of lease land. More work is needed in this area. The results for the base run are considered reasonable, however. Referring to Table 6.1 reveals an inverse relationship between expansion by purchasing land and leasing land. It is reasonable to expect that when resources are being used to purchase more land, it may be more difficult to obtain lease land. Further, the Johnson (1972) survey of grain farmers in the area of

this study found that, of the land purchased, approximately 50 percent was previously leased by the ultimate buyer. Since the model does not reduce the lease land when purchases are made, it is reasonable to have those farmers that are purchasing more land have less growth through leasing. As previously discussed, this is done by disallowing leasing of land in the same year that a purchase is made.

The general tradeoffs associated with aggressive growth appear to be: 1) a decline in income, 2) more variability in income, 3) a decline in family living expenditures, 4) an increase in the frequency of refinancing land, 5) an increase in growth in net worth (unless refinancing land is too frequent), and 6) a higher ending debt/asset ratio. A crucial component of the growth strategies outlined above involved the behavior of creditors. One reason for choosing the base run over the other strategies was that it provided for considerable expansion with relatively little reliance on refinancing land. In addition, the growth in net worth for the base run was higher than many of the other analyses. Finally, the measures of dispersion associated with the base run indicate that there is more stability associated with this strategy than many of the others.

Now that a base run has been selected, other questions can be addressed. The next section examines the influence of alternative inflation rates. From there, the discussion turns to development of sensitivity analysis to test some of the basic assumptions concerning land availability and expansion in the different land markets. Analysis is also developed to compare no growth strategies with growth strategies. This analysis is also used to test the consistency of the model. Finally, the discussion turns to changes across farms and in

the initial structure of the farms being analyzed.

Alternative Inflation Rates

The base analysis assumes that the ten year average trend on land prices will be three percent above the ten year trend on returns (i.e., Land inflates at 12 percent per year and returns inflate at 9 percent). The case has been made that land inflation benefits those who own land in two ways: 1) the capital gains associated with the inflation, and 2) the increased leverage associated with the inflation (and thus the ability to gain control of more land through purchases). Using the base analyses, these hypotheses can be examined by changing the level and the relationship of various inflation rates. This section performs three such analyses focusing on land inflation: 1) inflation on land set at the same rate as the general economy and returns (9%), 2) inflation on land set less than the general economy and returns (7%), and 3) inflation under control (i.e., a 2 percent rate) and set the same for land, the general economy, and returns.

Inflation on Land the Same as the General Economy

In the first analysis the inflation parameter in the Almon lag model was adjusted in order to obtain a long-run average inflation rate that would be equal to the rate for the general economy and returns. (Recall that the base analysis uses a 9 percent rate for the general economy and for returns.) The results for this analysis appear in Table 6.24. As predicted, the growth in net worth declines for all farms (compared to the base analysis in Table 6.1). The other results could also have been predicted. However, they raise questions

TABLE 6.24

INFLATION ON LAND THE SAME AS THE GENERAL ECONOMY

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	17112.	30509.	36881.	34803.
DISPERSION=	7513.	12382.	17049.	23900.
MEASURE OF VAR=	.44	.41	.46	.69

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	7959.	17190.	20518.	16249.
DISPERSION=	3963.	9203.	10857.	14876.
MEASURE OF VAR=	.50	.54	.53	.92

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1501.	3824.	4344.	4110.
DISPERSION=	886.	3387.	3389.	3381.
MEASURE OF VAR=	.59	.89	.78	.82

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16708.	17434.	18186.	17738.
DISPERSION=	984.	1654.	1908.	2330.
MEASURE OF VAR=	.06	.09	.10	.13

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	929299.	1988462.	3044800.	4073008.
DISPERSION=	141509.	294953.	479692.	689566.
MEASURE OF VAR=	.15	.15	.16	.17

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.3200	.0800	.1200	.5600
DISPERSION=	1.0693	.4000	.4397	1.1576
MEASURE OF VAR=	3.3415	5.0000	3.6641	2.0671

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0142	.0231	.0261	.0275
DISPERSION=	.0138	.0135	.0144	.0156
MEASURE OF VAR=	.9738	.5862	.5512	.5688

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2644	.2971	.3351	.3293
DISPERSION=	.0843	.0835	.0595	.0636
MEASURE OF VAR=	.3187	.2810	.1776	.1933

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	29.	134.	275.	382.
DISPERSION=	32.	54.	81.	106.
MEASURE OF VAR=	1.10	.40	.29	.28

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	326.	294.	216.	224.
DISPERSION=	277.	168.	137.	190.
MEASURE OF VAR=	.85	.57	.63	.85

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	655.	1029.	1391.	1806.
DISPERSION=	256.	160.	136.	200.
MEASURE OF VAR=	.39	.16	.10	.11

NUMBER OF BIDS ON LAND	65	139	174	158
PERCENT OF POSSIBLE BIDS	26	55	69	63
TOTAL PARCELS PURCHASED	13	37	71	83

regarding the hypothesis that higher inflation rates on land benefit landowners by allowing them to leverage existing land to purchase more land. All farmers purchase more land when the inflation on land decreases. Further, they do this with less adverse impacts on other performance variables. The three largest farmers have higher incomes and less frequency of refinancing land. This is clearly associated with the reduced debt service that results when land prices are not inflating at the higher levels. The smallest farmer purchases enough additional acres (versus his purchases in the base analysis) to cause his income to be less and the frequency for refinancing land to be greater. Since the smallest farmers purchase so few acres, it is difficult to draw any conclusions concerning the redistribution of land associated with this analysis. Of the three largest farmers, the relative gains in owned land are 4.6, 8.7, and 13 percent for the 2nd, 3rd, and 4th farmers respectively. Thus, the larger farmers appear to gain more owned acres when inflation rates are lower.

Inflation on Land 2 Percent Less Than the General Economy

Table 6.25 presents the analysis under the assumption that land will inflate at two percent below the inflation rates for the general economy and the returns. The results are consistent with those presented above. They also lend further support to the statement that the largest farmer appeared to gain more when inflation on land was lower. In this case, the 2nd and 3rd farmers purchase less land than they did above. The largest farmer purchases 5 percent more land than above. The largest farmer actually obtains land that the other two farmers had obtained in the analysis presented in Table 6.25. Even

TABLE 6.25

INFLATION ON LAND 2 PERCENT LESS THAN THE GENERAL ECONOMY

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	17801.	32673.	41476.	38846.
DISPERSION=	7275.	12321.	16603.	23037.
MEASURE OF VAR=	.41	.38	.40	.59

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	8059.	17846.	22402.	19116.
DISPERSION=	3918.	9580.	10257.	13229.
MEASURE OF VAR=	.49	.54	.46	.69

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1490.	4009.	4536.	4340.
DISPERSION=	912.	3785.	3276.	3271.
MEASURE OF VAR=	.61	.94	.72	.75

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16803.	17647.	18597.	18059.
DISPERSION=	915.	1580.	1885.	2311.
MEASURE OF VAR=	.05	.09	.10	.13

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	841901.	1793438.	2732612.	3585428.
DISPERSION=	142681.	286364.	485448.	662355.
MEASURE OF VAR=	.17	.16	.18	.18

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.2400	.0800	.0800	.3600
DISPERSION=	.8307	.4000	.4000	.8602
MEASURE OF VAR=	3.4611	5.0000	5.0000	2.3895

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0049	.0134	.0158	.0154
DISPERSION=	.0153	.0146	.0161	.0171
MEASURE OF VAR=	3.1055	1.0883	1.0146	1.1106

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2873	.2976	.3506	.3591
DISPERSION=	.0873	.0931	.0605	.0519
MEASURE OF VAR=	.3037	.3130	.1726	.1444

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	29.	130.	280.	405.
DISPERSION=	32.	52.	79.	122.
MEASURE OF VAR=	1.10	.40	.28	.30

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	363.	291.	221.	186.
DISPERSION=	276.	184.	148.	142.
MEASURE OF VAR=	.76	.63	.67	.76

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	692.	1021.	1401.	1790.
DISPERSION=	255.	169.	163.	166.
MEASURE OF VAR=	.37	.17	.12	.09

NUMBER OF BIDS ON LAND	68	142	180	163
PERCENT OF POSSIBLE BIDS	27	56	72	65
TOTAL PARCELS PURCHASED	13	35	73	86

though land is inflating at 2 percent less than the discount factor (the inflation rate for the general economy), the farmers still experience real growth in net worth.

Inflation Under Control (2 Percent Per Year)

A final analysis to test alternative inflation assumptions was developed assuming that inflation could be brought under control. In this analysis, all inflation rates are established at two percent per year.¹ A major concern associated with this analysis involved establishing an appropriate level for interest rates. Recall that the basic relationship in the base analysis was that interest rates would be two percent above (11%) the inflation rate for the general economy. For this analysis interest rates are set at three percent above the general inflation rate. Therefore, the fixed interest rate is set at 5 percent; the intermediate rate, at 6 percent; and the short-run rate, at 7 percent. All farmers in this analysis (Table 6.26) purchase roughly the same number of acres as they did in the analysis in Table 6.23 (the base run with land inflation set at the same rate as the general economy). Their real growth in net worth is also very similar. However, the largest farmer's growth in net worth is less than that of either the 2nd or 3rd farmer. This is one of the only analyses where the largest farmer's growth in net worth is notably lower than the other farmers. This is attributed to the fact that the

¹ This was done using the approach presented at the end of Chapter V. In order to obtain a two percent inflation rate on returns, commodity prices are inflated at one-half percent. In addition, the inflation factor in the Almon lag must be at 3.3 percent to obtain a 2 percent inflation rate on land.

TABLE 6.26

INFLATION UNDER CONTROL (2 PERCENT PER YEAR)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	20328.	38589.	52099.	54875.
DISPERSION=	7067.	10697.	14178.	20232.
MEASURE OF VAR=	.35	.28	.27	.37

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	12568.	27206.	36800.	40785.
DISPERSION=	4416.	9944.	12415.	16227.
MEASURE OF VAR=	.35	.37	.34	.40

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	2033.	5890.	8460.	10273.
DISPERSION=	1140.	3859.	5280.	6529.
MEASURE OF VAR=	.56	.66	.62	.64

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	18645.	20590.	22022.	22144.
DISPERSION=	877.	1110.	1218.	1819.
MEASURE OF VAR=	.05	.05	.06	.08

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	498401.	1019470.	1548037.	1960953.
DISPERSION=	94703.	140149.	249358.	373783.
MEASURE OF VAR=	.19	.14	.16	.19

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.2400	.0800	.0000	.2800
DISPERSION=	.8307	.4000	0.0000	.6137
MEASURE OF VAR=	3.4611	5.0000	0.0000	2.1919

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0168	.0224	.0244	.0204
DISPERSION=	.0166	.0130	.0147	.0177
MEASURE OF VAR=	.9886	.5830	.6021	.8680

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.3097	.3708	.4385	.4531
DISPERSION=	.1176	.1394	.0597	.0413
MEASURE OF VAR=	.3796	.3759	.1362	.0910

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	27.	133.	283.	386.
DISPERSION=	34.	69.	71.	81.
MEASURE OF VAR=	1.25	.52	.25	.21

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	370.	322.	291.	78.
DISPERSION=	243.	166.	173.	93.
MEASURE OF VAR=	.66	.52	.59	1.18

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	697.	1054.	1474.	1664.
DISPERSION=	237.	175.	161.	140.
MEASURE OF VAR=	.34	.17	.11	.08

NUMBER OF BIDS ON LAND	94	158	184	160
PERCENT OF POSSIBLE BIDS	37	63	73	63
TOTAL PARCELS PURCHASED	11	31	62	103

largest farmer is refinancing land more frequently than his competitors and the inflation on land is not enough to offset this refinancing. It is also due to the fact that the largest farmer is unable to gain as many leased acres. The general increase in income for all farmers is attributed to the lower interest rates and the lower purchase prices for land in the later years of the planning horizon. It is difficult to draw strong conclusions on the basis of these results since the interest rates were somewhat arbitrarily established (i.e., Under a reduced inflation economy the real rate of interest may be closer to 4 percent). The frequency of refinancing land indicates that farmer behavior could be altered to allow for more aggressive land expansion under these conditions. Apparently the leverage constraint does not prevent farmers from purchasing more acres under these conditions. However, examining the ending debt/asset ratio clearly illustrates the fact that assets are not inflating enough to reduce the impact of increasing debt. Therefore, these farmers are more highly leveraged at the end of the period than when they began (unlike most of the other analyses). This suggests that, if they had been more highly leveraged at the beginning of the period, their ability to purchase would have been more adversely affected (versus the same set of more highly leveraged farmers using the base analysis).

The conclusion is that, depending on the leveraged position when inflation is brought under control, farmers will either be able to increase their expansion of owned land or be unable to gain as much owned land as under current trends. Therefore, if inflation is brought under control, established farmers will be in a better

position to gain even more control by purchasing land and younger, more highly leveraged farmers will be in a relatively worse position.¹ This conclusion is not that surprising. One reason farmers take the risk of becoming highly leveraged is due to the fact that they expect inflation to continue at levels that will reduce this leveraged position as time passes. This study makes this assumption when negative cash flows are allowed. Indeed, inflation expectations and how closely expectations correspond with reality can be one of the most influential factors in the determination of which farmers are most capable of growing and which farmers can use existing land to the best advantage.²

Testing Basic Land Availability and Land Expansion Assumptions

A number of assumptions concerning the availability and the expansion of both purchase and lease land were necessary (see Chapters IV and V). The primary issue concerning these assumptions is their degree of importance for the analyses performed here. This section begins by altering some of the more important assumptions involving lease land. The first analysis examines the impact of allowing for

¹ Analyses are provided to support this conclusion. Table 6.3 presents the same set of farmers with an initial debt/asset ratio of .5 under the base conditions. Table D.9 presents these farmers under the 2 percent inflation conditions. Comparing these analyses reveals that farmers which are highly leveraged at the beginning of the horizon are not able to purchase as much land when inflation is brought under control.

² Again, future research using this model should allow for alternate (and, possibly, random) inflation rates over the planning horizon.

two parcels of lease land to become available every year (i.e., a 10 percent turnover rate on lease land--Table 5.6). Next, farmers are prevented from leasing land. The remaining sensitivity analyses on lease land change the basic assumptions associated with the allocation of lease land (landlord behavior). The availability of purchase land is also doubled by allowing for two parcels in each year. Finally, an analysis allowing for no land to be purchased is presented.

Allowing for Twice as Much Lease Land

The model was altered to allow for two parcels of lease land each year.¹ Table 6.27 demonstrates the impact of doubling the available lease land. This change increases the 2nd farmer's ability to purchase more land. This increase appears to be at the expense of the other farmers. The smallest farmer becomes less competitive in the land purchase market. This is probably due to the fact that as the other farmers move down the long-run costs curve due to increased control of leased acres, they are able to maintain a higher return (relative to the smallest farmer). This higher return makes them more competitive in the land purchase market. Again, the smallest farmer obtains the most lease land since the other farmers are precluded from obtaining lease land in the same year they purchase land. All farmers, except the largest farmer, enjoy a higher real growth in net worth. The largest farmer does not experience this growth since he is not able to purchase as many acres. The general conclusion, given this

¹ The same size parcels are used each year for simplicity. This is not expected to introduce any biases since the random properties of the original sample are still dominant.

TABLE 6.27

ALLOWING FOR TWICE AS MUCH LEASE LAND

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	21662.	28411.	33539.	31533.
DISPERSION=	8528.	13449.	18672.	21097.
MEASURE OF VAR=	.39	.47	.56	.67

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	8390.	14163.	16468.	14500.
DISPERSION=	4386.	9020.	9648.	13686.
MEASURE OF VAR=	.52	.64	.59	.94

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1301.	2637.	3066.	3528.
DISPERSION=	937.	2349.	2011.	2853.
MEASURE OF VAR=	.72	.89	.66	.81

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16869.	17413.	17767.	17350.
DISPERSION=	1256.	1488.	1852.	2029.
MEASURE OF VAR=	.07	.09	.10	.12

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1139527.	2415836.	3726701.	4974491.
DISPERSION=	181541.	342623.	543529.	682411.
MEASURE OF VAR=	.16	.14	.15	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.0400	.3200	.3600	.4000
DISPERSION=	.2000	1.0296	.8602	.7071
MEASURE OF VAR=	5.0000	3.2174	2.3895	1.7678

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0331	.0414	.0453	.0467
DISPERSION=	.0148	.0130	.0135	.0129
MEASURE OF VAR=	.4488	.3147	.2980	.2757

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2230	.3085	.2848	.2663
DISPERSION=	.0795	.0743	.0685	.0614
MEASURE OF VAR=	.3563	.2408	.2406	.2306

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	8.	147.	240.	318.
DISPERSION=	20.	43.	80.	109.
MEASURE OF VAR=	2.50	.29	.33	.34

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	758.	480.	432.	451.
DISPERSION=	249.	175.	196.	227.
MEASURE OF VAR=	.33	.36	.45	.50

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	1066.	1227.	1572.	1970.
DISPERSION=	250.	180.	196.	198.
MEASURE OF VAR=	.23	.15	.12	.10

NUMBER OF BIDS ON LAND	60	131	155	151
PERCENT OF POSSIBLE BIDS	23	52	61	60
TOTAL PARCELS PURCHASED	4	44	62	74

analysis, is that access to more lease land will be more beneficial to the smaller farmers than access to less lease land. (This conclusion does not account for the fact that refinancing land for the largest farmers is reduced due to the increased availability of lease land.)

Eliminating Lease Land

An additional way to test the general conclusion above was to eliminate the leasing of land. This test, presented in Table 6.28, supports the conclusion that leasing land improves the relative position of smaller farmers vis-a-vis larger farmers. Without lease land, the largest farmer obtains more purchased acres while all other farmers purchase less acres than in the base analysis. Despite purchasing less acres, the three smallest farmers also refinance land more often since they don't have the returns from lease land to aid in the purchase of new land. Further, these farmers also have a greater decline in the growth in net worth than the largest farmer. Although the accrual farm income is less for all four farmers, they all pay more taxes than in the base run. This demonstrates the influence of tax write-offs associated with the machinery expansion accompanying new lease land.

Changing the Allocative Procedure for Lease Land

The base analysis uses the proxy bid on lease land as an indicator of which farmers are favored by the landlord when he/she chooses a

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TABLE 6.28

ELIMINATING LEASE LAND

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	16008.	27255.	29754.	28028.
DISPERSION=	6030.	12254.	16533.	20533.
MEASURE OF VAR=	.38	.45	.56	.73

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	11033.	18493.	18176.	15516.
DISPERSION=	4879.	9485.	11631.	13874.
MEASURE OF VAR=	.44	.51	.64	.89

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	3092.	5418.	4627.	3938.
DISPERSION=	1823.	3321.	3290.	4040.
MEASURE OF VAR=	.59	.61	.71	1.03

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16695.	17639.	17485.	17143.
DISPERSION=	1026.	1312.	1954.	1983.
MEASURE OF VAR=	.06	.07	.11	.12

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1014933.	2249982.	3582687.	4981072.
DISPERSION=	88084.	269969.	470045.	606435.
MEASURE OF VAR=	.09	.12	.13	.12

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.2800	.5600	.6800	.6400
DISPERSION=	.6782	1.2936	1.1075	1.3191
MEASURE OF VAR=	2.4223	2.3100	1.6287	2.0611

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0230	.0349	.0417	.0470
DISPERSION=	.0079	.0111	.0120	.0116
MEASURE OF VAR=	.3448	.3170	.2878	.2477

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1346	.2673	.2729	.2804
DISPERSION=	.0829	.1049	.0684	.0598
MEASURE OF VAR=	.6160	.3925	.2505	.2131

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	14.	125.	229.	362.
DISPERSION=	23.	61.	75.	97.
MEASURE OF VAR=	1.58	.49	.33	.27

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	0.	0.	0.	0.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	314.	725.	1129.	1562.
DISPERSION=	23.	61.	75.	97.
MEASURE OF VAR=	.07	.08	.07	.06

NUMBER OF BIDS ON LAND			
47	131	150	142
PERCENT OF POSSIBLE BIDS			
18	52	59	56
TOTAL PARCELS PURCHASED			
8	39	56	82

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tenant.¹ If the farmer's proxy bid is within 96 percent of the maximum bid, he is considered for the lease land. (A random number allocates land from this point.) Since selection of the threshold of 96 percent was subjective, an analysis lowering this value to 90 percent is developed in Table D.9. Although there are differences (i.e., The smallest and third farmer obtain more lease land), this parameter does not appear to be excessively sensitive. A more sensitive assumption is that a farmer that purchases land cannot lease land in the same year. Table 6.29 reveals that changing this assumption results in a reallocation of lease land from the smallest farmer to the other three farmers. Again, it is believed that the logic of prohibiting leasing of land in the same year land is purchased is sound. However, the analysis in Table 6.29 does demonstrate that the smallest farmer generally is unable to be competitive (i.e., He is on a higher point on the long-run average cost curve) over most of the planning horizon.

Allowing for Twice as Much Purchase Land

The procedure for developing the availability of purchase land as discussed in Chapter V. It is generally believed that more than adequate availability of land is provided. However, since it is an extreme simplification to have the same four farmers competing for the same (random size) parcel of land every year, the availability of land is doubled by allowing up to two farms to acquire the current year's

¹ Chapter IV discusses how the proxy bid is a combination of the recent year's machinery complement and the expected return that the landlord associates with each farmer.

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TABLE 6.29

ALLOWING PURCHASE AND LEASE OF LAND IN THE SAME YEAR

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	17435.	28282.	28288.	32569.
DISPERSION=	4636.	13606.	19267.	19945.
MEASURE OF VAR=	.27	.48	.68	.61
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	10849.	15728.	14743.	16186.
DISPERSION=	3036.	9250.	11227.	11408.
MEASURE OF VAR=	.28	.59	.76	.70
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	2642.	3488.	3291.	3468.
DISPERSION=	1162.	2992.	2652.	2289.
MEASURE OF VAR=	.44	.86	.81	.66
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16927.	17533.	17219.	17643.
DISPERSION=	668.	1366.	2098.	1979.
MEASURE OF VAR=	.04	.08	.12	.11
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1040113.	2343762.	3680243.	4979019.
DISPERSION=	124629.	258941.	528133.	720346.
MEASURE OF VAR=	.12	.11	.14	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1600	.2400	.7600	.3600
DISPERSION=	.6245	.8794	1.3000	.6377
MEASURE OF VAR=	3.9031	3.6641	1.7105	1.7714
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0250	.0389	.0441	.0468
DISPERSION=	.0109	.0104	.0135	.0133
MEASURE OF VAR=	.4373	.2686	.3047	.2853
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1403	.2748	.2822	.2840
DISPERSION=	.0677	.0774	.0586	.0684
MEASURE OF VAR=	.4827	.2816	.2075	.2409
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	11.	123.	242.	347.
DISPERSION=	25.	46.	77.	109.
MEASURE OF VAR=	2.19	.37	.32	.32
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	104.	344.	288.	325.
DISPERSION=	133.	210.	167.	155.
MEASURE OF VAR=	1.28	.61	.58	.48
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	415.	1067.	1430.	1872.
DISPERSION=	127.	209.	181.	157.
MEASURE OF VAR=	.31	.20	.13	.08
NUMBER OF BIDS ON LAND	58	132	144	153
PERCENT OF POSSIBLE BIDS	23	52	57	61
TOTAL PARCELS PURCHASED	5	40	58	81

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random parcels. Table 6.30 demonstrates that, although all farmers are able to purchase more land, the net increase in purchased acres is relatively small. In the base analysis, an average of 738 acres is purchased in a ten year period by the four farmers. When land availability is doubled, an average of 828 acres is purchased. There is some redistribution as the smallest two farmers are able to increase their purchases relatively more than the largest two farmers. The importance of the size of the parcel is emphasized by these results as the average size of the purchase declines for all four farms when more parcels become available. The frequency of refinancing land increases for all farmers. If one of the criteria for acceptable performance is to keep this frequency lower (as discussed above), then behavior may be modified and less growth would occur. Therefore, the impact of increasing land availability would be even closer to the base analysis. A more aggressive behavior could also be analyzed with this increased land availability. However, the performance criteria presented in Table 6.29 demonstrate that the farmers are already strained and a more aggressive growth strategy would strain them even more.

Eliminating Land Purchases

The tradeoffs between an aggressive growth policy involving expansion through purchasing land versus a growth policy involving expansion only by leasing land are clearly demonstrated in Table 6.31. Farmers earn more, pay higher taxes, have no need to refinance land, pay off most of their debts, and show less increase in net worth under this growth strategy. Although the earnings are higher the tax

TABLE 6.30

ALLOWING FOR TWICE AS MUCH PURCHASE LAND

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-- 332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	13389.	18431.	18805.
DISPERSION=	5618.	13011.	14326.
MEASURE OF VAR=	.42	.71	.76
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	6986.	7695.	6555.
DISPERSION=	3580.	8460.	9008.
MEASURE OF VAR=	.51	1.10	1.37
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-			
MEAN VALUES =	1376.	1702.	1565.
DISPERSION=	1128.	1014.	669.
MEASURE OF VAR=	.82	.60	.43
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-			
MEAN VALUES =	16073.	16219.	15781.
DISPERSION=	853.	1455.	1625.
MEASURE OF VAR=	.05	.09	.10
ENDING NET WORTH -NOMINAL DOLLARS-			
MEAN VALUES =	1092000.	2450212.	3790688.
DISPERSION=	131390.	346241.	583743.
MEASURE OF VAR=	.12	.14	.15
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD			
MEAN VALUES =	.4400	.8800	1.0000
DISPERSION=	.9165	1.3013	1.3229
MEASURE OF VAR=	2.0830	1.4787	1.3229
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)			
MEAN VALUES =	.0295	.0428	.0468
DISPERSION=	.0110	.0132	.0142
MEASURE OF VAR=	.3737	.3082	.3041
ENDING DEBT/ASSET RATIO			
MEAN VALUES =	.2776	.2988	.2690
DISPERSION=	.0868	.0609	.0563
MEASURE OF VAR=	.3127	.2040	.2093
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	46.	163.	256.
DISPERSION=	28.	45.	93.
MEASURE OF VAR=	.59	.27	.36
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	240.	315.	296.
DISPERSION=	204.	252.	161.
MEASURE OF VAR=	.85	.80	.54
ENDING TOTAL TILLABLE ACRES CONTROLLED			
MEAN VALUES =	586.	1078.	1452.
DISPERSION=	205.	259.	155.
MEASURE OF VAR=	.35	.24	.11
NUMBER OF BIDS ON LAND			
PERCENT OF POSSIBLE BIDS	22	37	37
TOTAL PARCELS PURCHASED	22	59	69

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TABLE 6.31

ELIMINATING LAND PURCHASES

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	19132.	45425.	67526.	87661.
DISPERSION=	3398.	7541.	12453.	15309.
MEASURE OF VAR=	.18	.17	.18	.17

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	12825.	29200.	46040.	61135.
DISPERSION=	3172.	7486.	10628.	12569.
MEASURE OF VAR=	.25	.26	.23	.21

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	3556.	8192.	15535.	23011.
DISPERSION=	1384.	4092.	6279.	7841.
MEASURE OF VAR=	.39	.50	.40	.34

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17183.	19332.	20627.	21740.
DISPERSION=	498.	930.	895.	1058.
MEASURE OF VAR=	.03	.05	.04	.05

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1003253.	2187493.	3244037.	4275589.
DISPERSION=	87125.	165272.	268396.	318733.
MEASURE OF VAR=	.09	.08	.08	.07

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0000	.0000	.0000	.0000
DISPERSION=	0.0000	0.0000	0.0000	0.0000
MEASURE OF VAR=	0.0000	0.0000	0.0000	0.0000

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0219	.0326	.0328	.0330
DISPERSION=	.0080	.0071	.0077	.0069
MEASURE OF VAR=	.3650	.2170	.2339	.2107

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.0961	.0592	.0379	.0340
DISPERSION=	.0315	.0291	.0171	.0123
MEASURE OF VAR=	.3276	.4923	.4515	.3613

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	0.	0.	0.	0.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	69.	341.	318.	333.
DISPERSION=	146.	204.	204.	172.
MEASURE OF VAR=	2.13	.60	.64	.52

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	369.	941.	1218.	1533.
DISPERSION=	146.	204.	204.	172.
MEASURE OF VAR=	.40	.22	.17	.11

NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	0	0	0	0
TOTAL PARCELS PURCHASED	0	0	0	0

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payments offset some of this increase. For example, the largest farmer's accrual income increases 193 percent while his tax payments increase 557 percent. The net result is a 148 percent increase in income. Meanwhile, the ending net worth is 17 percent less under a no land purchase policy. (If this strategy was pursued, family living expenses would probably increase with a corresponding decrease in net worth.) If avoiding high tax payments is a major goal, this analysis demonstrates the advantage of an aggressive land purchase policy versus a no purchase policy.

No Land Expansion - Stochastic Analysis

Performing an analysis that involves no expansion of land also proved to be revealing. This analysis (Table 6.32) provides similar results to the one above, where farmers expanded only through leasing land. The differences (between this analysis and the one above) are predictable: 1) lower ending net worth, 2) lower ending debt/asset ratios, 3) lower accrual income, and 4) higher taxes. Once again, the tax advantages of growth are apparent when comparing Tables 6.31 and 6.32. When the four farmers do not expand their land base, they actually have less income and pay more taxes vis-a-vis the analysis in Table 6.31 where they expanded with lease land only. This condition reflects the increased income from more acres and the increased tax write-offs associated with expanding machinery to match newly leased acres.

TABLE 6.32

NO LAND EXPANSION - STOCHASTIC ANALYSIS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18876.	42968.	63894.	85505.
DISPERSION=	3273.	6439.	9679.	13058.
MEASURE OF VAR=	.17	.15	.15	.15

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	13464.	32408.	48073.	64238.
DISPERSION=	2787.	5554.	8332.	11214.
MEASURE OF VAR=	.21	.17	.17	.17

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	3935.	11143.	17778.	25563.
DISPERSION=	1204.	2967.	4939.	7067.
MEASURE OF VAR=	.31	.27	.28	.28

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17221.	19199.	20431.	21517.
DISPERSION=	395.	595.	783.	939.
MEASURE OF VAR=	.02	.03	.04	.04

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	986799.	2069336.	3121760.	4162183.
DISPERSION=	78215.	149983.	218859.	287495.
MEASURE OF VAR=	.08	.07	.07	.07

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0000	.0000	.0000	.0000
DISPERSION=	0.0000	0.0000	0.0000	0.0000
MEASURE OF VAR=	0.0000	0.0000	0.0000	0.0000

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0204	.0275	.0293	.0305
DISPERSION=	.0073	.0067	.0065	.0064
MEASURE OF VAR=	.3561	.2439	.2219	.2105

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.0841	.0328	.0265	.0246
DISPERSION=	.0225	.0136	.0099	.0088
MEASURE OF VAR=	.2677	.4137	.3715	.3571

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	0.	0.	0.	0.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	0.	0.	0.	0.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	300.	600.	900.	1200.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

NUMBER OF BIDS ON LAND	0	0	0	0
PERCENT OF POSSIBLE BIDS	0	0	0	0
TOTAL PARCELS PURCHASED	0	0	0	0

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Deterministic Analyses to Test the Model

There are a number of analyses that can be performed to further test the consistency of the model. These tests can provide insights into the appropriateness of the methodology and into the research problem. Three such analyses are presented in this section. The first test compares the no growth results from the analysis using random prices and yields (Table 6.31) with a no growth strategy using deterministic prices and yields. Next, the same type of comparison is made by allowing for growth under deterministic prices and yields to be compared with the base analysis. Finally, a deterministic analysis is made with growth and smaller size parcels of available purchase land. This analysis demonstrates the impact of the parcel size and the leverage position of different size farms.

No Land Expansion - Deterministic Analysis

Table 6.33 presents a deterministic analysis where no growth, through land purchases or leases, is allowed.¹ Comparing this analysis to the no growth strategy where random prices and yields were used provides a good indication of how well the random data set corresponds with the desired mean values for prices and yields after they have been transformed into income. Clearly, the results in Table 6.33 are very similar to those presented in Table 6.32. There are a number of possible explanations for the slightly higher income values received

¹ This analysis was performed for two simulations to demonstrate that exactly the same results are obtained when only trended mean prices and yields are used. (Notice there is no dispersion.)

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TABLE 6.33

NO LAND EXPANSION - DETERMINISTIC ANALYSIS

MONTE CARLO SUMMARY FOR 2 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	19376.	43456.	65038.	86452.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	13291.	31385.	47634.	63128.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	3880.	10644.	17330.	24770.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17511.	19819.	21426.	22775.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1002983.	2095086.	3166099.	4211891.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	0.0000	0.0000	0.0000	0.0000
DISPERSION=	0.0000	0.0000	0.0000	0.0000
MEASURE OF VAR=	0.0000	0.0000	0.0000	0.0000

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	0.0224	0.0296	0.0309	0.0319
DISPERSION=	0.0000	0.0000	0.0000	0.0000
MEASURE OF VAR=	0.0000	0.0000	0.0000	0.0000

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	0.0849	0.0337	0.0228	0.0203
DISPERSION=	0.0000	0.0000	0.0000	0.0000
MEASURE OF VAR=	0.0000	0.0000	0.0000	0.0000

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	0.	0.	0.	0.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	0.	0.	0.	0.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	300.	600.	900.	1200.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

NUMBER OF BIDS ON LAND	0	0	0	0
PERCENT OF POSSIBLE BIDS	0	0	0	0
TOTAL PARCELS PURCHASED	0	0	0	0

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in the stochastic analysis. Since returns are skewed to the right (see Table 5.15), the most likely explanation is that there are more incidents of extremely high returns than of extremely low returns. This allows farmers to pay-off more debts than they must acquire when using stochastic prices and yields.

Deterministic Analysis with Random Land Availability

The similarity of the results presented above raises questions regarding the use of random prices and yields. Is there any difference between using random prices and yields versus using the mean values when land expansion is allowed? Table 6.34 answers this question by using the same data as the base analysis (Random parcels of lease and purchase land are the same) with the exception of using the mean values for prices and yields. Interestingly, the purchased acres are very similar when comparing Table 6.34 and Table 6.1. However, it is evident that using deterministic prices and yields over-estimates the growth in net worth. This occurs due to the fact that most of the severe negative cash flows associated with growth are eliminated when deterministic prices and yields are used. (Notice the low frequency of refinancing land in Table 6.34.) Behavior could be modified in the deterministic analysis to increase the purchases of land. Therefore, the general conclusion is that use of stochastic prices and yields provides a better representation of reality than use of the mean values for prices and yields.

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TABLE 6.34

DETERMINISTIC ANALYSIS WITH RANDOM LAND AVAILABILITY

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH= 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18595.	30940.	32102.	34885.
DISPERSION=	4617.	8341.	7330.	7078.
MEASURE OF VAR=	.25	.27	.23	.20

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	9826.	15174.	15355.	17200.
DISPERSION=	2720.	4664.	5017.	3732.
MEASURE OF VAR=	.28	.31	.33	.22

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	2085.	2470.	2317.	2684.
DISPERSION=	1022.	1499.	1163.	1110.
MEASURE OF VAR=	.49	.61	.50	.41

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17368.	18559.	18373.	18589.
DISPERSION=	891.	1223.	1058.	1150.
MEASURE OF VAR=	.05	.07	.06	.06

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1091592.	2455688.	3830530.	5172919.
DISPERSION=	60751.	94186.	111675.	120422.
MEASURE OF VAR=	.06	.04	.03	.02

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.2000	.0000	.0800	.0800
DISPERSION=	.7071	0.0000	.4000	.2769
MEASURE OF VAR=	3.5355	0.0000	5.0000	3.4611

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0301	.0445	.0489	.0514
DISPERSION=	.0052	.0037	.0028	.0022
MEASURE OF VAR=	.1729	.0835	.0568	.0437

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1664	.2832	.2805	.2647
DISPERSION=	.0870	.0748	.0603	.0548
MEASURE OF VAR=	.5228	.2640	.2151	.2072

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	16.	134.	250.	338.
DISPERSION=	28.	50.	64.	62.
MEASURE OF VAR=	1.77	.37	.25	.18

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	182.	342.	256.	280.
DISPERSION=	195.	222.	177.	216.
MEASURE OF VAR=	1.07	.65	.69	.77

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	498.	1077.	1406.	1818.
DISPERSION=	191.	208.	176.	190.
MEASURE OF VAR=	.38	.19	.13	.10

NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	72	140	151	145
TOTAL PARCELS PURCHASED	7	42	62	81

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Deterministic Analysis With Smaller Parcels of Land

Important questions can be raised regarding how well placing four different size farmers in a closed land market to compete for the same parcel of land each year represents reality. It may be more realistic to have larger farmers competing for larger parcels and smaller farmers competing for smaller parcels. Other analyses have demonstrated that the size of available parcels is an important factor in growth. In order to provide smaller farmers more opportunity to compete for land, an analysis was developed that included a greater number of small parcels of purchase land. (Each 10-year planning horizon had 4-40 acre parcels, 5-80 acre parcels, and 1-240 acre parcel.)¹ The four farmers are able to purchase 100 percent of the available land under these conditions. (Total acres purchased are 800 versus 738 in Table 6.34 which uses random land availability.) The three smallest farmers are able to obtain more land when a greater number of small parcels are available. However, the increase is not considered substantial. Further examination of Table 6.35 reveals that the largest farmer obtained the 240 acre parcel in most of the analysis. (The average size parcel purchased by the largest farmer was 143 acres versus 61 acres for farmer 3.) Again, the interaction between size parcel and frequency of purchase (and bid) must be emphasized. The fact that larger farmers purchase larger parcels and get financially locked out of bidding in the years following a purchase

¹ The analyses here use deterministic prices and yields because of the design of the model. The preferred approach is the use of stochastic prices and yields.

TABLE 6.35

DETERMINISTIC ANALYSIS WITH SMALLER PARCELS OF LAND

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-- 332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	17246.	33704.	38861.
DISPERSION=	4655.	5356.	4183.
MEASURE OF VAR=	.27	.16	.11
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	9478.	18172.	20652.
DISPERSION=	3137.	4590.	3734.
MEASURE OF VAR=	.33	.25	.18
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-			
MEAN VALUES =	1953.	3502.	3258.
DISPERSION=	1111.	1487.	1051.
MEASURE OF VAR=	.57	.42	.32
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-			
MEAN VALUES =	17190.	19040.	19336.
DISPERSION=	831.	634.	486.
MEASURE OF VAR=	.05	.03	.03
ENDING NET WORTH -NOMINAL DOLLARS-			
MEAN VALUES =	1112588.	2450099.	3776234.
DISPERSION=	57833.	80530.	79706.
MEASURE OF VAR=	.05	.03	.02
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD			
MEAN VALUES =	.2800	.0000	.0000
DISPERSION=	.9798	0.0000	0.0000
MEASURE OF VAR=	3.4993	0.0000	0.0000
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)			
MEAN VALUES =	.0318	.0435	.0474
DISPERSION=	.0048	.0031	.0020
MEASURE OF VAR=	.1527	.0723	.0423
ENDING DEBT/ASSET RATIO			
MEAN VALUES =	.2240	.2930	.3555
DISPERSION=	.1299	.0670	.0362
MEASURE OF VAR=	.5799	.2286	.1019
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	35.	136.	302.
DISPERSION=	35.	45.	40.
MEASURE OF VAR=	1.00	.33	.13
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	162.	205.	120.
DISPERSION=	144.	141.	104.
MEASURE OF VAR=	.89	.69	.87
ENDING TOTAL TILLABLE ACRES CONTROLLED			
MEAN VALUES =	497.	941.	1322.
DISPERSION=	160.	141.	124.
MEASURE OF VAR=	.32	.15	.09
NUMBER OF BIDS ON LAND	137	222	217
PERCENT OF POSSIBLE BIDS	54	88	86
TOTAL PARCELS PURCHASED	14	57	122

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provides smaller farmers a greater opportunity to obtain the small parcels. This fact, coupled with the results presented in Table 6.35, lead to the conclusion that the Monte Carlo analysis captures reality better than anticipated. Larger farmers do compete for the largest parcels, and there are years when only the smaller farmers compete for the smaller parcels, when four farms are placed in the artificial land market created by this study.

Altering the Initial Farm Structure

The important issue of providing for control has been emphasized throughout this study. One of the primary techniques for providing for control across farms has been to maintain the same initial farm structure throughout the analyses. All behavioral variables have also been fixed across farms of different size. Further, behavioral parameters are tied to size in order to provide for consistent behavior as growth occurs. Without this type of control, it would have been more difficult to recognize some of the important relationships that were developed above.

This section relaxes some of the controlled variables. It begins by altering two of the most important structural parameters across all farms: 1) The debt/asset ratio is raised to .5, and 2) The percent of owned acres is raised to 67. Next, examples that involve alternative assumptions across farms are developed: 1) The minimum family living expenses are allowed to vary across farms, and 2) Farms of different size are assumed to market their grain at proportionally different prices. These changes demonstrate how the model could be used to

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develop representative farms.¹ Finally, a completely new set of low equity, minimum land ownership farms are developed to demonstrate the potential use of the model and to shed light on the barriers to entry question.

All Farms' Initial Debt/Asset Ratio = .5

This study uses a relatively low debt/asset ratio of .3 for all farmers. The important issue associated with increasing the ratio involves the relative impact on farms of different size. To answer this question the debt/asset ratio was increased to .5 for all farms.² Table 6.36 presents the results of this change. The relative position for all measurement variables (except for greater frequency of refinancing land and less acquisition of leased acres) remains the same. The results illustrate that the smallest farmer experiences many more years of negative cash flows with a substantial loss of leased land. The high frequency of refinancing and the limited opportunities for purchasing land indicate that, under these conditions, the highly leveraged small farmer will have trouble surviving. (Without outside income this farmer would not survive.) All farmers purchase less acres; yet, all farmers experience a greater growth in real net worth. This is attributed to the fact that the highly leveraged position at

¹ The next chapter develops more analyses where different behavior is assumed across farms. This is done with regard to the use of income tax laws.

² All analyses, up to this point, have had the same initial structures and, therefore, the same initial year presented in Table A.1, Appendix A. The initial year for these farmers (including balance sheets and income statements) appears in Table A.2, Appendix A.

TABLE 6.36

CHANGING THE INITIAL FARM STRUCTURE
 ALL FARMS' INITIAL DEBT/ASSET RATIO = .5
 (SEE TABLE A.2 FOR A SUMMARY OF YEAR 1)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES 600 ACRES 900 ACRES 1200 ACRES
 INITIAL NET WORTH- 239690 465502 685373 900230

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-
 MEAN VALUES = 11585. 25565. 28497. 27593.
 DISPERSION= 5120. 10744. 12829. 16321.
 MEASURE OF VAR= .44 .42 .45 .59

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-
 MEAN VALUES = 4547. 12275. 14314. 13800.
 DISPERSION= 2952. 7318. 8727. 9346.
 MEASURE OF VAR= .65 .60 .61 .68

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-
 MEAN VALUES = 879. 2239. 2507. 2548.
 DISPERSION= 780. 1914. 3338. 2989.
 MEASURE OF VAR= .89 .85 1.33 1.17

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-
 MEAN VALUES = 15712. 16907. 16635. 16361.
 DISPERSION= 820. 1393. 1363. 1629.
 MEASURE OF VAR= .05 .08 .08 .10

ENDING NET WORTH -NOMINAL DOLLARS-
 MEAN VALUES = 877142. 1914687. 2926810. 3980157.
 DISPERSION= 119939. 251383. 395723. 553839.
 MEASURE OF VAR= .14 .13 .14 .14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD
 MEAN VALUES = 1.3200 .1600 .0800 .7200
 DISPERSION= 1.6763 .3742 .2769 .9798
 MEASURE OF VAR= 1.2699 2.3385 3.4611 1.3608

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)
 MEAN VALUES = .0396 .0508 .0543 .0576
 DISPERSION= .0127 .0123 .0127 .0132
 MEASURE OF VAR= .3203 .2427 .2344 .2291

ENDING DEBT/ASSET RATIO
 MEAN VALUES = .2477 .2644 .2837 .3016
 DISPERSION= .0569 .0837 .0685 .0605
 MEASURE OF VAR= .2299 .3167 .2416 .2005

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD
 MEAN VALUES = 5. 51. 122. 214.
 DISPERSION= 13. 41. 71. 86.
 MEASURE OF VAR= 2.76 .80 .58 .40

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD
 MEAN VALUES = 218. 355. 293. 195.
 DISPERSION= 196. 247. 193. 135.
 MEASURE OF VAR= .90 .69 .66 .69

ENDING TOTAL TILLABLE ACRES CONTROLLED
 MEAN VALUES = 522. 1006. 1314. 1610.
 DISPERSION= 192. 238. 181. 121.
 MEASURE OF VAR= .37 .24 .14 .07

NUMBER OF BIDS ON LAND 12 84 104 103
 PERCENT OF POSSIBLE BIDS 4 33 41 41
 TOTAL PARCELS PURCHASED 3 20 38 69

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the beginning of the period is offset by the inflation in land prices. This clearly demonstrates the advantage of being highly leveraged in inflationary times and provides further explanation for this behavior when high inflation rates are expected. It also emphasizes some of the problems associated with terminating all performance measurements at the end of ten years. (If inflation continues, farmers that obtain more land through leverage will be in a better position than the values at the end of ten years suggest.) On the other hand, the analysis of these highly leveraged farms under conditions where inflation is brought under control (Table D.8) demonstrates that their growth in net worth will be less than farmers with lower initial debt/asset ratios. These relationships (between leverage and inflation) are extremely important contributors to the well-being of farmers when a relatively long time period is being considered. Developing a better understanding of these interactions should be an integral part of understanding structural changes in American Agriculture.

All Farms Own 67 Percent of Operated Land

All analyses in this study assume that the farmers lease two-thirds of their land. This assumption was altered by developing an analysis where the farmers owned two-thirds of their land (Table .37).¹ This change improved the relative position (vis-a-vis the base analysis) of the smaller farmers more than of the largest farmer.

¹ The initial year for these farmers (including balance sheets and income statements) appears in Table A.3, Appendix A.

TABLE 6.37

CHANGING THE INITIAL FARM STRUCTURE
ALL FARMS OWN 67 PERCENT OF OPERATED LAND
(SEE TABLE A.3 FOR A SUMMARY OF YEAR 1)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-- 569074	1109237	1646143	2167300

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	17785.	33750.	39337.
DISPERSION=	10460.	18169.	26348.
MEASURE OF VAR=	.59	.54	.67
			.51

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	9666.	18640.	21181.
DISPERSION=	7862.	13469.	18087.
MEASURE OF VAR=	.81	.72	.85
			.55

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-			
MEAN VALUES =	2610.	4622.	6362.
DISPERSION=	2034.	4265.	5905.
MEASURE OF VAR=	.78	.92	.93
			.69

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-			
MEAN VALUES =	16642.	17947.	18414.
DISPERSION=	1760.	1575.	2000.
MEASURE OF VAR=	.11	.09	.11
			.11

ENDING NET WORTH -NOMINAL DOLLARS-			
MEAN VALUES =	1929087.	4101268.	6334074.
DISPERSION=	209526.	391106.	646957.
MEASURE OF VAR=	.11	.10	.10
			.12

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD			
MEAN VALUES =	.8400	.3600	.8400
DISPERSION=	2.1150	1.2543	1.3748
MEASURE OF VAR=	2.5179	3.4842	1.6366
			1.9770

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)			
MEAN VALUES =	.0327	.0410	.0447
DISPERSION=	.0099	.0090	.0096
MEASURE OF VAR=	.3023	.2189	.2153
			.2428

ENDING DEBT/ASSET RATIO			
MEAN VALUES =	.1819	.2422	.2359
DISPERSION=	.0937	.0686	.0589
MEASURE OF VAR=	.5150	.2831	.2498
			.2052

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	45.	178.	310.
DISPERSION=	44.	76.	121.
MEASURE OF VAR=	.98	.43	.39
			.33

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	174.	341.	256.
DISPERSION=	185.	211.	172.
MEASURE OF VAR=	1.06	.62	.67
			.71

ENDING TOTAL TILLABLE ACRES CONTROLLED			
MEAN VALUES =	519.	1120.	1466.
DISPERSION=	197.	196.	175.
MEASURE OF VAR=	.38	.18	.12
			.09

NUMBER OF BIDS ON LAND	95	167	157	161
PERCENT OF POSSIBLE BIDS	37	66	62	64
TOTAL PARCELS PURCHASED	16	46	58	84

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All farmers, except the largest farmer, experience an increase in the growth in net worth. Although all farmers obtain more land (The four farmers purchased 82 percent of the available parcels), farmers 2 and 3 increase their owned acres more than the largest farmer. Accrual incomes also increase for all farmers except the smallest farmer. The largest farmer's income increases more than the other farmers' incomes.

Tying Family Living Expenditures to Net Worth

Legitimate questions can be raised regarding the small differences in family living expenses across farms with substantially different net worths. In order to demonstrate the impact of making different consumption assumptions for different size farms, the analysis in Table 6.38 was performed. In this analysis the minimum consumption was set at \$8000, \$12,000, \$18,000, and \$22,000 for farms 1, 2, 3, and 4 respectively. These changes result in a redistribution of growth potential from the largest two farmers to the smallest two farmers. The smallest two farmers purchase acres that previously went to the largest two farmers. The smallest farmer is the only one to experience an increase in the growth in net worth (vis-a-vis the base analysis). It is impossible to determine which farmers are in a better position, since the larger farmers are spending more on family consumption. However, this does indicate that if farmers consume on the basis of net worth as well as income, then the growth potential for larger farmers is less than suggested by the base analysis.

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TABLE 6.38

TYING FAMILY LIVING EXPENDITURES TO NET WORTH

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	16446.	25243.	27256.	28882.
DISPERSION=	7638.	13060.	17724.	21477.
MEASURE OF VAR=	.46	.52	.65	.74

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8736.	14876.	14539.	15519.
DISPERSION=	4858.	9343.	10928.	12365.
MEASURE OF VAR=	.56	.63	.75	.80

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1945.	3399.	3181.	3653.
DISPERSION=	1518.	2764.	2468.	2874.
MEASURE OF VAR=	.78	.81	.78	.79

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	14641.	19032.	24730.	28728.
DISPERSION=	986.	1566.	2084.	1955.
MEASURE OF VAR=	.07	.08	.08	.07

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1149842.	2272480.	3443325.	4617812.
DISPERSION=	161521.	260633.	518756.	665544.
MEASURE OF VAR=	.14	.11	.15	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	2800	.7600	.9600	1.0400
DISPERSION=	1.0214	1.4514	1.5133	1.2410
MEASURE OF VAR=	3.6480	1.9098	1.5763	1.1932

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0336	.0362	.0385	.0404
DISPERSION=	.0129	.0107	.0140	.0135
MEASURE OF VAR=	.3847	.2947	.3638	.3346

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1978	.3129	.2887	.2731
DISPERSION=	.1038	.0674	.0637	.0491
MEASURE OF VAR=	.5250	.2153	.2206	.1797

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	34.	141.	213.	285.
DISPERSION=	34.	43.	80.	87.
MEASURE OF VAR=	1.01	.31	.37	.30

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	198.	262.	338.	262.
DISPERSION=	207.	225.	174.	167.
MEASURE OF VAR=	1.04	.86	.52	.64

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	532.	1003.	1450.	1747.
DISPERSION=	198.	224.	153.	136.
MEASURE OF VAR=	.37	.22	.11	.08

NUMBER OF BIDS ON LAND				
68	130	122	132	
PERCENT OF POSSIBLE BIDS	27	52	48	52
TOTAL PARCELS PURCHASED	14	45	46	71

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Allowing Better Marketing by Larger Farmers

This study assumes that all farmers have similar managerial and marketing skills. It also assumes that there are no pecuniary economies of size associated with marketing grain.¹ These assumptions are relaxed by assuming that each farmer receives two percent higher prices for grain than his next smaller competitor. This is done by allowing the second farmer to obtain the normal price and discounting the smallest farmer's prices by two percent. The third farmer's prices are two percent above normal and the fourth farmer's prices are four percent above the normal price.² (Price expectations remain the same for all farmers.) The results of this analysis (Table 6.39) are predictable and require little discussion. The magnitude of the differences in measurement variables for the smallest farmer and the largest farmer is striking. Clearly, if such pecuniary economies exist, they are a major reason that larger farmers are able to grow more than their smaller competitors. This also demonstrates the importance of good marketing and good marketing information.

A New Set of Low Equity, Minimum Land Ownership Farms

In order to demonstrate the full flexibility of the model and to address the issue of barriers to entry, a new set of low equity,

¹ Krause and Kyle (1971) found evidence that pecuniary economies of size may exist in grain marketing.

² Table D.14 (Appendix D) presents a similar analysis using a one percent price differential.

TABLE 6.39

ALLOWING BETTER MARKETING BY LARGER FARMERS
(2 PERCENT PRICE DIFFERENTIAL BETWEEN FARMS)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	17010.	29179.	38845.	42733.
DISPERSION=	5608.	13824.	16323.	24361.
MEASURE OF VAR=	.33	.47	.42	.57
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	7646.	16618.	23419.	22677.
DISPERSION=	3367.	9881.	10697.	16960.
MEASURE OF VAR=	.44	.59	.46	.75
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1353.	3686.	5481.	6240.
DISPERSION=	966.	3359.	3391.	5093.
MEASURE OF VAR=	.71	.91	.62	.82
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16698.	17434.	18479.	18566.
DISPERSION=	709.	1607.	1708.	2079.
MEASURE OF VAR=	.04	.09	.09	.11
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1059062.	2366598.	3711585.	5302950.
DISPERSION=	139103.	266130.	474910.	712942.
MEASURE OF VAR=	.13	.11	.13	.13
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0400	.1200	.2000	.4000
DISPERSION=	.2000	.6000	.5000	.8165
MEASURE OF VAR=	5.0000	5.0000	2.5000	2.0412
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0270	.0398	.0448	.0522
DISPERSION=	.0120	.0105	.0118	.0127
MEASURE OF VAR=	.4455	.2649	.2624	.2436
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1882	.2618	.2953	.2845
DISPERSION=	.0693	.0739	.0737	.0558
MEASURE OF VAR=	.3681	.2821	.2497	.1962
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	10.	120.	256.	390.
DISPERSION=	21.	42.	92.	93.
MEASURE OF VAR=	2.18	.35	.36	.24
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	354.	288.	206.	213.
DISPERSION=	249.	154.	144.	168.
MEASURE OF VAR=	.70	.53	.70	.79
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	663.	1008.	1362.	1803.
DISPERSION=	244.	154.	153.	144.
MEASURE OF VAR=	.37	.15	.11	.08
NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	54	130	170	162
TOTAL PARCELS PURCHASED	21	52	68	64
	5	36	66	89

minimum land ownership farms was created.¹ In addition to the changes that are reflected in Table A.4, the cash flow requirement is set at \$0/acre, and the minimum family consumption levels are set at \$9000, \$12,000, \$18,000, and \$22,000 for farms 1, 2, 3, and 4 respectively. These farms represent young operators attempting to begin grain farming. The results of this analysis (Table 6.40) demonstrate the problems associated with entry into farming. Only the largest farmer is able to purchase any land (2-40 acre parcels out of the 250 opportunities). The growths in net worth illustrate that the farmers are barely keeping up with inflation. (Note that the second farmer actually has a negative real growth in net worth.) The largest two farmers are forced to refinance their small land base (i.e., Farmer 3 owns 50 acres and farmer 4 owns 100 acres) quite frequently. This is attributed to their greater expenditures on family living. All four of these farmers are barely able to remain viable over the ten years under these conditions. It is not reasonable to expect that bankers would be willing to refinance such a small amount of land as frequently as these results suggest. Adjustments in consumption would be necessary in order to remain in business.

Summary

The major objective of this chapter was to develop appropriate behavioral parameters, given the farmer goals. Clearly, behavior influences growth and farmer well-being. The other focus was on

¹ Table A.4 (Appendix A) presents the initial year's balance sheets and income statements for these four farms. These farms were created by Ed Rister, Michigan State University.

TABLE 6.40

A NEW SET OF LOW EQUITY, MINIMUM LAND OWNERSHIP FARMS
(SEE TABLE A.4 FOR A SUMMARY OF YEAR 1)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	400 ACRES	500 ACRES	600 ACRES
INITIAL NET WORTH-- 71723	93656	250253	453550

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	15897.	19172.	20542.
DISPERSION=	4850.	4661.	6531.
MEASURE OF VAR=	.31	.24	.32
			.37
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	7977.	11353.	12248.
DISPERSION=	3166.	3719.	5028.
MEASURE OF VAR=	.40	.33	.41
			.40
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-			
MEAN VALUES =	1414.	2195.	2288.
DISPERSION=	898.	1324.	1504.
MEASURE OF VAR=	.63	.60	.66
			.58
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-			
MEAN VALUES =	15601.	18994.	24817.
DISPERSION=	811.	743.	1062.
MEASURE OF VAR=	.05	.04	.04
			.04
ENDING NET WORTH -NOMINAL DOLLARS-			
MEAN VALUES =	219768.	216923.	503719.
DISPERSION=	75007.	61403.	111424.
MEASURE OF VAR=	.34	.28	.22
			.22
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD			
MEAN VALUES =	.0000	.0000	1.0800
DISPERSION=	0.0000	0.0000	1.3204
MEASURE OF VAR=	0.0000	0.0000	1.2225
			.8995
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)			
MEAN VALUES =	.0190	-.0052	.0062
DISPERSION=	.0318	.0262	.0205
MEASURE OF VAR=	1.6767	-5.0066	3.3322
			1.3007
ENDING DEBT/ASSET RATIO			
MEAN VALUES =	.3293	.3456	.3489
DISPERSION=	.1110	.1098	.0758
MEASURE OF VAR=	.3372	.3177	.2174
			.1683
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	0.	0.	0.
DISPERSION=	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00
			3.
			11.
			3.46
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	269.	197.	232.
DISPERSION=	102.	95.	113.
MEASURE OF VAR=	.38	.48	.49
			.37
ENDING TOTAL TILLABLE ACRES CONTROLLED			
MEAN VALUES =	569.	597.	732.
DISPERSION=	102.	95.	113.
MEASURE OF VAR=	.18	.16	.15
			.14

NUMBER OF BIDS ON LAND	0	0	1
PERCENT OF POSSIBLE BIDS	0	0	0
TOTAL PARCELS PURCHASED	0	0	0
			2
			0
			2

demonstration of the properties of the simulation model through sensitivity analyses. All results were feasible as important variables were changed.

Some of the most sensitive behavioral assumptions are: 1) the internal leverage control, 2) the cash flow requirement, and 3) family living expenditures. Results are also heavily dependent on the initial farm structure. (The beginning leverage and tenure position are most important.) Assumptions concerning alternative inflation rates are also extremely important. Finally, some of the factors that did not appear to be excessively sensitive include: 1) the cash flow and income tax management strategies, 2) the level of machinery investment, 3) the development of price expectations, 4) the allocative scheme for purchase land, and 5) the availability of purchase land.

CHAPTER VII

USING THE MODEL FOR POLICY ANALYSIS

The previous chapter was devoted to developing appropriate farmer behavior (given the specified goals) and validating the model through tests of consistency. Results underscored the influence of alternative behavior, environments, and initial structures on the opportunities available to different size farmers. Problems associated with evaluation of one opportunity set versus another made it extremely difficult to develop strong conclusions on the basis of the analyses. Yet, these are the conditions under which policies that impact all farmers must be made. Recognizing this reality, this chapter uses the model to begin the analysis of the impact of alternative policies on farms of different size. More specifically, alternative commodity policies involving more and less price stability and alternative income tax policies are analyzed. (Objectives 3 and 4 of this study.) Since this analysis is the first use of the model, particular attention is given to methodology and proper use of the model for analysis.

The Experimental Design

In order to develop general hypotheses concerning the impact of alternative policies on farms of different size, it is necessary to develop experiments that compare systems with and without a specified policy under a number of conditions (i.e., different behavior,

environments, and initial structures). If consistent patterns of performance emerge, then general hypotheses can be developed. Otherwise, only conditional statements can be made.

The analysis of alternative policies was performed by using the three random data sets (developed in Chapter V) that correspond with the three commodity policy scenarios. The base assumptions (Appendix A) were used in conjunction with the three random data sets to develop 100 simulations. Other analyses were performed under alternative initial farm structures and economic environments using only 25 simulations. Since the underlying price distributions change for these experiments, 100 or more simulations should be developed. However, results of the analyses using 100 simulations were judged unrevealing since the value of the additional information was judged to be less than the additional costs. These factors influenced the decision not to perform a large number of experiments (at this stage) to analyze alternative commodity policies.

Analyses of alternative tax policies were more revealing and less costly. Since these experiments used the same set of random data throughout, 25 simulations were judged to be adequate. Therefore, more experiments were developed to analyze tax policies. Yet, if policy-makers were using this model to develop new policies or change old policies, it would be necessary to develop more experiments to test the changes under different behavior, environments, and initial structures. The analysis on tax policies focused on changing initial farm structures. Little analysis was performed to test the impact of these tax policies under different economic environments and/or behavioral assumptions. This limits the ability to develop strong

onclusions.

Developing a New Measurement Variable

The problems associated with evaluating multiple measurement variables that reflect multiple farmer goals and distinct tradeoffs have been discussed. However, some of the measurement variables presented in the Monte Carlo Summary Tables were combined to aid in analysis of the relative impact of alternative policies.

The total capital generated by each farm family (including off-farm income) and the initial equity were developed for the policy analyses. Since all farmers behave in a similar fashion (i.e., management is the same) and all farm families fully utilize the same amount of labor (i.e., 1.5 man years are used even if some must be sold off the farm), the generated capital is almost exclusively a function of the initial equity. Generated capital is calculated by adding the net gains in market value net worth (1979 dollars) to the present value of the stream of family living expenditures over the planning period. Therefore, the value reflects earnings associated with the resources, as well as capital gains due to inflation. Recall that the market value net worth accounts for contingent tax liabilities associated with capital gains.) Ending net worth reflects any of the measurement variables including all after-tax income generated throughout the period, newly acquired land, and any re-financing of land required. Yet, it would be deceptive to depend only on the generated capital value to analyze policies. Evaluating the tradeoffs between performance measures remains a difficult task. Therefore, the Monte Carlo Summary Tables are presented (as well as

discussed) in order that the reader can draw his/her own conclusions.

Alternative Commodity Policies

Development of different random prices for the three commodity policy scenarios was discussed in Chapter V. It must be emphasized that this model does not account for the micro level impacts of alternative commodity policies. In order to do this, programs such as farmer held reserves, deficiency payments, commodity credit corporation loans, and set-asides would need to be developed along with farmer behavioral responses.¹ This study tests the impact of three hypothetical sets of policies that will impact price stability by allowing the various cash flow repercussions of more and less stable prices to work their way through the financial accounting systems of the individual farms. Chapter V discusses how the different sets of random data were developed to reflect three commodity policy scenarios: 1) the current market which corresponds to 1980 commodity policies, 2) the quasi-free market which was designed to reflect possible prices under a market absent of effective commodity policies, and 3) the restrictive market developed to reflect possible prices under commodity policies that are designed to introduce more price stability (i.e., higher loan rates and larger reserves with lower reserve release prices).

This analysis begins by comparing the current market with a quasi-free market (using 100 simulations). The next analysis compares

¹ FLIPSIM (developed by James Richardson at Texas A&M University) is a general farm firm simulator that does develop these types of policies.

the two extreme markets - the restrictive versus the quasi-free market. This is the only use of the restrictive market. The rest of the analyses compare the current market and the free market under the following conditions: 1) the maximum growth strategy, 2) inflation on land equal to the general inflation rate, 3) initial farm structures with two-thirds of the land owned, and 4) initial farm structures with a debt/asset ratio of .5. (Note: Sensitivity analysis are thus performed on a behavioral assumption, an environmental assumption, and two assumptions concerning farm structure.) Again, many more experiments would need to be conducted before definitive statements could be made.

The Current Market vs the Free Market

The first comparison using different sets of random prices was conducted with the current market prices (Table D.2) and the free market prices (Table 7.1). These analyses used the base assumptions appearing in Appendix A. As expected, the free market analysis results in more variability in income for all farms. This variability is reflected in an increased need to refinance land in order to cover negative cash flows during years of lower prices.

Higher average corn and soybean prices result in higher incomes and more generated capital for all farms under the free market prices.¹ Table 7.2 develops some of the important comparisons for the current versus the free market. The largest farmer obtains more purchase land

¹ Average (1980) prices for corn and soybeans are \$2.67 and \$6.95 versus \$2.72 and \$7.00 for the current and free market respectively.

TABLE 7.1

FREE MARKET PRICES - 100 SIMULATIONS

MONT CARLO SUMMARY FOR 100 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	21420.	34872.	36617.	37165.
DISPERSION=	7867.	16355.	20788.	27279.
MEASURE OF VAR=	.37	.47	.57	.73
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	11557.	19106.	19012.	16477.
DISPERSION=	5326.	11232.	14058.	18345.
MEASURE OF VAR=	.46	.59	.74	1.11
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	2742.	4600.	4822.	5012.
DISPERSION=	1799.	4020.	4382.	4859.
MEASURE OF VAR=	.66	.87	.91	.97
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17033.	17721.	17639.	17651.
DISPERSION=	1006.	1780.	1962.	2164.
MEASURE OF VAR=	.06	.10	.11	.12
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1131415.	2487079.	3841589.	5233625.
DISPERSION=	166399.	376831.	618854.	877669.
MEASURE OF VAR=	.15	.15	.16	.17
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1300	.2300	.4700	.8200
DISPERSION=	.7057	.8022	1.0294	1.3954
MEASURE OF VAR=	5.4288	3.4879	2.1902	1.7017
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0325	.0440	.0480	.0511
DISPERSION=	.0137	.0143	.0153	.0160
MEASURE OF VAR=	.4207	.3252	.3182	.3126
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1627	.2746	.2851	.2771
DISPERSION=	.0999	.0924	.0657	.0635
MEASURE OF VAR=	.6144	.3366	.2306	.2290
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	13.	132.	248.	353.
DISPERSION=	25.	60.	82.	103.
MEASURE OF VAR=	1.88	.45	.33	.29
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	278.	347.	255.	184.
DISPERSION=	189.	184.	175.	164.
MEASURE OF VAR=	.68	.53	.69	.89
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	591.	1078.	1403.	1737.
DISPERSION=	190.	201.	178.	175.
MEASURE OF VAR=	.32	.19	.13	.10
NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	253	525	594	569
TOTAL PARCELS PURCHASED	25	52	59	56
	26	164	231	326

TABLE 7.2

CURRENT MARKET VERSUS FREE MARKET
(100 SIMULATIONS - BASE DATA)

	<u>Farm 1</u>	<u>Farm 2</u>	<u>Farm 3</u>	<u>Farm 4</u>
Current market generated capital ¹ (1979 \$/Ac)	1015	941	900	901
Free market generated capital (1979 \$/Ac)	1051	967	934	938
Difference in owned acres = current-free	8	-4	10	-22
Difference in freq. of refinancing land = current-free	-.01	-.16	-.10	-.27
<u>Ratios of Generated Capital</u>	<u>Current Market vs Free Market</u>			
Farm 1 vs Farm 2	1.079 < 1.087			
Farm 1 vs Farm 3	1.128 > 1.125			
Farm 1 vs Farm 4	1.127 > 1.121			
Farm 2 vs Farm 3	1.045 > 1.035			
Farm 2 vs Farm 4	1.044 > 1.031			
Farm 3 vs Farm 4	1.000 > .996			

Compiled from Tables D.2 and 7.1.

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. The ratios are developed by converting these values to a per initial acre value and dividing a smaller farm's value by a larger farm's value (i.e., Farm 1 vs 2 is the per initial acre value of farm 1 divided by Farm 2's value, etc.). Although all farms may generate less or more capital under a proposed change, the ratios allow for comparisons of which size farms are relatively better or worse off under the change. "Greater than" and "less than" signs compare the policy change with the current policy. A (>) indicates that the smaller farmer would be in a better relative position without the policy change. A (<) indicates that the smaller farmer would be in a better relative position with the policy change.

under the free market. This appears to be at the expense of farms 1 and 3. Comparing the ratios of generated capital (see Table 7.2 for an explanation of these ratios) reveals that the smaller farmers generate relatively more capital than their larger counterparts under the current policy. The only case where a smaller farmer generates relatively more capital in the free market is farm 1 versus farm 2.

The Restrictive Market vs the Free Market

Similar outcomes were obtained when comparing the restrictive market (Table 7.3) and the free market (Table 7.1). Again, higher prices under the free market result in higher incomes.¹ Table 7.4 develops comparisons of the restrictive market and the free market. Larger farmers purchase relatively more land under the free market (Only the smallest farmer purchases less land). Once again, comparison of the generated capital ratios reveals that smaller farmers generate relatively more capital than larger farmers under lower and more stable prices. In this case, the magnitude of these differences is greater than in the current market comparison and all comparisons of a smaller versus a larger farm suggest that smaller farms generate relatively more capital under the restrictive policies.

¹ Average (1980) prices for corn and soybeans are \$2.63 and \$6.92 versus \$2.72 and \$7.00 for the restrictive and the free markets respectively.

TABLE 7.3

MORE RESTRICTIVE MARKET PRICES - 100 SIMULATIONS

MONTE CARLO SUMMARY FOR 100 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	17889.	29219.	30533.
DISPERSION=	6415.	12450.	16159.
MEASURE OF VAR=	.36	.43	.53
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	9236.	16302.	15342.
DISPERSION=	4151.	8573.	10815.
MEASURE OF VAR=	.45	.53	.70
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-			
MEAN VALUES =	1950.	3495.	3414.
DISPERSION=	1222.	2830.	2970.
MEASURE OF VAR=	.63	.81	.87
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-			
MEAN VALUES =	16940.	17625.	17527.
DISPERSION=	914.	1487.	1782.
MEASURE OF VAR=	.05	.08	.10
ENDING NET WORTH -NOMINAL DOLLARS-			
MEAN VALUES =	1088658.	2401064.	3687119.
DISPERSION=	128754.	277988.	470325.
MEASURE OF VAR=	.12	.12	.13
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD			
MEAN VALUES =	.1700	.2000	.4400
DISPERSION=	.5870	.6513	.8799
MEASURE OF VAR=	3.4528	3.2567	1.9997
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)			
MEAN VALUES =	.0293	.0411	.0445
DISPERSION=	.0108	.0108	.0117
MEASURE OF VAR=	.3697	.2617	.2635
ENDING DEBT/ASSET RATIO			
MEAN VALUES =	.1941	.2663	.2799
DISPERSION=	.0966	.0793	.0701
MEASURE OF VAR=	.4976	.2977	.2503
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	20.	128.	235.
DISPERSION=	28.	51.	78.
MEASURE OF VAR=	1.41	.40	.33
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	248.	274.	277.
DISPERSION=	215.	182.	198.
MEASURE OF VAR=	.87	.66	.71
ENDING TOTAL TILLABLE ACRES CONTROLLED			
MEAN VALUES =	568.	1002.	1412.
DISPERSION=	213.	197.	194.
MEASURE OF VAR=	.37	.20	.14

NUMBER OF BIDS ON LAND	215	510	552
PERCENT OF POSSIBLE BIDS	21	50	55
TOTAL PARCELS PURCHASED	39	153	239

TABLE 7.4

RESTRICTIVE MARKET VERSUS FREE MARKET
(100 SIMULATIONS - BASE DATA)

	<u>Farm 1</u>	<u>Farm 2</u>	<u>Farm 3</u>	<u>Farm 4</u>
Restrictive market generated capital ¹ (1979 \$/Ac)	988	905	861	856
Free market generated capital (1979 \$/Ac)	1051	967	934	938
Difference in owned acres = restrictive-free	7	-4	-13	-25
Difference in freq. of refinancing land = restrictive-free	.04	-.03	-.03	-.28

<u>Ratios of Generated Capital</u>	<u>Restrictive Market vs Free Market</u>
Farm 1 vs Farm 2	1.092 > 1.087
Farm 1 vs Farm 3	1.148 > 1.125
Farm 1 vs Farm 4	1.154 > 1.121
Farm 2 vs Farm 3	1.052 > 1.035
Farm 2 vs Farm 4	1.057 > 1.031
Farm 3 vs Farm 4	1.005 > .996

Compiled from Tables 7.1 and 7.3.

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream family living expenditures. The ratios are developed by converting these values to a per initial acre value and dividing a smaller farm's value by a larger farm's value (i.e., Farm 1 vs 2 is the per initial acre value of farm 1 divided by Farm 2's value, etc.). Although all farms may generate less or more capital under a proposed change, the ratios allow for comparisons of which size farms are relatively better off or worse off under the change. "Greater than" and "less than" signs compare the policy change with the current policy. A (>) indicates the smaller farmer would be in a better relative position without policy change. A (<) indicates that the smaller farmer would be in a better relative position with the policy change.

The Current Market Versus the Free Market

Under the Maximum Growth Strategy

Results from the above analyses raised questions regarding the consistency of the smaller farmers generating relatively more capital when prices are lower and more stable. A test of this consistency involves comparison of the current market and the free market under different behavioral assumptions. Table 7.6 provides such a comparison for the maximum growth strategy developed in Table 6.14. (The free market Monte Carlo Summary Table for this analysis is Table 7.5.) These results do not corroborate the above findings. Under these analyses farms 2 and 3 obtain more purchase land under the free market and farms 1 and 4 obtain less purchase land. Comparison between generated capital ratios indicates that in only half of the pairs (i.e., a pair is a small farm versus a larger farm) do smaller farmers generate relatively more capital than larger farmers, under lower and more stable prices. Although the largest farmer obtains less land under the free market prices, the frequency of refinancing land is substantially higher. This reflects the increased risk associated with purchasing larger parcels when there is greater price variability.

The Current Market Versus the Free Market When Inflation

on Land is the Same as the General Economy

Another basic assumption that was altered to test for consistency results in comparing the current and the free markets was the relationship between the inflation rates on land and the general

TABLE 7.6

CURRENT MARKET VERSUS FREE MARKET
MAXIMUM GROWTH STRATEGY

	<u>Farm 1</u>	<u>Farm 2</u>	<u>Farm 3</u>	<u>Farm 4</u>
Current ¹ market generated capital (1979 \$/Ac)	970	817	863	841
Free market generated capital (1979 \$/Ac)	1002	824	856	876
Difference in owned acres = current-free	10	-8	-13	7
Difference in freq. of refinancing land = current-free	0	-.04	.08	-.48

<u>Ratios of Generated Capital</u>	<u>Current Market vs Free Market</u>
Farm 1 vs Farm 2	1.188 < 1.216
Farm 1 vs Farm 3	1.125 < 1.170
Farm 1 vs Farm 4	1.154 > 1.144
Farm 2 vs Farm 3	.946 < .962
Farm 2 vs Farm 4	.971 > .941
Farm 3 vs Farm 4	1.026 > .978

Compiled from Tables 6.36 and 7.5.

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. The ratios are developed by converting these values to a per initial acre value and dividing a smaller farm's value by a larger farm's value (i.e., Farm 1 vs 2 is the per initial acre value of farm 1 divided by Farm 2's value, etc.). Although all farms may generate less or more capital under a proposed change, the ratios allow for comparisons of which size farms are relatively better or worse off under the change. "Greater than" and "less than" signs compare the policy change with the current policy. A (>) indicates that the smaller farmer would be in a better relative position without the policy change. A (<) indicates that the smaller farmer would be in a better relative position with the policy change.

economy. This analysis lowers the inflation rate on land so that it is approximately the same as the general economy inflation rate. Table 6.24 develops this analysis under the current market and Table 7.7 develops this analysis for the free market. Comparisons are presented in Table 7.8. Farms 1 and 4 gain more land under the free market. Observing the relationships between generated capital ratios reveals that in four of the six possible comparisons the smaller farmer generated relatively more capital under the current market.

The Current Market Versus the Free Market With Farmers Owning 67 Percent of the Operated Land

An initial structure change made to test the current versus the free market was to increase the proportion of owned land to two-thirds. Table 6.37 presents this analysis for the current market and Table 7.9 presents the analysis for the free market. Again, comparing the generated capital ratios in Table 7.10 does not reveal consistent patterns (i.e., Half of the paired comparisons suggest that smaller farmers generate relatively more capital under the current market). However, only the largest farmer purchases more land under the free market.

The Current Market Versus the Free Market With Farmers Having a Higher Initial Debt/Asset Ratio

Finally, an analysis that increased the initial debt/asset ratio .5 was performed. The current market analysis appears in Table 7.10 and the free market analysis appears in Table 7.11. Although all farms purchased less acres under the free market analysis, consistent

TABLE 7.7

FREE MARKET WHEN INFLATION ON LAND IS THE SAME
AS THE GENERAL ECONOMY

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18704.	32553.	40054.	37195.
DISPERSION=	7863.	16530.	25525.	27349.
MEASURE OF VAR=	.42	.51	.64	.74
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8945.	19564.	21987.	18468.
DISPERSION=	4204.	12390.	17136.	17251.
MEASURE OF VAR=	.47	.63	.78	.93
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1705.	5133.	5830.	5043.
DISPERSION=	1242.	5102.	4507.	4478.
MEASURE OF VAR=	.73	.99	.77	.89
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16659.	17428.	18069.	17627.
DISPERSION=	941.	1724.	2242.	2244.
MEASURE OF VAR=	.06	.10	.12	.13
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	962677.	1977089.	3039437.	4091689.
DISPERSION=	198599.	318481.	605203.	861052.
MEASURE OF VAR=	.21	.16	.20	.21
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1200	.2000	.6400	.7200
DISPERSION=	.4397	.8165	1.3808	1.2423
MEASURE OF VAR=	3.6641	4.0825	2.1575	1.7254
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0168	.0223	.0253	.0272
DISPERSION=	.0184	.0154	.0188	.0199
MEASURE OF VAR=	1.0982	.6882	.7415	.7297
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2620	.2792	.3276	.3430
DISPERSION=	.0995	.1043	.0546	.0635
MEASURE OF VAR=	.3798	.3736	.1665	.1850
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	32.	125.	256.	402.
DISPERSION=	35.	58.	62.	143.
MEASURE OF VAR=	1.08	.47	.24	.36
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	355.	272.	211.	222.
DISPERSION=	258.	207.	146.	177.
MEASURE OF VAR=	.72	.76	.69	.80
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	687.	997.	1367.	1824.
DISPERSION=	243.	187.	136.	187.
MEASURE OF VAR=	.35	.19	.10	.10
NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	77	144	170	163
TOTAL PARCELS PURCHASED	30	57	68	65
	13	34	67	87

TABLE 7.8

CURRENT MARKET VERSUS FREE MARKET
INFLATION ON LAND SAME AS GENERAL INFLATION

	<u>Farm 1</u>	<u>Farm 2</u>	<u>Farm 3</u>	<u>Farm 4</u>
Current market generated capital ¹ (1979 \$/Ac)	756	611	566	531
Free market generated capital (1979 \$/Ac)	801	603	563	536
Difference in owned acres = current-free	-3	9	19	-20
Difference in freq. of refinancing land = current-free	.2	-.12	-.52	-.16

<u>Ratios of Generated Capital</u>	<u>Current Market vs Free Market</u>
Farm 1 vs Farm 2	1.236 < 1.328
Farm 1 vs Farm 3	1.335 < 1.424
Farm 1 vs Farm 4	1.425 > 1.495
Farm 2 vs Farm 3	1.079 > 1.072
Farm 2 vs Farm 4	1.153 > 1.125
Farm 3 vs Farm 4	1.068 > 1.049

Compiled from Tables 6.24 and 7.11.

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. The ratios are developed by converting these values to a per initial acre value and dividing a smaller farm's value by a larger farm's value (i.e., Farm 1 vs 2 is the per initial acre value of farm 1 divided by Farm 2's value, etc.). Although all farms may generate less or more capital under a proposed change, the ratios allow for comparisons of which size farms are relatively better off or worse off under the change. "Greater than" and "less than" signs compare the policy change with the current policy. A (>) indicates that the smaller farmer would be in a better relative position without the policy change. A (<) indicates that the smaller farmer would be in a better relative position with the policy change.

TABLE 7.9

FREE MARKET WITH 67 PERCENT LAND TENURE

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES	
INITIAL NET WORTH-- 332820	647431	958180	1261250	
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	21145.	36095.	46756.	50736.
DISPERSION=	13090.	22691.	29145.	33695.
MEASURE OF VAR=	.62	.63	.62	.66
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	11117.	20605.	27938.	26834.
DISPERSION=	9546.	16853.	19945.	21416.
MEASURE OF VAR=	.86	.82	.71	.80
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	3095.	6085.	8759.	8588.
DISPERSION=	2459.	5936.	7282.	6937.
MEASURE OF VAR=	.79	.98	.83	.81
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16689.	17957.	18499.	18585.
DISPERSION=	1809.	1805.	2004.	2564.
MEASURE OF VAR=	.11	.10	.11	.14
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1980228.	4081078.	6307791.	8504181.
DISPERSION=	284744.	485887.	860859.	1227694.
MEASURE OF VAR=	.14	.12	.14	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.7600	.6000	.6000	.5600
DISPERSION=	2.0672	1.4434	1.1180	1.0832
MEASURE OF VAR=	2.7200	2.4056	1.8634	1.9343
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0348	.0403	.0440	.0461
DISPERSION=	.0133	.0113	.0128	.0137
MEASURE OF VAR=	.3811	.2799	.2920	.2977
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1498	.2306	.2266	.2205
DISPERSION=	.0768	.0738	.0520	.0464
MEASURE OF VAR=	.5124	.3201	.2293	.2106
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	32.	163.	286.	390.
DISPERSION=	38.	77.	104.	137.
MEASURE OF VAR=	1.20	.47	.36	.35
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	245.	331.	238.	245.
DISPERSION=	212.	166.	141.	191.
MEASURE OF VAR=	.87	.50	.59	.78
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	577.	1096.	1425.	1835.
DISPERSION=	207.	179.	147.	219.
MEASURE OF VAR=	.36	.16	.10	.12
NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	96	166	172	163
TOTAL PARCELS PURCHASED	38	66	68	65
	12	40	58	89

TABLE 7.10

CURRENT MARKET VERSUS FREE MARKET
67 PERCENT OF LAND OWNED

	<u>Farm 1</u>	<u>Farm 2</u>	<u>Farm 3</u>	<u>Farm 4</u>
Current market generated capital ¹ (1979 \$/Ac)	1374	1338	1348	1344
Free market generated capital (1979 \$/Ac)	1448	1324	1337	1342
Difference in owned acres = current-free	13	15	24	-11
Difference in freq. of refinancing land = current-free	.06	-.24	.24	-.12

<u>Ratios of Generated Capital</u>	<u>Current Market vs Free Market</u>
Farm 1 vs Farm 2	1.027 < 1.094
Farm 1 vs Farm 3	1.019 < 1.083
Farm 1 vs Farm 4	1.022 < 1.022
Farm 2 vs Farm 3	.992 > .990
Farm 2 vs Farm 4	.995 > .986
Farm 3 vs Farm 4	1.003 > .996

Compiled from Tables 6.37 and 7.9.

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. The ratios are developed by converting these values to a per initial acre value and dividing a smaller farm's value by a larger farm's value (i.e., Farm 1 vs 2 is the per initial acre value of farm 1 divided by Farm 2's value, etc.). Although all farms may generate less or more capital under a proposed change, the ratios allow for comparisons of which size farms are relatively better or worse off under the change. "Greater than" and "less than" signs compare the policy change with the current policy. A (>) indicates that the smaller farmer would be in a better relative position without the policy change. A (<) indicates that the smaller farmer would be in a better relative position with the policy change.

TABLE 7.11

FREE MARKET WITH FARMS HAVING .5 DEBT/ASSET RATIOS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	239690	465502	685373	900230
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	12714.	27673.	30607.	29968.
DISPERSION=	5424.	13992.	17083.	20507.
MEASURE OF VAR=	.43	.51	.56	.68
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	5800.	13535.	15955.	14311.
DISPERSION=	3577.	7837.	11776.	13543.
MEASURE OF VAR=	.62	.58	.74	.95
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1270.	2596.	3429.	3489.
DISPERSION=	1089.	2322.	4662.	4554.
MEASURE OF VAR=	.86	.89	1.36	1.31
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	15751.	16675.	16732.	16026.
DISPERSION=	725.	1541.	1461.	1651.
MEASURE OF VAR=	.05	.09	.09	.10
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	880921.	1970200.	2946959.	4020720.
DISPERSION=	139584.	350221.	474279.	737821.
MEASURE OF VAR=	.16	.18	.16	.18
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	1.3200	.2000	.2800	.7200
DISPERSION=	1.5199	.5000	.7371	1.2423
MEASURE OF VAR=	1.1514	2.5000	2.6325	1.7254
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0398	.0529	.0546	.0580
DISPERSION=	.0150	.0168	.0157	.0176
MEASURE OF VAR=	.3766	.3176	.2874	.3036
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2248	.2526	.3092	.2790
DISPERSION=	.0551	.0761	.0637	.0538
MEASURE OF VAR=	.2453	.3012	.2060	.1929
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	2.	50.	142.	192.
DISPERSION=	8.	44.	63.	92.
MEASURE OF VAR=	5.00	.88	.44	.48
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	202.	395.	262.	202.
DISPERSION=	228.	238.	158.	194.
MEASURE OF VAR=	1.13	.60	.60	.96
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	503.	1045.	1305.	1594.
DISPERSION=	227.	225.	147.	164.
MEASURE OF VAR=	.45	.22	.11	.10
NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	14	78	111	104
TOTAL PARCELS PURCHASED	5	31	44	41
	1	20	43	64



results were obtained when comparing the generated capital ratio. As Table 7.12 illustrates, although all farms generate less capital, under the current market, the smaller farms are impacted relatively less.

Interpretation of Commodity Policy Results

Two limitations prevent development of strong conclusions based on the above analyses: 1) The development of alternative price distributions to correspond with alternative policy scenarios involved a number of simplifying assumptions, and 2) More analyses under different behavior, environments, and farm structures need to be developed. These limitations are highly related. Due to the first limitation, more analyses were not developed. Recall that procedures for developing more reliable price distributions to correspond with alternative policies were discussed in Chapter V. These procedures involve further development of a macro level agricultural commodity model in order to generate distributions to correspond with alternative policies (i.e., The MSUAG model could be modified to provide such analyses). The prior discussion emphasized that the methodology used in this study was unique; and that, if relationships appeared on the basis of the preliminary analyses using the subjectively developed price distributions, then further work to develop more accurate price distributions would be merited.

The above analyses provided enough information to make some general statements concerning the impact of alternative commodity policies. In 27 of 36 paired comparisons of generated capital ratios, the smaller farms generated relatively more capital than the larger

TABLE 7.12

CURRENT MARKET VERSUS FREE MARKET
INITIAL DEBT/ASSET = .5

	<u>Farm 1</u>	<u>Farm 2</u>	<u>Farm 3</u>	<u>Farm 4</u>
Current market generated capital ¹ (1979 \$/Ac)	960	854	797	787
Free market generated capital (1979 \$/Ac)	966	889	808	799
Difference in owned acres = current-free	3	1	20	22
Difference in freq. of refinancing land = current-free	0	.04	.2	0
<u>Ratios of Generated Capital</u>	<u>Current Market vs Free Market</u>			
Farm 1 vs Farm 2	1.124 > 1.087			
Farm 1 vs Farm 3	1.204 > 1.197			
Farm 1 vs Farm 4	1.219 > 1.210			
Farm 2 vs Farm 3	1.071 > 1.101			
Farm 2 vs Farm 4	1.085 > 1.113			
Farm 3 vs Farm 4	1.012 > 1.011			

Compiled from Table 6.36 vs Table 7.1.

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. The ratios are developed by converting these values to a per initial acre value and dividing a smaller farm's value by a larger farm's value (i.e., Farm 1 vs 2 is the per initial acre value of farm 1 divided by Farm 2's value, etc.). Although all farms may generate less or more capital under a proposed change, the ratios allow for comparisons of which size farms are relatively better or worse off under the change. "Greater than" and "less than" signs compare the policy change with the current policy. A (>) indicates that the smaller farmer would be in a better relative position without the policy change. A (<) indicates that the smaller farmer would be in a better relative position with the policy change.

farms under a market with lower and more stable prices. Therefore, although all farms generated more capital under the higher and less stable prices, this analysis suggests that smaller farmers benefit relatively more under more stable commodity policies. It is difficult to determine whether the differences in average price levels or in price stability are more responsible for these results. In either case, properly accounting for the influence of alternative commodity policies on both the average prices and the variability in prices is essential before stronger conclusions can be developed using this methodology. The results of this analysis are considered revealing enough to merit further work in creating accurate price distributions under alternative commodity policies and then performing more experiments using the model developed in this study.

Analyzing Alternative Income Tax Policies

This model is better equipped to analyze alternative income tax policies than alternative commodity policies, although modifications could be made to improve the ability to analyze commodity policies. The section begins by developing experiments to isolate the influence of income taxes on growth. The remainder of this section discusses a number of experiments that were performed to test the impact of alternative income tax policies on farms of different size. Although the number of experiments conducted would need to be increased in order to develop strong conclusions, enough experiments were developed to formulate hypotheses. Since the structural assumptions are considered the most sensitive (for this analysis), five income tax policy changes are analyzed across three alternative structures. The five

policies are: 1) elimination of rapid methods of depreciation (requiring all farmers to use straight line depreciation), 2) elimination of cash accounting (requiring the use of accrual accounting), 3) reduction of capital gains taxes from 40 percent to 25 percent, 4) indexing taxes to inflation (9 percent per year), and 5) implementation of President Reagan's three year, ten percent per year tax cut. The policies are analyzed for: 1) the base farm structure, 2) a more highly leveraged farm structure, and 3) a greater tenure farm structure. The analysis requiring all farmers to use straight line depreciation also includes a behavioral change (i.e., less aggressive growth) and an environmental change (i.e., higher commodity prices). All of the tax changes could be extended in this fashion. The primary objective of this analysis is to demonstrate how the model can be applied. If policy makers were considering a tax policy change, the model could be used for a greater number of experiments to develop stronger conclusions concerning the likely impact of the change on farmers of different size. A final set of experiments was performed using the base set of data to evaluate the impact of the following changes: 1) eliminating income averaging, 2) reducing investment tax credits from ten percent to five percent, 3) taxing all capital gains as ordinary income, 4) using different depreciation techniques for farms of different size, and 5) using President Reagan's tax reductions plus the proposal to reduce the minimum number of years required to hold capital investments without investment tax recaptures (This change would enable use of fewer years to depreciate machinery and buildings).

The Tax Incentives to Grow

Much of the analysis in Chapter VI provides insight into the type of growth incentives that the current tax structure provides. When leasing of land was the only form of growth, the accrual income was higher than in the experiments where no land expansion occurred. Yet, the tax payments were considerably less, due to the tax write-offs associated with machinery expansion. This section develops a group of experiments that provide more insight into the interaction of the current tax policy and the growth process. The progressive nature of the current tax structure penalizes larger farms that choose not to grow. Their resources are generating higher net revenues since they lack interest write-offs associated with new loans accompanying growth.

One way to determine the incentives to grow is to compare the growth strategy presented in the base run with the no growth strategy presented in Table 6.32. This is done in Table 7.13 by using generated capital. Clearly, the farmers that grow generate more capital. Moreover, the larger farmers have even greater incentives to grow as evidenced by the percentage differences in generated capital. In order to determine the change in the incentives to grow if federal taxes were eliminated, two artificial experiments that eliminated federal taxes were developed.¹ These experiments were identical to those discussed above (with the exception of the elimination of federal

¹ State taxes and Social Security taxes were calculated. The marginal tax brackets were set at the state tax rate of 2.5 percent for evaluating the cash flow from new purchases.

taxes). These experiments negate the penalties of a progressive tax rate when a farmer chooses not to grow and the many tax write-offs associated with expansion. Therefore, the differences in generated capital under these two experiments reflect only the productivity of the additional resources and the capital gains associated with the real inflation rate on land (3 percent). As expected, the incentives to grow are not as pronounced without federal income taxes. However, the degree of the differences is much greater than expected. (See Table 7.13.) The incentives to grow due to the federal tax system appear to be approximately 174 percent higher when averaging across the four farms. If this estimate is remotely accurate, then over half of the incentives to grow can be tied to the federal tax system.

This (of course) means that less than half of the incentives to grow are due to the productive capabilities of the additional resources and the capital gains due to inflation. This set of experiments should be replicated under a variety of conditions to test the consistency of these results. It is also noteworthy that the relative incentives (across farms) to grow are quite similar with and without federal taxes. This suggests that the federal tax system, with its combined progressive tax structure and tax write-offs associated with growth, does not distort the competitive position of different size farms as much as originally believed. (It must be recognized that the distortions may be more pronounced if the smallest farmer were more highly leveraged or had less acres.) However, since land is a fixed resource, any policy that encourages unlimited growth will benefit larger farmers, who have greater growth opportunities, more than smaller farmers.

TABLE 7.13

TAX INCENTIVES TO GROW - COMPARING GENERATED CAPITAL UNDER GROWTH
AND NO GROWTH STRATEGIES WITH AND WITHOUT FEDERAL TAXATION¹

WITH FEDERAL TAXES					
	A	B	C	D	E
	Growth Base Run Table 6.1	No Growth Table 6.32	Differences Col. A - Col. B	\$/Initial Acre Differences	% Difference in Generated Capital Attributed to Growth
-----Generated Capital - 1,000 (1979) Dollars-----					
Farm 1 (130 acres)	298	256	42	140	16.4%
Farm 2 (600 acres)	533	419	114	190	27.2
Farm 3 (900 acres)	747	565	182	202	32.2
Farm 4 (1200 acres)	1026	712	314	262	44.1
WITHOUT FEDERAL TAXES					
	Growth Table D.13	No Growth Table D.12			
Farm 1	296	281	15	50	5.3%
Farm 2	547	507	40	67	7.9
Farm 3	788	715	73	81	11.3
Farm 4	1047	936	111	93	11.9

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. The incentives to grow are 180, 185, 150, and 182 percent higher for Farms 1, 2, 3, and 4 respectively when federal taxes are in effect.

Eliminating Rapid Depreciation Techniques

There is a variety of depreciation techniques available to farm operators. When farmers are growing, it is to their advantage to depreciate machinery and buildings more rapidly in order to reduce near term federal taxes and to increase cash flows. If growth is not occurring, such techniques are not as beneficial since new purchases of machinery and buildings will not be as frequent. Under these conditions, taking more depreciation in early years should result in higher tax payments in later years. If growth continues, purchases of machinery and buildings will continue and the tax impacts of the additional income will continue to be delayed. Thus far, all experiments in this study have used the double declining balance method plus the 20 percent additional first year depreciation. (See Chapter IV and Appendix B - Subroutines TAXES, INCAV, TAXCOM, MINTAX.) This section presents experiments that limit farmers to the use of only straight line depreciation.

Experiments using only straight line depreciation were conducted using the base data under a number of conditions: 1) the base structure (Table 7.14), 2) the initial farm structure with a .5 debt/asset ratio (Table 7.15), 3) the initial farm structure with 67 percent land ownership (Table 7.16), 4) less aggressive growth (Table 7.17), and 5) higher commodity prices (Table 7.18). Comparisons of the generated capital under these analyses appears in Tables 7.19 and 7.20. These tables include reference information regarding controls for these experiments (i.e., The control for these analyses involves the same conditions using double declining and first year accelerated



TABLE 7.14

USE OF STRAIGHT LINE DEPRECIATION
BASE STRUCTURE

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES 600 ACRES 900 ACRES 1200 ACRES
INITIAL NET WORTH- 332820 647431 958180 1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES = 18138. 28596. 31689. 29960.
DISPERSION= 4835. 13403. 19032. 18884.
MEASURE OF VAR= .27 .47 .60 .63

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES = 11971. 19368. 21064. 21315.
DISPERSION= 3227. 9273. 11365. 11560.
MEASURE OF VAR= .27 .48 .54 .54

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES = 2620. 4289. 4844. 5061.
DISPERSION= 1314. 3443. 3428. 3245.
MEASURE OF VAR= .50 .80 .71 .64

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES = 16835. 17348. 17517. 17327.
DISPERSION= 616. 1483. 2009. 1817.
MEASURE OF VAR= .04 .09 .11 .10

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES = 1057383. 2348730. 3649317. 4942939.
DISPERSION= 129801. 276855. 506280. 680538.
MEASURE OF VAR= .12 .12 .14 .14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES = .0000 .3200 .5200 .4000
DISPERSION= 0.0000 1.0693 .8718 .5774
MEASURE OF VAR= 0.0000 3.3415 1.6765 1.4434

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES = .0265 .0390 .0434 .0461
DISPERSION= .0113 .0111 .0129 .0127
MEASURE OF VAR= .4267 .2836 .2969 .2758

ENDING DEBT/ASSET RATIO

MEAN VALUES = .1836 .2861 .2752 .2881
DISPERSION= .0801 .0801 .0547 .0633
MEASURE OF VAR= .4361 .2800 .1988 .2198

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES = 13. 130. 226. 352.
DISPERSION= 22. 47. 74. 112.
MEASURE OF VAR= 1.74 .36 .33 .32

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES = 259. 309. 248. 245.
DISPERSION= 196. 176. 158. 197.
MEASURE OF VAR= .76 .57 .64 .81

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES = 572. 1038. 1374. 1797.
DISPERSION= 194. 183. 169. 164.
MEASURE OF VAR= .34 .18 .12 .09

NUMBER OF BIDS ON LAND 56 133 149 153
PERCENT OF POSSIBLE BIDS 22 53 59 61
TOTAL PARCELS PURCHASED 7 39 56 82

TABLE 7.15

USE OF STRAIGHT LINE DEPRECIATION
INITIAL DEBT/ASSET RATIO = .5

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	239690	465502	685373	900230

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	11282.	26326.	31073.	25961.
DISPERSION=	4858.	11048.	13205.	15443.
MEASURE OF VAR=	.43	.42	.42	.59

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	6409.	16549.	19306.	16995.
DISPERSION=	3318.	7842.	9781.	9689.
MEASURE OF VAR=	.52	.47	.51	.57

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1304.	3344.	3594.	3357.
DISPERSION=	987.	2703.	3831.	3544.
MEASURE OF VAR=	.76	.81	1.07	1.06

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	15615.	16903.	16755.	16179.
DISPERSION=	850.	1333.	1517.	1411.
MEASURE OF VAR=	.05	.08	.09	.09

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	860832.	1899202.	2923638.	3981493.
DISPERSION=	111121.	225666.	390146.	543417.
MEASURE OF VAR=	.13	.12	.13	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	1.4000	.0800	.1200	.6800
DISPERSION=	1.4720	.4000	.3317	.9883
MEASURE OF VAR=	1.0514	5.0000	2.7639	1.4533

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0379	.0501	.0543	.0577
DISPERSION=	.0120	.0112	.0126	.0130
MEASURE OF VAR=	.3165	.2240	.2317	.2249

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2498	.2597	.2868	.2969
DISPERSION=	.0569	.0762	.0690	.0525
MEASURE OF VAR=	.2276	.2934	.2406	.1768

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	3.	45.	117.	210.
DISPERSION=	11.	39.	63.	83.
MEASURE OF VAR=	3.46	.87	.54	.40

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	211.	384.	306.	160.
DISPERSION=	183.	193.	187.	140.
MEASURE OF VAR=	.87	.50	.61	.87

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	514.	1029.	1322.	1570.
DISPERSION=	180.	185.	202.	107.
MEASURE OF VAR=	.35	.18	.15	.07

NUMBER OF BIDS ON LAND	15	83	106	102
PERCENT OF POSSIBLE BIDS	5	33	42	40
TOTAL PARCELS PURCHASED	2	17	41	67

TABLE 7.16

USE OF STRAIGHT LINE DEPRECIATION
67 PERCENT LAND TENURE

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES	
INITIAL NET WORTH- 332820	647431	958180	1261250	
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	20324.	30284.	43294.	44451.
DISPERSION=	7474.	21626.	24986.	26001.
MEASURE OF VAR=	.37	.71	.58	.58
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	13694.	20261.	29395.	27626.
DISPERSION=	5451.	14252.	17810.	20715.
MEASURE OF VAR=	.40	.70	.61	.75
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	3455.	5358.	8552.	7990.
DISPERSION=	2160.	5328.	7145.	4774.
MEASURE OF VAR=	.63	.99	.84	.60
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16978.	17234.	18574.	18301.
DISPERSION=	1082.	2073.	1936.	1811.
MEASURE OF VAR=	.06	.12	.10	.10
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1912423.	4117974.	6252838.	8453891.
DISPERSION=	183517.	451354.	602075.	921035.
MEASURE OF VAR=	.10	.11	.10	.11
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.2800	.9600	.6000	.5600
DISPERSION=	.6782	1.5937	1.2583	1.3565
MEASURE OF VAR=	2.4223	1.6601	2.0972	2.4223
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0320	.0413	.0435	.0460
DISPERSION=	.0090	.0101	.0091	.0103
MEASURE OF VAR=	.2802	.2451	.2095	.2235
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1646	.2292	.2287	.2370
DISPERSION=	.0820	.0589	.0607	.0524
MEASURE OF VAR=	.4984	.2568	.2653	.2211
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	32.	170.	285.	418.
DISPERSION=	37.	72.	102.	117.
MEASURE OF VAR=	1.14	.43	.36	.28
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	224.	366.	250.	221.
DISPERSION=	198.	209.	162.	191.
MEASURE OF VAR=	.89	.57	.65	.87
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	556.	1136.	1434.	1838.
DISPERSION=	211.	227.	183.	142.
MEASURE OF VAR=	.38	.20	.13	.08
NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	102	149	169	166
TOTAL PARCELS PURCHASED	40	59	67	66
	12	38	60	93

TABLE 7.17

USE OF STRAIGHT LINE DEPRECIATION UNDER
LESS AGGRESSIVE GROWTH - (BREAKEVEN CASH FLOW)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	19335.	34246.	39986.	45598.
DISPERSION=	4260.	10391.	17308.	19015.
MEASURE OF VAR=	.22	.30	.43	.42
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	13520.	22588.	26227.	28082.
DISPERSION=	3107.	8071.	12242.	12714.
MEASURE OF VAR=	.23	.36	.47	.45
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	3394.	4930.	6172.	6577.
DISPERSION=	1393.	3685.	5258.	4619.
MEASURE OF VAR=	.41	.75	.85	.70
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17103.	18059.	18078.	18402.
DISPERSION=	484.	1147.	1717.	1863.
MEASURE OF VAR=	.03	.06	.09	.10
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1027661.	2338653.	3598829.	4890420.
DISPERSION=	110645.	252361.	429452.	587802.
MEASURE OF VAR=	.11	.11	.12	.12
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0000	.0000	.0800	.0800
DISPERSION=	0.0000	0.0000	.2769	.2769
MEASURE OF VAR=	0.0000	0.0000	3.4611	3.4611
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0240	.0387	.0423	.0453
DISPERSION=	.0099	.0101	.0113	.0112
MEASURE OF VAR=	.4120	.2611	.2662	.2482
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1283	.2081	.2262	.2299
DISPERSION=	.0520	.0748	.0478	.0466
MEASURE OF VAR=	.4050	.3595	.2112	.2025
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	3.	82.	166.	250.
DISPERSION=	11.	48.	53.	71.
MEASURE OF VAR=	3.46	.59	.32	.29
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	157.	339.	280.	285.
DISPERSION=	162.	226.	191.	196.
MEASURE OF VAR=	1.03	.67	.68	.69
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	460.	1021.	1346.	1734.
DISPERSION=	164.	224.	190.	175.
MEASURE OF VAR=	.36	.22	.14	.10
NUMBER OF BIDS ON LAND				
	28	99	112	108
PERCENT OF POSSIBLE BIDS				
	11	39	44	43
TOTAL PARCELS PURCHASED				
	2	28	51	68

TABLE 7.18

USE OF STRAIGHT LINE DEPRECIATION UNDER
HIGHER COMMODITY PRICES

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	24868.	45026.	54557.	59486.
DISPERSION=	8154.	14009.	19084.	22183.
MEASURE OF VAR=	.33	.31	.35	.37

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	16122.	31808.	37002.	38253.
DISPERSION=	5268.	11727.	13700.	16512.
MEASURE OF VAR=	.33	.37	.37	.43

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	3915.	9393.	10794.	11116.
DISPERSION=	2061.	5897.	6445.	7674.
MEASURE OF VAR=	.53	.63	.60	.69

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	17669.	18860.	19560.	19527.
DISPERSION=	850.	1275.	1470.	1901.
MEASURE OF VAR=	.05	.07	.08	.10

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1238881.	2593092.	4083125.	5625976.
DISPERSION=	196033.	273834.	464140.	651266.
MEASURE OF VAR=	.16	.11	.11	.12

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.2000	.0000	.1200	.0400
DISPERSION=	.6455	0.0000	.3317	.2000
MEASURE OF VAR=	3.2275	0.0000	2.7639	5.0000

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0400	.0476	.0535	.0579
DISPERSION=	.0144	.0100	.0108	.0110
MEASURE OF VAR=	.3586	.2094	.2021	.1895

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1789	.2499	.2874	.2958
DISPERSION=	.0891	.0942	.0681	.0635
MEASURE OF VAR=	.4978	.3770	.2368	.2148

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	26.	130.	274.	419.
DISPERSION=	32.	66.	84.	92.
MEASURE OF VAR=	1.27	.51	.31	.22

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	322.	314.	248.	178.
DISPERSION=	238.	142.	139.	138.
MEASURE OF VAR=	.74	.45	.56	.78

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	647.	1043.	1422.	1797.
DISPERSION=	231.	144.	148.	161.
MEASURE OF VAR=	.36	.14	.10	.09

NUMBER OF BIDS ON LAND	72	157	181	189
PERCENT OF POSSIBLE BIDS	28	62	72	75
TOTAL PARCELS PURCHASED	11	39	64	96

depreciation).¹

In nearly every analysis, when all farmers are forced to switch to straight line depreciation, the largest farmer purchases more acres and the other three farmers purchase less acres. (Only when the initial debt/asset ratio is .5 does the larger farmer also purchase less land.) These results were unexpected since it was hypothesized that larger farmers benefit relatively more from more rapid depreciation techniques. The results are not unreasonable, however. When farmers are forced to pay higher taxes, it impacts the smaller farmers' cash flow relatively more, since they are not generating as much cash nor do they have as much access to credit as the largest farmer. Therefore, land that smaller farmers were previously able to bid on goes to the largest farmer.² Since some of this land is in smaller size parcels, the largest farmer obtains more small parcels and this increases the frequency of his bidding. Purchases of larger parcels keep a bidder out of the market longer as he waits for his cash flow and leverage position to recover from the larger purchase. This reallocation in land prevents consistent patterns in the change in such measurement variables as accrual income, the frequency of refinancing land, and the growth in net worth from emerging. However, one variable that is consistent across all experiments that compare the use of straight line depreciation to the use of double declining

¹ Note that these tables also include results from analyses that are not discussed in this section.

² The cash flow constraint is probably responsible for preventing the three smallest farmers from bidding on previously obtained land. Again, this emphasizes the need to develop a counting mechanism in the model in order to track which constraints are binding for different analyses.

and first year accelerated depreciation is tax payments. As expected, taxes are higher for all farms using straight line depreciation across all analyses.

Turning to the generated capital, some surprising results emerge as the straight line depreciation is compared to what is term "Current Tax Policy" in Tables 7.19 and 7.20. (In this case, "Current Tax Policy" refers to the use of double declining and first year accelerated depreciation.) Since all farmers are paying higher taxes, they may be expected to generate less capital; and in nearly every case, this occurs. The exception involves the third farm under the base structure (Table 7.19). This farm actually generates more capital using straight line depreciation. The best explanation is that the estimated mean value for the ending net worth in the base run is too low. Recall from the previous chapter that farm three's growth in net worth usually responded differently than other farms when sensitivity analyses were performed on the base run.

Comparing the generated capital ratios for smaller farmers versus their larger counterparts also reveals unexpected results. Larger farmers were expected to fare relatively worse when forced to use straight line depreciation. Yet, in five of the six paired comparisons using the base farm, it is the smaller farmer that generates relatively less capital when he is forced to use straight line depreciation. The same patterns emerge when the initial debt/asset ratio is raised to .5 for all farms. These patterns were not prevalent in the analysis with farmers owning 67 percent of the operated land. It is also true that, in the greater tenure analysis, the larger farmers were able to generate relatively higher incomes, since they are

TABLE 7.19
GENERATED CAPITAL UNDER ALTERNATIVE TAX
POLICIES AND INITIAL FARM STRUCTURE¹

Farm Structure and Number	Current Tax Policy	Straight Line Depreciation	Accrual Accounting	Reducing Capital Gain Taxes to .25	Index Taxes to Inflation	President Reagan's Tax Proposal
Base Farms						
Debt/Asset = .3						
Percent Owned = 33						
(initial acres)						
1. (300)	298	282	261	354	296	301
2. (600)	533	518	475	641	541	539
3. (900)	747	759	711	927	778	759
4. (1200)	1026	1000	966	1279	1035	1034
Reference	Table 6.1	7.14	7.22	7.25	7.28	D.14
Highly Leveraged Farms						
Debt/Asset = .5						
Percent Owned = 33						
(initial acres)						
1. (300)	288	280	270	334	287	287
2. (600)	512	506	470	609	525	517
3. (900)	717	717	669	878	732	724
4. (1200)	944	943	880	1175	950	948
Reference	Table 6.36	7.15	7.23	7.26	7.29	D.15
Greater Tenure Farms						
Debt/Asset = .3						
Percent Owned = 67						
(initial acres)						
1. (300)	412	409	393	504	429	420
2. (600)	803	803	739	997	810	806
3. (900)	1213	1181	1139	1535	1248	1229
4. (1200)	1613	1586	1506	2033	1636	1637
Reference	Table 6.37	7.16	7.24	7.27	7.30	D.16

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. (All analyses are conducted with 25 simulations of 10 year periods).

TABLE 7.20
GENERATED CAPITAL RATIOS FOR COMPARING THE RELATIVE IMPACT OF TAX POLICIES,
GIVEN AN ALTERNATIVE INITIAL FARM STRUCTURE¹

Farm Structure and Number	Current Tax Policy	Straight Line Depreciation	Accrual Accounting	Reducing Capital Gain Taxes to .25	Index Taxes to Inflation	President Reagan's Tax Proposal
Base Farms						
Debt/Asset = .3						
Percent Owned = 33						
1 vs. 2	1.118 (>)	1.089 (>)	1.100 (>)	1.103 (>)	1.094 (>)	1.116
1 vs. 3	1.196 (>)	1.116 (>)	1.103 (>)	1.145 (>)	1.141 (>)	1.190
1 vs. 4	1.162 (>)	1.129 (>)	1.083 (>)	1.106 (>)	1.144 (<)	1.164
2 vs. 3	1.070 (>)	1.025 (>)	1.003 (>)	1.038 (>)	1.043 (>)	1.065
2 vs. 4	1.040 (>)	1.036 (>)	.984 (>)	1.003 (<)	1.045 (<)	1.042
3 vs. 4	.971 (<)	1.011 (<)	.982 (>)	.966 (<)	1.002 (<)	.978
Reference	Table 6.1	7.14	7.22	7.25	7.28	D.14
Highly Leveraged Farms						
Debt/Asset = .5						
Percent Owned = 33						
1 vs. 2	1.124 (>)	1.108 (<)	1.149 (>)	1.096 (>)	1.094 (>)	1.110
1 vs. 3	1.204 (>)	1.172 (<)	1.213 (>)	1.139 (>)	1.177 (>)	1.190
1 vs. 4	1.219 (>)	1.188 (<)	1.229 (>)	1.136 (>)	1.208 (>)	1.211
2 vs. 3	1.071 (>)	1.058 (>)	1.054 (>)	1.040 (<)	1.076 (<)	1.072
2 vs. 4	1.085 (>)	1.072 (>)	1.068 (>)	1.037 (<)	1.105 (<)	1.091
3 vs. 4	1.012 (<)	1.014 (<)	1.014 (>)	.997 (<)	1.027 (<)	1.018
Reference	Table 6.36	7.15	7.23	7.26	7.29	D.15
Greater Tenure Farms						
Debt/Asset = .3						
Percent Owned = 67						
1 vs. 2	1.027 (>)	1.018 (<)	1.065 (>)	1.012 (<)	1.059 (<)	1.042
1 vs. 3	1.019 (<)	1.038 (<)	1.036 (>)	.985 (<)	1.031 (<)	1.025
1 vs. 4	1.022 (<)	1.030 (<)	1.045 (>)	.992 (<)	1.049 (<)	1.026
2 vs. 3	.992 (<)	1.019 (>)	.972 (>)	.974 (>)	.973 (>)	.983
2 vs. 4	.995 (<)	1.012 (>)	.981 (>)	.981 (>)	.990 (>)	.985
3 vs. 4	1.003 (>)	.992 (<)	1.009 (<)	1.007 (<)	1.018 (>)	1.001
Reference	Table 6.37	7.16	7.24	7.27	7.30	D.16

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. The ratios are developed by converting these values to a per initial acre value and dividing a smaller farm's value by a larger farm's value (i.e., Farm 1 vs 2 is the per initial acre value of Farm 1 divided by Farm 2's value, etc.). Although all farms may generate less or more capital under a proposed change, the ratios allow for comparisons of which size farms are relatively better or worse off under the change. "Greater than" and "less than" signs compare the tax policy changes with the current tax policy. Therefore, all comparisons are made with the first column. A (>) indicates that the smaller farmer would be in a better relative position without the policy change. A (<) indicates that the smaller farmer would be in a better relative position with the policy change. (All analyses are conducted with 25 simulations of 10 year periods.)

obtaining total production on more acres (i.e., the additional owned acres). This information aided in developing other analyses that would provide more insight into the unexpected results obtained above. It is believed that larger farmers in the base analysis and in the higher leveraged analysis are extended (financially) to the point where they are not obtaining the full tax benefits associated with rapid depreciation techniques. Their taxable incomes are not greatly different from their counterparts because of the high interest payments associated with their aggressive growth. This reasoning was tested by performing two additional experiments that would increase income. In the first test, a behavioral change was made to reflect a less aggressive growth strategy (i.e., The expected cash flow associated with a new purchase of land had to be zero before the farmer would bid). This experiment did enhance the larger farmer's benefits associated with rapid depreciation techniques. In Table 7.21, five of the six paired comparisons reveal that larger farmers generate less capital when using straight line depreciation and when all farmers are not growing as rapidly. In the second test, an environmental change was made to increase income. Commodity prices were increased by increasing the inflation rate on commodity prices from 7.5 percent to 8 percent per year. This analysis was performed with the base data. Results in Table 7.21 reveal that the paired comparisons are equally split under these conditions.

These experiments suggest that the general belief that more rapid depreciation techniques benefit larger farmers relatively more is true as long as the larger farmers are not "overusing" their tax benefits. However, in the case of an aggressive local land market, where all

TABLE 7.21

GENERATED CAPITAL VALUES FOR FURTHER ANALYSES
USING STRAIGHT LINE DEPRECIATION¹

	A Behavioral Change		An Environmental Change	
	Less Aggressive Growth Base Run	Less Aggressive Growth-Straight Line Depreciation	Prices Base Run	Higher Prices Straight Line Depreciation
Reference Monte Carlo Table	6.9	7.17	D.11	7.18
Generated Capital				
(All values in \$1,000 increments - 1979 dollars)				
Farm 1	276	272	377	367
Farm 2	533	521	646	637
Farm 3	757	743	991	962
Farm 4	1014	989	1340	1310

Generated Capital Ratios						
Farm						
1 vs 2	1.034	<	1.045	1.165	>	1.154
1 vs 3	1.093	<	1.100	1.140	<	1.145
1 vs 4	1.089	<	1.102	1.124	>	1.121
2 vs 3	1.057	>	1.052	.978	<	.993
2 vs 4	1.052	<	1.054	.964	<	.972
3 vs 4	.992	<	1.002	.986	>	.979

¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. The ratios are developed by converting these values to a per initial acre value and dividing a smaller farm's value by a larger farm's value (i.e., Farm 1 vs 2 is the per initial acre value of Farm 1 divided by Farm 2's value, etc.). Although all farms may generate less or more capital under a proposed change, the ratios allow for comparisons of which size farms are relatively better or worse off under the change. "Greater than" and "less than" signs compare the tax policy changes with the current tax policy. Therefore, all comparisons are made with the first column. A (>) indicates that the smaller farmer would be in a better relative position without the policy change. A (<) indicates that the smaller farmer would be in a better relative position with the policy change. (All analyses are conducted with 25 simulations of 10 year periods.)

size farmers are purchasing land to the extent that their taxable income is not greatly different due to interest write-offs, it may well be that the smaller farmers have an opportunity to gain relatively more by using more rapid depreciation techniques.¹

Eliminating the Use of Cash Accounting

Farmers are unique in their ability to use cash accounting when calculating income taxes. This provides the opportunity to defer income in good years by storing more grain or by purchasing next year's inputs early and writing them off as a current year's expense. This study does not account for early purchases of inputs, but it does provide tax management through changes in grain inventory. Deferring income tax when growth is occurring can be very beneficial; the present value of money is very important for growing farmers. Not only does deferring income taxes increase the available cash flow, but the probability that there will be even more tax write-off in future years, due to continued growth is high. Therefore, even if grain inventories are withdrawn in the year after cash accounting has been used to defer tax payments, there will likely be more tax write-offs and, thus, a tax payment lower than the amount originally deferred. Forcing farmers to account for inventory changes through the use of accrual accounting should constrain growth.

¹ Again, it must be emphasized that the issue is "What are the opportunities?" In reality, the majority of farmers do not use rapid depreciation techniques, although larger farmers probably use such techniques more than smaller farmers.

Indeed, the results of the experiments where farmers are forced to use accrual accounting suggest that growth would be constrained. Tax payments and the frequency of refinancing land are substantially higher for all farms in every experiment. (These analyses appear in Tables 7.22, 7.23 and 7.24 for the base farms, the highly leveraged farms, and the greater tenured farms respectively.) The higher level of refinancing land would very likely be unacceptable to either the farmer or the creditors, and they would likely alter the control mechanism to obtain less growth in owned acres. (New purchases are responsible for the need to refinance land.) Once again, there appears to be a reallocation of land purchases from the smaller farmers to the larger farmers. Again, this demonstrates that when the cash flows of the smaller farmers are adversely impacted, they are placed at a greater disadvantage than larger farmers.

Examination of the generated capital (Table 7.19) supports the hypothesis that use of accrual accounting would retard growth versus the use of cash accounting. Under each experiment, all farms generate less capital when using accrual accounting. The relative impact of this change on farms of different size is not clear when using the generated capital ratios (Table 7.20). There is an equal number of comparisons with small farmers generating relatively more capital and relatively less capital. Therefore, the major conclusion is that this change would retard growth in net worth as well as purchased acres, since the refinancing of land is considered too frequent and undesirable. Redistribution of land purchases seems to be toward the larger farmers. However, the impact of this change on the relative capital generating capacity of farms of different size is unclear.

TABLE 7.22

USE OF ACCRUAL ACCOUNTING
BASE FARMS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	18393.	28045.	28848.	29285.
DISPERSION=	4994.	12585.	17116.	17965.
MEASURE OF VAR=	.27	.45	.59	.61

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	15659.	22102.	19567.	17608.
DISPERSION=	6019.	14552.	19757.	20441.
MEASURE OF VAR=	.38	.66	1.01	1.16

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	4608.	8183.	9806.	10725.
DISPERSION=	2369.	5290.	6876.	7706.
MEASURE OF VAR=	.51	.65	.70	.72

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16666.	16900.	16949.	17270.
DISPERSION=	627.	1136.	1514.	1406.
MEASURE OF VAR=	.04	.07	.09	.08

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1012162.	2257717.	3550229.	4863051.
DISPERSION=	112433.	219014.	401933.	598241.
MEASURE OF VAR=	.11	.10	.11	.12

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.1200	.5200	1.3200	1.6000
DISPERSION=	.4397	1.0847	1.2819	1.4142
MEASURE OF VAR=	3.6641	2.0860	.9712	.8839

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0226	.0355	.0410	.0447
DISPERSION=	.0099	.0089	.0106	.0113
MEASURE OF VAR=	.4381	.2516	.2578	.2524

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2088	.2996	.3226	.3093
DISPERSION=	.0915	.0772	.0607	.0484
MEASURE OF VAR=	.4381	.2578	.1883	.1565

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	11.	123.	253.	355.
DISPERSION=	22.	53.	67.	82.
MEASURE OF VAR=	1.93	.43	.27	.23

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	298.	318.	258.	187.
DISPERSION=	207.	209.	169.	172.
MEASURE OF VAR=	.70	.66	.65	.92

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	609.	1042.	1410.	1742.
DISPERSION=	208.	191.	173.	162.
MEASURE OF VAR=	.34	.18	.12	.09

NUMBER OF BIDS ON LAND	52	131	153	161
PERCENT OF POSSIBLE BIDS	20	52	61	64
TOTAL PARCELS PURCHASED	6	39	60	86

TABLE 7.23

USE OF ACCRUAL ACCOUNTING
INITIAL DEBT/ASSET RATIO = .5

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	239690	465502	685373	900230

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	11486.	25778.	28220.	26771.
DISPERSION=	4109.	10597.	13461.	15635.
MEASURE OF VAR=	.36	.41	.48	.58

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	8459.	19902.	18606.	13830.
DISPERSION=	4952.	11973.	15311.	18250.
MEASURE OF VAR=	.59	.60	.82	1.32

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	2445.	6526.	7949.	9202.
DISPERSION=	1693.	4479.	6175.	7033.
MEASURE OF VAR=	.69	.69	.78	.76

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	15457.	16420.	16322.	16085.
DISPERSION=	708.	1214.	1178.	1349.
MEASURE OF VAR=	.05	.07	.07	.08

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	841338.	1825381.	2819423.	3833240.
DISPERSION=	86691.	195992.	325662.	419974.
MEASURE OF VAR=	.10	.11	.12	.11

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	1.8400	.5200	1.0800	1.8400
DISPERSION=	1.2806	1.0050	1.1874	1.4048
MEASURE OF VAR=	.6960	1.9327	1.0995	.7635

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0360	.0465	.0510	.0543
DISPERSION=	.0097	.0100	.0109	.0103
MEASURE OF VAR=	.2688	.2145	.2143	.1903

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2647	.2841	.3157	.3334
DISPERSION=	.0560	.0803	.0580	.0541
MEASURE OF VAR=	.2115	.2825	.1835	.1621

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	2.	46.	126.	219.
DISPERSION=	8.	39.	54.	72.
MEASURE OF VAR=	5.00	.85	.43	.33

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	253.	398.	256.	154.
DISPERSION=	175.	237.	175.	136.
MEASURE OF VAR=	.69	.60	.69	.89

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	554.	1045.	1282.	1573.
DISPERSION=	172.	232.	165.	109.
MEASURE OF VAR=	.31	.22	.13	.07

NUMBER OF BIDS ON LAND	13	81	105	113
PERCENT OF POSSIBLE BIDS	5	32	42	45
TOTAL PARCELS PURCHASED	1	17	44	69

TABLE 7.24

USE OF ACCRUAL ACCOUNTING
67 PERCENT LAND TENURE

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	569074	1109237	1646143	2167300
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18456.	34554.	35822.	40195.
DISPERSION=	9582.	18872.	23696.	25244.
MEASURE OF VAR=	.52	.55	.66	.63
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	14461.	27009.	24288.	26165.
DISPERSION=	10335.	20740.	26085.	27565.
MEASURE OF VAR=	.71	.77	1.07	1.05
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	5055.	11450.	13511.	18185.
DISPERSION=	3477.	7213.	9608.	10792.
MEASURE OF VAR=	.69	.63	.71	.59
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16362.	17316.	17910.	17649.
DISPERSION=	1457.	1624.	1854.	1671.
MEASURE OF VAR=	.09	.09	.10	.09
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1891232.	3964418.	6170178.	8277207.
DISPERSION=	184293.	338053.	562245.	875894.
MEASURE OF VAR=	.10	.09	.09	.11
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	1.2400	1.0800	1.8400	1.9600
DISPERSION=	2.3144	1.9562	1.9723	2.0510
MEASURE OF VAR=	1.8665	1.8113	1.0719	1.0464
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0309	.0379	.0423	.0440
DISPERSION=	.0090	.0080	.0085	.0098
MEASURE OF VAR=	.2909	.2100	.2011	.2219
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1989	.2322	.2803	.2539
DISPERSION=	.0856	.0633	.0514	.0344
MEASURE OF VAR=	.4301	.2726	.1835	.1355
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	42.	144.	346.	422.
DISPERSION=	39.	77.	95.	99.
MEASURE OF VAR=	.94	.53	.28	.24
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	227.	389.	205.	240.
DISPERSION=	194.	207.	143.	165.
MEASURE OF VAR=	.85	.53	.70	.69
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	569.	1133.	1450.	1862.
DISPERSION=	195.	205.	174.	159.
MEASURE OF VAR=	.34	.18	.12	.09
NUMBER OF BIDS ON LAND				
	97	167	169	171
PERCENT OF POSSIBLE BIDS				
	38	66	67	68
TOTAL PARCELS PURCHASED				
	15	35	67	94

Reducing the Capital Gains Tax to 25 Percent

Capital gains are currently taxed at 40 percent of their value. Only a couple of years ago the rate was 50 percent. The appreciated value of land is considered a capital gain when the land is sold. This study uses the contingent capital gains taxes to develop market value net worth. Leverage constraints are based on the market value net worth. Therefore, lowering the capital gains taxes should result in an increase in purchased acres and in net worth.

Results from experiments using the base farm structure, the highly leveraged farm structure, and the greater tenure farm structure appear in Tables 7.25, 7.26 and 7.27 respectively. In most cases, the farms do purchase more land, with a corresponding increase in the frequency of refinancing land. Only in the case where the initial tenure is 67 percent do the largest farmers fail to purchase more land. In these cases, the smaller farmers obtain land that previously went to the largest farmer. Therefore, the leverage ratio does not constrain purchases in these experiments.

The generated capital (Table 7.19) is 16 to 26 percent higher as a result of this 15 percent reduction in capital gains taxes. It is relatively higher when farmers own a higher proportion of operated land and when farmers begin with a lower debt/asset ratio. As expected, larger farmers would benefit relatively more if the capital gains tax rate were lowered. That is, 17 of 18 paired comparisons of the generated capital ratios reveal that the smaller farmers' gains in generated capital are relatively less than the larger farmers' gains.

TABLE 7.25

REDUCING CAPITAL GAINS TAXES TO 25 PERCENT
BASE FARMS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	17381.	28470.	29259.	27918.
DISPERSION=	6525.	14429.	17273.	22113.
MEASURE OF VAR=	.38	.51	.59	.79
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8150.	15790.	15616.	12330.
DISPERSION=	3470.	10043.	12705.	16964.
MEASURE OF VAR=	.43	.64	.81	1.38
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1468.	3604.	3837.	3358.
DISPERSION=	864.	3486.	2853.	2105.
MEASURE OF VAR=	.59	.97	.74	.63
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16863.	17356.	17703.	17222.
DISPERSION=	864.	1830.	1798.	2136.
MEASURE OF VAR=	.05	.11	.10	.12
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1226267.	2640843.	4043752.	5607745.
DISPERSION=	190746.	315909.	508116.	789587.
MEASURE OF VAR=	.16	.12	.13	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.2000	.3600	.7600	.8400
DISPERSION=	.7071	1.1504	1.2000	1.4341
MEASURE OF VAR=	3.5355	3.1955	1.5789	1.7073
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0371	.0463	.0491	.0537
DISPERSION=	.0142	.0112	.0116	.0133
MEASURE OF VAR=	.3816	.2414	.2363	.2475
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2150	.2613	.3179	.2802
DISPERSION=	.0834	.0810	.0727	.0529
MEASURE OF VAR=	.3877	.3098	.2287	.1887
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	24.	123.	269.	349.
DISPERSION=	31.	53.	85.	84.
MEASURE OF VAR=	1.27	.43	.32	.24
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	318.	293.	224.	226.
DISPERSION=	253.	177.	172.	200.
MEASURE OF VAR=	.79	.61	.77	.89
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	642.	1016.	1393.	1774.
DISPERSION=	244.	166.	200.	180.
MEASURE OF VAR=	.38	.16	.14	.10
NUMBER OF BIDS ON LAND	66	140	156	148
PERCENT OF POSSIBLE BIDS	26	55	62	59
TOTAL PARCELS PURCHASED	11	34	68	79

TABLE 7.26

REDUCING CAPITAL GAINS TAXES TO 25 PERCENT
INITIAL DEBT/ASSET RATIO = .5

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	239690	465502	685373	900230

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	11974.	25227.	24802.	21517.
DISPERSION=	5411.	12002.	14339.	14540.
MEASURE OF VAR=	.45	.48	.58	.68

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	4610.	12033.	12177.	9703.
DISPERSION=	3292.	7700.	9915.	10264.
MEASURE OF VAR=	.71	.64	.81	1.06

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	894.	2111.	2238.	2212.
DISPERSION=	702.	2345.	2645.	2685.
MEASURE OF VAR=	.78	1.11	1.18	1.21

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	15704.	16773.	16312.	15669.
DISPERSION=	985.	1463.	1721.	1520.
MEASURE OF VAR=	.06	.09	.11	.10

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	985631.	2147034.	3316782.	4541573.
DISPERSION=	140099.	279783.	444141.	642575.
MEASURE OF VAR=	.14	.13	.13	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	1.1600	.2400	.6000	.8800
DISPERSION=	1.5460	.5228	1.0000	1.0132
MEASURE OF VAR=	1.3327	2.1784	1.6667	1.1514

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0466	.0566	.0605	.0641
DISPERSION=	.0131	.0121	.0127	.0135
MEASURE OF VAR=	.2807	.2146	.2097	.2113

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2494	.2926	.3099	.3065
DISPERSION=	.0541	.0893	.0688	.0579
MEASURE OF VAR=	.2170	.3053	.2220	.1887

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	3.	67.	152.	235.
DISPERSION=	11.	55.	65.	95.
MEASURE OF VAR=	3.46	.82	.43	.41

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	283.	384.	253.	141.
DISPERSION=	234.	247.	176.	112.
MEASURE OF VAR=	.82	.64	.70	.80

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	586.	1051.	1305.	1576.
DISPERSION=	230.	225.	171.	126.
MEASURE OF VAR=	.39	.21	.13	.08

NUMBER OF BIDS ON LAND	16	97	104	104
PERCENT OF POSSIBLE BIDS	6	38	41	41
TOTAL PARCELS PURCHASED	2	25	46	73

TABLE 7.27

REDUCING CAPITAL GAINS TAXES TO 25 PERCENT
67 PERCENT LAND TENURE

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	569074	1109237	1646143	2167300

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	17397.	32629.	38941.	48637.
DISPERSION=	10352.	18853.	27132.	22840.
MEASURE OF VAR=	.60	.58	.70	.47

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	9546.	18088.	20128.	25462.
DISPERSION=	7508.	14009.	19944.	12892.
MEASURE OF VAR=	.79	.77	.99	.51

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	2601.	4633.	6342.	6316.
DISPERSION=	2018.	4240.	5934.	4240.
MEASURE OF VAR=	.78	.92	.94	.67

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16565.	17888.	18426.	18723.
DISPERSION=	1748.	1607.	2029.	2023.
MEASURE OF VAR=	.11	.09	.11	.11

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	2148844.	4562762.	7096004.	9500841.
DISPERSION=	246296.	424705.	741581.	1163730.
MEASURE OF VAR=	.11	.09	.10	.12

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.7200	.4800	.8800	.3600
DISPERSION=	1.7205	1.2949	1.4526	.8103
MEASURE OF VAR=	2.3895	2.6976	1.6507	2.2510

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0390	.0465	.0506	.0521
DISPERSION=	.0104	.0088	.0099	.0114
MEASURE OF VAR=	.2676	.1895	.1955	.2190

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1882	.2480	.2343	.2119
DISPERSION=	.0952	.0696	.0600	.0435
MEASURE OF VAR=	.5059	.2807	.2559	.2051

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	48.	184.	309.	378.
DISPERSION=	43.	81.	120.	123.
MEASURE OF VAR=	.90	.44	.39	.33

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	186.	338.	251.	285.
DISPERSION=	195.	225.	174.	201.
MEASURE OF VAR=	1.05	.67	.69	.70

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	534.	1123.	1460.	1862.
DISPERSION=	212.	222.	175.	167.
MEASURE OF VAR=	.40	.20	.12	.09

NUMBER OF BIDS ON LAND	98.	167	154	165
PERCENT OF POSSIBLE BIDS	39	66	61	65
TOTAL PARCELS PURCHASED	17	47	56	85

Indexing Taxes to Inflation

When inflation causes nominal income to increase this pushes tax payers into higher marginal tax brackets. Proposals have been made to index tax brackets to inflation in order to tax real dollars at the same rate. Since the tax system is progressive, indexing taxes to inflation should benefit larger farmers relatively more than smaller farmers. Experiments were conducted under the three farm structures to test the impact of indexing taxes.¹ Tables 7.28, 7.29, and 7.30 present these experiments for the base farm structures, the highly leveraged farm structures, and the greater tenured farm structures, respectively. Generally, the results indicate that all farmers pay less taxes and have higher ending net worths when taxes are indexed. Also, in most cases, there are more land purchases. The smallest farmer does purchase slightly less land in two of the three experiments.

President Reagan's Tax Cut Proposals

At the time of this writing, President Reagan has proposed to cut taxes by 10 percent per year for the next three years. Therefore, the same approach as presented above was imposed for the first three years in the planning horizon (i.e., nominal taxable income was discounted by 10 percent the first year, 20 percent the second year, and 30 percent thereafter). The same results as those presented above were

¹ This was accomplished by converting nominal taxable income into real taxable income (using the 9 percent inflation rate) and calculating taxes with the real taxable income.

TABLE 7.28

INDEXING TAXES TO INFLATION
BASE FARMS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	16982.	28669.	30353.	32135.
DISPERSION=	6056.	13774.	19916.	18822.
MEASURE OF VAR=	.36	.48	.66	.59

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	9158.	16175.	15827.	17114.
DISPERSION=	4332.	9128.	12259.	10405.
MEASURE OF VAR=	.47	.56	.77	.61

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1152.	1985.	2298.	2612.
DISPERSION=	499.	927.	1298.	1257.
MEASURE OF VAR=	.43	.47	.57	.48

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16880.	17659.	17383.	17579.
DISPERSION=	904.	1599.	2247.	1888.
MEASURE OF VAR=	.05	.09	.13	.11

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1089734.	2395284.	3699226.	5019892.
DISPERSION=	143708.	323388.	550232.	720387.
MEASURE OF VAR=	.13	.14	.15	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.2800	.2400	.5600	.3600
DISPERSION=	1.2083	.7234	1.0033	.5686
MEASURE OF VAR=	4.3154	3.0142	1.7917	1.5795

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0292	.0407	.0446	.0475
DISPERSION=	.0121	.0126	.0138	.0133
MEASURE OF VAR=	.4147	.3091	.3090	.2796

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1762	.2939	.2616	.2727
DISPERSION=	.1132	.0803	.0803	.0607
MEASURE OF VAR=	.6424	.2732	.3071	.2225

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	21.	141.	226.	342.
DISPERSION=	33.	43.	90.	102.
MEASURE OF VAR=	1.58	.31	.40	.30

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	213.	336.	306.	206.
DISPERSION=	213.	204.	161.	160.
MEASURE OF VAR=	1.00	.61	.53	.77

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	534.	1077.	1431.	1749.
DISPERSION=	212.	201.	164.	137.
MEASURE OF VAR=	.40	.19	.11	.08

NUMBER OF BIDS ON LAND	61	132	145	150
PERCENT OF POSSIBLE BIDS	24	52	57	59
TOTAL PARCELS PURCHASED	8	41	53	83

TABLE 7.29

INDEXING TAXES TO INFLATION
INITIAL DEBT/ASSET RATIO = .5

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES 600 ACRES 900 ACRES 1200 ACRES
INITIAL NET WORTH- 239690 465502 685373 900230

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-
MEAN VALUES = 11339. 25720. 26928. 26017.
DISPERSION= 4692. 11562. 14006. 16354.
MEASURE OF VAR= .41 .45 .52 .63

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-
MEAN VALUES = 4787. 11528. 13648. 12682.
DISPERSION= 2880. 7051. 9355. 9493.
MEASURE OF VAR= .60 .61 .69 .75

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-
MEAN VALUES = 549. 1058. 1384. 1531.
DISPERSION= 261. 475. 1018. 959.
MEASURE OF VAR= .48 .45 .74 .63

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-
MEAN VALUES = 15806. 16999. 16526. 16351.
DISPERSION= 815. 1500. 1496. 1681.
MEASURE OF VAR= .05 .09 .09 .10

ENDING NET WORTH -NOMINAL DOLLARS-
MEAN VALUES = 871819. 1943184. 2964514. 3988229.
DISPERSION= 122452. 271149. 423007. 573194.
MEASURE OF VAR= .14 .14 .14 .14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD
MEAN VALUES = 1.2000 .2000 .1600 .7200
DISPERSION= 1.6833 .4082 .3742 .9798
MEASURE OF VAR= 1.4027 2.0412 2.3385 1.3608

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)
MEAN VALUES = .0390 .0521 .0555 .0578
DISPERSION= .0129 .0132 .0134 .0136
MEASURE OF VAR= .3309 .2534 .2420 .2351

ENDING DEBT/ASSET RATIO
MEAN VALUES = .2363 .2552 .2929 .3051
DISPERSION= .0549 .0923 .0664 .0680
MEASURE OF VAR= .2323 .3617 .2265 .2227

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD
MEAN VALUES = 3. 48. 138. 221.
DISPERSION= 11. 38. 62. 92.
MEASURE OF VAR= 3.46 .80 .45 .42

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD
MEAN VALUES = 203. 387. 234. 237.
DISPERSION= 171. 231. 134. 174.
MEASURE OF VAR= .84 .60 .57 .73

ENDING TOTAL TILLABLE ACRES CONTROLLED
MEAN VALUES = 506. 1035. 1271. 1658.
DISPERSION= 167. 219. 150. 157.
MEASURE OF VAR= .33 .21 .12 .09

NUMBER OF BIDS ON LAND 13 82 103 103
PERCENT OF POSSIBLE BIDS 5 32 41 41
TOTAL PARCELS PURCHASED 2 18 43 69

TABLE 7.30

INDEXING TAXES TO INFLATION
67 PERCENT LAND TENURE

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES 600 ACRES 900 ACRES 1200 ACRES
INITIAL NET WORTH- 569074 1109237 1646143 2167300

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES = 18468. 32852. 43334. 43568.
DISPERSION= 10913. 20338. 26742. 24440.
MEASURE OF VAR= .59 .62 .62 .56

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES = 9712. 18106. 23468. 22552.
DISPERSION= 8183. 14583. 18245. 13226.
MEASURE OF VAR= .84 .81 .78 .59

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES = 1221. 2576. 3663. 3996.
DISPERSION= 672. 1473. 2283. 1955.
MEASURE OF VAR= .55 .57 .62 .49

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES = 16867. 18140. 18839. 18568.
DISPERSION= 1863. 1956. 2239. 2115.
MEASURE OF VAR= .11 .11 .12 .11

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES = 1964684. 4114452. 6406537. 8563365.
DISPERSION= 221142. 409626. 708716. 1068729.
MEASURE OF VAR= .11 .10 .11 .12

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES = .8800 .7200 .6400 .5200
DISPERSION= 2.1276 1.5684 1.2871 .8226
MEASURE OF VAR= 2.4177 2.1784 2.0111 1.5819

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES = .0344 .0413 .0457 .0470
DISPERSION= .0103 .0093 .0103 .0116
MEASURE OF VAR= .2983 .2261 .2262 .2475

ENDING DEBT/ASSET RATIO

MEAN VALUES = .1578 .2510 .2180 .2209
DISPERSION= .1021 .0776 .0512 .0479
MEASURE OF VAR= .6470 .3093 .2350 .2167

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES = 38. 189. 288. 408.
DISPERSION= 45. 77. 102. 133.
MEASURE OF VAR= 1.18 .41 .35 .33

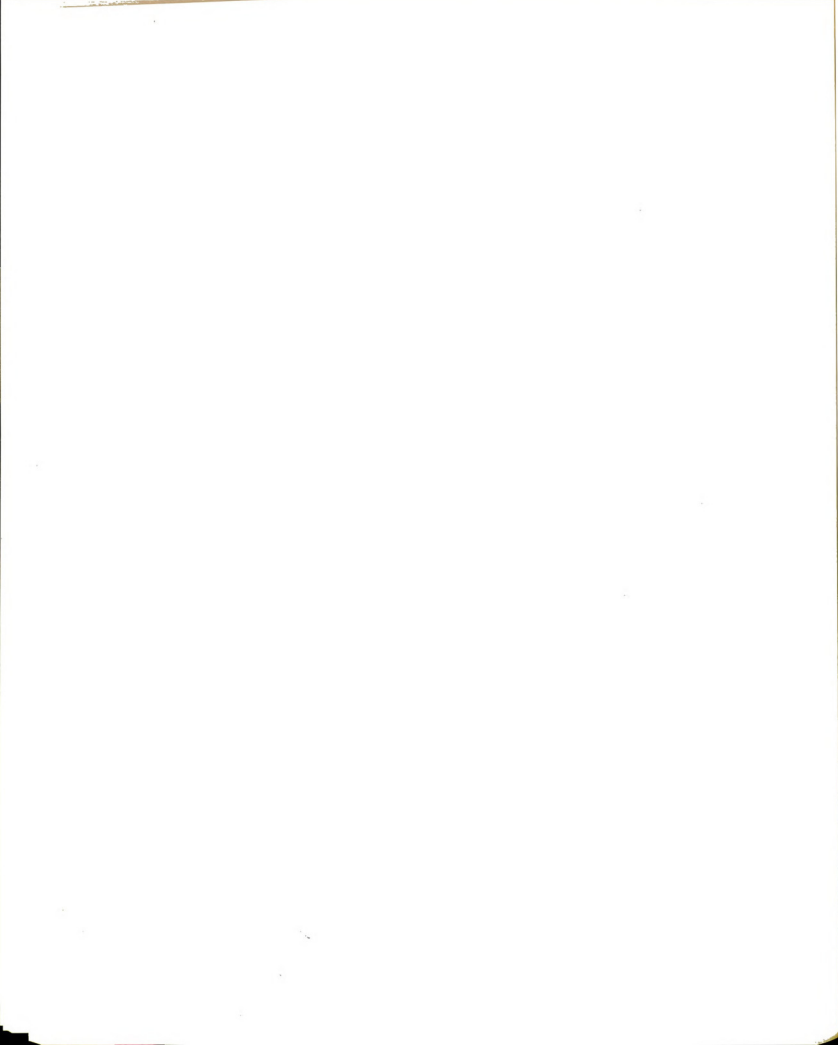
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES = 214. 331. 245. 269.
DISPERSION= 219. 200. 142. 223.
MEASURE OF VAR= 1.02 .60 .58 .83

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES = 553. 1122. 1433. 1877.
DISPERSION= 221. 192. 151. 188.
MEASURE OF VAR= .40 .17 .11 .10

NUMBER OF BIDS ON LAND 94 170 164 158
PERCENT OF POSSIBLE BIDS 37 68 65 63
TOTAL PARCELS PURCHASED 13 48 58 86

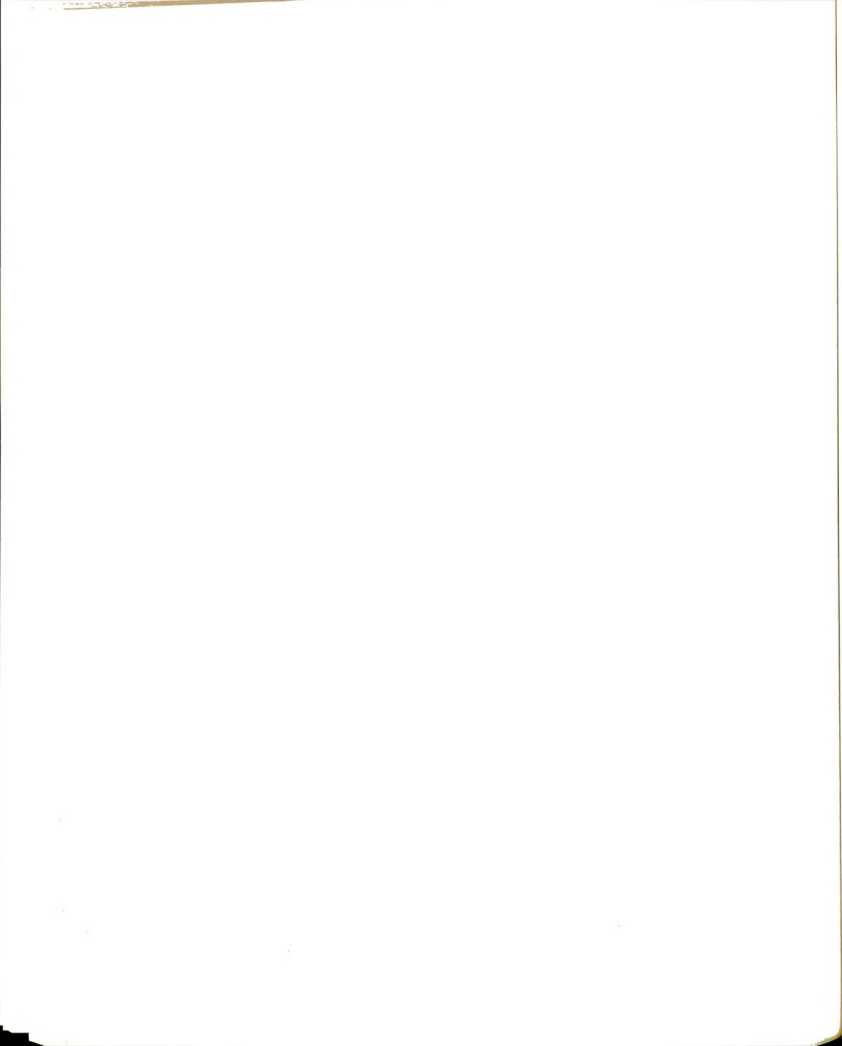


expected with the exception of less gains in generated capital. These expectations were fulfilled; and, since the results do not present new information, the Monte Carlo Summary Tables D.14-D.16 appear in Appendix D.

Other Tax Policy Experiments

In order to further demonstrate the type of tax policy changes that can be examined using this model, five other experiments were developed using the base data.¹ The first of these experiments is an extension of President Reagan's tax proposals. In this experiment the number of years for depreciating machinery and buildings was reduced from 7 to 5 years and from 10 to 8 years respectively. These changes reflect a proposal to reduce the number of years a capital investment must be held without recapturing investment tax credits. The second experiment eliminates the income averaging option. This experiment was not expected to have severe impacts since the model assumes that farmers attempt to adjust year-to-year taxable income in order to avoid drastic shifts in tax commitments. The third experiment reduced the investment tax credit rate from ten percent to five percent. In the fourth experiment, all capital gains were taxed at the full rate. Finally, the fifth experiment forced the first three farmers to use straight line depreciation and the largest farmer to use double declining and first year accelerated depreciation.

¹ The Monte Carlo Summary Tables for these experiments appear in Table D.17-D.21 in Appendix D, since these experiments are not performed under other than base conditions.



The generated capital values for these experiments appear in Table 7.31. These results are only summarized since these experiments were conducted to demonstrate areas for further research and were not intended to be used for analysis. The relationships for the generated capital, when comparisons are made to the base run, are: 1) More capital is generated under the extended set of Reagan tax proposals (More capital is also generated when this set of proposals is compared to the tax cut only), 2) Slightly less capital is generated when income averaging is eliminated, 3) Less capital is generated when the investment tax credit rate is reduced, 4) Substantially less capital is generated if contingent capital gains are taxed as ordinary income, and 5) All farms generate less capital when the first three farmers use straight line depreciation and the fourth farmer uses the more rapid depreciation techniques. Once again, the relative gains and losses in generated capital can be summarized by examining the paired generated capital ratios. These comparisons are summarized as follows: 1) In 5 of the 6 pairs the larger farmers are in a relatively better position with the extended Reagan proposals; 2) Larger farmers are in a relatively better position in all paired comparisons eliminating income averaging; 3) Larger farmers are in a relatively better position in 5 of the 6 comparisons reducing investment tax credit rates; 4) Smaller farmers are in a relatively better position in all comparisons taxing capital gains as ordinary income; and 5) In 5 of the 6 comparisons larger farmers are in a relatively better position when the first three farmers use straight line depreciation and the largest farmer uses more rapid depreciation techniques.

TABLE 7.31

OTHER ANALYSIS COMPARING THE RELATIVE IMPACT OF TAX POLICIES,
GIVEN THE BASE FARM STRUCTURE¹

	Current Tax Policy	Reagan Tax Cuts and Less Years Depreciation	Disallow Income Averaging	Investment Tax Credits to .05	Tax All Capital Gains	Allow Different Depreciation Techniques
Reference Monte Carlo Tables	6.1	D.17	D.18	D.19	D.20	D.21
Generated Capital (All values are in \$1,000 increments - 1979 Dollars)						
Farm 1 (300 acres)	298	298	296	293	117	284
Farm 2 (600 acres)	533	540	530	527	146	519
Farm 3 (900 acres)	747	767	743	736	124	757
Farm 4 (1200 acres)	1026	1050	1022	1016	98	1003
Generated Capital Ratios						
Farm						
1 vs 2	1.118 (>)	1.104 (>)	1.116 (>)	1.113 (<)	1.599 (>)	1.093
1 vs 3	1.196 (>)	1.165 (>)	1.194 (>)	1.194 (<)	2.815 (>)	1.123
1 vs 4	1.162 (>)	1.159 (>)	1.157 (>)	1.154 (<)	4.749 (>)	1.130
2 vs 3	1.070 (>)	1.056 (>)	1.069 (<)	1.073 (<)	1.760 (>)	1.028
2 vs 4	1.040 (>)	1.029 (>)	1.036 (>)	1.037 (<)	2.969 (>)	1.034
3 vs 4	.971 (<)	.974 (>)	.969 (>)	.966 (<)	1.687 (<)	1.006

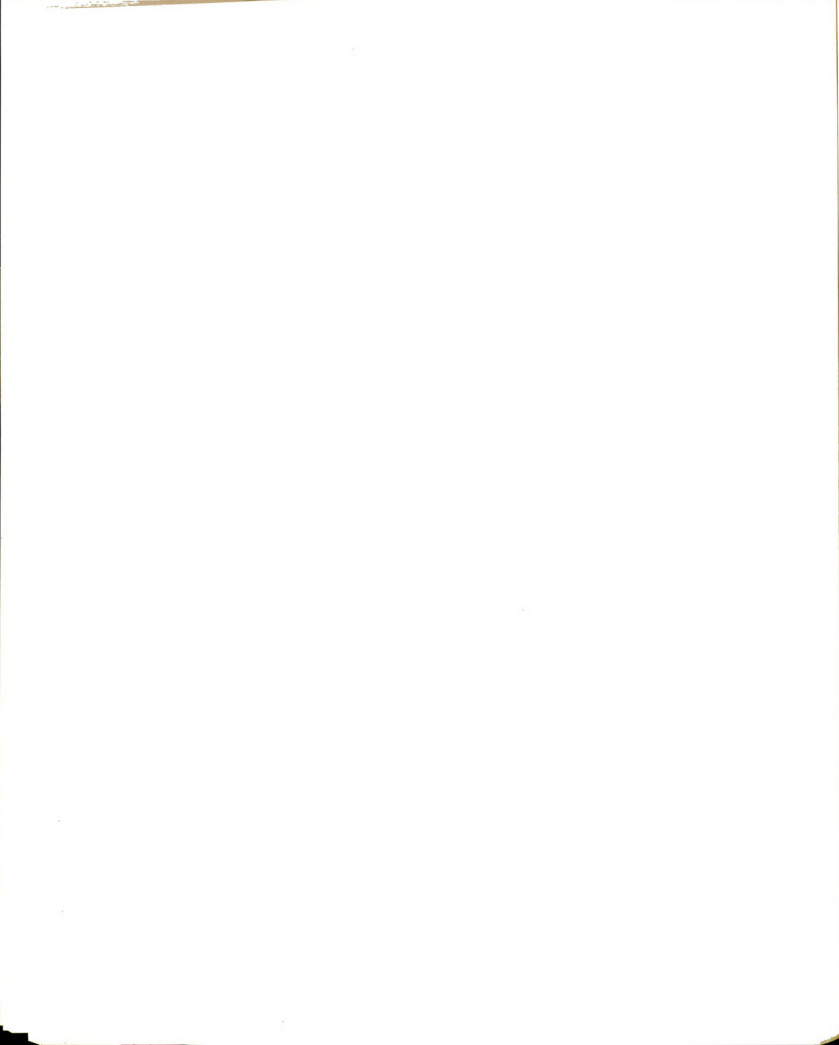
¹ Generated capital is calculated by adding the net gain (1979 dollars) in market value net worth to the present value of the stream of family living expenditures. The ratios are developed by converting these values to a per initial acre value and dividing a smaller farm's value by a larger farm's value (i.e., Farm 1 vs 2 is the per initial acre value of Farm 1 divided by Farm 2's value, etc.). Although all farms may generate less or more capital under a proposed change, the ratios allow for comparisons of which size farms are relatively better or worse off under the change. "Greater than" and "less than" signs compare the tax policy changes with the current tax policy. Therefore, all comparisons are made with the first column. A (>) indicates that the smaller farmer would be in a better relative position without the policy change. A (<) indicates that the smaller farmer would be in a better relative position with the policy change. (All analyses are conducted with 25 simulations of 10 year periods.)

These results raise interesting questions. But, temptations to draw conclusions are resisted, since more experiments under a number of conditions should be conducted to test the consistency of the results.

Concluding Comment on Tax Policy Analyses

Although the analyses of various tax policies were revealing, the most important contribution of this analysis was the methodology developed to analyze a proposed policy. Developing a number of experiments under a number of behavioral, environmental, and structural assumptions is considered essential. Not only can this provide insights into which size farmers may benefit the most under different conditions, such experiments can also be used in conjunction with census data to develop general conclusions in regard to the number of farmers that may benefit and whether larger or smaller farmers would benefit the most from a proposed policy. Since general policies that impact all size farmers are more common than policies directed at different size farmers, and since these policies must be made in an environment that includes many diverse producers, this is an important contribution.

The intent of this study has been to analyze possible policy changes. No attempt was made to develop policies that would benefit different size farmers differently. However, this type of model could be used to develop and analyze policies directed at different size farmers. This is particularly true with regard to income tax policies. For example, farms with gross sales of over \$200,000 could be forced to use accrual accounting.

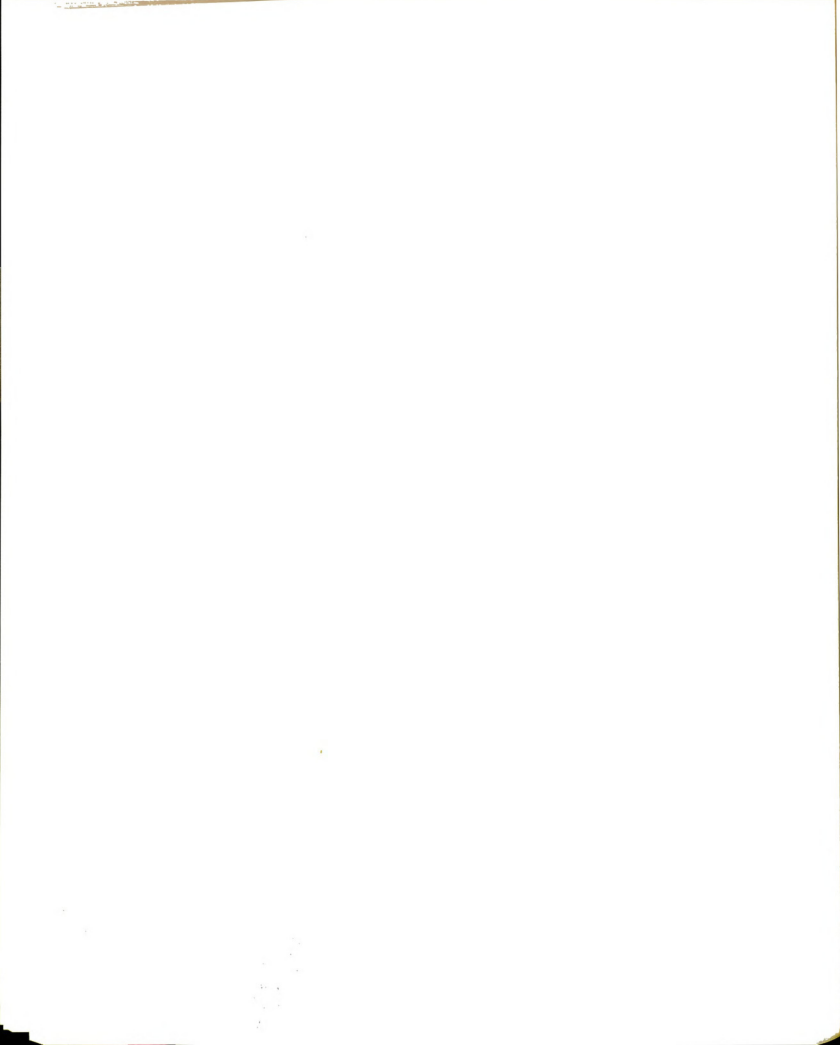


CHAPTER VIII

SUMMARY AND CONCLUSIONS

This study was undertaken in response to re-emerging concerns over structural trends in the agricultural sector. Since these concerns relate to the trend toward larger and fewer farms, this study has focussed on the growth phase of the farm firm. Development of the political and the economic environment in which the farm firm must operate was a prerequisite to understanding the growth process. This was accomplished by using the systems approach and institutional economics to develop a multiple farm firm-household growth simulation model that allows for alternative assumptions involving initial endowments for farmers, behavioral responses of farm managers, the economic environment, and the institutional environment. The model is limited to corn and soybean farms in the Corn Belt.

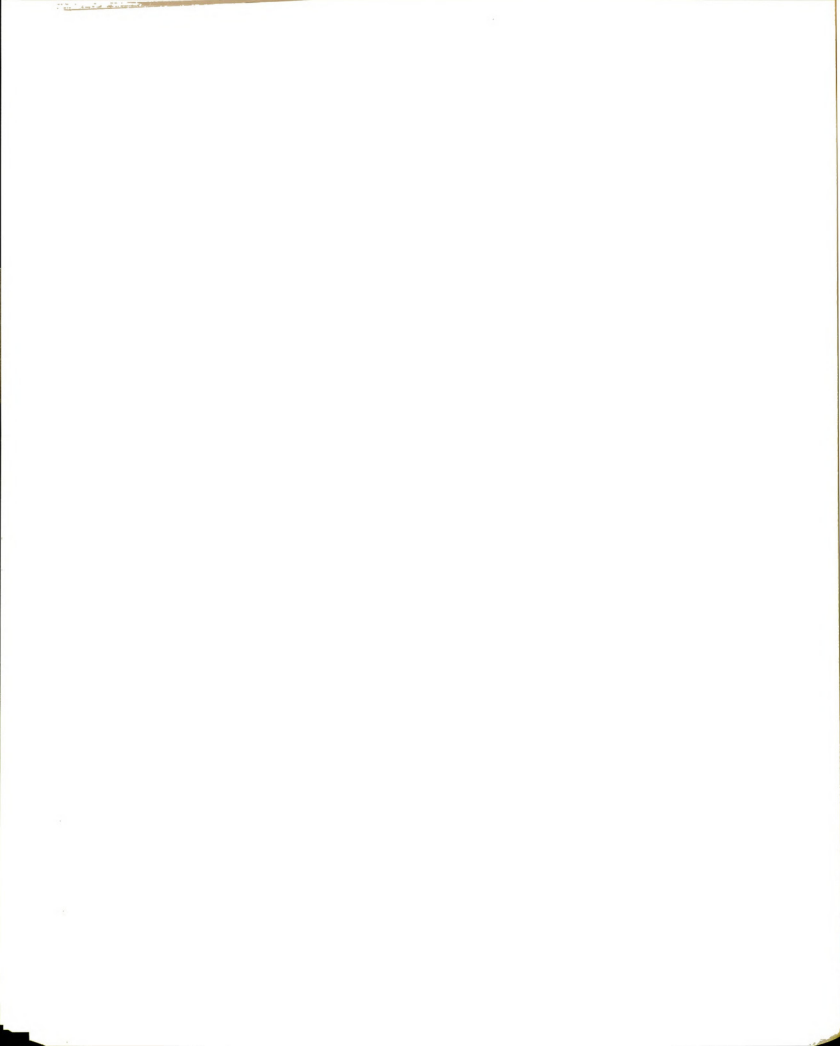
The model was used to develop insights into the opportunity sets available to different size farmers under the existing economic and institutional environments. By using the systems concept of design, appropriate farmer behavior was developed to aid in reaching specified multiple goals of farmers. Once behavioral responses were established, controlled experiments were conducted to provide insights into the way alternative economic and institutional environments influence the opportunity sets of different size farmers. Since control of land is a major aspect of the trend toward larger and fewer farms,



particular attention was given to simulating a local purchase and lease land market in which four different size farms were allowed to compete. The ability to acquire new land, without risking going out of business, was considered a major measurement variable when evaluating the opportunity sets of different size farmers. Another measurement variable that allowed for evaluation of the impact of alternative commodity and income tax policies on farms on different size was the generated capital over a ten year planning horizon. Generated capital is the growth in market value net worth and the total family consumption over the period. Since the management and family labor were fixed for all farm sizes, the generated capital variable is solely a function of the initial endowment (i.e., farm size and net worth) and the economic and institutional environment.

Review of the Methodology

The model simulates the growth and financial well-being of four corn and soybean farms simultaneously over a maximum period of 15 years. (This study limited planning horizons to 10 years.) Random prices, yields, and purchase and lease land availability are provided, thus requiring that a number of simulations of the desired planning period be developed in order to obtain average values that reflect realistic variability in returns, cash flows, and ability to grow and prosper. (This study uses 25 simulations of 10 year planning horizons for most analyses.) The model uses such financial measures as debt/asset ratios, equity, expected cash flows, and changes in owner equity, to aid in investment decisions. Standard operating procedures (using these variables) were developed to reflect creditor's behavior.



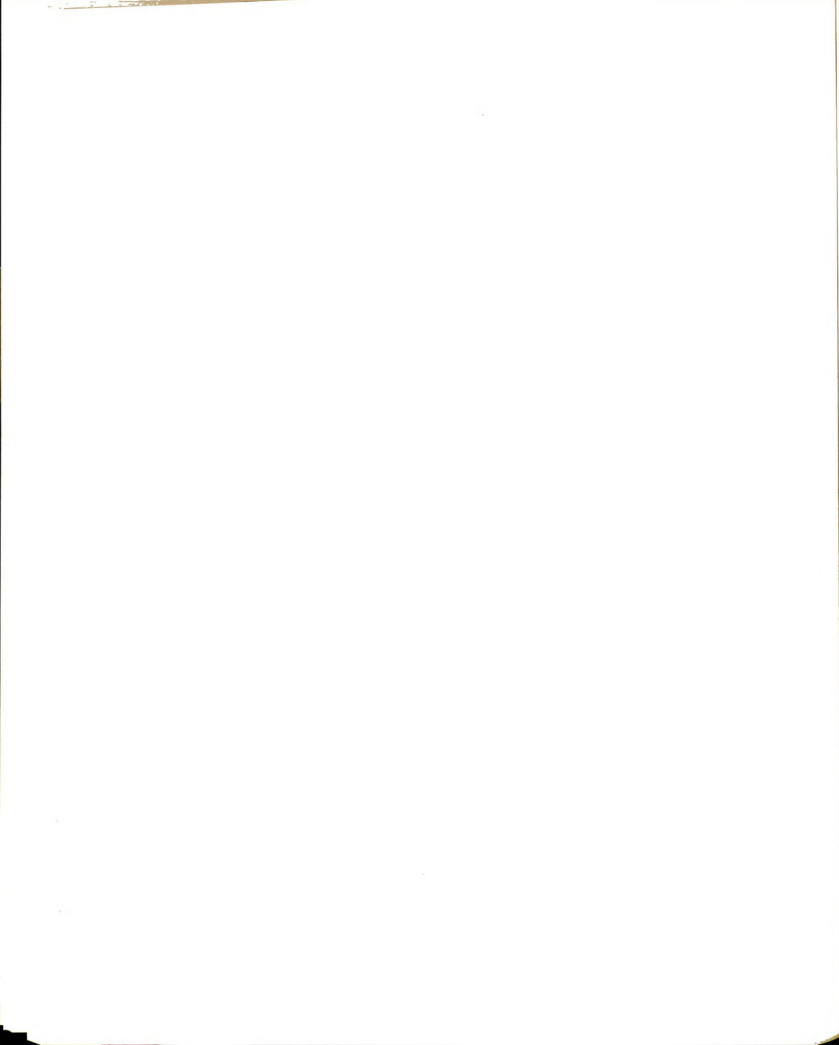
Similar techniques were created to reflect the farmer's preferences for use of credit.

The model progresses through a year of production and investment decisions by first allowing farmers to acquire new purchase or lease land. All farmers evaluate their operation and its financial ability to support the new addition with a matching machinery complement. The majority of purchase land is allocated using a capital budgeting procedure to evaluate which farmer will obtain the highest net present value cash flow from the new purchase. Land prices are established by an Almon lag model that accounts for a series of high and/or low returns. A major strength of this model is the manner in which cost equations are used to evaluate the whole farm expected cash flow and income tax position, if the new parcel of land were purchased. Once new land is acquired, decisions are made on the level of machinery complement to be purchased. The model allows for five discrete levels of machinery complements. Crop mix decisions are made on the basis of expected prices, costs, yields, and machinery complement. Expected yields are a function of machinery complement, farm size, and crop mix. Actual production is adjusted by the same random deviation (from the expected yield) for each farm. At the year's end, actual production, random prices, and tenure (i.e., share leasing must be accounted for) determine the available revenue. Decisions on the percent of the current year's crop to store are made based on cash flow and income tax repercussions. The current year's taxes are calculated using standard procedures and income averaging. (The minimum tax is chosen.) The tax calculations account for many of the various opportunities provided to farmers: cash accounting,

investment tax credits with carry-over provisions, a variety of depreciation techniques, interest write-offs, etc. At the end of each year, all financial variables are updated and cash flow is balanced.

The model developed for this study uses a variety of unique techniques. Possibly the most important contribution involves the manner in which a local land market was developed in which four farmers must compete for a single parcel of purchase and lease land in each year. Although reliable data on land availability was not available, the technique used to develop land availability is an improvement over previous simulation studies that used unrealistic constraints on land availability. The development of a competitive lease market is also a contribution. Although this is one of the major areas requiring future improvement, the lease land allocation procedure appears to be reasonable (i.e., Increased use of resources to purchase land results in obtaining less lease land). The use of simplified budgeting techniques that use yield discounts developed by a linear program proved important in reducing the cost of the model. Another important contribution of this model is the use of upper and lower bounds and exponentially weighted values to provide consistency in control variables that influence stability (i.e., in family living and income tax payments). Finally, the development of multi-variate prices and yields that account for market relationships within and between years is a worthwhile addition.

As with any attempt to model reality, there must be gross simplifications. The model developed here is no exception. Some of the most limiting simplifications include the following: 1) the use of an aggregated machinery complement, 2) the consideration of only sole



proprietor corn and soybean farmers in the Corn Belt, 3) the lack of reliable information on farmer behavior, 4) the use of only two marketing options, 5) the elimination of off-farm investment, 6) the replacement of machinery on a continuous (dollar/acre) basis, 7) the use of only equal payment amortized intermediate and fixed loans, 8) the heavy dependence on the Almon lag model and land inflation assumptions without appropriate land price adjustments as policies change, and 9) the lack of learning behavior as mistakes are made (This must be done with researcher interaction). Many of these simplifications could be rectified. However, legitimate concerns over whether the additional benefits would offset the increased cost of running the model would need to be addressed. This is particularly true for developing disaggregate machinery complements (i.e., a system that would track each piece of machinery's age, useful life, and actual use). In order to make the model more applicable, additional work should be done to make the model easily adapted to grain farms in different regions. Possibly, the most fruitful addition to this model would be a reliable land bid model that would reflect different tax policies and/or perceptions of risk associated with commodity programs. Attempts to accomplish this, using the Lee/Rask model, were unsuccessful due to the sensitive nature of assumptions on inflation expectations. Therefore, incorporation of a land bid model that allows for adjustments in inflation expectations and risk preferences could possibly enhance the predictive power of the model without altering the allocation of land greatly. Recall the experiment in which land was allocated randomly to those farmers that were financially able to place bids. This would provide a better estimate of

future land prices. A capitalization model or an econometric model may be suitable.

Testing the Credibility of the Model

Developing a systems simulation model that is credible involves an iterative process whereby the researcher and the model complement one another. The researcher must have a working knowledge of the system being studied and use the simulation model to develop the system. When a computer model is developed, the computer is used to retain and recall vast amounts of information while tracking changing states of nature over time. Under these conditions, the computer is merely an extension of the researcher's mental capacity. Development of the model used in this study proceeded under these premises. In a broader sense, the model developed here reflects the researcher's paradigm. As Johnson and Rausser (1977) point out: "a paradigm typically defines a large set of possible hypotheses and makes no claims for the validity of any particular member of that set. Paradigms, unlike the hypotheses to which they give rise, cannot be validated by experimental or statistical method" (p. 186-187). Therefore, it is difficult to check the model developed in this study for external consistency (validation). This is particularly true when the purposes of the model and the experimental approach are reviewed. Recall that this research developed behavior to reflect potential opportunities for growth of different size farms. Since the farming sector is extremely heterogenous, the intent was not to devise typical behavior. In order to statistically validate the model, a historical sample of farms that practiced the designed behavior would need to be

identified. This is not practical. However, results can be evaluated in light of established theory and institutional knowledge and logical consistency can be verified. This was done time and again as numerous sensitivity analyses (all of which are not reported here) were performed. In early stages of development, these tests aided in identification of areas that did not conform to the researcher's paradigm (i.e., Due to structural design or improper specification, the results did not appear to be logically consistent). As development of the model progressed, these inconsistencies were eliminated until all sensitivity tests produced plausible (in the judgement of the researcher) results.

Another test of validity involves the internal consistency of the model. This model was developed in a number of stages, testing the consistency of each individual component. In some cases (such as the cost curves), individual components were tested against the data sources used to create them. Developing logically consistent subsystems enhanced the confidence that was placed in the total system simulation model. The test of clarity requires that all assumptions and equations be presented. This is done in various sections of this study. A number of sensitivity analyses are also presented to allow the reader to judge the logical consistency of the model. Finally, the model is yet to be tested for workability. If it can be used to aid decision-makers in making appropriate decisions, then it would be workable.

Conclusions and Policy Implications

Behavior and Growth

The goals and related behavior of farmers certainly influence their well-being. Experiments reported in Chapter VI demonstrate the probable outcomes associated with more and less aggressive growth behavior. Distinct tradeoffs exist. Under the conditions outlined in this study, more aggressive growth should result in: 1) lower and more variable incomes (during the growth phase), 2) sacrifices in family living, 3) increased gains in net worth (There is a point at which more aggressive growth results in decreased gains in net worth), 4) more reliance on credit, and 5) more reliance on refinancing land to balance more frequent negative cash flows. Although a number of behavioral parameters were developed and tested to provide aggressive growth with little or no risk of becoming insolvent, the two most important parameters are: 1) the farmer's internal credit rationing (based on the leverage position) and 2) the projected cash flow associated with new land purchases. Under inflationary conditions, a projected negative cash flow can be tolerated. Control variables that were tied to farm size provided similar behavior for different size farms that did not have to be altered as growth occurred.

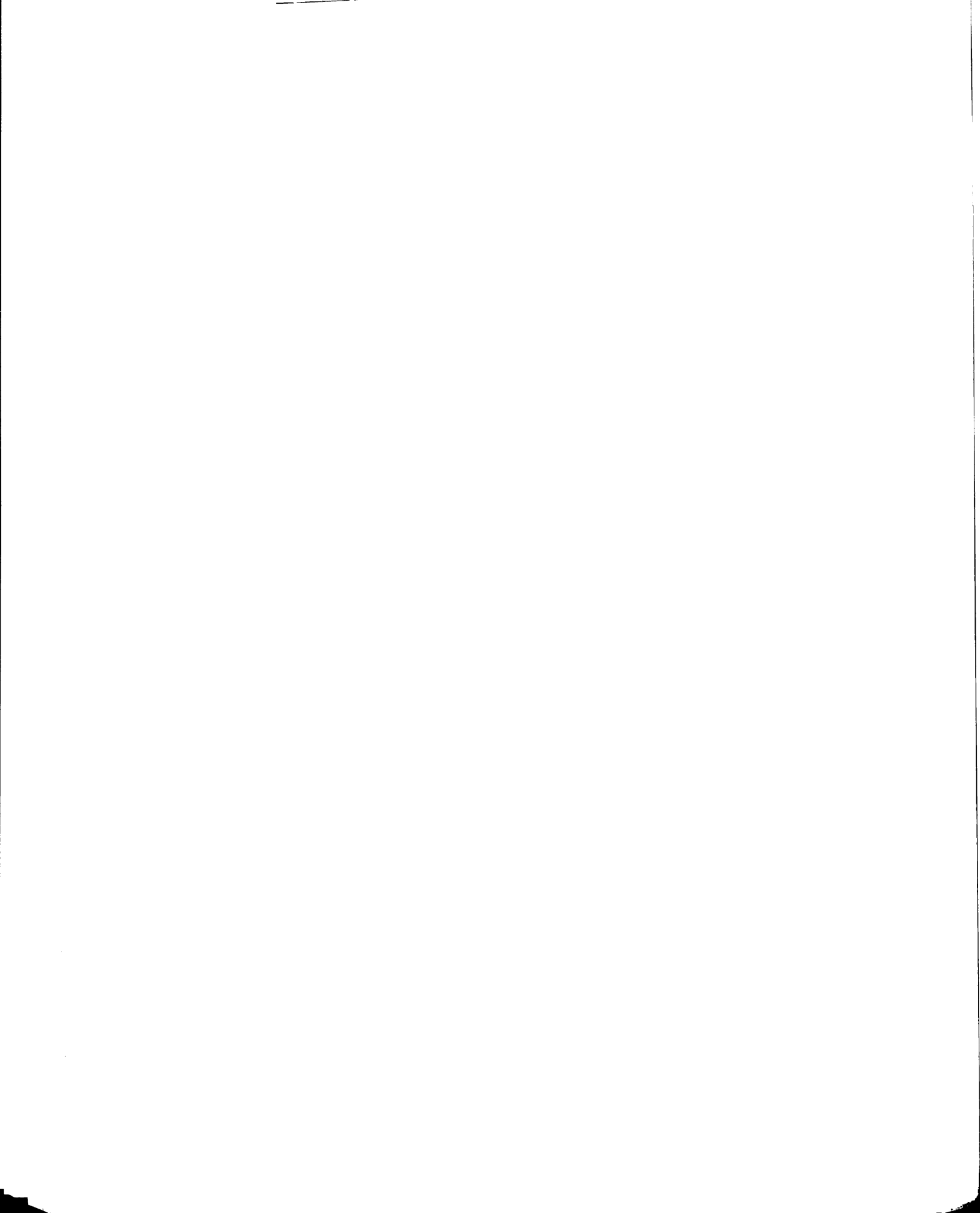
Drains on cash flow can also influence the growth potential of the farm. Experiments conducted in Chapter IV demonstrated that there are distinct tradeoffs associated with growth and expenditures for family living. As with most drains on cash flow, smaller farmers' growth potential is impacted relatively more from similar changes in

family consumption.¹ Generally all experiments involved similar levels of family consumption across farms of different size. Although little empirical work has been done to demonstrate a positive relationship between family living expenditures and net worth, an experiment was conducted to test how this may change the growth potential across different size farms. Under these conditions, the distortion in the opportunities for growth would be less severe.

The importance of outside income for smaller farmers was emphasized by developing experiments where no outside income was allowed. Without outside income, smaller, highly leveraged farmers would not be successful in growing corn and soybeans in the Corn Belt. This emphasizes the barriers to entry. Further experiments were also performed to illustrate the absence of growth opportunities for low-equity beginning farmers. Under the conditions developed for this study, such farmers have nearly no opportunity for purchasing land. However, they should be able to lease additional land. These experiments also emphasized the important tradeoffs between family living expenditures and growth potential.

Most experiments involved modestly leveraged farmers (i.e., with an initial debt/asset ratio of 30 percent) who owned one-third of their land. When different size farmers were allowed to own two-thirds of their land in the beginning year, the competitive position

¹ Although the model is capable of developing different assumptions concerning the degree of adaptability of different size farmers, no such analyses were performed. The argument has been made that smaller farmers are willing to adjust their family living patterns more severely than larger farmers. If this is true, then this study may overemphasize the impact of drains on cash flow on smaller farmers. (Recall that all analyses reflect the influence of price and yield risks.)

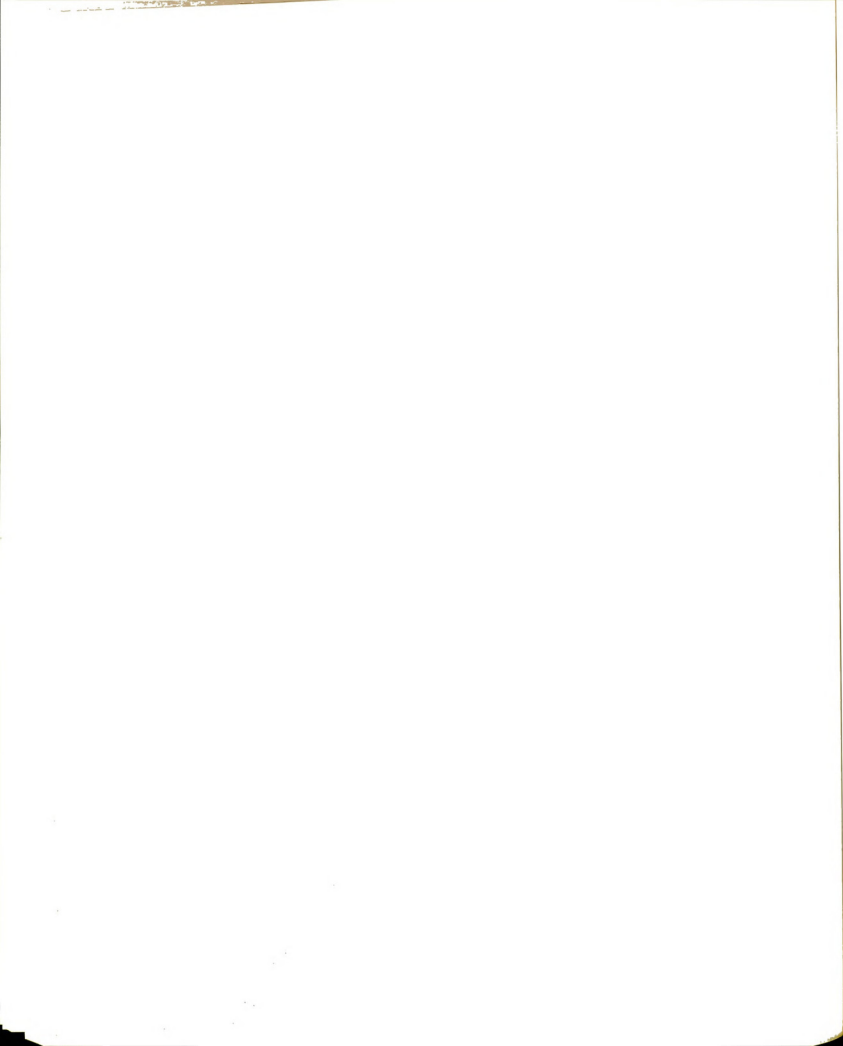


of smaller farmers was improved. This emphasizes the importance of land ownership to support new land purchases. As expected, experiments involving more highly leveraged farmers demonstrated that these farmers have less opportunity to purchase land. However, they should experience greater growths in net worth. This reflects the incentives associated with being highly leveraged during inflationary periods.

Inflation and Growth

A limited number of experiments were developed to provide further insights into the interaction of structural changes and inflation. Most of the analyses in this study assume that land will inflate at a higher rate than the general economy. When land inflation was set at the same rate as the general economy, all farmers purchased more land. And larger farmers gained relatively more control over land. This suggests that there are limits to the gains associated with land inflation. These results may have been different if the same comparisons would have been made for more highly leveraged farmers. Such farmers would very likely gain more under conditions where land inflated at higher rates than the general economy.

Since land investments are being made on the basis of expected increases in land prices, substantial structural adjustments can be expected if inflation is brought under control. In order to demonstrate possible repercussions associated with lower inflation rates, an experiment that assumed all items would inflate at two percent per year (over the next ten years) was conducted. Under these conditions lower leveraged farmers would be in an even better position to purchase land than under the base assumptions. Highly leveraged farmers

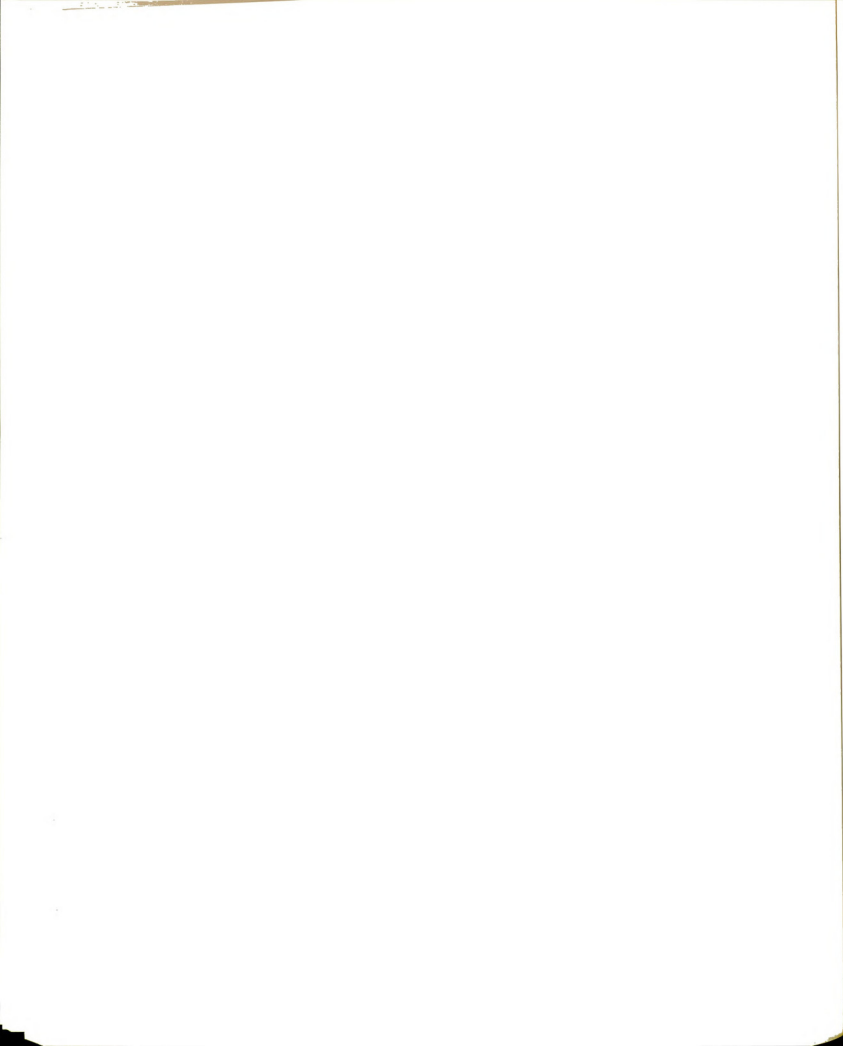


would be much more vulnerable to production and marketing risks, since they would not be able to depend on land inflation for securing emergency credit. If it is the case that younger beginning farmers are more highly leveraged than older established farmers, bringing inflation under control could actually exacerbate the trend toward larger and fewer farms. Clearly, more work is needed to bridge the gaps between the micro implications and the current structure before such a conclusion can be reached.

The Important Role of Leasing Land

Controlled experiments that provided similar behavior and initial endowments demonstrated that larger farmers (using acres as the only measure of size) have more opportunities to grow than smaller farmers. Larger farmers should experience greater growth rates in net worth and in owned acres. When larger farmers are aggressive in the purchase land markets, they should experience less growth in leased land than their smaller counterparts who rely more on leasing land for growth.

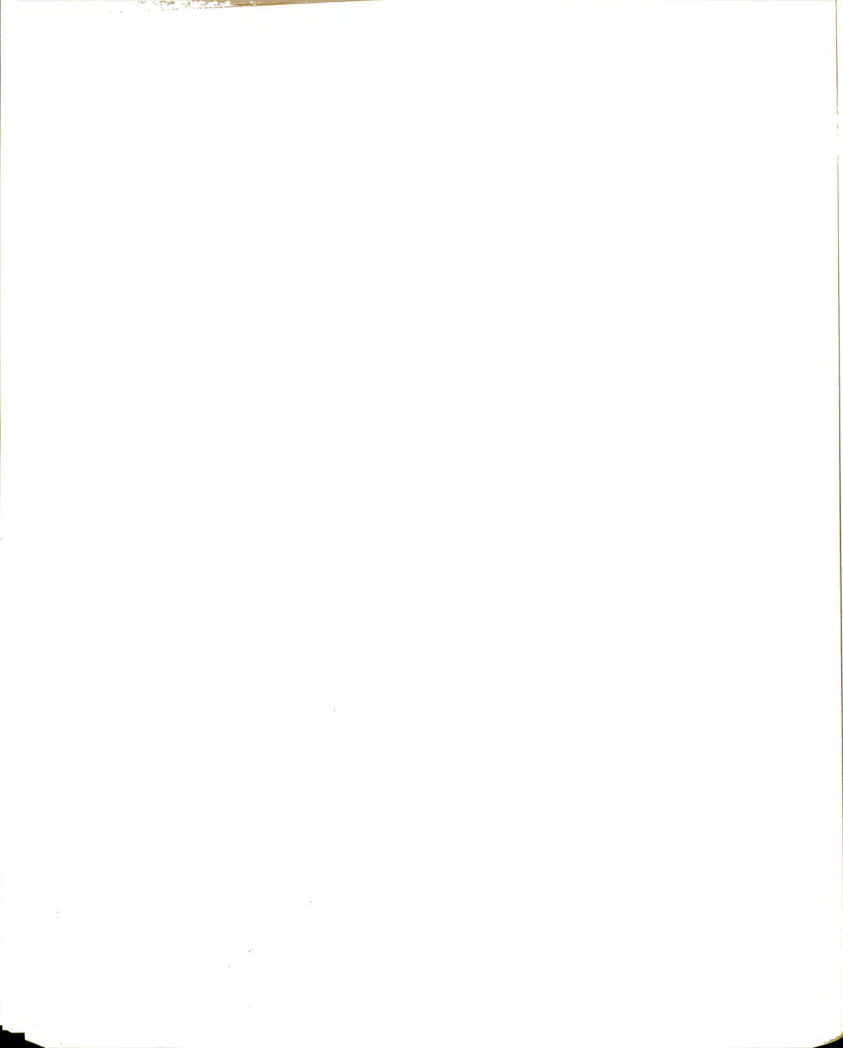
Without the option to lease land, the distribution of opportunities is even more distorted. Leasing land provides smaller farmers with greater incomes and greater opportunity to increase their efficiency. This makes them more competitive in the purchase land market. Therefore, leasing land and machinery (which was not allowed in this study) will play an increasingly important role in the future structure of agriculture. This is especially true in light of the current trend of outside investors owning a greater proportion of the agricultural resources. This study allocated lease land with some degree of randomness in order to reflect the absence of a true market. Other



studies have stressed the important social ties that exist between landlord and tenant. Experiments conducted in Chapter IV demonstrated that larger farmers would likely obtain a greater proportion of the fixed supply of lease land if landlords were only concerned about returns. Therefore, the social aspect of the lease land market very likely results in smaller farmers obtaining more lease land than they would obtain if a competitive market existed. If this is the case, this provides a reason to be concerned about outside investments in land. Roughly 80 percent of the farm land in the U.S. is owned by residents of the same county as the land is in. If more land is controlled by non-residents, the opportunities for a social lease market would decrease. Thus, larger farmers that could provide greater returns to landlords would have more opportunities to gain control over lease land.

Using the Model for Policy Analysis

The above discussion focused on the general environment and structural interactions. The focus now turns to use of the model for policy analysis. A major contribution of this study involved development of a consistent methodology to use a micro model for policy analysis. The flexibility of the model developed in this study allowed for a number of experiments altering the most crucial assumptions. When the most basic environmental and behavioral assumptions are altered along with the use of alternative initial endowments for individual farmers, the consistency of the impact of a policy proposal on farms of different size can be tested. Consistent results can be used as support for developing hypotheses with regard to how that

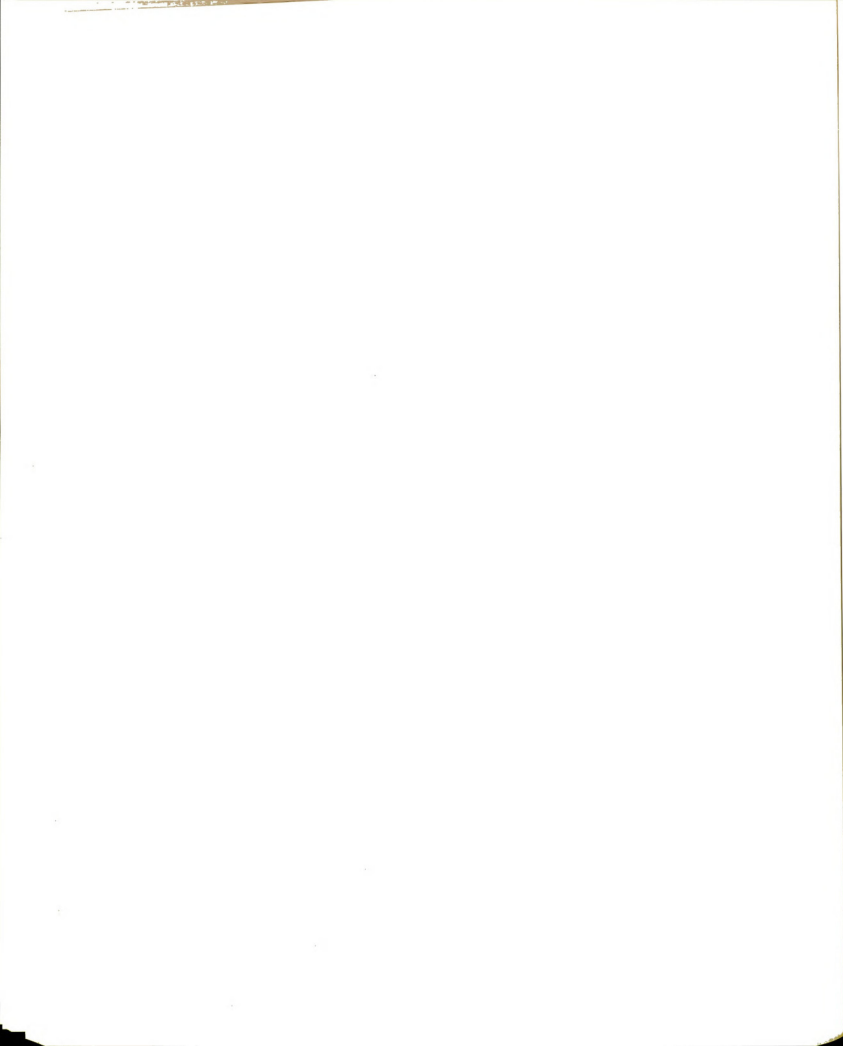


policy may impact different size farmers and/or all farmers. In the absence of consistent results, conditional statements can be made and the most sensitive assumptions can be identified. Such an identification process is important in developing future research.

Price Stability and Farm Structure

Policy analysis in Chapter VII began by considering the relative impact of more and less stable prices on farms of different size. Random prices were developed by using alternative price distributions designed to reflect commodity policies that represented a more stable thrust (i.e., the restrictive market), a less stable thrust (i.e., the quasi-free market), and the current emphasis (i.e., 1980 policies). A major concern was that price distributions were based on researcher judgement. The preferred approach would have been to use a macro model that developed agricultural prices based on U.S. policy and random world yields (i.e., a model such as the MSUAG model). This limited the experiments that were performed using the different price distributions. However, the several experiments that were developed suggest that smaller farmers are relatively more competitive in the land market and generate relatively more capital under more stable and lower average prices. These results were consistent with a number of other experiments where smaller farmers were relatively worse off when cash flows were less stable. When these results are viewed in light of Robinson's hypothesis¹ that high price years spur investment because farmers have both the capacity and tax incentive to invest,

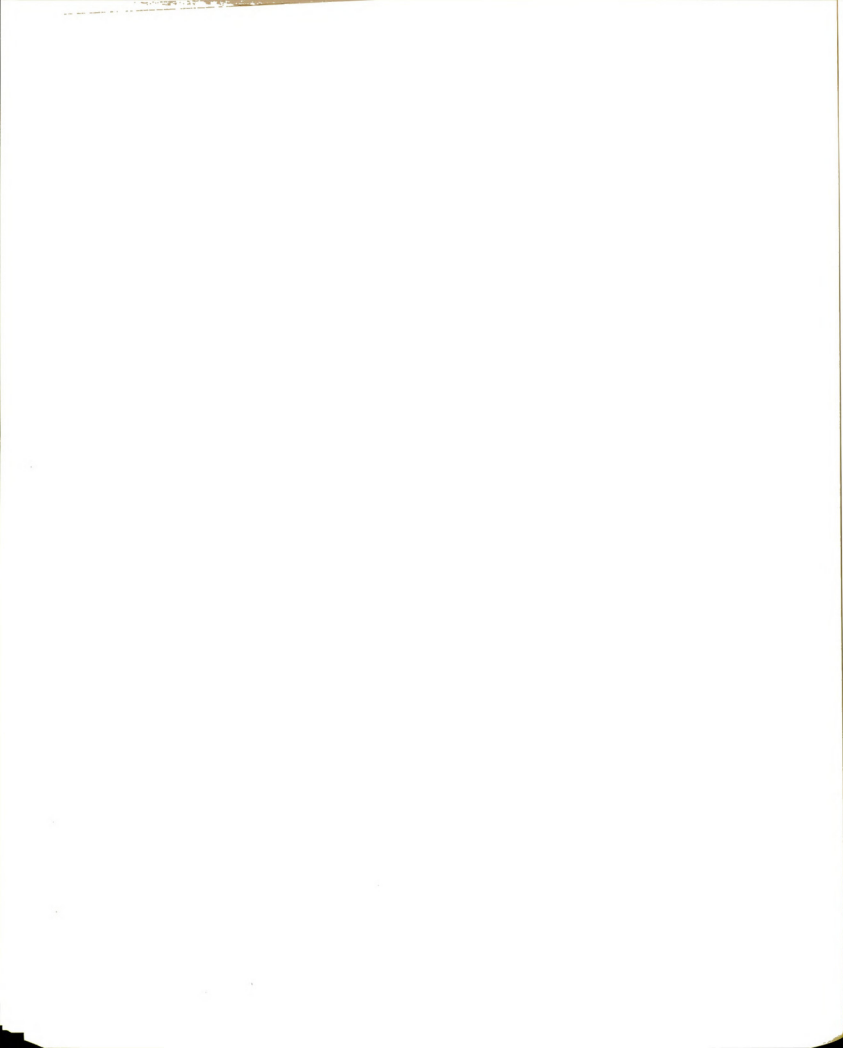
¹ See Cook and Marion, 1981.



and it is recognized that this study does not allow for this type of interaction, there is stronger support for believing that price instability may contribute to the trend toward larger and fewer farms. Further research is needed to determine how different size and financially structured farmers respond to price instability. If such research supports the findings of this study, policy makers would have more information to use when making decisions on price stabilization policies.

Income Tax Policies and Farm Structure

Since the model developed here was designed to explain factors that contribute to the trend toward larger and fewer farms, special experiments were devised in Chapter VII to test the incentives to grow provided by the federal income tax system. The extent to which the federal tax system encourages growth was far greater than anticipated. Under the conditions of this study, and for the type of farms analyzed, growth oriented farmers versus no growth farmers should be able to generate approximately 170 percent more capital (over a ten year period) than they would be able to in the absence of federal income taxes. Although the purchased acres were similar for growth oriented farmers under the current tax system and in the absence of federal taxes, the rewards associated with growth are considerably less in the absence of federal income taxes. This reflects the penalties associated with a progressive tax system on the one hand (i.e., Larger farmers who choose not to grow will pay higher taxes) and the tax write-offs associated with growth on the other. Indeed, the findings of this study suggest that the federal tax system provides more



incentives to grow than the additional income generated by growth and the capital gains associated with a three percent real inflation rate on land prices (an assumption of this study). It must be recognized that these results involve only a ten year planning horizon in the growth phase. Therefore, the tax repercussions associated with growth are not realized within the horizon (i.e., At some point, the farmer will not be growing as aggressively, and the newly acquired resources will generate enough income to force higher tax payments). However, this discussion emphasizes the growth trap that is created by current tax policies. When a farmer intends to stop growing, he soon discovers that his tax liabilities are higher than they have ever been, and this provides additional incentives to continue growing.

Experiments were also developed to test the impact of rapid depreciation techniques. Comparisons between use of more rapid depreciation techniques (i.e., double declining balance plus first year accelerated depreciation) and use of straight line depreciation were made. All growth oriented farmers in this study benefited more from rapid depreciation techniques. However, the general hypothesis that larger farmers benefit relatively more from such techniques than smaller farmers could not be supported. The relative benefits depend on the aggressive nature of farmers in a local land market. Under conditions where all size farmers are growth oriented, larger farmers have adequate tax write-offs to offset the advantages of rapid depreciation techniques. Moreover, in an aggressive land market, eliminating rapid depreciation techniques may actually damage smaller farmers' competitive advantage to the point that larger farmers are able to purchase more land. Again, this emphasizes the negative

results associated with adversely impacting smaller farmers' cash flows. Some policy analysts have proposed that eliminating rapid depreciation techniques could slow the trend toward larger and fewer farms. This study does not support such a proposal. However, if it is true that larger farmers are using such techniques and smaller farmers are not, then this proposal would be legitimate. Experiments that decrease the number of years for depreciating machinery and buildings suggest that larger farmers benefit more from such practices.

Another tax policy that was examined involved the use of cash accounting versus accrual accounting. Clearly, cash accounting benefits all commercial farmers. Moreover, findings in Chapter VII suggest that farmers benefit more from cash accounting than from rapid methods of depreciation. The benefits would likely have been greater if this study had allowed for end-of-year adjustments in input inventories. Determination of which farmers benefit more from cash accounting could not be made.

The one tax policy that provides the greatest impact on generated capital is the capital gains tax rate. Lowering this rate provides additional incentives to grow. And larger farmers benefit more than smaller farmers, since they own more land. Proposals to tax capital gains at the same rate as ordinary income, in order to slow the trend toward larger and fewer farms, appear to be well founded.

Indexing taxes to inflation also allows all farmers to generate more capital over a ten year planning horizon. Again, determining which size farmers would benefit relatively more from such a proposal could not be done. When these results are combined with the findings

above that demonstrate that the progressive tax structure provides additional incentives to grow, it illustrates the complexity of the tax and growth connection. On the one hand, a policy-maker that may be concerned with slowing the trend toward larger and fewer farms may believe that any policy that would allow farmers to generate more capital would be undesirable. However, the important comparison must be the difference in generated capital for growth oriented farmers versus those not similarly oriented. Although no such experiments were performed for proposals to index taxes, it is likely that the difference in generated capital for growth oriented farmers versus stable farmers is less when taxes are indexed to inflation. Therefore, the belief that indexing taxes would contribute to the trend toward larger and fewer farms may be totally wrong. (Indexing taxes may actually reduce the desire to grow in an effort to avoid higher income taxes.) More information on how farmers respond to the incentives provided by the federal income tax system is needed before this determination can be made.

This study has been most concerned with explaining some of the interactions between macro policies and firm level growth. The emphasis has been on the opportunities provided to different size farms. No attempt has been made to develop policies that would slow the trend toward larger and fewer farms. However, the model developed here could be used to test policies that are geared toward different size and/or financially structured farms. Such experiments could be used to identify policies that would rearrange the opportunities provided to different size farms. Providing less growth incentives for larger farmers would enable smaller farmers to grow more.

A Future Research Agenda

Future research could usefully focus on improving the simulation model and, then, using it to develop deeper insights into the interaction between macro policies and firm level growth and/or viability. Many of the shortcomings discussed could be rectified. Both farm management and policy research could be conducted with the model. It may also be desirable to develop the model so that it could be used in a teaching and/or extension environment.

One of the first areas requiring attention centers around the measurement variables and the approach used to test the relative impact of proposed policies on farms of different size. Throughout this study the difficulty of dealing with the multiple goals of farmers and multiple outcomes has been emphasized. The aspect of year-to-year variability in incomes, family living expenditures, and cash flows was not adequately addressed. Even the generated capital values were evaluated as if they were certain. Thus, the Monte Carlo aspects of the model have not been fully exploited. Using this model in conjunction with recent developments in the area of risk and uncertainty could be a major area for useful future research. Not only would such work contribute to farm management research, but it should also enhance the researcher's ability to determine if farmers would benefit under certain conditions and which farmers would benefit more in a risky environment. The model could be used to generate cumulative distributions of an important measurement variable (such as

100 values of generated capital over a 10 year horizon).¹ By making progressively more restrictive assumptions about farmers' risk preferences, stochastic dominance could then be used to determine which cumulative distribution dominated the others (i.e., Dominance indicates the preferred conditions and/or policy). If such techniques are used, one would still need to deal with the problem of multiple dimensions (i.e., across farms and between different conditions).

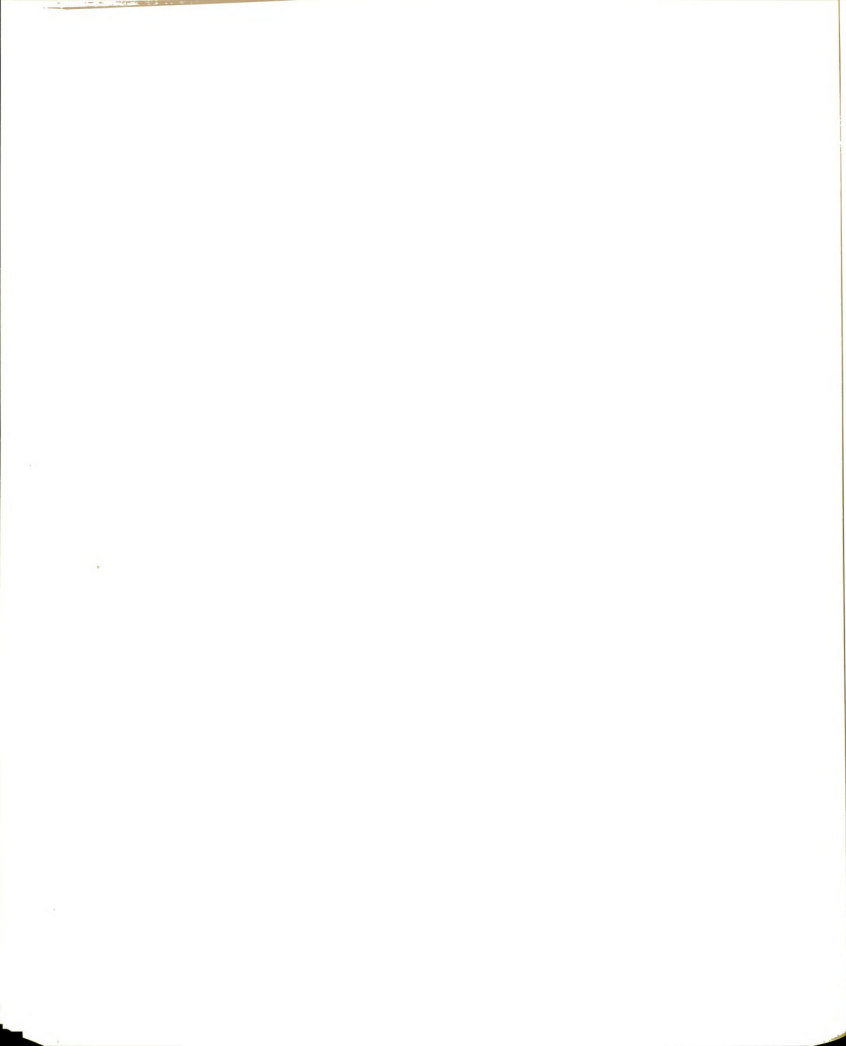
The limited amount of work done with inflation in this study demonstrated that it has varying impacts on different size and financially structured farms. Further, the simplifying assumption of constant inflation rates over the planning horizon eliminates much of the risk associated with farming. Since inflation and inflation expectations have become major forces in farm management decisions, additional work is needed to evaluate: 1) how individual farm managers can best cope with varying and unknown changes in the rate of inflation, and 2) how inflation and alternative policies may interact to change the future structure of agriculture. Research on inflation should proceed by developing appropriate relationships between cyclical inflation rates on various items and interest rates. If such relationships can be developed, the model developed here could be used to address a number of important inflation issues such as: 1) which farmers have more opportunities under different inflationary conditions, 2) how inflation and the current income tax policies interact to provide different opportunities to different size farmers, and

¹ Note that this approach still involves only one measurement variable. Thus, assumptions concerning minimally acceptable levels for other variables must still be made.

3) what the structural repercussions will be if inflation is brought under control.

As discussed above, the model could be used to test new policies that are designed to slow the trend toward larger and fewer farms. Possibly, the most promising area for this type of research would involve testing changes in federal tax laws. Placing restrictions on the use of certain tax privileges for farmers that have gross sales of greater than a specified amount may be tested. For example, all farms with gross sales of over \$200,000 could be restricted to the use of accrual accounting. This would prevent the larger farmers from taking advantage of cash accounting techniques. Also, an upper limit on interest write-offs associated with land debt may be tested. Incorporating such restrictions into the model developed here would be a relatively simple task. Commodity policy research could also be more fully developed. If individual commodity policies were incorporated into the model so that each farmer could participate, more insight would be gained on the relative impact of different proposals. It is also important that more research be conducted to develop more accurate price distributions to correspond with alternative commodity policies.

Another research extension of the methodology developed here may be to model a total geographical region. Although the computer costs for such a project are currently prohibitive, if computer technology continues to improve, the day may come when such an effort is feasible. A major problem with most growth studies (as well as this study) is the improper accounting for land availability. These studies generally only focus on the acquisition of purchase and/or

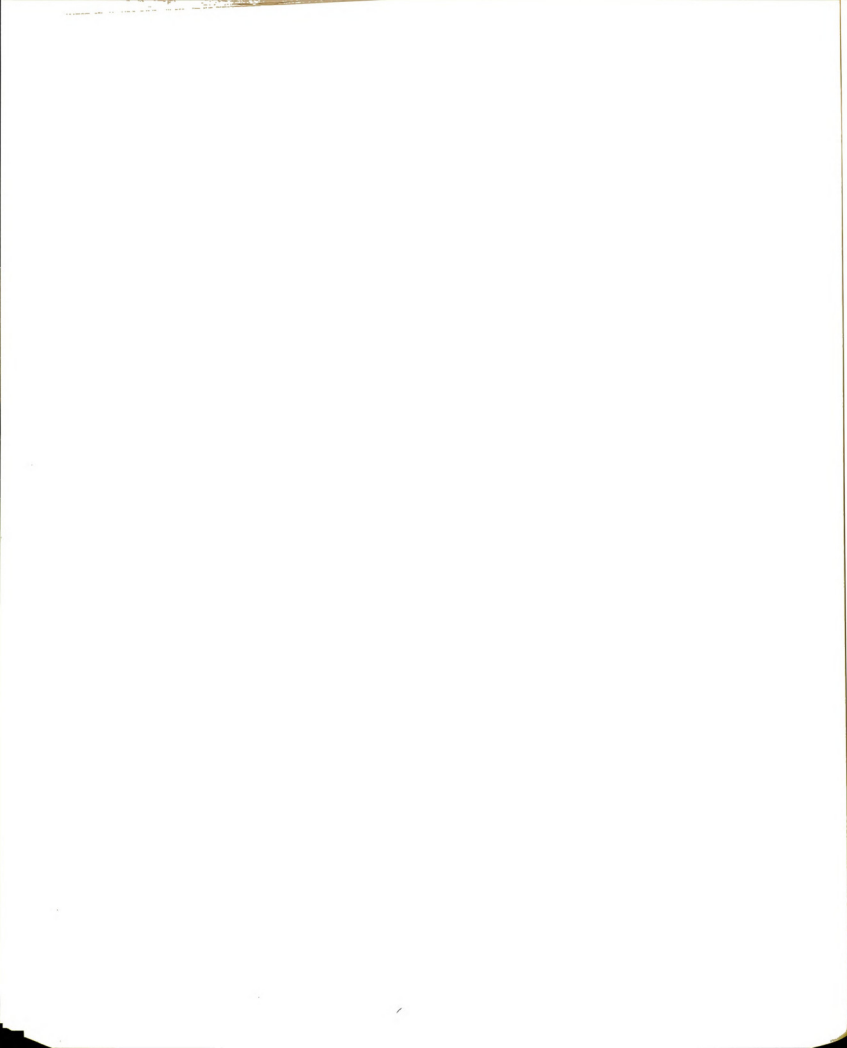


lease land and do not allow for disinvested acres to reenter the market. Therefore, important interactions in the land market are ignored by assuming some fixed availability of land. A model that would include all farms in a geographic region would constrain unrealistic growth by a more appropriate accounting of land availability. In addition, the market conditions (i.e., good and bad years) would determine land availability. Under such experiments, a better accounting of who losses and who gains from alternative policies and economic conditions could be made. Clearly, developing such a model would be a monumental task. Many of the problems of this study would still be present. One of the major concerns would be choosing the length of the planning horizon. In this study, it was determined that modeling years beyond the 10th year would be of diminishing value. Such a short period was justified by focusing on the growth phase of the life cycle. For a regional model, 10 years would not be adequate because of the need to account for different farmers in various stages of the life cycle. Thus, a planning horizon of 20 or more years would be needed. Many issues (primarily behavioral) must be resolved before such a model could be used for predictive purposes. However, even under the current state of the arts, such a model could provide additional explanatory information.

Finally, the model could be modified to make it more user oriented, creating an extension and/or teaching tool. A workshop setting could be devised where farmers and/or students analyze a grain farm of the desired size and financial configuration. By introducing the proper use of records, alternative strategies could be evaluated to determine the trade-offs associated with growth. The model could be used to aid

beginning farmers in choosing appropriate strategies in becoming established. Further, the model could be used in a policy course to demonstrate how alternative policies impact different size farmers.

As the farming sector continues to be more heterogenous, it will become more essential to analyze policy proposals on a micro level. Naturally, extensions must be made with aggregate data to fully appreciate the structural impact of a policy change. However, knowledge of the opportunities provided to different size and/or financially structured farms can only be obtained using firm level research. This study has extended an accepted methodology to provide such research.



APPENDICES

APPENDIX A
BASE DATA AND SUMMARY OF BEGINNING YEAR
FOR DIFFERENT FARM STRUCTURES

The list of variables provided in the first five pages of this Appendix illustrate the changes that can be made by potential users. The values given are those used for the base analyses. All values appear in computer format (i.e., The format in which they are used by the computer model). Therefore, many percentage values appear as factors (i.e., 1.018 trend on corn yields indicates a 1.8 percent annual trend, the required equity value in land as a percent of new land price appears as .25 and indicates 25 percent, etc.).

Tables A.1-A.4 provide a summary of the beginning year for the four basic farm structures used in this study. These tables provide results that are developed by the model in the start-up sequence, using the base data. As long as the farm structure and the most essential base data remain the same, the beginning year will also be the same.

APPENDIX A

INFLATION AND GROWTH RATES

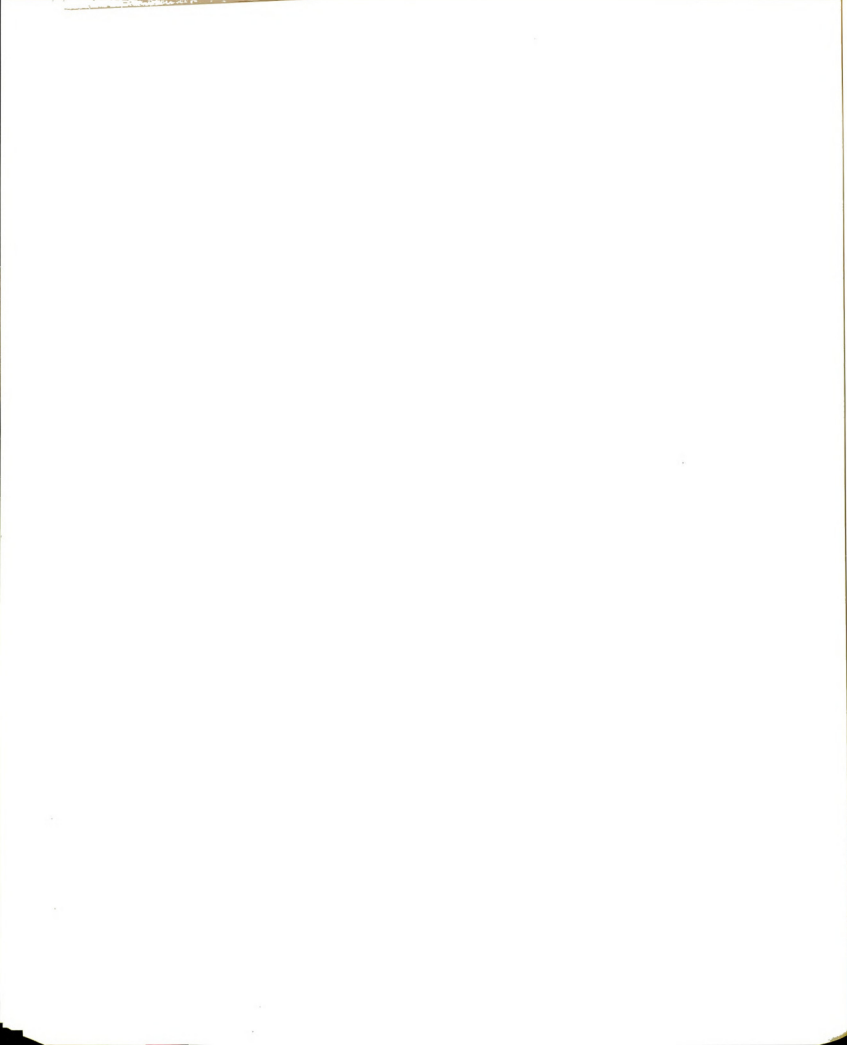
V1	TREND ON CORN YIELDS	1.018
V2	TREND ON SOYBEN YIELDS	1.005
V3	INFLATION ON OPERATING COSTS	1.09
V4	EXPECTED GROWTH RATE IN FARM INCOME	1.07
V5	EXPECTED INFLATION RATE IN LAND PRICES	1.09
V6	GENERAL PRICE INDEX	1.09
V7	INFLATION ON MACHINERY REPLACEMENT	1.09
V8	INFLATION ON BUILDING REPLACEMENT	1.09
V9	INFLATION ON OUTSIDE INCOME	1.09
V10	INFLATION ON CORN & SOYBEAN PRICES	1.075

CREDIT AND LENDER BEHAVIOR DATA

V11	INTERMEDIATE INTEREST RATE	0.120
V12	FIXED INTEREST RATE	0.110
V13	BEGINNING AVERAGE INTERMEDIATE INTEREST	0.090
V14	BEGINNING AVERAGE FIXED INTEREST	0.080
V15	OPERATING INTEREST	0.130
V16	YEARS FOR NEW INTERMEDIATE LOAN	7
V17	YEARS FOR NEW FIXED (LAND) LOAN	30
V18	REMAINING LIFE ON INITIAL INTERMEDIATE LOANS	5
V19	REMAINING LIFE ON INITIAL FIXED (LAND) LOANS	23
V20	REQUIRED EQUITY IN LAND AS A PERCENT OF NEW LAND	.25
V21	DOWNPAYMENT REQUIREMENT ON MACHINERY AND BUILDINGS	.20
V22	MAXIMUM LIQUIDITY RATE ALLOWED	2.
V23	CHARGE FOR REFINANCING LAND	1.02
V24	MAXIMUM FIXED RATIO ALLOWED	.75
V25	MAXIMUM PERCENT OF GROSS RETURN FOR OPERATING LOAN	.75
V26	MAXIMUM CURRENT LIABILITIES/CURRENT ASSETS RATIO	1.5
V27	PERCENT OF GROSS RETURN FOR YEAR END CURRENT LIAB	.50

TAX INFORMATION

V28	ALLOWED DEDUCTION FOR EACH TAX EXEMPTION	1000.000
V29	YEARS MACHINERY IS DEPRECIATED	7.000
V30	YEARS BUILDINGS ARE DEPRECIATED	10.000
V31	MAXIMUM FIRST YEAR DEPRECIATION	4000.000
V32	INVESTMENT TAX CREDIT RATE	0.100
V33	MAXIMUM INVESTMENT TAX CREDIT ALLOWED	25000.000
V34	PROPERTY TAX RATE	0.007
V35	SOCIAL SECURITY TAX RATE	0.093
V36	MAX SOCIAL SECURITY TAX	2762.000
V37	EXCESS DEDUCTIONS - PERCENT FAM LIV	0.100
V38	INITIAL CAPITAL GAINS OR LOSS INCOME	0.
V39	INITIAL INVESTMENT TAX CREDIT CARRYOVER	0.
V40	NUMBER OF TAX EXEMPTIONS	4.
V41	FILING STATUS (3=JOINT)	3.
V42	DEPRECIATION METHOD 4=008 DEC + 1ST YR - CONVERTED TO STRAIGHT LINE AT HALF OF DEPRECIABLE LIFE)	4.



BUILDING AND MACHINERY INFORMATION

V43	YEARS BUILDINGS ARE PRODUCTIVELY USED	18.0
V44	YEARS MACHINERY IS PRODUCTIVELY USED	10.0
V45	REMAIN LIFE OF INITIAL BUILDING COMPLEMENT	18.0
V46	REMAIN LIFE OF INITIAL MACHINERY COMPLEMENT	10.0
V47	CONVERSION FACTOR - BOOK VALUE TO CURRENT - BUILD	1.8
V48	CONVERSION FACTOR - BOOK VALUE TO CURRENT - MACH	2.0

FARMER BEHAVIORAL PARAMETERS

V49	UPPER BOUND ON EXPECTED INCREASE IN RETURNS	1.05
V50	LOWER BOUND ON EXPECTED INCREASE IN RETURNS	.95
V51	AVERAGE PERCENT OF GRAIN STORED	.7
V52	UPPER BOUND ON STORAGE -PERCENT OF AVERAGE	1.2
V53	LOWER BOUND ON STORAGE - PERCENT OF AVERAGE	.5
V54	SECOND ADJUSTMENT IN STORAGE - PERCENT OF LOWER BOUND	.5
V55	MINIMUM (\$/AC) ACCEPTABLE NEGATIVE CASH FLOW ALLOWED WHEN CONSIDERING A NEW LAND PURCHASE	50.0
V56	UPPER BOUND - RELATION OF PROJECTED INCOME TO MOVING AVG INCOME - BEFORE TAXABLE FARM INCOME IS ADJUSTED DOWN- WARD BY STORING MORE GRAIN	1.5
V57	MINIMUM (\$/AC) TAXABLE FARM INCOME DESIRED	10.0
V58	MAXIMUM FAMILY CONSUMPTION (1979 DOLLARS)	40000.0
V59	MINIMUM FAMILY CONSUMPTION (1979 DOLLARS)	10000.0
V60	UPPER BOUND ON FAMILY CONSUMPTION -PERCENT OF AVG	1.3
V61	LOWER BOUND ON FAMILY CONSUMPTION -PERCENT OF AVG	.8
V62	EXPONENTIAL WEIGHT FOR SHORT RUN PRICE EXPECTATIONS	.4
V63	EXPONENTIAL WEIGHT FOR LONG RUN PRICE EXPECTATIONS	.25
V64	MINIMUM CASH REQUIREMENT - PERCENT OF AVG FAMILY LIV	.5
V65	CHARGE FOR OPERATOR MANAGEMENT - PERCENT OF GROSS SALES	.07
V66	CHARGE FOR OPERATOR AND FAMILY LABOR - \$/MON	1000.
V67	OPPORTUNITY COSTS - USED FOR LAND VALUATION	.11
V68	PLANNING HORIZON - USED FOR LAND VALUATION	30.
V69	CROP MIX ADJUSTMENT (1= TOTAL ADJUSTMENT : 0 = AT LEAST 30 PERCENT OF ACRES IN CORN OR SOYBEANS)	0.
V70	RESERVE REQUIREMENT (NUMBER OF YEAR OF CREDIT AND CASH RESERVE DESIRED TO MATCH ANNUAL DEBT SERVICE)	2.
V71	INTERNAL LIQUIDITY CONSTRAINT (THIS NUMBER TIMES EQUITY IS THE MAXIMUM DEBT DESIRED)	1.3
V72	PERCENT OF YEAR OPERATING LOAN IS HELD	.67
V73	MINIMUM MOVING AVG OWNER EQUITY (\$/AC) BEFORE EXPANSION OF ABOVE AVERAGE MACHINERY IS CONSIDERED	-50.
V74	LAND PURCHASE STOPPER (IF CURRENT RATIO IS ABOVE THIS LEVEL- LAND WILL NOT BE PURCHASED)	1.5
V75	LEASE ACRE REDUCER (IF REFINANCING OF LAND FOR EXPONENTIAL MOVING AVERAGE MORE THAN THIS (\$/AC) THEN 40 ACRES OF LAND IS RELINQUISHED)	200.0
V76	LEASE ACRE SAVER (IF MOST RECENT YEARS' REFINANCED LAND IS NOT ABOVE THIS LEVEL (\$/AC) LEASE LAND IS NOT RELINQUISHED)	75.0
V77	THRESHOLD WHERE LANDLORD CANNOT DISTINGUISH BETWEEN EXPECTED SHARE OF PROFIT	.96
V78	DOLLAR PER MONTH FOR OUTSIDE EMPLOYMENT	1000.

INITIAL PRODUCTION DATA

V79	\$/POUND FOR ACTUAL NITROGEN	.24
V80	\$/BUSHEL FOR GRAIN HAULING	.07
V81	\$/BUSHEL FOR GRAIN DRYING	.23
V82	\$/MONTH FOR HIRED LABOR	1000.00
V83	POUNDS/ACRE OF ACTUAL NITROGEN	150.00
V84	MONTHS OF AVAILABLE FAMILY AND OPERATOR LABOR	18.00
V85	INTEREST FOR OUTSIDE INVESTMENTS (SAVINGS)	.10
V86	EXPECTED NATIONAL AVERAGE CORN PRICE	2.55
V87	EXPECTED NATIONAL AVERAGE SOYBEAN PRICE	6.60
V88	LOAN RATE FOR CORN	2.30
V89	CALL LEVEL FOR CORN	3.26
V90	LOAN RATE FOR SOYBEANS	4.00
V91	CALL LEVEL FOR SOYBEANS	10.00
V92	TILLABLE ACRES BY SIZE FOR TABLE LOOK-UPS	
	200.0 289.0 390.0 540.0 675.0 800.0 1005.0 1330.0 1600.0	
V93	MACHINERY \$/AC BY SIZE FOR TABLE LOOK-UPS	
	102.4 100.2 103.4 100.5 96.8 101.1 102.9 97.5 96.0	
V94	BUILDINGS \$/AC BY SIZE FOR TABLE LOOK-UPS	
	78.0 55.0 55.0 54.0 54.0 44.0 40.0 42.0 40.0	
V95	CORN YIELD BU/AC BY SIZE FOR TABLE LOOK-UPS	
	140.4 142.1 143.3 144.1 144.4 144.2 144.2 145.0 143.4	
V96	SOYB YIELD BU/AC BY SIZE FOR TABLE LOOK-UPS	
	43.5 44.6 44.6 45.2 45.4 45.6 45.2 45.0 44.5	
V97	CORN YIELD DISCOUNTS - FOR EXCELLENT MACHINERY COMPLEMENT	
	1.000 1.000 1.000 1.000 0.998 0.996 0.993 0.988 0.983 0.977 0.969	
V98	CORN YIELD DISCOUNTS - FOR ABOVE AVERAGE MACHINERY COMPLEMENT	
	1.000 1.000 1.000 1.000 0.997 0.992 0.986 0.976 0.966 0.953 0.938	
V99	CORN YIELD DISCOUNTS - FOR AVERAGE MACHINERY COMPLEMENT	
	1.000 1.000 1.000 1.000 0.995 0.988 0.978 0.964 0.948 0.929 0.907	
V100	CORN YIELD DISCOUNTS - FOR BELOW AVERAGE MACHINERY COMPLEMENT	
	1.000 1.000 1.000 1.000 0.994 0.984 0.971 0.952 0.931 0.905 0.875	
V101	CORN YIELD DISCOUNTS - FOR POOR MACHINERY COMPLEMENT	
	1.000 1.000 1.000 0.994 0.984 0.971 0.952 0.931 0.905 0.875 0.840	
V102	SOYBEAN YIELD DISCOUNTS - FOR EXCELLENT MACHINERY COMPLEMENT	
	1.000 1.000 0.998 0.996 0.993 0.990 0.985 0.980 0.975 0.968 0.960	
V103	SOYBEAN YIELD DISCOUNTS - FOR ABOVE AVERAGE MACHINERY COMPLEMENT	
	1.000 1.000 0.996 0.993 0.986 0.980 0.971 0.961 0.950 0.936 0.921	
V104	SOYBEAN YIELD DISCOUNTS - FOR AVERAGE MACHINERY COMPLEMENT	
	1.000 1.000 0.994 0.990 0.979 0.970 0.957 0.942 0.922 0.904 0.882	
V105	SOYBEAN YIELD DISCOUNTS - FOR BELOW AVERAGE MACHINERY COMPLEMENT	
	1.000 1.000 0.993 0.987 0.973 0.960 0.943 0.923 0.900 0.873 0.843	
V106	SOYBEAN YIELD DISCOUNTS - FOR POOR MACHINERY COMPLEMENT	
	1.000 0.993 0.987 0.973 0.960 0.943 0.923 0.900 0.873 0.843 0.808	

PURCHASE AND LEASE LAND INFORMATION

V107	FORCED MINIMUM INFLATION IN LAND PRICES	1.0
V108	FORCED LAND DOWNPAYMENT	0.1
V109	NONLAND COSTS OF CORN - \$/AC	228.0
V110	NONLAND COSTS OF SOYBEANS - \$/AC	175.0
V111	AVERAGE CORN YIELD FOR OUTSIDE BIDDER	145.0
V112	AVERAGE SOYBEAN YIELD FOR OUTSIDE BIDDER	45.0
V113	MAXIMUM PERCENT PAID ABOVE AVERAGE SELLING PRICE	1.0
V114	MAX BID ON LAND MUST BE THIS CLOSE TO AVERAGE	0.98
V115	MIN SIZE WHERE PRICE IS AFFECTED BY SIZE	100.0
V116	PERCENT DISCOUNT DUE TO LARGER SIZE PARCEL	1.0
V117	SHARE PERCENT ON RETURNS, FERT, SEED AND CROP	0.5
V118	SHARE PERCENT ON INSURANCE & MISC	0.8
V119	PERCENT OF LAND VALUE FOR CASH RENT (0=LEASE)	0.0
V120	AVERAGE PRICE/TILLABLE ACRE	3500.0
V121	ALLOW PURCHASE OF NEW LAND (1=YES, 0=NO)	1.0
V122	ALLOW LEASING OF NEW LAND (1=YES, 0=NO)	1.0
V123	ACRES OF EXISTING LAND USED TO COVER NEW ACRES	4.0
V124	BUDGETED RETURN TO LAND 1974-1979 USED IN ALMON LAG LAND MODEL	
	130.9 180.3 145.0 145.3 149.0 150.0	
V125	ACRES AVAILABLE FOR SELL 1980-1994 FOR DETERMINISTIC RUN	
	80. 40.240. 80. 40. 40. 40. 80. 80. 80.160. 80.240. 40. 80.	
V126	ACRES AVAILABLE FOR LEASE 1980-1994 FOR DETERMINISTIC RUN	
	120. 80. 40. 40. 40. 40.200. 80.160. 40.120.640.160.200. 40.	

INITIAL ENDOWMENTS

		FARM 1	FARM 2	FARM 3	FARM 4
V127	TILLABLE ACRES	300	600	900	1200
V128	LEASED ACRES	200	400	600	800
V129	OWNED ACRES	100	200	300	400
V130	SAVINGS	0	0	0	0
V131	CASH ON HAND	10000	10000	10000	10000
V132	CURRENT LIABILITIES	0	0	0	0
V133	79 TAXAB INCOME	6500	14500	14000	25000
V134	78 TAXAB INCOME	8000	14000	24000	28000
V135	77 TAXAB INCOME	9000	19000	35000	46000
V136	76 TAXAB INCOME	17000	31000	58000	70000
V137	OPERATOR AGE	35	35	35	35
V138	DEBT/ASSET RATIO	.3	.3	.3	.3
V139	PRICE FACTOR (MKT PREMIUM)	1.0	1.0	1.0	1.0

STOCHASTIC DATA *

V140	RANDOM NATIONAL AVERAGE CORN PRICE
V141	RANDOM NATIONAL AVERAGE SOYBEAN PRICE
V142	RANDOM DEVIATIONS IN CORN YIELDS FOR CENTRAL ILL FARMS WITH BEST SOILS - 85 RATING AND ABOVE
V143	RANDOM DEVIATIONS IN SOYBEAN YIELDS FOR CENTRAL ILL FARMS WITH BEST SOILS - 85 RATING AND ABOVE
V144	RANDOM PARCEL OF PURCHASE LAND
V145	RANDOM PARCEL OF LEASE LAND

*/ THESE VARIABLES ARE USED ONLY WHEN A STOCHASTIC RUN IS MADE. THERE ARE 1500 OF EACH OF THESE VARIABLES TO ALLOW FOR ANALYSES OF UP TO 100 FIFTEEN YEAR PLANNING HORIZONS.

CHANGING BASIC ASSUMPTIONS AND ALLOWING FOR SENSITIVITY ANALYSES
(WHEN VALUE IS GREATER THAN 0 - SENSITIVITY IS IN EFFECT)

V146	ALLOWING 2 PARCELS OF PURCHASE LAND	0.000
V147	ALLOWING 2 PARCELS OF LEASE LAND	0.000
V148	ALLOWING EXPANSION OF LEASE AND PUR	0.000
V149	ALLOWING ONLY AVERAGE MACHINERY COMP	0.000
V150	VALUING INTERMEDIATE ASSETS AT MKT VALUE	0.000
V151	USING COST BASIS NET WORTH TO ALLOCATE CREDIT	0.000
V152	DISALLOW OUTSIDE INCOME	0.000
V153	DISALLOW CUSTOM WORK	0.000
V154	DISALLOW PURCHASE OF LAND AFTER 10 YEARS	0.000
V155	DISALLOW LEASING OF LAND AFTER 10 YEARS	0.000
V156	DISALLOW INCOME AVERAGING	0.000
V157	PRESIDENT REAGAN'S 3 YR 10 PERCENT TAX CUT	0.000
V158	ACCRUAL ACCOUNTING FOR TAXES	0.000
V159	ELIMINATE FEDERAL TAXES	0.000
V160	INDEX FOR INDEXING INCOME TAXES	1.000
V161	INDEX FOR INFLATING CONTROL VARIABLES	1.040
V162	LEE-RASK MODEL TO ALLOCATE AND SET LAND PRICES	0.000

TABLE A.1

INITIAL YEAR FOR ALL ANALYSES WITH DEBT/ASSET RATIO = .3
AND PERCENT TENURE = 33 (BASE CONDITIONS)

SUMMARY OF INITIAL AVERAGE YEAR - 1979 DOLLARS-				
TILLABLE ACRES	300.	600.	900.	1200.
OWNED ACRES	100.	200.	300.	400.
CORN YIELDS	141.2	140.7	140.7	141.2
SOYBEAN YIELDS	42.9	44.6	44.7	44.4
ANNUAL AVERAGE CORN PRICE	2.53			
SOYBEAN PRICE	6.47			

*****MARKET VALUE BALANCE SHEET*****				
CURRENT ASSETS				
SAVINGS	0.	0.	0.	0.
CASH ON HAND	9318.	10410.	11136.	11795.
GRAIN INVENTORY	45460.	96427.	144753.	192970.
TOTAL	54778.	106837.	155888.	204765.
INTERMEDIATE ASSETS				
TOTAL	72712.	137432.	210542.	274672.
FIXED ASSETS(LAND)				
TOTAL	350070.	700140.	1050210.	1400280.
TOTAL ASSETS	477560.	944409.	1416640.	1879718.
LIABILITIES				
CURRENT LIABILITIES	568.	2926.	5505.	8337.
INTERMED LIABILITIES	21205.	33905.	50410.	63921.
LONG TR LIABILITIES	103296.	206593.	309889.	413185.
CONTINGENT LIABILITIES				
CAPITAL GAINS TAXES	19671.	53554.	92657.	133019.
TOTAL LIABILITIES	144740.	296978.	458461.	618463.
MARKET VALUE NET WORTH	332820.	647431.	958180.	1261255.

*****COST BASIS BALANCE SHEET*****				
CURRENT ASSETS				
TOTAL	54778.	106837.	155888.	204765.
INTERMEDIATE ASSETS				
TOTAL	45297.	85552.	131038.	170955.
FIXED ASSETS(LAND)				
TOTAL	227521.	455043.	682564.	910086.
TOTAL ASSETS	327596.	647431.	969491.	1285806.
TOTAL LIABILITIES	125069.	243424.	365804.	485444.
COSTS BASIS NET WORTH	202527.	404008.	603687.	800363.

*****INCOME STATEMENT FOR YEAR ENDING DEC 31, 1979*****				
TOTAL CASH REVENUE	58738.	125934.	189038.	252045.
TOTAL CASH EXPENSES	37339.	81792.	123400.	165641.
NET CASH FARM INCOME	21399.	44142.	65638.	86404.
TOTAL DEPRECIATION	7372.	14169.	21800.	28426.
CROP INVENTORY CHANGE	0.	0.	0.	0.
NET FARM INCOME	14028.	29973.	43837.	57978.
TOTAL NONFARM INCOME	6579.	4411.	2135.	0.
TOTAL NET INCOME	20607.	34384.	45973.	57978.
TAXABLE FARM INCOME	4565.	16411.	26800.	37892.
NET CASH FLOW POSITION	1997.	10051.	16970.	23976.

TABLE A.2

INITIAL YEAR FOR ALL ANALYSES WITH DEBT/ASSET RATIO = .5
AND PERCENT TENURE = 33

SUMMARY OF INITIAL AVERAGE YEAR - 1979 DOLLARS-				
TILLABLE ACRES	300.	600.	900.	1200.
OWNED ACRES	100.	200.	300.	400.
CORN YIELDS	141.4	140.7	140.7	141.2
SOYBEAN YIELDS	42.9	48.6	44.7	44.4
ANNUAL AVERAGE CORN PRICE	2.53	SOYBEAN PRICE	6.47	

*****MARKET VALUE BALANCE SHEET*****				
CURRENT ASSETS				
SAVINGS	0.	0.	0.	0.
CASH ON HAND	8522.	9291.	9704.	10131.
GRAIN INVENTORY	49460.	96427.	144753.	132970.
TOTAL	53982.	105718.	154457.	203101.
INTERMEDIATE ASSETS				
TOTAL	72712.	137432.	210542.	274672.
FIXED ASSETS(LAND)				
TOTAL	350070.	700140.	1050210.	1400280.
TOTAL ASSETS	476765.	943291.	1415209.	1878053.
LIABILITIES				
CURRENT LIABILITIES	6574.	6654.	8398.	9666.
INTERMED LIABILITIES	38669.	73260.	112300.	146495.
LONG TR LIABILITIES	172161.	344321.	516482.	688642.
CONTINGENT LIABILITIES				
CAPITAL GAINS TAXES	19671.	53554.	92657.	133019.
TOTAL LIABILITIES	237075.	477789.	729836.	977822.
MARKET VALUE NET WORTH	239690.	465502.	685373.	900231.

*****COST BASIS BALANCE SHEET*****				
CURRENT ASSETS				
TOTAL	53982.	105718.	154457.	203101.
INTERMEDIATE ASSETS				
TOTAL	45297.	85552.	131038.	170955.
FIXED ASSETS(LAND)				
TOTAL	227521.	455043.	682564.	910086.
TOTAL ASSETS	326801.	646313.	968059.	1284142.
TOTAL LIABILITIES	217404.	424235.	637180.	844803.
COSTS BASIS NET WORTH	109397.	222078.	330880.	439339.

*****INCOME STATEMENT FOR YEAR ENDING DEC 31, 1979*****				
TOTAL CASH REVENUE	58738.	125934.	189038.	252045.
TOTAL CASH EXPENSES	44611.	96161.	145058.	194377.
NET CASH FARM INCOME	14127.	29773.	43981.	57668.
TOTAL DEPRECIATION	7372.	14169.	21800.	28428.
CROP INVENTORY CHANGE	0.	0.	0.	0.
NET FARM INCOME	6755.	15604.	22180.	29242.
TOTAL NONFARM INCOME	6579.	4411.	2135.	0.
TOTAL NET INCOME	13334.	20015.	24316.	29242.
TAXABLE FARM INCOME	-2707.	2043.	5143.	9156.
NET CASH FLOW POSITION	-6574.	-6435.	-7874.	-8725.

TABLE A.3

INITIAL YEAR FOR ALL ANALYSES WITH DEBT/ASSET RATIO = .3
AND PERCENT TENURE = 67

SUMMARY OF INITIAL AVERAGE YEAR - 1979 DOLLARS-				
TILLABLE ACRES	300.	600.	900.	1200.
OWNED ACRES	200.	400.	600.	800.
CORN YIELDS	141.2	140.7	140.7	141.2
SOYBEAN YIELDS	42.9	44.6	44.7	44.4
ANNUAL AVERAGE CORN PRICE	2.53	SOYBEAN PRICE	6.47	

*****MARKET VALUE BALANCE SHEET*****				
CURRENT ASSETS				
SAVINGS	0.	0.	0.	0.
CASH ON HAND	9343.	10582.	11361.	12113.
GRAIN INVENTORY	56824.	120530.	180936.	241205.
TOTAL	66166.	131112.	192296.	253318.
INTERMEDIATE ASSETS				
TOTAL	84738.	156894.	240113.	297553.
FIXED ASSETS(LAND)				
TOTAL	700035.	1400070.	2100105.	2800140.
TOTAL ASSETS	850939.	1688076.	2532514.	3351011.
LIABILITIES				
CURRENT LIABILITIES	389.	3361.	6405.	10757.
INTERMED LIABILITIES	26507.	41878.	62418.	74132.
LONG TR LIABILITIES	206562.	413123.	619685.	826247.
CONTINGENT LIABILITIES				
CAPITAL GAINS TAXES	48408.	120477.	197864.	272575.
TOTAL LIABILITIES	281865.	578839.	886371.	1183711.
MARKET VALUE NET WORTH	569074.	1109237.	1646143.	2167300.

*****COST BASIS BALANCE SHEET*****				
CURRENT ASSETS				
TOTAL	66166.	131112.	192296.	253318.
INTERMEDIATE ASSETS				
TOTAL	52925.	97896.	149794.	185468.
FIXED ASSETS(LAND)				
TOTAL	454975.	909949.	1364924.	1819899.
TOTAL ASSETS	574065.	1138958.	1707015.	2258685.
TOTAL LIABILITIES	233457.	458362.	688507.	911136.
COSTS BASIS NET WORTH	340608.	680595.	1018507.	1347549.

*****INCOME STATEMENT FOR YEAR ENDING DEC 31, 1979*****				
TOTAL CASH REVENUE	73249.	157071.	235778.	314362.
TOTAL CASH EXPENSES	51089.	109310.	164476.	219447.
NET CASH FARM INCOME	22160.	47760.	71302.	94915.
TOTAL DEPRECIATION	8079.	15314.	23540.	29772.
CROP INVENTORY CHANGE	0.	0.	0.	0.
NET FARM INCOME	14081.	32446.	47762.	65143.
TOTAL NONFARM INCOME	6579.	4411.	2135.	0.
TOTAL NET INCOME	20660.	36857.	49898.	65143.
TAXABLE FARM INCOME	3032.	17969.	29333.	43981.
NET CASH FLOW POSITION	309.	7927.	13849.	20641.

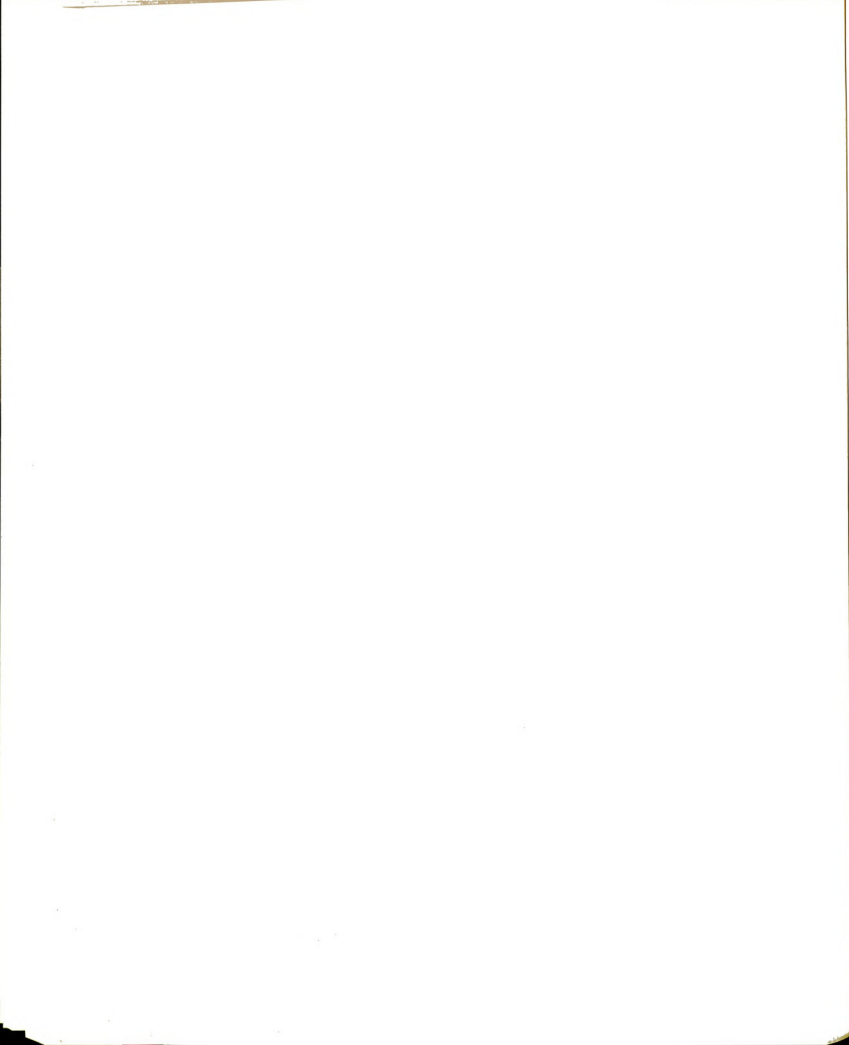


TABLE A.4

INITIAL YEAR FOR A SPECIAL SET OF LOW EQUITY, MINIMUM LAND
OWNERSHIP FARMS CREATED IN TABLE 6.40

SUMMARY OF INITIAL AVERAGE YEAR - 1979 DOLLARS-				
TILLABLE ACRES	300.	400.	500.	600.
OWNED ACRES	1.	1.	83.	200.
CORN YIELDS	141.2	139.9	140.4	140.7
SOYBEAN YIELDS	42.9	43.9	44.3	44.6
ANNUAL AVERAGE CORN PRICE	2.53	SOYBEAN PRICE	6.47	

*****MARKET VALUE BALANCE SHEET*****				
CURRENT ASSETS				
SAVINGS	0.	0.	0.	0.
CASH ON HAND	8628.	10363.	13377.	15294.
GRAIN INVENTORY	34209.	47940.	70078.	96427.
TOTAL	42838.	58304.	83455.	111722.
INTERMEDIATE ASSETS				
TOTAL	59321.	81181.	110624.	137432.
FIXED ASSETS(LAND)				
TOTAL	3570.	4760.	291725.	700140.
TOTAL ASSETS	105729.	144244.	485804.	949294.
LIABILITIES				
CURRENT LIABILITIES	928.	2874.	14405.	24605.
INTERMED LIABILITIES	30349.	43740.	59185.	73260.
LONG TR LIABILITIES	1756.	2341.	143467.	344321.
CONTINGENT LIABILITIES				
CAPITAL GAINS TAXES	973.	1634.	18495.	53554.
TOTAL LIABILITIES	34006.	50588.	235552.	495740.
MARKET VALUE NET WORTH	71723.	93656.	250253.	453554.

*****COST BASIS BALANCE SHEET*****				
CURRENT ASSETS				
TOTAL	42838.	58304.	83455.	111722.
INTERMEDIATE ASSETS				
TOTAL	36803.	50365.	68785.	85552.
FIXED ASSETS(LAND)				
TOTAL	2320.	3094.	189601.	455043.
TOTAL ASSETS	81961.	111762.	341841.	652316.
TOTAL LIABILITIES	33032.	48955.	217057.	442185.
COSTS BASIS NET WORTH	48928.	62807.	124784.	210131.

*****INCOME STATEMENT FOR YEAR ENDING DEC 31, 1979*****				
TOTAL CASH REVENUE	44370.	62849.	91672.	125934.
TOTAL CASH EXPENSES	25115.	38116.	63932.	96161.
NET CASH FARM INCOME	19255.	24734.	27740.	29773.
TOTAL DEPRECIATION	6584.	9010.	11702.	14169.
CROP INVENTORY CHANGE	0.	0.	0.	0.
NET FARM INCOME	12671.	15723.	16038.	15604.
TOTAL NONFARM INCOME	6579.	5868.	5146.	4411.
TOTAL NET INCOME	19251.	21592.	21184.	20015.
TAXABLE FARM INCOME	6392.	8394.	5199.	2043.
NET CASH FLOW POSITION	1613.	-1749.	-13819.	-24415.

APPENDIX B

MORE DETAIL ON THE COMPUTER SIMULATION MODEL

This Appendix is to be read in conjunction with Chapter IV. It is organized by sections that correspond with those in Chapter IV. Except for Section 1, these sections are subroutines in the simulation model. This Appendix provides the most essential model equations in a sequential fashion. User-supplied input variables that are provided in Appendix A are used in many of the equations herein. Due to the complexity of the model, it was necessary to present equations with variable names (actual names used in the model). Newly used variable names are identified at the end of each section and all variables are alphabetized at the end of this Appendix.

SECTION 1 - START UP SEQUENCE

- 1.1 - EACH FARM IS PROVIDED WITH AN AVERAGE MACHINERY AND BUILDING COMPLEMENT USING DATA SETS V92-V94. THIS INVOLVES INTERPOLATION THROUGH A TABLE LOOK-UP FUNCTION USING BOOK VALUE AND CORRESPONDING ACRES. THIS RESULTS IN A BOOK VALUE INVESTMENT PER ACRE FOR EACH FARM BASED ON SIZE. THESE VALUES ARE CONVERTED TO A CURRENT VALUE USING V47 AND V48. MACHINERY COMPLEMENTS ARE BASED ON TOTAL ACRES OPERATED AND BUILDING COMPLEMENTS ARE BASED ON OWNED ACRES PLUS 20 PERCENT TO COVER LEASED ACRES.

$CVCPM = XMAH * V48 * ACRE$
 $CVCPB = XBUL * V47 * (ACOWN + .2 * ACREN)$

- 1.2 - INTERMEDIATE ASSETS ARE THE CURRENT MARKET VALUE FOR MACHINERY AND BUILDINGS.

$XIMED = CVCPM + CVCPB$

- 1.3 - FIXED ASSETS ARE THE VALUE OF OWNED LAND.

$FIXAT = V129 * V120$

- 1.4 - THE DEBT/ASSET RATIO IS USED TO DEVELOP THE INITIAL INTERMEDIATE AND FIXED LIABILITIES.

$XIMEDL = V138 * XIMED$
 $FIXLB = V138 * FIXAT$

- 1.5 - THESE DEBTS ARE SET UP ON AN AMORTIZATION SCHEDULE USING V13, 14, 18, AND 19. THIS AMOUNTS TO MAKING AN ESTIMATE OF THE AVERAGE REMAINING LIFE ON THESE LOANS AND AN AVERAGE INTEREST RATE WHICH ARE USED TO ESTIMATE ONE AMORTIZATION SCHEDULE FOR ALL PREVIOUS YEARS. IF THE OPERATION WERE ASSUMED TO BE RELATIVELY NEW, THE AVERAGES WOULD BE VERY CLOSE TO V11, 12, 16, AND 17.

- 1.6 - THE INITIAL WEAR OUT RATE FOR MACHINERY AND BUILDINGS IS DEVELOPED USING A 20 PERCENT SALVAGE VALUE AND A CONSTANT WEAR OUT RATE OVER THE LIFE OF THE INITIAL COMPLEMENT.

$WERM = (CVCPM * .8) / V46$

- 1.7 - SUBROUTINE DEPC IS USED TO CALCULATE AN INITIAL TAXABLE DEPRECIATION USING STRAIGHT LINE PLUS FIRST YEAR ACCELERATED DEPRECIATION ON THE CURRENT VALUE OF THE INITIAL COMPLEMENTS. AN INITIAL REPLACEMENT DEPRECIATION IS CALCULATED USING STRAIGHT LINE ON THE INITIAL COMPLEMENTS.

- 1.8 - THE INITIAL COSTS BASIS FOR LAND AND MACHINERY IS DEVELOPED BY ASSUMING EACH FARMER STARTED FARMING AT AGE 25 AND THEN DEFLATING THE CURRENT VALUES BY ONE-HALF OF THE TOTAL YEARS ENGAGED IN FARMING.

$COSL = ACOWN * V120 / V5 ** ((V140 - 25) / 2)$
 (MACHINERY AND BUILDINGS ARE NEVER DEFLATED USING MORE THAN ONE-HALF OF THEIR USEFUL LIFE)

- 1.9 - ONCE THE ABOVE INITIAL VALUES ARE ESTABLISHED, THE MODEL USES SUBROUTINES PREXP, COSTS, CASHFO, AND BALANC TO DEVELOP AN AVERAGE YEAR OF PRODUCTION. (THESE SUBROUTINES ARE EXPLAINED BELOW.) THE AVERAGE VALUES ARE USED AS THE INITIAL EXPONENTIAL AVERAGES IN MOVING AVERAGE EQUATIONS AS EXPLAINED BELOW.

NEW VARIABLE KEY - SECTION 1

BVCPB - BOOK VALUE OF BUILDINGS (ARRAY BY YEAR)
 BVCPM - BOOK VALUE OF MACHINERY (ARRAY BY YEAR)
 CVC PB - CURRENT VALUE OF BUILDINGS (ARRAY BY YEAR)
 CVC PM - CURRENT VALUE OF MACHINERY (ARRAY BY YEAR)
 DEPCOS - DEPRECIATION COSTS FOR MACHINERY AND BUILDINGS
 FIXAT - FIXED ASSETS
 FIXLB - FIXED LIABILITIES
 WERM - WEAR OUT RATE OF MACHINERY (ARRAY BY YEAR)
 XIMEDL - INTERMEDIATE LIABILITIES

SECTION 2 - SUBROUTINE PREXP

- 2.1 - EACH YEAR'S NATIONAL AVERAGE PRICE IS REGIONALIZED AND THEN INFLATED AFTER THE INITIAL YEAR.

FOR DETERMINISTIC RUNS:

$CHCR = (.156 + .93 * V86) * V10^{**}(T)$
 $CHSO = (.334 + .929 * V87) * V10^{**}(T)$

FOR STOCHASTIC RUNS:

$CHCR = (.156 + .93 * V140) * V10^{**}(T)$
 $CHSO = (.334 + .929 * V141) * V10^{**}(T)$

- 2.2 - LONG AND SHORT-RUN PRICE EXPECTATIONS ARE DEVELOPED USING THE REGIONAL PRICES IN EXPONENTIALLY SMOOTHED EQUATIONS. THE PREVIOUS YEARS EXPECTED PRICE IS INFLATED BY ONE HALF OF THE ACTUAL INFLATION ON PRICES.

$EXPCL[T+1] = (V63 * CHCR[T]) + ((1 - V63) * EXPCL[T]) * (V10 + 1)^{.5}$
 $EXPC[T+1] = (V62 * CHCR[T]) + ((1 - V62) * EXPC[T]) * (V10 + 1)^{.5}$

- 2.3 - LOAN RATES AND CALL LEVELS SERVE AS LOWER AND UPPER BOUNDS ON EXPECTED PRICES. EACH YEAR THE LOAN RATES AND CALL LEVELS ARE INFLATED IN THE SAME FASHION AS PRESENTED IN STEP 1 ABOVE.

- 2.4 - TWO PRICES ARE DEVELOPED FROM THE REGIONAL PRICE DATA. ONE REFLECTS HARVEST TO END OF YEAR SEASONALITY AND THE OTHER REFLECTS SEASONALITY FROM THE FIRST OF THE YEAR TO THE NEXT HARVEST. ALLOWANCES (I.E., PREMIUMS AND DISCOUNTS) CAN BE MADE TO REFLECT DIFFERENCES IN MARKETING ABILITY BETWEEN FARMERS.

$HRVPRC[T] = (.986 * CHCR[T] - .056) * V139$
 $HRVPRS[T] = (.1774 + .8898 * CHSO[T]) * V139$
 $POSTHC[T+1] = (.0469 + .995 * CHCR[T]) * V139$
 $POSTHS[T+1] = 1.047 * CHSO[T] - .0774 * V139$

NEW VARIABLE KEY - SECTION 2

CHCR - REGIONAL AVERAGE PRICE OF CORN
 CHSO - REGIONAL AVERAGE PRICE OF SOYBEANS
 EXPC - SHORT RUN EXPECTED REGIONAL PRICE FOR SOYBEANS
 EXPCL - LONG RUN EXPECTED REGIONAL PRICE FOR CORN
 HRVPRC - HARVEST PRICE FOR CORN (OCT-DEC)
 HRVPRS - HARVEST PRICE FOR SOYBEANS (OCT-DEC)
 POSTHC - POST HARVEST PRICE FOR CORN (JAN-SEPT)
 POSTHS - POST HARVEST PRICE FOR SOYBEANS (JAN-SEPT)

SECTION 3 - SUBROUTINE LANDPR

- 3.1 - THE INFLATED NONLAND COSTS FOR EACH ACRE ARE CALCULATED FOR OUTSIDE BIDDER. (THE OUTSIDE BIDDER USES THE CROP MIX FROM THE FIRST FARM IN THE MODEL).

$$COSCS = (PERC * V109 + (1 - PERC) * V110) * V3 ** (T)$$

- 3.2 - GROSS RETURNS ARE CALCULATED FOR THE OUTSIDE BIDDER.

FOR DETERMINISTIC RUNS:

$$GRET = (PERC * CHCR * V111 * V1 ** (T) + (1 - PERC) * CHSO * V112 * V2 ** (T))$$

FOR STOCHASTIC RUNS:

$$GRET = (PERC * CHCR * (V111 * V1 ** (T) + V142)) + (1 - PERC) * CHSO * (V112 * V2 ** (T) + V143)$$

- 3.3 - BUDGETED RETURN FOR THE OUTSIDE BIDDER IS CALCULATED AND STORED FOR THE ALMON LAG IN STEP 3.5.

$$BRET = GRET - COSCS$$

- 3.4 - A CONSUMER PRICE INDEX IS UPDATED EACH YEAR (1979=100).

$$CPI = V6 ** (T) * 100.$$

- 3.5 - THE ALMON LAG FOR ILLINOIS FARM LAND IS USED TO DEVELOP AN INDEX FOR LAND PRICES (1979=100).

$$\begin{aligned}
 XLANIN = & -23.8207 - 210.06 * V12 * .73 * CPI + .00118 * BRET[T-1] * .0686 \\
 & * BRET[T-2] * .1052 * BRET[T-3] * .1166 * BRET[T-4] * .1029 * \\
 & BRET[T-5] * .064 * BRET[T-6]
 \end{aligned}$$

- 3.6 - AN AVERAGE SELLING PRICE IS ESTABLISHED USING THIS INDEX. THE AVERAGE PRICE IS ASSUMED TO BE BOUNDED BY SOME FACTOR (IF V107 IS ABOVE 1 - LAND PRICE WILL ALWAYS INFLATE).

$$\begin{aligned}
 AVPRLN = & V120 * XLANIN * .01 \\
 \text{IF } AVPRLN[T] < & AVPRLN[T-1] * V107 \\
 \text{THEN } AVPRLN[T] = & AVPRLN[T-1] * V107
 \end{aligned}$$

NEW VARIABLE KEY - SECTION 3

AVPRLN - AVERAGE SELLING PRICE OF LAND
 BRET - BUDGETED RETURN PER ACRE FOR OUTSIDE BIDDER
 COSCS - NONLAND COSTS PER ACRE FOR OUTSIDE BIDDER

CPI - GENERAL ECONOMY PRICE INDEX
 GRETS - GROSS RETURNS PER ACRE FOR OUTSIDE BIDDER
 PERC - PERCENT OF ACREAGE PLANTED IN CORN
 XLANIN - LAND INDEX

SECTION 4 - SUBROUTINE BALANC

- 4.1 - THE BALANCE SHEET VALUE FOR LAND IS THE MAXIMUM VALUE OF THREE ALTERNATIVES: 1) THE SELLING PRICE OF THE CURRENT YEAR'S PARCEL OF LAND; 2) THE AVERAGE SELLING PRICE OF LAND ESTABLISHED BY THE OUTSIDE BIDDER; OR 3) AN INFLATED VALUE OF LAST YEAR'S BALANCE SHEET VALUE.
- IF (SELPR[T]>0) THEN (AV[T-1]*V5)=0
 AV[T]=MAX OF(SELPR[T],AVPRLN[T],(AV[T-1]*V5))
- 4.2 - INTERMEDIATE AND FIXED ASSETS ARE UPDATED. AFTER THE INITIAL YEAR, THE INTERMEDIATE ASSETS ARE VALUED AT THE INFLATED REPLACEMENT BOOK VALUES (OBTAINED FROM SUBROUTINE REPL AS EXPLAINED BELOW) OF MACHINERY AND BUILDING COMPLEMENTS. THERE IS AN OPTION TO USE CURRENT MARKET VALUES IF V 149 > 0.
- FIXAT=ACOWN*AV
 XIMED=SUM OF INFLATED REPLACEMENT BOOK VALUES
 IF V150 > 0
 THEN XIMED=ACTCAM*ACRE+ACTCAB*ACOWN
- 4.3 - INTERMEDIATE AND FIXED LIABILITIES ARE UPDATED BY ADDING ALL PREVIOUS YEAR'S OUTSTANDING BALANCES. IN THE CASE OF FIXED LIABILITIES, ANY OF THE CURENT YEAR'S REFINANCED LAND AND ANY DOWNPAYMENT ON NEW LAND THAT COULD NOT BE MADE BY EQUITY IN EXISTING LAND IS ADDED.
- 4.4 - THE COSTS BASIS FOR LAND AND MACHINERY AND BUILDINGS IS UPDATED.
- COSM[T]=COSTMB[T]+COSM[T-1]-DEPCOSET]
- 4.5 - TOTAL ASSETS AND LIABILITIES ARE ALSO UPDATED.
- ASSET=CAST+XIMED+FIXAT
 XLIB=CLYR+XIMEDL+FIXLB
- 4.6 - CONTINGENT CAPITAL GAINS ARE ESTIMATED AND TAXES ARE CALCULATED ON 40 PERCENT OF THE VALUE USING TAXCOM.
- CAPGAI=.4*((FIXAT-COSL)+(XIMED-COSH))
 CONLIB=(VALUE FROM TAXCOM)
- TWO NET WORTH VALUES ARE CALCULATED: 1) MARKET VALUE; AND 2) COST BASIS VALUE.
- WORNET=ASSET-XLIB-CONLIB
 CBNETW=CAST+COSH+COSL-XLIB
- 4.8 - TOTAL CREDIT RESERVES ARE THE MINIMUM OF A LENDER'S CONSTRAINT AND THE INTERNAL CREDIT RESTRAINT. (THERE IS AN OPTION TO USE COSTS COSTS BASIS NET WORTH.

```
TOTRES=MIN OF((WORNET*V22-XLIB),(WORNET*V71-XLIB))
IF V151 > 0 THEN TOTRES=CBNETW*V22-XLIB
```

4.9 - THE CURRENT YEAR'S NET UNREALIZED CAPITAL GAINS IS COMPUTED.

```
UCAPGACTJ=(WORNETCTJ-WORNETCT-1J)-(CBNETWCTJ-CBNETWCT-1J)
```

4.10- CHANGES IN COST BASIS OWNER EQUITY AND CURRENT MARKET VALUE OWNER EQUITY ARE CALCULATED.

```
COWNEQ=TNETIN-FAM-TAXPAYCT-1J
TOTCOE=VCAPGA+COWEQ
```

NEW VARIABLE KEY - SECTION 4

```
ACOWN - OWNED TILLABLE ACRES
ACRE - TOTAL TILLABLE ACRES
ACTCAB - BUILDINGS INVESTMENT $/ACRE
ACTCAM - MACHINERY INVESTMENT $/ACRE
AV - BALANCE SHEET VALUE OF LAND
CAPGAI - TOTAL CAPITAL GAINS IN MACHINERY, BUILDINGS, AND LAND
CAST - CURRENT ASSETS
CBNETW - COST BASIS NET WORTH
CLYR - CURRENT LIABILITIES
CONLIB - CONTINGENT LIABILITIES (CAPITAL GAINS TAXES)
COSL - COST BASIS FOR LAND
COSM - COST BASIS OF MACHINERY AND BUILDINGS
COSTMB - COST OF CURRENT YEAR'S MACHINERY AND BUILDINGS
SELPR - SELLING PRICE OF LAND PARCEL
TOTCOE - CHANGE IN CURRENT MARKET VALUE OWNER EQUITY
TOTRES - TOTAL CREDIT REVENUE
UCAPGA - NET UNREALIZED CAPITAL GAINS (CAPITAL GAINS TAXES OUT)
WORNET - MARKET VALUE NET WORTH
XIMED - INTERMEDIATE ASSETS
XLIB - TOTAL LIABILITIES
```

SECTION 5 - SUBROUTINE LANEXP

5.1 - THE USER CAN PREVENT PURCHASING AND LEASING OF NEW LAND IN SEVERAL WAYS;
1) THROUGHOUT THE PERIOD, 2) AFTER 10 YEARS, AND 3) AFTER THE TOTAL ACRES
HAVE INCREASED AT A USER SPECIFIED LEVEL.

```
QPUR=V121
QLEA=V122
IF YEAR > 1989 AND V154 > 0 THEN QPUR=0
IF YEAR > 1989 AND V155 > 0 THEN QLEA=0
THEN QPUR=0 AND QLEA=0
IF QPUR=0 NO PURCHASE LAND IS SOUGHT
IF QLEA=0 NO LEASE LAND IS SOUGHT
```

5.2 - AVAILABLE LAND FOR SALE AND LEASE IS ESTABLISHED.

```
FOR DETERMINISTIC RUNS:
  ACRSEL=V122[CT]
  ACRLEA=V123[CT]

FOR STOCHASTIC RUNS:
  ACRSEL=V144[CT,ITERATION]
```


ACRLEA=V145[T,ITERATION]

5.3 - FEEDBACK AVERAGES ARE UPDATED.

EXPECTATIONS ON INCREASES IN NET RETURNS TO LAND:
 $AVGBRICT=.005*(RETULT/RETULT-1)+.995*AVGBRICT-1]$

EXPECTATIONS ON LAND INFLATION:
 $AVGLIFCT=.02*(AVPRLNCT/AVPRLNCT-1)+.98*AVGLIFCT-1]$

EXPECTATIONS ON SHORT-RUN OWNER EQUITY:
 $AVGOEQCT=.8*COWNEQCT-1]+.2*AVGOEQCT-1]$

5.5 - MACHINERY AND BUILDING REPLACEMENT COSTS ARE ESTIMATED.

$REPNE=COSTMBCT-1]*V7$
 (THIS ESTIMATE IS ADJUSTED DOWNWARD IF MACHINERY WAS
 PURCHASED IN THE PREVIOUS YEAR TO ACCOMPANY NEW LAND).

5.4 - COSTS ASSOCIATED WITH THE PURCHASE OF THE NEW LAND IS ESTIMATED.

$COSACS=AVPRLN*ACRSEL$
 $COSMAC=XMAH*V48*V7**T*ACRSEL$
 $COSBUL=XBUL*V47*V8**T*ACRSEL*.9$

5.6 - EQUITY REQUIREMENT FOR LAND AND DOWNPAYMENT REQUIREMENT FOR MACHINERY AND BUILDINGS IS ESTIMATED.

$TOTDOW=COSACS*V20+(COSMAC+COSBUL+REPNE)*V21$

5.7 - REMAINING BORROWING ASSOCIATED WITH EQUITY IN LAND IS USED TO CONTROL LAND REFINANCING ABILITY.

$RESLTL=FIXAT*V24-FIXLB-(COSACS*(1-V20))$

5.8 - SUBROUTINE COSTS IS USED TO ESTIMATE NET RETURN PER ACRE ASSOCIATED WITH THE NEW PURCHASE. THE NEW ACRES MOVE THE FARM ALONG THE LONG-RUN AVERAGE COSTS CURVE. THE NET RETURN CALCULATION INCLUDES A CHARGE FOR OPERATOR AND FAMILY LABOR AND MANAGEMENT.

5.9 - SUBROUTINE COSTS IS ALSO USED TO ESTIMATE THE PROBABLE IMPACT OF THE NEW PURCHASE ON TAXABLE INCOME AND ON CASH FLOW. FIRST A DEPRECIATION COST IS ESTIMATED AND THEN THE NEW INTEREST ASSOCIATED WITH THE LOANS FOR MACHINERY AND LAND ARE SUMMED TO THE TAXABLE COST COMING FROM SUBROUTINE COSTS.

$DEPEST=PVM/V29*1.5$
 $TAXCOS=TAXCT+DEPEST*FI*XI$

5.10- THEN AN EXPECTED NET INCOME IS ESTIMATED AND ADJUSTED BY ALL TAX EXEMPTIONS BEFORE SUBROUTINE TAXCOM IS USED TO ESTIMATE THE TAXES AND MARGINAL TAX BRACKET THAT MAY RESULT AFTER THE PURCHASE OF THE NEW LAND.

$EXFNET=TOTREV+CUSWOR+OUTINC-TAXCOS$
 $TAXINE=EXFNET-V37*AVGFAM-V28*V40$
 IF $XMARTX=0$ AND $XMTRCT-1] > .3$ THEN $XMARTX=.2$

5.11- SUBROUTINE LOAN IS USED TO ESTIMATE THE ANNUAL DEBT SERVICING COSTS ASSOCIATED WITH THE LAND PURCHASE AND THE ACCOMPANYING

MACHINERY AND BUILDING COMPLEMENT.

ADDEBT=AL+AM

- 5.12- EXPECTED CASH FLOWS ASSOCIATED WITH THE NEW PURCHASE ARE ESTIMATED, AND AN ACCEPTABLE LEVEL OF EXPECTED CASH FLOW IS CHOSEN.

ECASHI=TOTREV+CUSWOR+OUTINC
 ECASHO=VARCOS+FIXCOS+PRINPY[T-1]+ADDEBT+TAXR+AVGFAM
 ECASHF=ECASHI-ECASHO
 TEST=-(V55*(ACRE+ACRSEL))

- 5.13- A NUMBER OF CRITERIA ARE EXAMINED TO DETERMINE THE FARM'S FINANCIAL POSITION AND HOW IT MAY CHANGE WITH THE LAND PURCHASE. IF NONE OF THE FOLLOWING CONDITIONS ARE TRUE, SUBROUTINE MAXBID IS USED TO PLACE A BID ON THE PARCEL OF LAND:

IF V121=0
 IF CLYR/CAST > V74
 IF REFLANCT-2 & T-1] > V75*ACRE
 IF TOTRES < RESERV
 IF AVGOEQ < 0.
 IF TOTRES < COSACS+COSMAC+COSBUL+REPNE
 IF RESLTL < TOTDOW-CAST
 IF V120*EXPRET < ADDEBT/ACRSEL
 IF ECASHF < TEST

- 5.14- ESTIMATES ARE MADE ON THE COSTS AND DOWNPAYMENT ASSOCIATED WITH A MACHINERY COMPLEMENT TO ACCOMPANY THE NEW PARCEL OF LEASE LAND. IF NONE OF THE FOLLOWING CONDITIONS ARE TRUE, THE FARM IS IN THE RUNNING FOR LEASING NEW LAND:

IF V122=0
 IF TOTRES < RESERV
 IF TOTRES < COSMAC+REPNE
 IF FIXAT*V24-FIXLB < TOTDOW-CAST

NEW VARIABLE KEY - SECTION 5

ACRLEA - SIZE PARCEL AVAILABLE FOR LEASE
 ACRSEL - SIZE PARCEL AVAILABLE FOR SELL
 ADDEBT - ANNUAL DEBT SERVICE ASSOCIATED WITH NEW LAND PURCHASE
 AL - AMORTIZED PAYMENT ON FIXED LOAN IF NEW LAND IS ACQUIRED
 AM - AMORTIZED PAYMENT ON INTERMEDIATE LOAN IF NEW LAND IS ACQUIRED
 AVGBRI - EXPECTED INCREASE IN NET RETURN/ACRE
 AVGFAM - EXPONENTIALLY AVERAGED FAMILY LIVING EXPENSES
 AVGLIF - EXPECTATIONS ON LAND INFLATION
 AVGOEQ - EXPECTATIONS ON SHORT-RUN CHANGES IN OWNER EQUITY
 COSACS - COST OF NEW PURCHASE ACRE
 COSMAC - COST OF NEW MACHINERY COMPLEMENT
 COWNEQ - CHANGE IN OWNER EQUITY
 CUSWOR - CUSTOM WORK
 DEPEST - ESTIMATE DEPRECIATION ON MACHINERY AND BUILDING IF NEW LAND IS PURCHASED
 ECASHF - EXPECTED CASH FLOW IF NEW LAND IS PURCHASED
 ECASHI - EXPECTED CASH INFLOW IF NEW LAND IS PURCHASED
 ECASHO - EXPECTED CASH OUTFLOW IF NEW LAND IS PURCHASED
 EXFNET - EXPECTED NET TAXABLE FARM INCOME IF NEW LAND IS PURCHASED
 EXPRET - EXPECTED NET RETURN PER ACRE (NO LAND CHARGES)
 FI - FIXED INTEREST IF NEW LAND IS PURCHASED

FIXCOS - TOTAL FIXED COSTS
 OUTINC - OUTSIDE INCOME
 PRINPY - TOTAL PRINCIPAL PAYMENTS
 PVM - EXPECTED EXPENDITURE ON MACHINERY AND BUILDINGS IF NEW LAND IS
 PURCHASED
 QPUR - PURCHASE LAND STOPPER
 QLEA - LEASE LAND STOPPER
 REPNED - REPLACEMENT NEEDS FOR MACHINERY AND BUILDINGS
 RESERV - DESIRED CREDIT AND CASH RESERVES
 RESLTL - REMAINING BORROWING CAPACITY ASSOCIATED WITH OWNED LAND
 RETU - ACTUAL NET RETURN PER ACRE (NO LAND CHARGES)
 TAXCOS - ESTIMATED TAXABLE EXPENSES IF NEW LAND IS PURCHASED
 TAXCT - TAXABLE COST ITEMS
 TAXINE - ESTIMATED INCOME THAT TAXES WILL BE PAID ON NEW LAND IS
 PURCHASED
 TAXR - TAX FROM STANDARD TAX METHOD
 TEST - ACCEPTABLE LEVEL OF EXPECTED CASH FLOW BEFORE CONSIDERING
 PURCHASE OF NEW LAND
 TOTDOW - TOTAL DOWNPAYMENT OR REQUIRED EQUITY IN LAND
 VARCOS - TOTAL VARIABLE COSTS
 XI - INTERMEDIATE INTEREST IF NEW LAND IS PURCHASED
 XMAH - AVERAGE MACHINERY INVESTMENT REQUIRED (\$/ACRE)
 XMARTX - EXPECTATIONS ON MARGINAL TAX BRACKET
 XMTR - ACTUAL MARGINAL TAX BRACKET (CURRENT YEAR)

SECTION 6 - SUBROUTINES MAXBID AND LANBID

- 6.1 - THE EQUATIONS FOR THE LEE-RASK MODEL ARE NOT PRESENTED HERE. THE BASIC EQUATIONS CAN BE REVIEWED IN THE LEE AND RASK ARTICLE. (AJAE 58(1976): P. 984-990) THE REMAINDER OF THIS SECTION DEALS WITH SUBROUTINE LANBID.
- 6.2 - THE AMORTIZED ANNUAL PAYMENT FOR A NEW ACRE OF LAND IS CALCULATED FIRST.

$$AL = ((V12 * (1 + V12) ** V17) / ((1 + V12) ** V17 - 1)) * (AVPRLN * (1 - V108))$$

- 6.3 - EACH YEAR'S (OF THE PLANNING HORIZON) DISCOUNTED CASH FLOW IS CALCULATED. A SAMPLE OF THE SECOND YEAR IN A PLANNING HORIZON IS PRESENTED BELOW:

EXR[T=2] = EXPRET * V4 ** 2
 TAXES[T=2] = (EXR[YR=2] - AINT) * XMARTX
 CFL = EXR[T=2] - AL - TAXES[T=2]
 PVCFL = (1 + V67) ** (-2) * CFL

- 6.4 - AFTER EACH YEAR'S PRESENT VALUE CASH FLOW IS CALCULATED, THE ENTIRE STREAM IS SUMMED TO OBTAIN A PROXY BID.

$$BIDA = PVCFL \text{ FOR EACH YEAR OF V68 }$$

NEW VARIABLE KEY - SECTION 6

EXR - EXPECTED NOMINAL RETURN USED IN EVALUATING CASH FLOW
 TAXES - EXPECTED TAX PAYMENT FOR STREAM OF CASH FLOWS
 CFL - AFTER TAX NOMINAL CASH FLOWS
 PVCFL - DISCOUNTED CASH FLOWS FOR LAND PURCHASE DECISIONS
 BIDA - TOTAL DISCOUNTED CASH FLOW FROM A PRESPECTIVE LAND PURCHASE

SECTION 7 - SUBROUTINE LANALC

- 7.1 - THIS IS THE ONLY SUBROUTINE WHERE ALL FARMS CONVERGE. IF NO FARM IS ABLE TO BID ON THE PARCEL OF LAND AVAILABLE FOR SALE OR IF ALL BIDS ARE NOT CLOSE TO THE OUTSIDE BID, THE OUTSIDE BIDDER OBTAINS THE LAND AT THE AVERAGE SELLING PRICE.
- IF BID < V114*AVPRLN
THEN THE BID IS ACCEPTALBE
- 7.2 - EITHER THE LEE-RASK PRICE OR THE DISCOUNTED CASH FLOW BID CAN BE USED.
- IF V162=0 BIDA IS USED
IF V162>0 BID IS USED
- 7.3 - WHEN EVEN ONE OF THE FARMS HAS A BID ON THE LAND THAT IS GREATER THAN THE AVERAGE SELLING PRICE, ALL BIDS ARE COMPARED AND THE FARM WITH THE MAXIMUM BID OBTAINS THE LAND AT EITHER ONE DOLLAR OVER THE NEXT HIGHEST BIDDER OR AT THE AVERAGE SELLING PRICE (THE MAXIMUM OF THESE TWO). THE SELLING PRICE IS ALSO CONSTRAINED TO NO GREATER THAN A USER SPECIFIED PERCENT OF THE AVERAGE SELLING PRICE OF LAND. IF THE USER WANTS TO USE THE LEE-RASK MODEL TO ALLOCATE LAND ONLY AND NOT TO ESTABLISH THE SELLING PRICE, V113 SHOULD=1.
- SELPR=MAX OF (PRACR2,AVPRLN)
IF SELPR.> V113*AVPRLN
THEN SELPR=V113*AVPRLN
- 7.4 - ADJUSTMENTS CAN BE MADE IN THE SELLING PRICE WHEN LARGE PARCELS OF LAND ARE INVOLVED. (PRICE CAN NEVER GO BELOW AVERAGE SELLING PRICE).
- IF ACRSEL > V115 THEN SELPR=SELPR+V116
- 7.5 - ALLOCATION OF TWO PARCELS OF PURCHASE LAND OF THE SAME SIZE IN THE SAME YEAR IS ALLOWED AS A SENSITIVITY TEST. IF THE SECOND HIGHEST BIDDER IS ABOVE THE AVERAGE SELLING PRICE, HE GETS A PARCEL AT THE SELLING PRICE.
- IF V146 > 0 AND PRACR2 > AVPRLN*V113
THEN SECOND HIGHEST BIDDER ALSO ACQUIRES A PARCEL OF LAND
- 7.6 - THE LANDLORD'S SHARE OF RETURNS ARE ADJUSTED TO REFLECT THE LANDLORD'S CONFIDENCE IN THE FARMER'S ABILITY TO HANDLE NEW LAND (CONFIDENCE INCREASES AS MACHINERY COMPLEMENTS INCREASE).
- AVMAH[T]=.7*RATMACT]+.3*AVMACT-1]
BIDRET=BIDRET*AVMAH
- 7.7 - WHEN THE MACHINERY COMPLEMENT HAS BEEN CONSISTENTLY LOW, THE FARMER LOSES FORTY ACRES OF LEASE LAND DUE TO LANDLORD DISSATISFACTION.
- IF AVMAH < .91 THEN ACREN=ACREN-40
- 7.8 - THE FARMER THAT SHOULD PROVIDE THE LANDLORD WITH THE GREATEST RETURN IS SELECTED. THIS IS COMPARED TO THE USER SUPPLIED THRESHOLD LEVEL FOR THE LANDLORD TO DISTINGUISH BETWEEN RETURNS AND THE FARMERS THAT ARE WITHIN THE RANGE ARE IN THE RUNNING TO OBTAIN THE LEASE PARCEL. THOSE CONSIDERED ARE DETERMINED AS

FOLLOWS:

UNLESS $V148 > 0$ $BIDRET = 0$ FOR THE FARMER THAT PURCHASES LAND
 $BIDRET > BIDM * V77$

- 7.9 - AMONG THE FARMERS REMAINING IN THE LANDLORD'S FAVOR, A RANDOM (0,1) NUMBER IS USED TO ALLOCATE THE LEASE LAND. THE SAME RANDOM NUMBER SEED IS USED TO BEGIN EACH NEW ANALYSIS.
- 7.10- TWO PARCELS OF LEASE LAND ARE ALLOWED AS A SENSITIVITY TEST. THE FARM OBTAINING THE FIRST PARCEL IS PREVENTED FROM OBTAINING ANOTHER PARCEL AND STEPS 7.8 - 7.9 ARE REPEATED IF $V147 > 0$.

NEW VARIABLE KEY - SECTION 7

AVMAH - WEIGHTED AVERAGE ON MACHINERY COMPLEMENT
 BID - BID PRICE ON LAND FROM EACH FARM
 BIDM - MAXIMUM EXPECTED LANDLORD RETURN
 BIDRET - LANDLORD'S EXPECTED RETURN PER ACRE
 PRACR2 - SECOND HIGHEST BID PRICE ON LAND
 RATMAH - CURRENT YEAR'S RATIO OF ACTUAL MACHINERY COMPLEMENT

SECTION 8 - SUBROUTINE INVEST

- 8.1 - OWNED AND LEASED ACRES ARE UPDATED TO REFLECT ANY NEW ACQUISITIONS.
- 8.2 - ESTIMATES OF REQUIRED AVERAGE INVESTMENTS IN MACHINERY AND BUILDINGS (\$1/AC) ARE MADE IN A SIMILAR FASHION TO THAT PRESENTED IN SECTION 5.4 ABOVE.
- 8.3 - THE CURRENT YEAR'S LAND LOAN IS ADJUSTED TO REFLECT: 1) NEW PURCHASE; 2) LAST YEAR'S REFINANCING; AND 3) ANY OF THE DESIRED LAND DOWNPAYMENT THAT COULD NOT BE MADE IN THE PREVIOUS YEAR.

$DEBLAN[T] = TCL - DOWL + REFLAN[T-1] + ADDLN[T-1]$

- 8.4 - DESIRED RESERVES ARE ADJUSTED TO REFLECT NEW DEBT SERVICING ASSOCIATED WITH LAND EXPANSION.

IF $ACONEW = 0$ THEN $ADDEBT = 0$
 IF $ACLNEW = 0$ THEN $ADDEBL = 0$
 $RESERV = RESERV + (ADDEBT + ADDEBL) * V70$

- 8.5 - TOTAL RESERVES ARE ADJUSTED BY COSTS OF LAND, BUILDING, AND MACHINERY.

$TOTRES = TOTRES - DOWL - COSTMA - COSTBU$

- 8.6 - A NUMBER OF CRITERIA ARE USED TO DETERMINE THE LEVEL OF MACHINERY AND BUILDING COMPLEMENT TO PURCHASE. FIVE FACTORS ARE USED TO ADJUST THE AVERAGE MACHINERY COMPLEMENT AND THREE FACTORS ARE USED TO ADJUST THE COMPLEMENT. ANY ONE OF THE FOLLOWING CONDITIONS OVER-RULES THE OTHERS. THAT IS, IF MORE THAN ONE CONDITION IS MET, THEN THE LOWEST ADJUSTMENT FACTOR RULES. MACHINERY INVESTMENTS CAN BE FORCED TO AVERAGE IF $V149 > 0$.

IF THIS IS TRUE THEN $XINVSM = 8$ $XINVS8 =$
 $TOTRES > 2 * RESERV$ 1.1 1.0

TOTRES > 1.5*RESERV	1.05	1.0
TOTRES > RESERV	1.0	1.0
TOTRES > .75*RESERV	.95	.95
TOTRES < .75*RESERV	.9	.9
YEAR=1980	1.0	1.0
ACONEW > 0.	1.0	.9
AVGOEQ < V73*ACRE	1.0	1.0
V149 > 0	1.0	1.0

- 8.7 - SUBROUTINE REPL IS CALLED TWICE TO DETERMINE THE ACTUAL INVESTMENT IN MACHINERY AND BUILDINGS. MACHINERY SALVAGE VALUE REDUCES THE EXPENDITURE. SALVAGE VALUE FOR THE INITIAL COMPLEMENT IS CALCULATED IN THE FIRST YEAR AND INFLATED THEREAFTER. SALVAGE VALUE FOR MACHINERY PURCHASED AFTER YEAR 1 IS THE REMAINING CURRENT VALUE.

IF YEAR=1 THEN SALM=CVCPMT-1]*.1/V44
UNTIL INITIAL COMPLEMENT OUTLIVES USEFULNESS, IT IS INFLATED.
EACH YEAR

SALMCTJ=SALMCTJ*V7
SALMCTJ=CVCPMT-V44]
COSTMB=CVCPM-SALM+CVCPB

- 8.8 - THE MACHINERY RATIO IS CALCULATED ON THE BASIS OF ACTUAL AND AVERAGE INVESTMENT PER ACRE.

RATMAH=ACTCAM/CVCAPM

- 8.9 - INTERMEDIATE DEBTS ARE SET BASED ON INVESTMENTS IN MACHINERY AND BUILDINGS.

DEBNLC=COSTMB-DOWMB
IF SAVE > DEBNLC THEN DEBNLC=0

- 8.10- SUBROUTINE DEPC IS USED TO DEVELOP A TAX DEPRECIATION AND A REPLACEMENT DEPRECIATION WHICH IS USED IN CALCULATING ACCRUAL FARM INCOME.

WHEN TAX DEPRECIATION IS CALCULATED, THE USER CHOOSES THE METHOD:

IDPR=V42
DEPCOS=DEPCSM+DEPCSB

WHEN REPLACEMENT DEPRECIATION IS CALCULATED, DOUBLE DECLINING DEPRECIATION IS ALWAYS USED:

IDPR=6
DEPCIS=DEPCM2+DEPCB2

- 8.11- AFTER REPLACEMENT DEPRECIATION IS CALCULATED, EACH OF THE PREVIOUS YEAR'S REPLACEMENT BOOK VALUES ARE INFLATED.

BVCPM2[T=1,...,T=YR]=BVCPM2[T=1,...,T=YR]*V7
BVCPB2[T=1,...,T=YR]=BVCPB2[T=1,...,T=YR]*V8

- 8.12- SUBROUTINE BOR IS CALLED TO SET UP NEW LOAN SCHEDULES AND ACCUMULATE PREVIOUS SCHEDULES FOR INTERMEDIATE AND FIXED LOANS.

- 8.13- EXPECTED VARIABLE COSTS AND FAMILY LIVING EXPENSES ARE ESTIMATED TO DETERMINE IF AN OPERATING LOAN IS NEEDED.

```

IF (CAST-DOWMB) > EXCOST THEN
IF (CAST-DOWMB) < EXCOST THEN
  DPRC=EXCOST-(CAST-DOWMB)

```

8.14- THE DEBT SERVICING COSTS ARE CALCULATED AND DESIRED RESERVES ARE UPDATED.

```

CLY=CLYR[T]-TAXPAY[T-1]
DEBSC=DPRC*V15*V72+CLY*V15
DEBINT=DEBSI+DEBSF
DEBPRN=DPRI+DPRF
RESERV=(DEBINT+DEBPRN)*V70

```

NEW VARIABLE KEY - SECTION 8

```

ACLNEW - NEW ACRES LEASED
ACONEW - NEW ACRES PURCHASED
ACTCAM - ACTUAL COST OF MACHINERY COMPLEMENT ($/ACRE)
ADDEBL - ADDITION TO DEBT SERVICE ASSOCIATED WITH LEASE LAND
ADDEBT - ADDITION TO DEBT SERVICE ASSOCIATED WITH PURCHASE LAND
ADDLN - DESIRED DOWNPAYMENT THAT IS NOT MET
AVGFAM - EXPONENTIALLY FAMILY LIVING AVERAGE
BVCPB2 - INFLATED REPLACEMENT BOOK VALUE FOR BUILDINGS (ARRAY BY YEAR)
BVCPM2 - INFLATED REPLACEMENT BOOK VALUE FOR MACHINERY (ARRAY BY YEAR)
CLY - ONE YEAR CURRENT LOANS
COSTBU - COST OF BUILDINGS (ESTIMATE)
COSTMA - COST OF MACHINERY (ESTIMATE)
CVCAPM - COST FOR AVERAGE MACHINERY COMPLEMENT ($/ACRE)
CYCPB - ACTUAL COST OF NEW BUILDINGS (ARRAY BY YEAR)
CYCPM - ACTUAL COST OF NEW MACHINERY (ARRAY BY YEAR)
DEBINT - INTEREST CHARGES ON INTERMEDIATE AND FIXED LOANS
DEBLAN - OUTSTANDING PRINCIPLE ON FIXED DEBTS (ARRAY BY YEAR)
DEBNLC - OUTSTANDING PRINCIPLE ON INTERMEDIATE DEBTS (ARRAY BY YEAR)
DEBPRN - PRINCIPLE CHARGES ON INTERMEDIATE AND FIXED LOANS
DEBSC - INTEREST CHARGE ON OPERATING LOANS
DEBSF - INTEREST CHARGES ON FIXED LOANS
DEBSI - INTEREST CHARGES ON INTERMEDIATE LOANS
DEPCB2 - REPLACEMENT DEPRECIATION FOR BUILDINGS
DEPCIS - TOTAL REPLACEMENT DEPRECIATION
DEPCM2 - REPLACEMENT DEPRECIATION FOR MACHINERY
DEPCOS - ACCUMULATED TAXABLE DEPRECIATION
DEPCSB - TAXABLE DEPRECIATION FOR BUILDINGS
DEPCSM - TAXABLE DEPRECIATION FOR MACHINERY
DOWL - DESIRED DOWNPAYMENT ON LAND
DOWMB - DOWNPAYMENT ON MACHINERY AND BUILDINGS
DPRC - SHORT-TERM OPERATING LOANS
DPRF - INTEREST CHARGES ON FIXED LOANS
DPRI - PRINCIPLE CHARGES ON INTERMEDIATE LOANS
EXCOSE - EXPECTED VARIABLE COSTS ASSOCIATED WITH CORN AND SOYBEANS
EXCOST - ESTIMATE OF CASH NEEDS TO GET TO NEXT HARVEST
IDPR - DEPRECIATION METHOD
REFLAN - REFINANCED LAND
SALM - SALVAGE VALUE OF MACHINERY
TCL - COST OF NEW LAND PURCHASE
XINVS - RATIO OF DESIRED TO AVERAGE BUILDING COMPLEMENT/ACRE
XINVS - RATIO OF DESIRED TO AVERAGE MACHINERY COMPLEMENT/ACRE

```

NOTE - THE FOLLOWING SUBROUTINE IS CALLED TWICE. ONCE FOR REPLACEMENT OF MACHINERY AND ONCE FOR REPLACEMENT OF BUILDING. THE FOCUS HERE IS ON MACHINERY

SECTION 9 - SUBROUTINE REPL -----

- 9.1 - EACH PREVIOUS YEAR'S MACHINERY COMPLEMENT IS ALLOWED TO INFLATE AT THE REPLACEMENT INFLATION RATE (THIS IS TO INSURE THAT SIMILAR COMPLEMENTS ARE BEING CONSIDERED).

$CVCPM[TS] = CVCPM[TS] * V7$
 $TS = (T - V44) - (T)$

- 9.2 - EACH PREVIOUS YEAR'S MACHINERY COMPLEMENT WEARS OUT AT A CONSTANT RATE.

$CVCPM[TS] = CVCPM[TS] - WERM[TS]$
 $TS = (T - V44) - (T)$

- 9.3 - EACH PREVIOUS YEAR'S CURRENT VALUE OF MACHINERY IS SUMMED TO OBTAIN THE TOTAL COMPLEMENT.

$TCV = CVCPM[T - V44 \text{ OR } 1] + \dots + CVCPM[T - 1]$

- 9.4 - THE DESIRED LEVEL OF MACHINERY INVESTMENT IS DEVELOPED.

$REQ = XINVSM * CVCAPM * ACRE$

- 9.5 - NEW INVESTMENTS EQUALS THE DIFFERENCE BETWEEN THE DESIRED LEVEL AND THE CURRENT EXISTING LEVEL.

$CVCPM = REQ - TCV$

(NO DISINVESTMENT IS ALLOWED; THEREFORE, THIS NUMBER CANNOT BE = 0. IN YEARS WHEN RENTED LAND IS RELINQUISHED, THERE MAY BE NO PURCHASES.)

- 9.6 - THE WEAR OUT RATE FOR THE NEW YEAR'S INVESTMENT IS CALCULATED.

$WERM = CVCPM * (1/V44)$

- 9.7 - INTERMEDIATE ASSETS ARE THE TOTAL CURRENT VALUE OF EACH YEAR'S MACHINERY COMPLEMENT.

$XIMEDM = TCV + CVCPM$

- 9.8 - INVESTMENT INVESTED PER ACRE IS AN IMPORTANT ELEMENT IN THE PRODUCTION PROCESS.

$ACTCAM = XIMEDM / ACRE$

NEW VARIABLE KEY - SECTION 9

REQ - REQUIRED CURRENT VALUE OF MACHINERY (OR BUILDINGS) TO MATCH
 DESIRED INVESTMENT
 TCV - TOTAL CURRENT VALUE OF MACHINERY (OR BUILDINGS) BEFORE NEW PURCH.

SECTION 10 - SUBROUTINE DEPR

10.1 - SIX DEPRECIATION OPTIONS ARE AVAILABLE:

V42=1	STRAIGHT LINE ONLY
V42=2	STRAIGHT LINE PLUS FIRST YEAR ACCELERATED
V42=3	DOUBLE DECLINING PLUS FIRST YEAR ACCELERATED
V42=4	DOUBLE DECLINING PLUS FIRST YEAR ACCELERATED CONVERTED TO STRAIGHT LINE HALF WAY THROUGH THE DEPRECIATION PERIOD
V42=5	DOUBLE DECLINING CONVERTED TO STRAIGHT LINE
V42=6	DOUBLE DECLINING ONLY

10.2 - UNDER EACH OF THE ALTERNATIVES, EACH YEAR'S BOOK VALUE IS ACCOUNTED FOR SEPARATELY. THE CURRENT YEAR IS ESTABLISHED AS FOLLOWS:

BVCPM=CVCPM-SALM
 IF V42=2,3, OR 4 THEN CURRENT YEAR'S BOOK VALUE IS
 ADJUSTED BY THE FIRST YEAR ACCELERATED DEPRECIATION
 $FYR=.2 \times BVCPM$
 IF $FYR > V31$ THEN $FYR=V31$
 $BVCPM=BVCPM-FYR$
 IF V42=1,5, OR 6 THEN $FYR=0$

10.3 - UNDER THE STRAIGHT LINE METHOD (V42=1 OR 2), THE DEPRECIATION SCHEDULE IS CONSTANT OVER THE LIFE. EACH ANNUAL DEPRECIATION VALUE IS ESTABLISHED ON THE BASIS VALUE IN THE PURCHASE YEAR.

$DEPRM=BVCPM/V29$

10.4 - UNDER THE DOUBLE DECLINING BALANCE METHOD (V42=3-6) THE DEPRECIATION VALUE IS ADJUSTED EACH YEAR, BASED ON THE REMAINING BOOK VALUE.

$DEPRM[TS]=BVCPM[TS] \times (2/V29)$
 $TS=(T-V29),T$

10.5 - WHEN CONVERTING THE DOUBLE DECLINING BALANCE METHOD TO STRAIGHT LINE, THE REMAINING BOOK VALUE AT HALF OF THE DEPRECIATION LIFE IS SET UP ON A DEPRECIATION SCHEDULE AS IN 10.3.

$DEPRM=BVCPM/(V29/2)$

10.6 - EACH YEAR'S BOOK VALUE IS ADJUSTED BY THE DEPRECIATION VALUE.

$BVCPM[TS]=BVCPM[T]-DEPRM[TS]$
 $TS=(T-V29),T$

10.7 - THE ACCUMULATED DEPRECIATION IS CALCULATED BY SUMMING EACH YEAR'S DEPRECIATION VALUE AND ANY FIRST YEAR DEPRECIATION.

$DEPCSM=BVCPM[T-V44 \text{ OR } 1] + \dots + BVCPM[1] + FYR$

NEW VARIABLE KEY - SECTION 10

SALM - SALVAGE VALUE ON MACHINERY
 FYR - FIRST YEAR ACCELERATED DEPRECIATION
 DEPRM - DEPRECIATION VALUE FOR MACHINERY (ARRAY BY YEAR)
 DEPCSM - TOTAL DEPRECIATION FOR MACHINERY

NOTE- THE FOLLOWING SUBROUTINE AMORTIZES BOTH INTERMEDIATE AND FIXED LOANS. THE CALCULATIONS PRESENTED ARE FOR INTERMEDIATE LOANS.

SECTION 11 - SUBROUTINE LOAN -----

- 11.1 - THE ANNUAL AMORTIZATION SCHEDULE IS DEVELOPED WITH A STANDARD AMORTIZATION FORMULA.

$$AMOR=((V11*(1+V11)**V16)/((1+V11)**V16-1))*DEBNLC$$

- 11.2 - THE INTEREST PORTION OF THE AMORTIZED PAYMENT IS CALCULATED BASED ON THE ORIGINAL PRESENT VALUE.

$$AINT=8EBNLC*V11$$

- 11.3 - THE PRINCIPLE PORTION IS THEN THE AMOUNT OF THE AMORTIZATION PAYMENT NOT GOING TO INTEREST.

$$APRIN=AMOR-AINT$$

- 11.4 - THE REMAINING PRINCIPLE BECOMES THE DIFFERENCE BETWEEN THE ORIGINAL PRINCIPLE AND THE PRINCIPAL PORTION.

$$DEBNLC=DEBNLC-APRIN$$

NEW VARIABLE KEY - SECTION 11

AINT - INTEREST PORTION OF AMORTIZED PAYMENT
 AMOR - ANNUAL AMORTIZED PAYMENT FOR INTERMEDIATE LOANS (ARRAY BY YEAR)
 APRIN - PRINCIPAL PORTION OF AMORTIZED PAYMENT

NOTE - AGAIN THE FOLLOWING SUBROUTINE IS USED TO UPDATE BOTH INTERMEDIATE AND FIXED LOANS. THIS SECTION ALSO FOCUSES ON THE CALCULATIONS FOR INTERMEDIATE LOANS.

SECTION 12 - SUBROUTINE BOR -----

- 12.1 - SUBROUTINE LOAN IS USED TO ESTABLISH THE CURRENT YEAR'S LOAN INFORMATION. BOR UPDATES PREVIOUS YEARS IN A SIMILAR FASHION AS DESCRIBED IN SECTION 11. IT BEGINS BY EXAMINING THE REMAINING BALANCE ON PREVIOUS YEAR'S DEBTS - CHECKING FOR ANY PREPAYMENTS THAT MAY HAVE BEEN MADE.

IF DEBNLC[TS]=0 THEN NO INTEREST OR PRINCIPLE CHARGE ARE CALCULATED
 TS=(T-V16)--(T) OR 1

- 12.2 - IF THE DEBT PLUS ANY ACCUMULATED INTEREST HAS BEEN REDUCED BELOW THE AMORTIZED PAYMENT, THE AMORTIZED PAYMENT IS ADJUSTED TO PAY OFF THAT YEAR'S DEBT.

IF (DEBNLC[TS]*(1+V11)) < AMOR[TS] THEN
 AMOR[TS]=DEBNLC[TS]*(1+V11)
 TS=(T-V16)--(T) OR 1

- 12.3 - THE SAME SEQUENCE AS PRESENTED IN 11.2-11.4 IS USED TO ALLOCATE EACH YEAR'S INTEREST AND PRINCIPLE AND ADJUST THE REMAINING BALANCE.

AINT[TS]=DEBNLC[TS]*V11
 APRIN[TS]=AMOR[TS]-AINT[TS]
 DEBNLC[TS]=DEBNLC[TS]-APRIN[TS]
 TS=(T-V16)--(T) OR 1

- 12.4 - EACH YEAR'S PRINCIPLE AND INTEREST IS ACCUMULATED TO OBTAIN THE TOTAL PRINCIPLE AND INTEREST CHARGES FOR THE CURRENT YEAR.

```
DEBSI[T]=AINT[T-V16 OR 1]+AINT[T]
DPRI[T]=APRIN[T-V16 OR 1]+APRIN[T]
```

- 12.5 - THE INTERMEDIATE DEBTS ARE THE ACCUMULATED REMAINING DEBTS.

```
XIMEDC[T]=DEBNLC[T-V16 OR 1]+DEBNLC[T]
```

NEW VARIABLE KEY - SECTION 12

ALL VARIABLES HAVE BEEN PREVIOUSLY DEFINED.

SECTION 13 - SUBROUTINE COSTS

- 13.1 - THE INFLATION FACTOR FOR COSTS OF PRODUCTION IS ESTABLISHED.

```
PCINF=V3**(T)
```

- 13.2 - THERE ARE SEVERAL ADJUSTMENTS MADE TO TOTAL TILLABLE ACRES. THESE ADJUSTMENTS ALLOW FOR USE OF QUADRATIC COST FUNCTIONS AND FOR CONSIDERATION OF LAND EXPANSION (COSTS CURVES FLATTEN OUT AT 1600 ACRES).

```
IF EXPANSION IS BEING CONSIDERED THEN ADDACR=ACRSEL
OTHERWISE ADDACR=0
A=(ACRE+ADDACR)*.01
AO=ACOWN+ADDACR
A1=A
IF A > 16 THEN A=16
```

- 13.3 - LABOR REQUIREMENTS ARE CALCULATED AND ALLOCATED TO OPERATOR AND FAMILY AND HIRED LABOR.

```
XLABT=8.65+1.2L5*A1+.0653*A1**2
FAML=9.36+.669*A1+.006*A1**2
IF FAML > V84 THEN FAML=V84
CLABOR=(XLABT-FAML)*V82*PCINF
(CLABOR CAN NEVER BE NEGATIVE)
```

- 13.4 - THREE PER ACRE VARIABLE COST ESTIMATES ARE DEVELOPED FOR CORN AND SOYBEANS: 1) FERTILIZER COSTS; 2) SEED AND CROP COSTS; AND 3) MACHINERY REPAIR COSTS. A TOTAL VARIABLE COST FOR BOTH CORN AND SOYBEANS AND AN EXPECTED CASH FLOW ARE CALCULATED.

```
FC=50.88+.75*A-.057*A**2
FS=15.97-.011*A-.001*A**2
SDC=37.66-.249*A-.0184*A**2
SDS=24.407+.4035*A-.0264*A**2
XMC=24.479-.3182*A+.0178*A**2
XMS=20.909-.189*A+.0094*A**2
CC=(FC+SDC+XMC)*PCINF
SC=(FS+SDS+XMS)*PCINF
EXCOSE=CC+CS
```

- 13.5 - AN OPPORTUNITY COST IS ADDED TO THESE VARIABLE COSTS TO ACCOUNT FOR

RESOURCES INVESTED IN THE CROPS BEFORE ANY REVENUE IS RECEIVED.

CORCOS=CC+[CC*V15*V72]
SOYCOS=SC+[SC*V15*V72]

- 13.6 - THE TABLE LOOK-UP FUNCTION IS USED TO OBTAIN A CORRESPONDING RELATIONSHIP BETWEEN POTENTIAL YIELDS AND FARM SIZE. THESE POTENTIAL YIELDS ARE ADJUSTED TO ACCOUNT FOR TRENDS IN PRODUCTIVITY AND AN ESTIMATE IS MADE TO ACCOUNT FOR HARVEST LOSSES.

CYD=ACCYD*V1***(T)
SYD=ACSYD*V2***(T)
ACCYD=ACCYD*.978
ACSYD=ACSYD*.978

- 13.7 - A PER ACRE CHARGE THAT INCLUDES HIRED LABOR AND AN ESTIMATE FOR FAMILY AND OPERATOR LABOR IS CALCULATED.

LABFAC=CLABOR/(A1*100)+(FAHL/(A1*100)*V66*PCINF)

- 13.8 - AN ADJUSTMENT IN VARIABLE COSTS IS MADE TO REFLECT ALL LABOR CHARGES AND A CHARGE FOR MANAGEMENT. THE VARIABLE COSTS ARE ALSO ADJUSTED BY TAKING OUT THOSE COST ITEMS THAT WILL VARY BY YIELD. THESE COST ITEMS ARE INFLATED FIRST.

PNITO=V79*PCINF
HAUL=V80*PCINF
DRYING=V81*PCINF
VCCRN=CORCOS+LABFAC*1.09+V66*ACSYD*EXPS-PNITO*V83-(HAUL+DRYING)
*ACCYD
VCSOY=SOYCOS+LABFAC*.9+V66*ACSYD*EXPS-HAUL*ACSYD

NOTE - AT THIS POINT SUBROUTINE MIX IS CALLED TO DETERMINE EXPECTED YIELDS AND RETURNS AND AN APPROPRIATE CROP MIX. IF COSTS HAS BEEN CALLED TO AID IN EVALUATION OF LAND EXPANSION, THE CALCULATIONS BELOW ARE TO ESTIMATE THE EXPECTED TOTAL REVENUE AND EXPENSES THAT MAY RESULT IF THE LAND IS PURCHASED. THIS IS USED TO ESTIMATE EXPECTED MARGINAL TAXES RESULTING AFTER THE PURCHASE AND THE EXPECTED CASH FLOW. THE CALCULATIONS ARE ALSO MADE TO DETERMINE THE ACTUAL OUTCOME OF THE CURRENT YEAR'S PRODUCTION.

- 13.9 - AN EXPECTED RETURN ABOVE NONLAND COST, CONSIDERING ONLY THE COST ITEMS THE LANDLORD SHARES IN, IS CALCULATED. (THIS IS THE VALUE THAT THE LANDLORD USES TO ALLOCATE LEASE LAND.)

BIDRET=(EXPC*EXCYD-CORCOS)*PERC+(EXPS*EXSYD-SOYCOS)*(1-PERC)

- 13.10- DIFFERENT YIELDS ARE USED DEPENDING ON THE TYPE OF RUN BEING MADE.

WITH A DETERMINISTIC RUN, INITIALIZATION, AND/OR LAND EXPANSION:
ACCYD=EXCYD
ACSYD=EXSYD
WITH A STOCHASTIC RUN:
ACCYD=EXCYD+V142
ACSYD=EXCYD+V143

- 13.11- ACRES PLANTED TO CORN AND SOYBEANS ARE CALCULATED.

CAC=ACRE*PERC
SAC=ACRE*(1-PERC)

- 13.12- TWO FACTORS ARE CALCULATED TO REFLECT THE FARMER'S SHARE OF COSTS ASSOCIATED WITH LEASE ACRES. THE FIRST FACTOR IS FOR COST OF FERTILIZER, SEED AND CROP, AND SHARE IN RETURN. THE SECOND FACTOR REFLECTS THE SHARE OF INSURANCE, BUILDING REPAIRS, AND MISCELLANEOUS COSTS SHARED BY THE FARMER. (NOTE - IF CASH RENTAL IS BEING USED, V117 AND V118=1.)

RENFSC=(ACREN+V117+ACOWN)/ACRE
 RENFIR=(ACREN+V118+ACOWN)/ACRE

- 13.13- TWO STEPS ARE INVOLVED TO ADJUST THE ACTUAL VARIABLE COSTS INCURRED IN GROWING CORN AND SOYBEANS: 1) THE COSTS ARE ADJUSTED TO TAKE OUT THE LANDLORD'S SHARE AND THE COST ITEMS THAT VARY WITH YIELD; AND 2) THE COSTS PER ACRE ARE CONVERTED TO TOTAL VARIABLE COSTS FOR ALL ACRES, REFLECTING THE DIFFERENCE IN COSTS DUE TO YIELD VARIATION.

CADJ=((FC+SDC)*RENFSC+XMC)*PCINF-((PNITO*V83+(HAUL+DRYING)
 *ACCYD(J))*RENFSC
 SADJ=((FS+SOS)*RENFSC+XMS)*PCINF-(HAUL+ACSYD)*RENFSC
 VCOSCR=CAC*(CADJ+(PNITO*ACTNIT+(HAUL+DRYING)*RENFSC+ACCYD))
 VCOSSO=SAC*(SADJ+(HAUL*RENFSC+ACSYD))

- 13.14- THE ACTUAL LABOR REQUIREMENTS AND HIRED LABOR COSTS ARE ALSO ADJUSTED BY THE CROP MIX.

XLABT=XLABT*(.89+.21*PERC)
 CLABOR=(XLABT-FAML)*V82*PCINF

- 13.15- SOME OTHER COST ITEMS INCLUDE: 1) PROPERTY TAXES; 2) BUILDING REPAIRS; AND 3) INSURANCE.

PROTAX=V3+*FIXAT
 BULREP=(3.73-.359*A+.019*A**2)*PCINF*ACRE*RENFIR
 XINSUR=(8.79-.5423*A+.026*A**2)*PCINF*ACRE*RENFIR

- 13.16- TWO SOURCES OF OUTSIDE INCOME EXIST: 1) CUSTOM WORK WITH EXCESS MACHINERY; AND 2) USE OF RESIDUAL OPERATOR AND FAMILY LABOR.

CUSWOR=(22.8*RATHAH-20.52)*ACRE*PCINF
 OUTINC=(V84-FAML)*V78*V9***(T)
 IF V153 > 0 THEN CUSWOR=0
 IF V152 > 0 THEN OUTINC=0

- 13.17- IF CASH RENTAL IS CHOSEN INSTEAD OF SHARE RENTAL, V119 > 0 AND RENTAL COSTS WILL BE POSITIVE.

RENCOS=AVPRLN+V119*ACREN

- 13.18- A NUMBER OF DIFFERENT COSTS ARE SUMMED UP FOR USE IN CASHFO OR FOR EVALUATION OF THE INCOME TAX AND CASH FLOW REPERCUSSIONS OF PURCHASING THE NEW PARCEL OF LAND.

VARCOS=RENCOS+VCOSCR+VCOSSO+DEBSC+CLABOR
 FIXCOS=PROTAX+BULREP+DEBINT+XINSUR
 PRINPY=OPRC+DEBPRN
 IF EXPANSION IS BEING CONSIDERED, THEN DEPCOSCT]=DEPCOSCT-1]
 TAXCT=VARCOS+FIXCOS+DEPCOS

- 13.19- FARMER'S SHARE OF TOTAL CORN AND SOYBEAN BUSHELS IS CALCULATED AND THE

TOTAL REVENUE OF THIS YEAR'S CROP IS ESTIMATED BASED ON THE HARVEST PRICE ESTIMATE.

$COBU = CAC * ACCYO * RENFSC$

$SOBU = SAC * ACSYD * RENFSC$

$TOTREV = COBU * HRVPRC + SOBU * HRVPRS$

IF EXPANSION IS BEING CONSIDERED THEN $TOTREV = COBU * EXPC + SOBU * EXPS$

13.20- A CHARGE FOR FAMILY AND OPERATOR LABOR (USED ON THE FARM) AND MANAGEMENT IS ESTIMATED.

$COFLM = FAML * V66 + TOTREV * V65$

NEW VARIABLE KEY - SECTION 13

AO - OWNED ACRES IF NEW PARCEL OF LAND IS PURCHASED
 A - HUNDRED OF ACRES USED FOR COSTS CALCULATIONS
 ACCYO - ACTUAL CORN YIELD
 ACSYD - ACTUAL SOYBEAN YIELD
 AO - OWNED ACRES IF NEW PARCEL OF LAND IS PURCHASED
 A1 - HUNDRED OF ACRES USED FOR LABOR CALCULATIONS
 BULREP - BUILDING REPAIRS
 CAC - CORN ACRES
 CADJ - ACTUAL VARIABLE COST FOR CORN LESS ITEMS THAT VARY IN COST BY YIELD
 CC - INFLATED VARIABLE COST FOR CORN
 CLABOR - COST OF HIRED LABOR
 COBU - FARMER'S SHARE OF CORN BUSHELS
 COFLM - CHARGE FOR FAMILY AND OPERATOR LABOR AND MANAGEMENT
 CORCOS - INFLATED VARIABLE COST PLUS OPPORTUNITY COST FOR CORN
 CYD - POTENTIAL CORN YIELD
 DRYING - PRICE PER BUSHEL FOR DRYING CORN
 FAML - FAMILY AND OPERATOR LABOR
 FC - FERTILIZER COST FOR CORN
 FS - FERTILIZER COST FOR SOYBEANS
 HAUL - PRICE PER BUSHEL FOR HAULING GRAIN
 LABFAC - TOTAL LABOR CHARGE
 PCINF - INFLATION FACTOR FOR COST OF PRODUCTION
 PNITO - PRICE PER POUND OF ACTUAL NITROGEN
 PROTAX - PROPERTY TAXES
 RENCOS - CASH RENTAL CHARGES
 RENFIR - LEASE FACTOR OF FARMER'S SHARE OF INSURANCE AND BUILDING
 RENFSC - LEASE FACTOR OF FARMER'S SHARE OF VARIABLE COSTS AND RETURNS
 SAC - SOYBEAN ACRES
 SADJ - ACTUAL VARIABLE COST FOR SOYBEANS LESS ITEMS THAT VARY IN COST BY YIELD
 SC - INFLATED VARIABLE COST FOR SOYBEANS
 SOC - SEED AND CROP EXPENSES FOR CORN
 SOS - SEED AND CROP EXPENSES FOR SOYBEANS
 SOBU - FARMER'S SHARE OF SOYBEAN BUSHELS
 SOYCOS - INFLATED VARIABLE COST PLUS OPPORTUNITY COST FOR SOYBEANS
 SYD - POTENTIAL SOYBEAN YIELD
 TOTREV - TOTAL HARVEST VALUE OF CURRENT YEAR'S GRAIN
 VCCRN - VARIABLE COST FOR CORN, INCLUDES ALL LABOR AND MANAGEMENT
 VCOSCR - ACTUAL VARIABLE COSTS FOR CORN, ACCOUNTING FOR YIELD VARIABILITY
 VCOSSO - ACTUAL VARIABLE COSTS FOR SOYBEANS, ACCOUNTING FOR YIELD VARIABILITY
 VCSOY - VARIABLE COST FOR SOYBEANS, INCLUDES ALL LABOR AND MANAGEMENT
 XINSUR - INSURANCE CHARGES

XLABT - TOTAL LABOR REQUIREMENTS
 XMC - MACHINERY REPAIR COST FOR CORN
 XMS - MACHINERY REPAIR COST FOR SOYBEANS

NOTE - THE FOLLOWING SUBROUTINES WERE ADAPTED FROM TELPLAN 41 DEVELOPED BY J. ROY BLACK, AGRICULTURAL ECONOMICS AND MAURICE VITOSH, CROP AND SOIL SCIENCE, MICHIGAN STATE UNIVERSITY.

SECTION 14 - SUBROUTINES MIX, FERTI, AND YIELD

14.1 - THE APPROPRIATE SET OF YIELD DISCOUNT DATA IS SELECTED BASED UPON THE MACHINERY COMPLEMENT.

IF	THEN	CORN DISCOUNTS USED=	SOYBEAN DISCOUNTS USED=
RATMAH=1.1		V97	V102
RATMAH=1.05		V98	V103
RATMAH=1.		V99	V104
RATMAH= .95		V100	V105
RATMAH= .9		V101	V106

14.2 - EXPECTED PRICES USED WILL DEPEND ON WHETHER MIX IS BEING USED TO DETERMINE SHORT-RUN PLANTING OR FOR LONGER RUN EXPECTATIONS ON RETURNS WHEN PLACING A BID ON LAND.

IF PLANTING DECISIONS ARE BEING MADE:
 EXC=EXPC
 EXS=EXPS
 IF LAND INVESTMENTS DECISIONS ARE BEING MADE:
 EXS=EXPCL
 EXS=EXPSL

14.3 - AN ADJUSTMENT IN NITROGEN REQUIREMENT IS MADE TO REFLECT SOYBEANS GROWN IN THE PREVIOUS YEAR.

ADJ=10.*(1-PERC)

14.4 - A NET PER BUSHEL PRICE IS ESTABLISHED BY TAKING OFF THE COST THAT VARY BY YIELD.

PRCNET=EXC-HAUL-DRYING
 PRSNET=EXS-HAUL

14.5 - AT THIS POINT, ELEVEN POSSIBLE CROP MIXES ARE EVALUATED (I.E. CORN=0 PERCENT - CORN=100 PERCENT). THE APPROPRIATE NITROGEN APPLICATION IS DETERMINED FOR EACH CROP MIX THROUGH AN ITERATIVE PROCESS THAT USES FERTILIZER RESPONSE FUNCTIONS TO CHOOSE THE NITROGEN APPLICATION THAT WILL YIELD THE GREATEST REVENUE ABOVE NITROGEN COSTS.

REV=PRCNET*AYLD-ACTNIT*PNITO

14.6 - THE POTENTIAL YIELDS ARE ADJUSTED BASED ON NITROGEN APPLICATION (FOR CORN ONLY) AND THE APPROPRIATE YIELD DISCOUNT FACTOR. THERE ARE ELEVEN YIELD DISCOUNT FACTORS ASSOCIATED WITH EACH CROP MIX ALTERNATIVE. TO MAKE THIS CLEAR, A SPECIFIC EXAMPLE IS USED:

- ASSUME AN EXCELLENT MACHINERY COMPLEMENT (I.E. RATMAH=1.1)
 - CORN DISCOUNT=V97 AND SOYBEAN DISCOUNT=V102

- ASSUME A CROP MIX WITH 60 PERCENT CORN AND 40 PERCENT SOYBEANS
- THE DISCOUNTS (IN THE V97 AND V102 DATA SETS) CORRESPONDING WITH THIS CROP MIX WILL BE 7 OVER FOR CORN AND 5 OVER FOR SOYBEANS (EACH OF THE DATA SET GOES FROM A MIX OF 0 FOR THAT CROP TO 100)
- THEREFORE, THE CORN DISCOUNT=.993 AND THE SOYBEAN DISCOUNT=.990

YL=CYD*.993+(ADJUSTMENT FOR NITROGEN APPLICATION)
YS=SYD*.990

- 14.7 - AN EXPECTED RETURN PER ACRE IS CALCULATED FOR EACH OF THE ELEVEN POSSIBLE CROP MIXES.

RET=PERC*(YL*PRCNET-ACTNIT*PNITO-VCCRN)+(1-PERO)*(YS*PRSNET-VCSOY)

- 14.8 - THE MAXIMUM RETURN IS CHOSEN IF V69=1. WHEN V69=0, THE MIX THAT YIELDS THE MAXIMUM RETURN IS CHECKED AGAINST THE BOUNDS OF 30 PERCENT CORN AND 70 PERCENT CORN. IF IT IS OUTSIDE THESE BOUNDS, A CROP MIX OF 30 OR 70 PERCENT IS CHOSEN.

IF PERC < .3 THEN PERC=.3
IF PERC > .7 THEN PERC=.7

- 14.9 - ONCE THE CROP MIX IS SELECTED, THE CORRESPONDING EXPECTED RETURNS, NITROGEN USAGE, AND EXPECTED CORN AND SOYBEANS YIELDS ARE ESTABLISHED.

NEW VARIABLE KEY - SECTION 14

ADJ - ADJUSTMENT IN NITROGEN NEEDS ASSOCIATED WITH ROTATION
EXC - EITHER SHORT-RUN OR LONG-RUN PRICE EXPECTATIONS ON CORN
EXS - EITHER SHORT-RUN OR LONG-RUN PRICE EXPECTATIONS ON SOYBEANS
PRCNET - NET PER BUSHEL PRICE OF CORN
PRSNET - NET PER BUSHEL PRICE OF SOYBEANS
RET - EXPECTED RETURN TO AN ACRE OF CORN AND SOYBEANS UNDER DIFFERENT CROP MIXES
REV - NET RETURN TO CORN ABOVE NITROGEN COSTS
YC - EXPECTED YIELD OF CORN ADJUSTED BY CROP MIX
YS - EXPECTED YIELD OF SOYBEANS ADJUSTED BY CROP MIX

SECTION 15 - SUBROUTINE CASHFO

- 15.1 - THE VALUE OF THE PREVIOUS YEAR'S GRAIN INVENTORY IS STORED TO ACCOUNT FOR INVENTORY CHANGES AND THE PREVIOUS YEAR'S GRAIN INVENTORY IS UPDATED TO REFLECT AFTER THE FIRST OF THE YEAR PRICE MOVEMENTS FOR THE OLD CROP. ANY INTEREST ON SAVINGS IS ALSO CALCULATED.

GRINV[T-1]=CBUSTO[T-1]*POSTHC[T]+SBUSTO[T-1]*POSTHS[T]
XINERN=SAVE*V85

- 15.2 - THE TOTAL AVAILABLE REVENUE FOR COVERING CASH OUTFLOWS IS CALCULATED BY ASSUMING AN AVERAGE STORAGE YEAR AND ALL CASH INFLOWS.

AVAREV=(1-V51)*TOTREV+GRINV[T-1]+OUTINC+CUSWOR+OPRC*XINERN

- 15.3 - AN ESTIMATE OF THE MAJOR PORTION OF CASH OUTFLOWS IS MADE.

PARTCF=VARCOS+FIXCOS+DOWN+PRINPY+TAXPAY[T-1]+AVGFAM

- 15.4 - THE FIRST ESTIMATE OF THE PERCENT OF GRAIN TO STORE IS MADE ON THE BASIS OF CASH NEEDS AND UPPER AND LOWER BOUNDS ALLOWED ON THE PERCENT OF STORAGE.

```
STOFAC=AVAREV/PARTCF
IF STOFAC > V52 THEN STOFAC=V52
IF STOFAC < V53 THEN STOFAC=V53
PGSTOR=STOFAC*V51
```

- 15.5 - BEFORE TAX FARM INCOME IS EVALUATED UNDER THIS STORAGE PERCENTAGE. (LAST YEAR'S GRAIN IS ALWAYS SOLD.)

```
GRINV[T]=PGSTOR*TOTREV
GRET=GRINV[T-1]+TOTREV-GRINV[T]
FNET=CUSWOR+GRET-TAXCT
```

- 15.6 - IF THE STORAGE PERCENTAGE YIELDS A NEGATIVE TAXABLE FARM INCOME, THE PERCENT STORAGE IS REDUCED UNTIL INCOME IS AT A USER SPECIFIED LEVEL (\$/AC) OR THE LOWEST PERCENT OF STORAGE ALLOWED.

```
IF FNET < 0 THEN
  PGSTOR=(CUSWOR+GRINV[T-1]-TAXCT+TOTREV-(V57*ACRE))/TOTREV
IF PGSTOR < (V51+V53+V54) THEN PGSTOR=V51+V53+V54
```

- 15.7 - ON THE OTHER HAND, IF THE TAXABLE FARM INCOME IS CONSIDERABLY HIGHER THAN PREVIOUS YEARS, THE PERCENT OF STORAGE OBTAINED IN STEP 15.4 WILL BE ADJUSTED UPWARD TO REDUCE TAXABLE INCOME IN THAT YEAR. THIS PERCENTAGE IS ALSO BOUNDED BY SOME UPPER STORAGE LIMIT.

```
IF FNET > (V56*AVGTX) THEN
  PGSTOR=(CUSWOR+GRINV[T-1]-TAXCT+TOTREV-(V56*AVGTX))/TOTREV
IF PGSTOR > V51+V52 THEN PGSTOR=V51+V52
(PGSTOR CAN NEVER BE GREATER THAN 1)
```

- 15.8 - AFTER THE PERCENT OF GRAIN TO BE STORED HAS BEEN DETERMINED, THE ACTUAL TAXABLE FARM INCOME IS CALCULATED AS IN 15.5 AND SUBROUTINE TAXES IS USED TO CALCULATE NEXT YEAR'S TAX PAYMENTS. INCOME IS SEPARATED INTO FARM INCOME AND NONFARM INCOME.

```
TNFINC=OUTINC+XINERN
```

- 15.9 - CHANGES IN GRAIN INVENTORY ARE ACCOUNTED FOR AND AN ACCRUAL FARM INCOME IS CALCULATED. A RETURN TO FARM CAPITAL ABOVE LABOR AND MANAGEMENT IS ALSO CALCULATED. ACCRUAL INCOME CAN BE USED TO CALCULATE FEDERAL TAXES.

```
CINV=GRANIN[T-1]-GRINV[T]
FNETIN=GRET+CUSWOR-VARCOS-FIXCOS-DEPCOS+CINVC
RETAIL=FNETIN-COFLM
IF V158 > 0 THEN FNET=TOTREV+CINV+CUSWOR-TAXCT
```

- 15.10- THE ACCRUAL FARM INCOME AND THE TOTAL OUTSIDE INCOME IS ADJUSTED BY THE TAX PAYMENTS MADE THIS YEAR, AND THIS NUMBER IS USED TO CALCULATE FAMILY LIVING EXPENSES USING SUBROUTINE FAMILY.

```
TOTIN=FNETIN+TNFINC-TAXPAYCT-1]
```

- 15.11- ONCE THE FAMILY LIVING LEVEL IS ESTABLISHED, THE ACTUAL CASH FLOW POSITION CAN BE ESTABLISHED.

CASHCT=PARTCF+FAM-AVGFAM
 CASHIN=GRET+OUTINC+CUSWOR+XINERN+DPRC
 CASFL=CASHIN-CASHCT

- 15.12- AT THIS POINT THE AVERAGE FAMILY LIVING EXPENSES AND THE AVERAGE TAXABLE INCOME ARE UPDATED WITH THE EXPONENTIALLY SMOOTHED EQUATIONS.

AVGFAM=.4*FAM+.6*AVGFAM
 AVGTX=.4*FNET+.6*AVGTX

- 15.13- A MINIMUM CASH RESERVE (CHECKING ACCOUNT) IS ESTABLISHED AND COST FLOW IS ESTABLISHED BASED ON PREVIOUS CASH RESERVES AND SAVINGS AND THE DESIRE TO PAY OFF ALL CURRENT DEBTS.

CASMIN=V61*AVGFAM
 CFLOW=CASHFL+CASH+SAVE-CASMIN-CLY

- 15.14- CURRENT LIABILITIES ARE SET EQUAL TO THE TOTAL TAX PAYMENT DUE IN THE NEXT YEAR. (THIS WILL BE INCREASED IF ONE YEAR LOANS ARE REQUIRED.)

CLYR=TAXPAY

- 15.15- THESE ARE A NUMBER OF ALTERNATIVE CALCULATIONS THAT CAN BE MADE AT THIS POINT. STEPS 15.16-15.21 COVER THE STAGES WHEN THE CASH FLOW (CFLOW ABOVE) IS NEGATIVE AND STEPS 15.22-15.23 COVER THE STAGES WHEN THIS CASH FLOW IS POSITIVE.

- 15.16- FIRST, CURRENT LIABILITIES (ONE YEAR LOANS) ARE BORROWED IN AN ATTEMPT TO COVER THE NEGATIVE CASH FLOW. THE CONSTRAINTS ON CURRENT LIABILITIES ARE CHECKED AGAINST THE NEGATIVE CASH FLOW AND CONTINGENT TAXES.

CNEG=ABSOLUTE VALUE OF CFLOW
 CMAX=V27*EXGRET-TAXPAY[T]
 CSTR=V26*(CAST+CINVC)-TAXPAY[T]
 CLY=MIN OF (CNEG,CMAX,CSTR)

- 15.17- THE REMAINING NEGATIVE CASH FLOW IS ADJUSTED BY THE SHORT-TERM LOAN BORROWED AND THE CURRENT LIABILITIES ARE UPDATED.

CNEG=CNEG-CLY
 CLYR=TAXPAY+CLY
 IF CNEG=0 GO TO STEP 15.24

- 15.18- WHEN THERE ARE STILL CASH FLOWS THAT HAVEN'T BEEN COVERED AND LAND HAS BEEN PURCHASED IN THE CURRENT YEAR, REEXAMINATION OF THE DOWNPAYMENT IS MADE (I.E. IT IS ADJUSTED DOWNWARD TO ZERO OR ENOUGH TO COVER NEGATIVE CASH FLOW, WITH DUE CONSIDERATION FOR INTEREST CHANGES).

DLN=SELPR*ACONEW*V108*(1+V12)
 IF CNEG < DLN THEN CNEG=CNEG*(1+V12)
 ADDLN=MIN OF (DLN,CNEG)
 CNEG=CNEG-ADDLN
 IF CNEG=0 THEN GO TO 15.24

- 15.19- IF THERE ARE STILL NEGATIVE CASH FLOWS, REFINANCING LAND IS USED. THERE ARE CONSTRAINTS TO ABSOLUTE REFINANCING ALLOWED AND THE FREQUENCY OF REFINANCING LAND. FIXED ASSETS AND LIABILITIES ARE ALSO UPDATED.

```

REFLAN=CNEG*V23
FIXAT=ACOWN*SELPR
FIXLB=FIXLB+DEBLAN+ADDLN+REFLAN
IF (FIXLB/FIXAT) > V24 THEN GO TO SECTION 15.21

```

- 15.20- WHEN RECENT REFINANCING OF LAND HAS BEEN AT UNACCEPTABLE LEVELS (DETERMINED BY THE USER), THEN THE FARMER RELINQUISHES 40 ACRES OF LEASE LAND TO REDUCE CASH NEEDS FOR MACHINERY REPLACEMENT. THIS INVOLVES CONSIDERATION OF AN EXPONENTIALLY WEIGHTED REFINANCE AND THE CURRENT YEAR'S VALUE.

```

AVGREFCTJ=.5*REFLANCTJ+.5*AVGREFCT-1J
IF AVGREF > (V75*ACRE) AND REFLANCTJ > (V76*ACRE) THEN
  ACREN=ACREN-40
  GO TO SECTION 15.24

```

- 15.21- WHEN THE MAXIMUM FIXED RATIO IS EXCEEDED BECAUSE OF REFINANCING LAND, FORTY ACRES OF LEASE LAND IS RELINQUISHED AND 90 PERCENT OF THE VALUE OF MACHINERY COMPLEMENT TO GO WITH THE FORTY ACRES IS USED TO INCREASE THE CEILING ON CURRENT LOANS.

```

ACREN=ACREN-40.
CLMAX=ACTCAM*40*.9+CLYR
CLYR=CLYR+(FIXLB-FIXAT*V24)
IF CLYR > CLMAX OR ACREN < 40 THEN
  THE FARM BECOMES INSOLVENT, OTHERWISE REFLAN=REFLAN-(FIXLB-FIXAT*
  V24) AND CALCULATIONS PROCEED AT STEP 15.24

```

- 15.22- WHEN CASH FLOW IS POSITIVE, A SAVINGS ACCOUNT WILL BE ESTABLISHED TO HELP PAY VARIABLE COSTS THAT CANNOT BE COVERED BY CURRENT ASSETS.

```

SAVE=MIN OF (CFLOW OR (VARCOS-CRINV-CASHIN))

```

- 15.23- IF CASH FLOW IS STILL POSITIVE, CALCULATIONS ARE MADE TO REDUCE INTERMEDIATE DEBTS UNTIL THERE IS NO MORE EXCESS CASH OR INTERMEDIATE DEBTS. (OLDEST DEBTS ARE REDUCED FIRST.) IF THERE IS STILL EXCESS CASH, THE SAME PROCEDURE IS USED ON FIXED DEBTS AND, FINALLY, ANY REMAINING CASH, AFTER ALL DEBTS ARE PAID, IS ADDED TO SAVINGS.

- 15.24- ONCE CASH FLOW IS BALANCED, SEVERAL OTHER VALUES ARE UPDATED.

```

CASH=CASHIN
CAST=CASH+GRINV+SAVE
CBUSTO=COBU*PGSTOR
SBUSTO=SOBU*PGSTOR
COWNEQ=TNETIN-FAM-TAXPAYCT-1J

```

NEW VARIABLE KEY - SECTION 15

```

AVAREV - AVAILABLE CASH INFLOWS AT YEAR'S END
AVGREF - MOVING AVERAGE FOR REFINANCED LAND
AVGTX - EXPONENTIAL WEIGHT BEFORE TAX FARM INCOME
CASHCT - ACTUAL CASH OUTFLOWS
CASHIN - ACTUAL CASH INFLOW
CASHIN - CASH REQUIREMENT
CBUSTO - CORN BUSHELS STORED
CFLOW - ADJUSTED CASH FLOW-ACCOUNTS FOR BALANCING CURRENT POSITION
CINV - CHANGE IN GRAIN INVENTORY FROM END OF ONE YEAR TO NEXT
CLMAX - ADDITION TO CONSTRAINT ON CURRENT LOANS (ASSOCIATED WITH
        RELEASING LEASE LAND)

```

CLY - CURRENT ONE YEAR LOANS (DISTINGUISHED FROM OPERATING LOAN)
 CMAX - CONSTRAINT ON CURRENT LIABILITIES (FUNCTION OF GROSS RETURNS)
 CNEG - ABSOLUTE VALUE OF END OF YEAR CASH POSITION
 CSTR - CONSTRAINT ON CURRENT LIABILITIES (FUNCTION OF CURRENT ASSETS)
 DLN - LAND EQUITY REQUIREMENT OR DOWNPAYMENT ON NEW LAND
 FAM - FAMILY LIVING EXPENSES
 FNET - NET TAXABLE FARM INCOME (INCLUDES GRAIN AND CUSTOM WORK)
 FNETIN - ACCRUAL FARM INCOME (ACCOUNTS FOR INVENTORY CHANGE)
 GRANIN - PREVIOUS YEAR'S GRAIN INVENTORY VALUED AT HARVEST PRICE
 GRET - GROSS FARM INCOME FROM GRAIN
 GRINV - VALUE OF GRAIN INVENTORY
 PARTCF - ESTIMATE OF YEAR'S END CASH OUTFLOW
 RETALL - ACCRUAL RETURN TO CAPITAL (CHARGES OUT FOR LABOR AND MANAGEMENT)
 SBUSTO - SOYBEAN BUSHELLS STORED
 STOFAC - STORAGE FACTOR USED TO ADJUST PERCENT STORED
 TNFINC - GROSS NON-FARM INCOME
 TOTIN - INCOME VALUE USED FOR FAMILY LIVING-ACCRUAL FARM INCOME LESS TAXES
 XINERN - INTEREST EARNING ON ANY OUTSIDE INVESTMENT

NOTE - THE FOLLOWING SUBROUTINES WERE ADAPTED FROM TELPLAN 05, DEVELOPED BY M. P. KELSEY AND S.B. HARSH, DEPARTMENT OF AGRICULTURAL ECONOMICS, MICHIGAN STATE UNIVERSITY.

SECTION 16 - SUBROUTINES TAXES, INCAV, TAXCOM, MINTAX

16.1 - ANY EXCESS DEDUCTIONS (I.E. ABOVE THE 3400 MINIMUM FOR A JOINT RETURN) AND INVESTMENT TAX CREDIT ARE CALCULATED.

DEDIT=V37*AVGFAM
 TINVC=COSTMB*V32+CAROV

16.2 - PREVIOUS FOUR YEARS OF INCOME ARE ADJUSTED BY THE NUMBER OF EXEMPTIONS TO ALLOW FOR INCOME AVERAGING.

TXIN1=PINC1-V40*V28
 TXIN2=PINC2-V40*V28
 TXIN3=PINC3-V40*V28
 TXIN4=PINC4-V40*V28

16.3 - THE CURRENT YEAR'S TAXABLE INCOME LESS EXCESS DEDUCTIONS IS DETERMINED.

TAXIN=FNET+OUTINC+XINERN-DEDIT

16.4 - ALLOWANCES ARE MADE TO INDEX TAXABLE INCOME (I.E., A SUBSTITUTE FOR INDEXING TAX BRACKETS) EITHER BY A FIXED RATE (USUALLY 1.0) OVER THE ENTIRE PERIOD OR BY PRESIDENT REAGAN'S 3 YEAR 10 PERCENT PER YEAR PROPOSAL.

FACTAX=V160** (T)
 OR IF V157 > 0 AND
 YEAR=1981 THEN FACTAX=1.1
 YEAR=1982 THEN FACTAX=1.2
 YEAR=1983 OR ABOVE THEN FACTAX=1.3
 TAXIN=TAXIN/FACTAX

- 16.5 - THE VALUES FOR CONSIDERATION OF INCOME AVERAGING ARE UPDATED, ALLOWING FOR NEGATIVE VALUES OF TAXIN. IT IS ONLY AFTER THE UPDATING THAT ANY NEGATIVE TAXIN IS FORCED TO ZERO. (NEGATIVE VALUES ARE RESTRICTED TO NO MORE THAN -10000).

```
IF TAXIN < -10000 TAXIN=-10000
PINC4=PINC3
PINC3=PINC2
PINC2=PINC1
PINC1=TAXIN
```

- 16.6 - THE CURRENT YEAR'S TAXABLE INCOME IS NOW ADJUSTED BY THE NUMBER OF EXEMPTIONS AND THIS IS THE VALUE USED IN SUBROUTINES TAXCOM, INCAV, AND MINTAX.

```
TAXINA=TAXIN-V40*V28
```

- 16.7 - SUBROUTINE TAXCOM GOES THROUGH THE STANDARD TAX TABLES UNTIL THE TAXABLE INCOME IS GREATER THAN THE LOWER VALUE OF THE TAX BRACKET THAT CORRESPONDS TO THE INCOME. TAXES ARE THEN COMPUTED BY ADDING THIS LOWER VALUE TO THE MARGINAL INCOME TIMES THE RELEVANT BRACKET.

```
BKSP=TAXINA-LWBK
TAXR=ITXBS+BKSP*TXBK
```

- 16.8 - SUBROUTINE INCAV FIRST CHECKS TO SEE IF INCOME AVERAGING MAY REDUCE TAX PAYMENTS AND THEN TAXCOM IS USED TO CALCULATE TWO TAX LEVELS THAT ARE USED TO MAKE THE FINAL DETERMINATIONS OF WHAT THE TAX PAYMENT WOULD BE IF USING INCOME AVERAGING.

```
TOT30=(TXIN1+TXIN2+TXIN3+TXIN4)*.30
AMT1=TAXINA-TOT30-3000.
IF AMT1 < 0 THEN INCOME AVERAGING WILL NOT PAY
AMT2=TOT30+(.20*(TAXINA-TOT30))
(TAXES ARE COMPUTED USING AMT2 AND TOT30. THE CORRESPONDING
TAXES FROM THESE COMPUTATIONS ARE TAX1 AND TAX2.)

TAXIA=TAX2+(5.*(TAX1-TAX2))
```

- 16.9 - SUBROUTINE MINTAX COMPUTES A POTENTIAL ALTERNATIVE MINIMUM TAX USING WHAT IS CALLED "ALTERNATIVE MINIMUM TAXABLE INCOME."

```
AMT=TAXINA-STANDARD DEDUCTIONS ($3400)
```

THREE MARGINAL TAX RATES ARE USED TO COMPUTE THE POTENTIAL ALTERNATIVE MINIMUM TAX (TAX CODE SECTION 55):

- 1) 10% OF INCOME OVER \$20000 (IN \$20000-\$60000 RANGE)
- 2) +20% OF INCOME OVER \$60000 (IN \$60000-\$100000 RANGE)
- 3) +25% OF INCOME OVER \$100000 (IN OVER \$100000 RANGE)

- 16.10- THE INITIAL TAX PAYMENT WILL BE THE MINIMUM OF THE TAX PAYMENT CALCULATED IN THE STANDARD MANNER AND THE INCOME AVERAGING VALUE. INCOME AVERAGING IS LOCKED OUT WHEN V156 > 0.

```
IF V156 > 0 TAXIA=999999.
AMTA=MIN OF (TAXR,TAXIA)
```

- 16.11- THIS VALUE IS ADJUSTED BY THE MAXIMUM ALLOWABLE INVESTMENT TAX CREDIT.

THERE ARE THREE INVESTMENT TAX CREDIT LIMITS CONSIDERED: 1) THE TOTAL AVAILABLE; 2) THE TAX AMOUNT; AND 3) THE UPPER AMOUNT ALLOWED (TAX CODE SECTION 46).

1) $TCR = TINV$
 2) $AMTA$
 3) IF $AMTA > V33$ AND $TINV > V33$ THEN $TINV = V33 + .8 * (AMTA - V33)$
 $AINCR = \text{MIN OF } (TCR, AMTA, TINV)$
 $AMTR = AMTA - AINCR$

16.12- IF THE INVESTMENT TAX CREDITS RESULT IN THE TAX PAYMENT BEING LESS THAN THE ALTERNATIVE MINIMUM TAX, THEN THE ALTERNATIVE MINIMUM TAX IS PAID AND THE USED INVESTMENT TAX CREDIT IS ADJUSTED AND ANY CREDIT NOT USED GOES TO INVESTMENT TAX CREDIT CARRYOVER.

IF $AMTA < MINTX$ THEN $FEDTAX = MINTX$
 AND $AINCR = AINCR - (MINTX - AMT)$
 $CAROV = TCR - AINCR$

16.13- THE MARGINAL TAX BRACKET IS SET BASED ON WHICH METHOD OF COMPUTATION IS USED.

WITH STANDARD TAX METHODS
 $XMTR = TXBKR * .01$
 WITH THE INCOME AVERAGING METHOD
 $XMTR = TXBKIA * .01$

16.14- SOCIAL SECURITY TAXES ARE BASED ON FARM INCOME ONLY, WITH A MAXIMUM LEVEL.

$SOCSEC = FNET + V35$
 IF $SOCSEC > V36$ THEN $SOCSEC = V36$

16.15- STATE TAXES ARE A FIXED PERCENT OF FEDERAL TAXABLE INCOME.

$TAXST = TAXINA * .025$

16.16 - UNDER SPECIAL CASES FEDERAL TAXES CAN BE SET EQUAL TO ZERO.

IF $V159 > 0$
 THEN $FEDTAX = 0$.

16.17- TOTAL TAX PAYMENT DUE IN THE FOLLOWING YEAR IS THE SUM OF ALL TAXES

$TAXPAY = SOCSEC + FEDTAX + TAXST$

NEW VARIABLE KEY - SECTION 16

$AINCR$ - ALLOWED INVESTMENT TAX CREDIT
 AMT - ALTERNATIVE MINIMUM TAXABLE INCOME
 $AMTA$ - PRELIMINARY ESTIMATE OF FEDERAL TAX
 $AMT1$ - CHECK TO SEE IF INCOME AVERAGING MAY PAY
 $AMT2$ - THE SECOND INCOME VALUES USING INCOME AVERAGING
 $BKSP$ - INCOME ON WHICH MARGINAL TAX RATE APPLIES
 $CAROV$ - CARRY OVER OF ANY UNUSED TAX CREDIT
 $DEDIT$ - EXCESS TAX DEDUCTIONS
 $FACTAX$ - DISCOUNT FACTOR FOR INDEXING TAXES
 $FEDTAX$ - FEDERAL TAX
 $ITXBS$ - TAX THAT CORRESPONDS TO LOWER INCOME VALUE (LWBK)
 $LWBK$ - LOWER INCOME VALUE FOR RELEVANT TAX BRACKET

MINTX - MINIMUM TAX
 PINC1 - TAXABLE INCOME BEFORE TAX EXEMPTIONS-PREVIOUS YEAR
 PINC2 - TAXABLE INCOME BEFORE TAX EXEMPTIONS-TWO YEARS BACK
 PINC3 - TAXABLE INCOME BEFORE TAX EXEMPTIONS-THREE YEARS BACK
 PINC4 - TAXABLE INCOME BEFORE TAX EXEMPTIONS-FOUR YEARS BACK
 SOCSEC - SOCIAL SECURITY TAX
 TAXIA - TAX COMPUTED FROM INCOME AVERAGING
 TAXIN - CURRENT YEAR'S TAXABLE INCOME BEFORE TAX EXEMPTIONS
 TAXINA - ADJUSTED CURRENT YEAR'S TAXABLE INCOME
 TAXST - STATE TAXES
 TAX1 - AN INTERMEDIATE VALUE FOR CALCULATING TAXIA
 TAX2 - AN INTERMEDIATE VALUE FOR CALCULATING TAXINA
 TCR - INITIAL INVESTMENT TAX CREDIT
 TINVC - INVESTMENT TAX CREDIT
 TOT30 - THIRTY PERCENT OF THE SUM OF THE PREVIOUS FOUR YEARS ADJUSTED
 TAXABLE INCOME
 TxBK - TAX BRACKET FROM STANDARD TAX METHOD
 TxBK1A - TAX BRACKET FROM INCOME AVERAGING METHOD
 TxBKR - TAX BRACKET FROM STANDARD METHOD
 TXIN1 - ADJUSTED TAXABLE INCOME-PREVIOUS YEAR
 TXIN2 - ADJUSTED TAXABLE INCOME-TWO YEARS BACK
 TXIN3 - ADJUSTED TAXABLE INCOME-THREE YEARS BACK
 TXIN4 - ADJUSTED TAXABLE INCOME-FOUR YEARS BACK

SECTION 17 - SUBROUTINE FAMILY

- 17.1 - MINIMUM AND MAXIMUM LEVELS OF FAMILY CONSUMPTION ARE INFLATED EACH YEAR.

XMIN=V58*V6**(YR-1)
 XMAX=V59*V6**(YR-1)

- 17.2 - FAMILY CONSUMPTION IS CALCULATED USING THE ACCRUAL AFTER TAX INCOME VALUE, WITH A FORCED MINIMUM LEVEL. (THE INCOME VALUE IS NEVER ALLOWED TO BE NEGATIVE - ZERO IS USED.)

FAM=XMIN*61.*TOTIN**5

- 17.3 - THIS VALUE IS CHECKED AGAINST UPPER AND LOWER BOUNDS TO PROVIDE STABILITY IN CONSUMPTION.

IF FAM > (AVGFAM*V60) THEN FAM=AVGFAM*V60
 IF FAM < (AVGFAM*V61) THEN FAM=AVGFAM*V61
 IF FAM > XMAX THEN FAM=XMAX

NEW VARIABLE KEY - SECTION 17

XMAX - MAXIMUM FAMILY LIVING CONSTRAINT
 XMIN - MINIMUM FAMILY LIVING CONSTRAINT

SECTION 18 - SUBROUTINE ACC -----

- 18.1 - A PRESENT VALUE FACTOR IS CALCULATED TO CONVERT MEASUREMENT VARIABLES INTO 1979 DOLLARS (INFLATION ON FAMILY LIVING IS USED).

FAC=V6**(-T)

- 18.2 - FOUR MEASUREMENT VARIABLES ARE CONVERTED TO 1979 DOLLARS.

TV(1)[TS]=FNETIN[TS]/FAC[T]
TV(2)[TS]=FNET[TS]/FAC[T]
TV(3)[TS]=TAXPAY[TS]/FAC[TS]
TV(4)[TS]=FAMCTS[TS]/FAC[TS]

WHERE TS=1 - LAST YEAR IN PLANNING HORIZON (IYEAR)

- 18.3 - THE MAXIMUM AND MINIMUM PRESENT VALUES FOR ACCRUAL FARM INCOME AND TAXABLE FARM INCOME ARE IDENTIFIED.

V(9)=MAX(TV(1)[TS])
V(10)=MIN(TV(1)[TS])
V(11)=MAX(TV(2)[TS])
V(12)=MIN(TV(2)[TS])

- 18.4 - SUBROUTINE DATANL IS USED TO CALCULATE THE AVERAGE VALUES FOR THE FOUR MEASUREMENT VARIABLES FROM 18.2.

V(1)=MEAN OF TV(1) USING IYEAR
V(2)=MEAN OF TV(2) USING IYEAR
V(3)=MEAN OF TV(3) USING IYEAR
V(4)=MEAN OF TV(4) USING IYEAR

- 18.5 - THE CHANGE IN ACRES OWNED AND LEASED IS EVALUATED AND THE NOMINAL ENDING NET WORTH IS RECORDED. IN ADDITION, THE ANNUAL RATE OF CHANGE IN NET WORTH IS CALCULATED.

V(5)=ACOWN[IYEAR]-ACOWN[1]
V(6)=ACRENC[IYEAR]-ACRENC[1]
V(7)=WORNET[IYEAR]
V(9)=EXPONENTIAL(ANTILOG(WORNET[IYEAR]/WORNET[1])/IYEAR)

- 18.6 - AT THE END OF THE MONTE CARLO SUBROUTINE, DATANL IS USED TO CALCULATE MEANS, STANDARD DEVIATIONS, AND COEFFICIENTS OF VARIATION FOR EACH OF ONE DOZEN MEASUREMENT VARIABLES (V(1-12)).

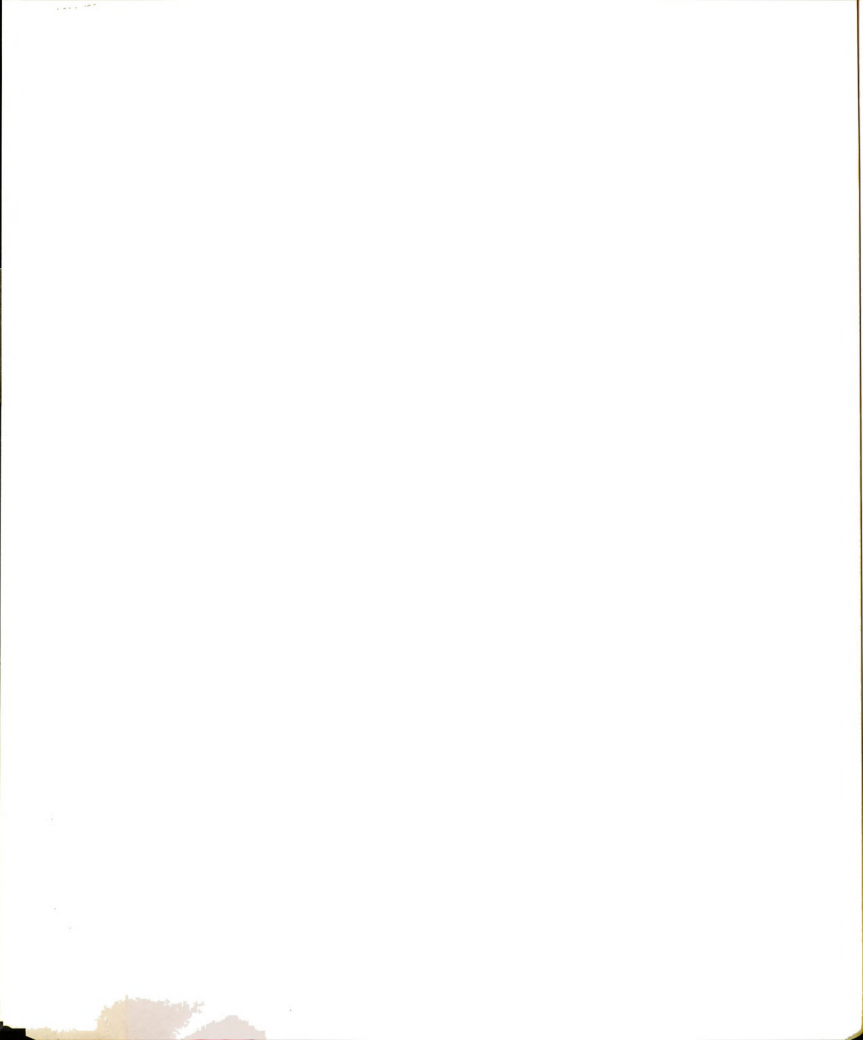
NEW VARIABLE KEY - SECTION 18

FAC - PRESENT VALUE FACTOR USED TO PLACE VARIABLES IN 1979 DOLLARS
TV(1) - PRESENT VALUES FOR EACH YEAR'S ACCRUAL FARM INCOME
TV(2) - PRESENT VALUES FOR EACH YEAR'S TAXABLE FARM INCOME
TV(3) - PRESENT VALUES FOR EACH YEAR'S TAXES AND SOCIAL SECURITY
TV(4) - PRESENT VALUES FOR EACH YEAR'S FAMILY LIVING EXPENDITURES
V(1) - PRESENT VALUE AVERAGE ACCRUAL FARM INCOME (OVER PLANNING HORIZON)
V(2) - PRESENT VALUE AVERAGE TAXABLE FARM INCOME (OVER PLANNING HORIZON)
V(3) - PRESENT VALUE AVERAGE TAXES AND SOCIAL SECURITY (OVER PLANNING HORIZON)
V(4) - PRESENT VALUE AVERAGE FAMILY LIVING EXPENDITURE (OVER PLANNING HORIZON)
V(5) - OWNED ACRES ACQUIRED OVER THE PERIOD
V(6) - LEASED ACRES ACQUIRED OVER THE PERIOD

V(7) - ENDING NET WORTH (NOMINAL DOLLARS)
V(8) - ANNUAL REAL GROWTH IN NET WORTH
V(9) - MAXIMUM PRESENT VALUE ACCRUAL FARM INCOME
V(10) - MINIMUM PRESENT VALUE ACCRUAL FARM INCOME
V(11) - MAXIMUM PRESENT VALUE TAXABLE FARM INCOME
V(12) - MINIMUM PRESENT VALUE TAXABLE FARM INCOME

ALPHABETIZED VARIABLE LIST

A - HUNDRED OF ACRES USED FOR COSTS CALCULATIONS
 ACCYO - ACTUAL CORN YIELD
 ACLNEW - NEW ACRES LEASED
 ACONEW - NEW ACRES PURCHASED
 ACOWN - OWNED TILLABLE ACRES
 ACRE - TOTAL TILLABLE ACRES
 ACRLEA - SIZE PARCEL AVAILABLE FOR LEASE
 ACRSEL - SIZE PARCEL AVAILABLE FOR SELL
 ACSYD - ACTUAL SOYBEAN YIELD
 ACTCAB - BUILDINGS INVESTMENT \$/ACRE
 ACTCAM - ACTUAL COST OF MACHINERY COMPLEMENT (\$/ACRE)
 ACTCAM - MACHINERY INVESTMENT \$/ACRE
 ADDEBL - ADDITION TO DEBT SERVICE ASSOCIATED WITH LEASE LAND
 ADDEBT - ANNUAL DEBT SERVICE ASSOCIATED WITH NEW LAND PURCHASE
 ADDEBT - ADDITION TO DEBT SERVICE ASSOCIATED WITH PURCHASE LAND
 ADDLN - DESIRED DOWNPAYMENT THAT IS NOT MET
 ADJ - ADJUSTMENT IN NITROGEN NEEDS ASSOCIATED WITH ROTATION
 AINCR - ALLOWED INVESTMENT TAX CREDIT
 AINT - INTEREST PORTION OF AMORTIZED PAYMENT
 AL - AMORTIZED PAYMENT ON FIXED LOAN IF NEW LAND IS ACQUIRED
 AM - AMORTIZED PAYMENT ON INTERMEDIATE LOAN IF NEW LAND IS ACQUIRED
 AMOR - ANNUAL AMORTIZED PAYMENT FOR INTERMEDIATE LOANS (ARRAY BY YEAR)
 AMT - ALTERNATIVE MINIMUM TAXABLE INCOME
 AMTA - PRELIMINARY ESTIMATE OF FEDERAL TAX
 AMT1 - CHECK TO SEE IF INCOME AVERAGING MAY PAY
 AMT2 - THE SECOND INCOME VALUES USING INCOME AVERAGING
 AO - OWNED ACRES IF NEW PARCEL OF LAND IS PURCHASED
 APRIN - PRINCIPAL PORTION OF AMORTIZED PAYMENT
 AV - BALANCE SHEET VALUE OF LAND
 AVAREV - AVAILABLE CASH INFLOWS AT YEAR'S END
 AVGBRI - EXPECTED INCREASE IN NET RETURN/ACRE
 AVGFAM - EXPONENTIALLY AVERAGED FAMILY LIVING EXPENSES
 AVGLIF - EXPECTATIONS ON LAND INFLATION
 AVGOEQ - EXPECTATIONS ON SHORT-RUN CHANGES IN OWNER EQUITY
 AVGREF - MOVING AVERAGE FOR REFINANCED LAND
 AVGTX - EXPONENTIAL WEIGHT BEFORE TAX FARM INCOME
 AVMAH - WEIGHTED AVERAGE ON MACHINERY COMPLEMENT
 AVPRLN - AVERAGE SELLING PRICE OF LAND
 A1 - HUNDRED OF ACRES USED FOR LABOR CALCULATIONS
 BID. - BID PRICE ON LAND FROM EACH FARM
 BIDA - TOTAL DISCOUNTED CASH FLOW FROM A PRESPECTIVE LAND PURCHASE
 BIDM - MAXIMUM EXPECTED LANDLORD RETURN
 BIDRET - LANDLORD'S EXPECTED RETURN PER ACRE
 BKSP - INCOME ON WHICH MARGINAL TAX RATE APPLIES
 BRET - BUDGETED RETURN PER ACRE FOR OUTSIDE BIDDER
 BULREP - BUILDING REPAIRS
 BVCPB - BOOK VALUE OF BUILDINGS (ARRAY BY YEAR)
 BVCPB2 - INFLATED REPLACEMENT BOOK VALUE FOR BUILDINGS (ARRAY BY YEAR)
 BVCPM - BOOK VALUE OF MACHINERY (ARRAY BY YEAR)
 BVCPM2 - INFLATED REPLACEMENT BOOK VALUE FOR MACHINERY (ARRAY BY YEAR)
 CAC - CORN ACRES
 CADJ - ACTUAL VARIABLE COST FOR CORN LESS ITEMS THAT VARY IN
 COST BY YIELD
 CAPGAI - TOTAL CAPITAL GAINS IN MACHINERY, BUILDINGS, AND LAND



CAROV - CARRY OVER OF ANY UNUSED TAX CREDIT
 CASHCT - ACTUAL CASH OUTFLOWS
 CASHIN - ACTUAL CASH INFLOW
 CASMIN - CASH REQUIREMENT
 CAST - CURRENT ASSETS
 CBNETW - COST BASIS NET WORTH
 CBUSTO - CORN BUSHELS STORED
 CC - INFLATED VARIABLE COST FOR CORN
 CFL - AFTER TAX NOMINAL CASH FLOWS
 CFLOW - ADJUSTED CASH FLOW-ACCOUNTS FOR BALANCING CURRENT POSITION
 CHCR - REGIONAL AVERAGE PRICE OF CORN
 CHSO - REGIONAL AVERAGE PRICE OF SOYBEANS
 CINV - CHANGE IN GRAIN INVENTORY FROM END OF ONE YEAR TO NEXT
 CLABOR - COST OF HIRED LABOR
 CLMAX - ADDITION TO CONSTRAINT ON CURRENT LOANS (ASSOCIATED WITH
 RELEASING LEASE LAND)
 CLY - CURRENT ONE YEAR LOANS (DISTINGUISHED FROM OPERATING LOAN)
 CLYR - CURRENT LIABILITIES
 CMAX - CONSTRAINT ON CURRENT LIABILITIES (FUNCTION OF GROSS RETURNS)
 CNEG - ABSOLUTE VALUE OF END OF YEAR CASH POSITION
 COBU - FARMER'S SHARE OF CORN BUSHELS
 COFLM - CHARGE FOR FAMILY AND OPERATOR LABOR AND MANAGEMENT
 CONLIB - CONTINGENT LIABILITIES (CAPITAL GAINS TAXES)
 CORCOS - INFLATED VARIABLE COST PLUS OPPORTUNITY COST FOR CORN
 COSACS - COST OF NEW PURCHASE ACRE
 COSCS - NONLAND COSTS PER ACRE FOR OUTSIDE BIDDER
 COSL - COST BASIS FOR LAND
 COSM - COST BASIS OF MACHINERY AND BUILDINGS
 COSMAC - COST OF NEW MACHINERY COMPLEMENT
 COSTBU - COST OF BUILDINGS (ESTIMATE)
 COSTMA - COST OF MACHINERY (ESTIMATE)
 COSTMB - COST OF CURRENT YEAR'S MACHINERY AND BUILDINGS
 COWNEQ - CHANGE IN OWNER EQUITY
 CPI - GENERAL ECONOMY PRICE INDEX
 CSTR - CONSTRAINT ON CURRENT LIABILITIES (FUNCTION OF CURRENT ASSETS)
 CUSWOR - CUSTOM WORK
 CVCAPM - COST FOR AVERAGE MACHINERY COMPLEMENT (\$/ACRE)
 CVCPB - CURRENT VALUE OF BUILDINGS (ARRAY BY YEAR)
 CVCPB - ACTUAL COST OF NEW BUILDINGS (ARRAY BY YEAR)
 CVCPM - CURRENT VALUE OF MACHINERY (ARRAY BY YEAR)
 CVCPM - ACTUAL COST OF NEW MACHINERY (ARRAY BY YEAR)
 CYD - POTENTIAL CORN YIELD
 DEBINT - INTEREST CHARGES ON INTERMEDIATE AND FIXED LOANS
 DEBLAN - OUTSTANDING PRINCIPLE ON FIXED DEBTS (ARRAY BY YEAR)
 DEBNLC - OUTSTANDING PRINCIPLE ON INTERMEDIATE DEBTS (ARRAY BY YEAR)
 DEBPRN - PRINCIPLE CHARGES ON INTERMEDIATE AND FIXED LOANS
 DEBSC - INTEREST CHARGE ON OPERATING LOANS
 DEBSF - INTEREST CHARGES ON FIXED LOANS
 DEBSI - INTEREST CHARGES ON INTERMEDIATE LOANS
 DEDIT - EXCESS TAX DEDUCTIONS
 DEPCB2 - REPLACEMENT DEPRECIATION FOR BUILDINGS
 DEPCIS - TOTAL REPLACEMENT DEPRECIATION
 DEPCM2 - REPLACEMENT DEPRECIATION FOR MACHINERY
 DEPCOS - DEPRECIATION COSTS FOR MACHINERY AND BUILDINGS
 DEPCOS - ACCUMULATED TAXABLE DEPRECIATION
 DEPCS8 - TAXABLE DEPRECIATION FOR BUILDINGS
 DEPCSM - TOTAL DEPRECIATION FOR MACHINERY
 DEPCSM - TAXABLE DEPRECIATION FOR MACHINERY
 DEPEST - ESTIMATE DEPRECIATION ON MACHINERY AND BUILDING IF NEW LAND
 IS PURCHASED

DEPRM - DEPRECIATION VALUE FOR MACHINERY (ARRAY BY YEAR)
 DLN - LAND EQUITY REQUIREMENT OR DOWNPAYMENT ON NEW LAND
 DOWL - DESIRED DOWNPAYMENT ON LAND
 DOWMB - DOWNPAYMENT ON MACHINERY AND BUILDINGS
 OPRC - SHORT-TERM OPERATING LOANS
 DPRF - INTEREST CHARGES ON FIXED LOANS
 DPRI - PRINCIPLE CHARGES ON INTERMEDIATE LOANS
 DRYING - PRICE PER BUSHEL FOR DRYING CORN
 ECASHF - EXPECTED CASH FLOW IF NEW LAND IS PURCHASED
 ECASHI - EXPECTED CASH INFLOW IF NEW LAND IS PURCHASED
 ECASHO - EXPECTED CASH OUTFLOW IF NEW LAND IS PURCHASED
 EXC - EITHER SHORT-RUN OR LONG-RUN PRICE EXPECTATIONS ON CORN
 EXCOSE - EXPECTED VARIABLE COSTS ASSOCIATED WITH CORN AND SOYBEANS
 EXCOST - ESTIMATE OF CASH NEEDS TO GET TO NEXT HARVEST
 EXFNET - EXPECTED NET TAXABLE FARM INCOME IF NEW LAND IS PURCHASED
 EXPC - SHORT RUN EXPECTED REGIONAL PRICE FOR SOYBEANS
 EXPCL - LONG RUN EXPECTED REGIONAL PRICE FOR CORN
 EXPRET - EXPECTED NET RETURN PER ACRE (NO LAND CHARGES)
 EXR - EXPECTED NOMINAL RETURN USED IN EVALUATING CASH FLOW
 EXS - EITHER SHORT-RUN OR LONG-RUN PRICE EXPECTATIONS ON SOYBEANS
 FAC - PRESENT VALUE FACTOR USED TO PLACE VARIABLES IN 1979 DOLLARS
 FACTAX - DISCOUNT FACTOR FOR INDEXING TAXES
 FAM - FAMILY LIVING EXPENSES
 FAML - FAMILY AND OPERATOR LABOR
 FC - FERTILIZER COST FOR CORN
 FEDTAX - FEDERAL TAX
 FI - FIXED INTEREST IF NEW LAND IS PURCHASED
 FIXAT - FIXED ASSETS
 FIXCOS - TOTAL FIXED COSTS
 FIXLB - FIXED LIABILITIES
 FNET - NET TAXABLE FARM INCOME (INCLUDES GRAIN AND CUSTOM WORK)
 FNETIN - ACCRUAL FARM INCOME (ACCOUNTS FOR INVENTORY CHANGE)
 FS - FERTILIZER COST FOR SOYBEANS
 FYR - FIRST YEAR ACCELERATED DEPRECIATION
 GRANIN - PREVIOUS YEAR'S GRAIN INVENTORY VALUED AT HARVEST PRICE
 GRET - GROSS FARM INCOME FROM GRAIN
 GRETS - GROSS RETURNS PER ACRE FOR OUTSIDE BIDDER
 GRINV - VALUE OF GRAIN INVENTORY
 HAUL - PRICE PER BUSHEL FOR HAULING GRAIN
 HRVPRC - HARVEST PRICE FOR CORN (OCT-DEC)
 HRVPRS - HARVEST PRICE FOR SOYBEANS (OCT-DEC)
 IDPR - DEPRECIATION METHOD
 ITXBS - TAX THAT CORRESPONDS TO LOWER INCOME VALUE (LWBK)
 LABFAC - TOTAL LABOR CHARGE
 LWBK - LOWER INCOME VALUE FOR RELEVANT TAX BRACKET
 MINTX - MINIMUM TAX
 OUTINC - OUTSIDE INCOME
 PARTCF - ESTIMATE OF YEAR'S END CASH OUTFLOW
 PCINF - INFLATION FACTOR FOR COST OF PRODUCTION
 PERC - PERCENT OF ACREAGE PLANTED IN CORN
 PINC1 - TAXABLE INCOME BEFORE TAX EXEMPTIONS-PREVIOUS YEAR
 PINC2 - TAXABLE INCOME BEFORE TAX EXEMPTIONS-TWO YEARS BACK
 PINC3 - TAXABLE INCOME BEFORE TAX EXEMPTIONS-THREE YEARS BACK
 PINC4 - TAXABLE INCOME BEFORE TAX EXEMPTIONS-FOUR YEARS BACK
 PNITO - PRICE PER POUND OF ACTUAL NITROGEN
 POSTHC - POST HARVEST PRICE FOR CORN (JAN-SEPT)
 POSTHS - POST HARVEST PRICE FOR SOYBEANS (JAN-SEPT)
 PRACR2 - SECOND HIGHEST BID PRICE ON LAND
 PRCNET - NET PER BUSHEL PRICE OF CORN
 PRINPY - TOTAL PRINCIPAL PAYMENTS

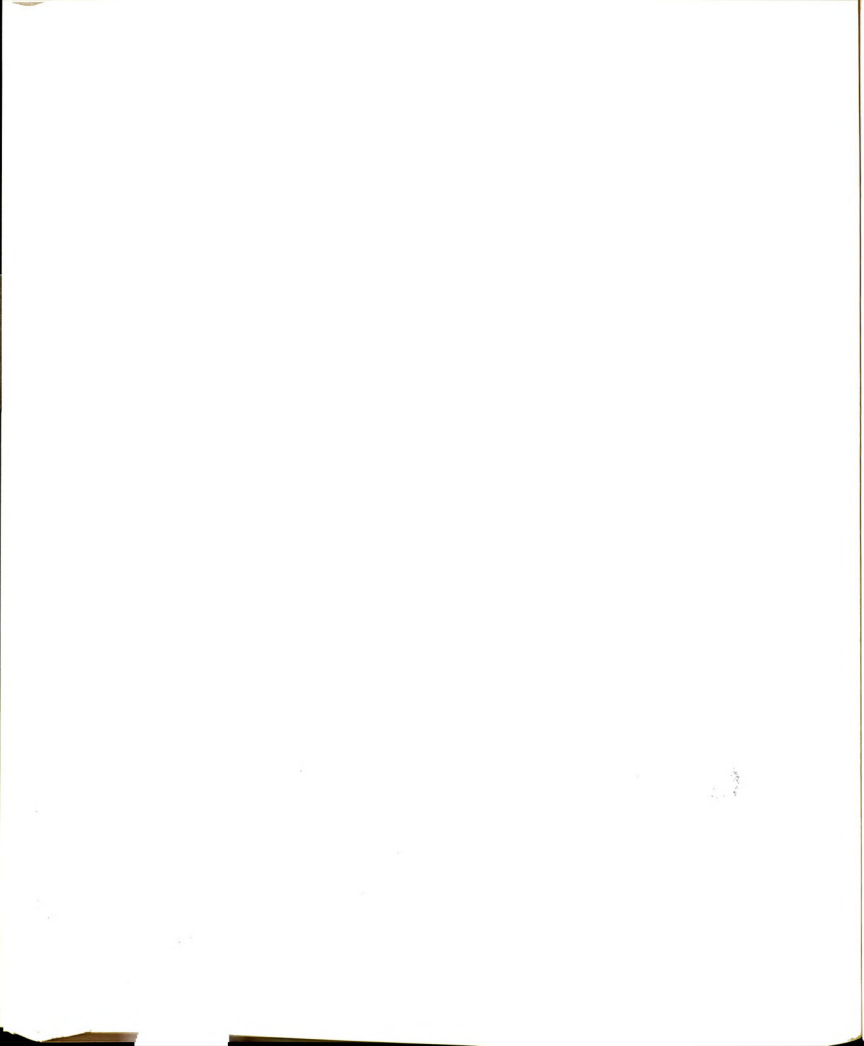
PROTAX - PROPERTY TAXES
 PRSNET - NET PER BUSHEL PRICE OF SOYBEANS
 PVM - EXPECTED EXPENDITURE ON MACHINERY AND BUILDINGS IF NEW LAND IS
 PURCHASED
 QPUR - PURCHASE LAND STOPPER
 QLEA - LEASE LAND STOPPER
 RATMAH - CURRENT YEAR'S RATIO OF ACTUAL MACHINERY COMPLEMENT
 REFLAN - REFINANCED LAND
 RENCOS - CASH RENTAL CHARGES
 RENFIR - LEASE FACTOR OF FARMER'S SHARE OF INSURANCE AND BUILDING
 RENFSC - LEASE FACTOR OF FARMER'S SHARE OF VARIABLE COSTS AND RETURNS
 REPNEED - REPLACEMENT NEEDS FOR MACHINERY AND BUILDINGS
 REQ - REQUIRED CURRENT VALUE OF MACHINERY (OR BUILDINGS) TO MATCH
 DESIRED INVESTMENT
 RESERV - DESIRED CREDIT AND CASH RESERVES
 RESLTL - REMAINING BORROWING CAPACITY ASSOCIATED WITH OWNED LAND
 RET - EXPECTED RETURN TO AN ACRE OF CORN AND SOYBEANS UNDER DIFFERENT
 CROP MIXES
 RETALL - ACCRUAL RETURN TO CAPITAL (CHARGES OUT FOR LABOR AND
 MANAGEMENT)
 RETU - ACTUAL NET RETURN PER ACRE (NO LAND CHARGES)
 REV - NET RETURN TO CORN ABOVE NITROGEN COSTS
 SAC - SOYBEAN ACRES
 SADJ - ACTUAL VARIABLE COST FOR SOYBEANS LESS ITEMS THAT VARY IN
 COST BY YIELD
 SALM - SALVAGE VALUE OF MACHINERY
 SBUSTO - SOYBEAN BUSHEL'S STORED
 SC - INFLATED VARIABLE COST FOR SOYBEANS
 SDC - SEED AND CROP EXPENSES FOR CORN
 SDS - SEED AND CROP EXPENSES FOR SOYBEANS
 SELPR - SELLING PRICE OF LAND PARCEL
 SOBU - FARMER'S SHARE OF SOYBEAN BUSHEL'S
 SOCSEC - SOCIAL SECURITY TAX
 SOYCOS - INFLATED VARIABLE COST PLUS OPPORTUNITY COST FOR SOYBEANS
 STOFAC - STORAGE FACTOR USED TO ADJUST PERCENT STORED
 SYD - POTENTIAL SOYBEAN YIELD
 TAXCOS - ESTIMATED TAXABLE EXPENSES IF NEW LAND IS PURCHASED
 TAXCT - TAXABLE COST ITEMS
 TAXIA - TAX COMPUTED FROM INCOME AVERAGING
 TAXIN - CURRENT YEAR'S TAXABLE INCOME BEFORE TAX EXEMPTIONS
 TAXINA - ADJUSTED CURRENT YEAR'S TAXABLE INCOME
 TAXINE - ESTIMATED INCOME THAT TAXES WILL BE PAID ON NEW LAND IS
 PURCHASED
 TAXR - TAX FROM STANDARD TAX METHOD
 TAXST - STATE TAXES
 TAX1 - AN INTERMEDIATE VALUE FOR CALCULATING TAXIA
 TAX2 - AN INTERMEDIATE VALUE FOR CALCULATING TAXINA
 TCL - COST OF NEW LAND PURCHASE
 TCR - INITIAL INVESTMENT TAX CREDIT
 TCY - TOTAL CURRENT VALUE OF MACHINERY (OR BUILDINGS) BEFORE NEW PURCH.
 TEST - ACCEPTABLE LEVEL OF EXPECTED CASH FLOW BEFORE CONSIDERING
 PURCHASE OF NEW LAND
 TINVC - INVESTMENT TAX CREDIT
 TNFINC - GROSS NON-FARM INCOME
 TOTCOE - CHANGE IN CURRENT MARKET VALUE OWNER EQUITY
 TOTDOW - TOTAL DOWNPAYMENT OR REQUIRED EQUITY IN LAND
 TOTIN - INCOME VALUE USED FOR FAMILY LIVING-ACCRUAL FARM INCOME
 LESS TAXES
 TOTRES - TOTAL CREDIT REVENUE
 TOTREV - TOTAL HARVEST VALUE OF CURRENT YEAR'S GRAIN

TOT30 - THIRTY PERCENT OF THE SUM OF THE PREVIOUS FOUR YEARS ADJUSTED
 TAXABLE INCOME
 TV(1) - PRESENT VALUES FOR EACH YEAR'S ACCRUAL FARM INCOME
 TV(2) - PRESENT VALUES FOR EACH YEAR'S TAXABLE FARM INCOME
 TV(3) - PRESENT VALUES FOR EACH YEAR'S TAXES AND SOCIAL SECURITY
 TV(4) - PRESENT VALUES FOR EACH YEAR'S FAMILY LIVING EXPENDITURES
 TXBK - TAX BRACKET FROM STANDARD TAX METHOD
 TXBKIA - TAX BRACKET FROM INCOME AVERAGING METHOD
 TXBKR - TAX BRACKET FROM STANDARD METHOD
 TXIN1 - ADJUSTED TAXABLE INCOME-PREVIOUS YEAR
 TXIN2 - ADJUSTED TAXABLE INCOME-TWO YEARS BACK
 TXIN3 - ADJUSTED TAXABLE INCOME-THREE YEARS BACK
 TXIN4 - ADJUSTED TAXABLE INCOME-FOUR YEARS BACK
 UCAPGA - NET UNREALIZED CAPITAL GAINS (CAPITAL GAINS TAXES OUT)
 V(1) - PRESENT VALUE AVERAGE ACCRUAL FARM INCOME (OVER PLANNING HORIZON)
 V(2) - PRESENT VALUE AVERAGE TAXABLE FARM INCOME (OVER PLANNING HORIZON)
 V(3) - PRESENT VALUE AVERAGE TAXES AND SOCIAL SECURITY (OVER PLANNING
 HORIZON)
 V(4) - PRESENT VALUE AVERAGE FAMILY LIVING EXPENDITURE (OVER PLANNING
 HORIZON)
 V(5) - OWNED ACRES ACQUIRED OVER THE PERIOD
 V(6) - LEASED ACRES ACQUIRED OVER THE PERIOD
 V(7) - ENDING NET WORTH (NOMINAL DOLLARS)
 V(8) - ANNUAL REAL GROWTH IN NET WORTH
 V(9) - MAXIMUM PRESENT VALUE ACCRUAL FARM INCOME
 V(10) - MINIMUM PRESENT VALUE ACCRUAL FARM INCOME
 V(11) - MAXIMUM PRESENT VALUE TAXABLE FARM INCOME
 V(12) - MINIMUM PRESENT VALUE TAXABLE FARM INCOME
 VARCOS - TOTAL VARIABLE COSTS
 VCCRN - VARIABLE COST FOR CORN, INCLUDES ALL LABOR AND MANAGEMENT
 VCOSCR - ACTUAL VARIABLE COSTS FOR CORN, ACCOUNTING FOR YIELD
 VARIABILITY
 VCOSSO - ACTUAL VARIABLE COSTS FOR SOYBEANS, ACCOUNTING FOR YIELD
 VARIABILITY
 VCSOY - VARIABLE COST FOR SOYBEANS, INCLUDES ALL LABOR AND MANAGEMENT
 WERM - WEAR OUT RATE OF MACHINERY (ARRAY BY YEAR)
 WORNET - MARKET VALUE NET WORTH
 XI - INTERMEDIATE INTEREST IF NEW LAND IS PURCHASED
 XIMED - INTERMEDIATE ASSETS
 XIMEDL - INTERMEDIATE LIABILITIES
 XINERN - INTEREST EARNING ON ANY OUTSIDE INVESTMENT
 XINSUR - INSURANCE CHARGES
 XINVSB - RATIO OF DESIRED TO AVERAGE BUILDING COMPLEMENT/ACRE
 XINVSM - RATIO OF DESIRED TO AVERAGE MACHINERY COMPLEMENT/ACRE
 XLABT - TOTAL LABOR REQUIREMENTS
 XLANIN - LAND INDEX
 XLIB - TOTAL LIABILITIES
 XMAH - AVERAGE MACHINERY INVESTMENT REQUIRED (\$/ACRE)
 XMARTX - EXPECTATIONS ON MARGINAL TAX BRACKET
 XMAX - MAXIMUM FAMILY LIVING CONSTRAINT
 XMC - MACHINERY REPAIR COST FOR CORN
 XMIN - MINIMUM FAMILY LIVING CONSTRAINT
 XMS - MACHINERY REPAIR COST FOR SOYBEANS
 XMTR - ACTUAL MARGINAL TAX BRACKET (CURRENT YEAR)
 YC - EXPECTED YIELD OF CORN ADJUSTED BY CROP MIX
 YS - EXPECTED YIELD OF SOYBEANS ADJUSTED BY CROP MIX

APPENDIX C

UNIVERSITY OF ILLINOIS COSTS DATA

This study relies on costs data developed by the University of Illinois from records kept in cooperation with the Illinois Farm Management Associations. Two of the data sources are reproduced in this appendix in order to provide the reader further opportunity to familiarize himself/herself with the Region studied and the format of major data sources.



APPENDIX C

UNIVERSITY OF ILLINOIS COSTS DATA

This study relies on costs data developed by the University of Illinois from records kept in cooperation with the Illinois Farm Management Associations. Two of the data sources are reproduced in this appendix in order to provide the reader further opportunity to familiarize himself/herself with the Region studied and the format of major data sources.

TABLE C.1¹Average Costs, Return, and Financial Summary of Grain Farms by Size and High Soil Rating, Northern Illinois, 1978^a

Range in size (total acres).....	GRAIN FARMS WITH SOIL RATING 86-100 ^{b/}									
	180-259 Number of farms.....	260-339 83	340-499 264	500-649 166	650-799 113	800-949 67	950-1199 36	1200-1999 30		
Size of farm.....	223	301	419	573	716	862	1,053	1,474		
Acres of tillable land.....	215	289	403	552	690	824	1,005	1,401		
Soil rating on tillable land.....	94	94	94	93	93	94	93	94		
DOLLAR COSTS PER FARM										
Soil fertility.....	\$ 7,712	\$ 7,937	\$ 11,256	\$ 16,073	\$ 19,510	\$ 22,458	\$ 30,692	\$ 37,797		
Buildings and fence.....	2,315	2,330	3,101	3,949	4,394	5,458	5,994	8,119		
Machinery and equipment.....	11,832	14,686	20,827	27,605	31,968	40,657	49,258	67,325		
Labor.....	10,792	10,715	12,007	14,460	17,146	19,412	23,761	32,046		
Taxes.....	4,027	5,051	7,186	9,646	11,932	14,428	16,930	22,994		
Seed and crop expenses.....	5,069	7,257	10,275	13,917	18,358	21,352	24,564	36,838		
Livestock expense.....	41	65	67	55	139	81	50	92		
Insurance and miscellaneous expense.....	1,500	2,011	2,726	3,432	4,025	4,937	6,156	8,604		
Interest on capital.....	27,863	36,035	50,296	68,084	85,129	101,981	122,496	170,926		
Total non-feed costs.....	71,151	86,065	117,821	158,021	192,601	230,763	279,900	384,731		
Total value of feed fed.....	24	56	79	67	111	113	26	247		
DOLLAR RETURNS PER FARM										
Feed and grain returns.....	\$ 64,245	\$ 84,369	\$ 110,711	\$ 164,438	\$ 205,609	\$ 244,465	\$ 293,864	\$ 422,017		
Livestock return above feed.....	59	75	101	155	155	341	78	283		
Custom work.....	898	949	1,245	1,474	2,079	2,756	3,811	4,225		
Other cash income.....	1,103	906	1,435	2,311	2,466	2,864	2,870	4,225		
Value of farm production.....	66,304	86,299	121,492	168,229	210,330	250,425	300,623	431,465		
Management returns.....	-4,847	213	3,671	10,209	17,729	19,662	20,723	46,724		
Farm production per \$1.00 of non-feed costs.....	.93	1.00	1.03	1.06	1.09	1.09	1.07	1.12		
Farm production per man.....	65,009	82,952	104,626	119,071	128,321	134,058	132,061	147,202		
FINANCIAL SUMMARY										
Cash sales.....	\$ 66,489	\$ 81,033	\$ 113,322	\$ 154,296	\$ 193,110	\$ 232,089	\$ 270,656	\$ 305,041		
Sales of capital items.....	727	742	509	1,449	910	825	2,644	2,856		
Total cash income.....	67,215	81,775	113,831	155,745	194,020	232,914	273,300	307,897		
Purchased livestock.....	20	37	137	197	414	483	56	165		
Purchased feed.....	135	129	361	232	632	1,422	639	4,491		
Cash operating expenses.....	25,751	30,604	43,614	61,043	74,756	91,023	117,016	157,273		
Purchase of capital items.....	-8,990	10,639	15,203	22,624	25,133	31,990	41,406	52,209		
Total cash expenditures.....	34,914	41,409	59,315	84,096	100,396	124,918	159,117	214,133		
Cash balance.....	\$ 32,301	\$ 40,335	\$ 54,516	\$ 71,648	\$ 93,084	\$ 107,996	\$ 122,182	\$ 173,759		
Inventory change.....	-27	5,346	8,632	14,345	18,226	20,208	22,662	51,062		
Capital change.....	1,063	822	1,397	3,906	3,997	5,751	11,491	10,632		
Farm products consumed.....	8	36	36	17	40	33	0	16		
Net farm earnings.....	33,345	46,539	64,501	89,917	115,347	133,988	156,336	235,471		
Labor and mgt. earnings.....	5,269	10,276	13,727	20,442	28,074	29,908	30,202	57,632		
Capital and mgt. earnings per acre.....	103.08	120.45	128.73	138.03	143.69	141.10	136.61	149.13		
Rate earned on invest. ²	3.55	4.25	4.56	4.88	5.11	5.04	4.93	5.35		

a/ Variations in totals are due to rounding to the nearest dollar. High soil ratings (86-100) include farms with nearly level well-drained prairie soils.

b/ Value of feed fed to livestock was less than one percent of feed and grain returns.

1. Reproduced from "1978 54th Annual Summary of Illinois Farm Business Records."

TABLE C.2¹Average Operating Costs, Investments, and Land Use of Grain Farms by Size and High Soil Rating, Northern Illinois, 1978^a

GRAIN FARMS WITH SOIL RATING 86-100 ^b									
	180-259	260-339	340-499	500-649	650-799	800-949	950-1199	1200-1999	
Range in size (total acres).....	41	88	264	166	113	67	36	30	
Number of farms.....	41	88	264	166	113	67	36	30	
COSTS AND RETURNS PER									
TILLABLE ACRE									
Soil fertility.....	\$ 35.92	\$ 27.44	\$ 27.95	\$ 29.11	\$ 28.28	\$ 27.25	\$ 30.54	\$ 26.90	\$
Buildings and fence.....	10.70	8.05	7.90	7.15	6.37	6.62	5.96	5.79	
Machinery and equipment.....	55.11	50.78	51.73	50.00	46.34	49.34	49.01	40.06	
Labor.....	50.27	37.05	29.82	26.19	24.85	23.55	23.64	22.87	
Value of feed fed.....	.11	.19	.19	.12	.16	.13	.02	.17	
Feed and grain returns.....	299.28	291.75	294.87	297.89	298.08	296.68	292.43	301.28	
Livestock return above feed.....	.27	.25	.24	.01	.22	.41	.07	.20	
Value of farm productions.....	300.88	298.42	301.78	304.76	304.92	303.91	299.16	300.02	
Total non-feed costs.....	331.46	297.69	292.67	286.27	279.22	280.06	278.54	274.67	
Management returns.....	-22.58	.73	9.11	18.49	25.70	23.86	20.62	33.35	
SELECTED COST ITEMS									
Fertilizer, annual.....	\$ 7.12	\$ 7.937	\$ 11.256	\$ 16.070	\$ 19.510	\$ 22.436	\$ 30.692	\$ 37.797	
Building repairs.....	726	855	967	1,201	1,050	1,857	2,397	3,112	
Machinery depreciation.....	1,588	1,475	2,214	2,668	3,344	3,601	3,597	5,007	
Machinery and equipment depreciation.....	5,620	7,600	11,082	14,598	16,882	21,792	23,675	33,714	
Machinery repairs, supplies.....	2,338	2,740	3,963	5,902	6,483	8,510	11,361	14,390	
Machinery hire.....	879	913	1,136	1,082	1,270	1,573	3,446	5,087	
Gasoline and oil.....	1,863	2,296	4,192	4,313	5,306	6,795	8,292	10,692	
Unpaid labor charge.....	10,379	10,291	10,615	10,825	12,403	12,345	13,110	17,821	
Hired labor charge.....	463	424	1,393	3,635	4,657	7,066	10,643	14,225	
Total months of labor.....	12.2	12.5	13.9	17.0	19.7	22.4	27.3	35.2	
Months of hired labor.....	.4	.7	1.8	4.6	5.4	8.3	12.3	14.8	
FARM INVESTMENT									
Livestock inventory.....	\$ 75	\$ 146	\$ 202	\$ 281	\$ 542	\$ 690	\$ 80	504	
Grain inventory.....	53,435	62,765	88,552	127,493	150,855	176,877	215,020	294,456	
Remaining capital cost in.....									
Buildings and auto.....	21,578	27,912	40,897	53,551	62,426	81,220	97,007	130,982	
Machinery and fence.....	13,764	13,656	21,427	26,887	33,426	35,538	35,411	50,301	
Soil fertility.....	0	0	0	6	2	227	0	0	
Value of land (current).....	556,622	740,021	1,032,684	1,411,520	1,766,195	2,119,363	2,559,135	3,589,914	
Total Farm Investment.....	647,433	852,501	1,163,622	1,619,730	2,013,445	2,413,916	2,906,172	4,066,167	
Total investment per acre.....	2,699.66	2,832.65	2,023.77	2,824.39	2,812.73	2,800.12	2,761.37	2,759.39	
Machinery investment per tillable acre.....	100.52	96.52	101.58	97.01	90.50	98.57	96.61	93.50	
PERCENT OF TILLABLE LAND IN									
Corn and corn silage.....	52.0	51.0	51.8	52.4	53.5	52.7	54.7	56.4	
Soybeans.....	43.2	45.0	43.8	43.5	43.2	42.3	40.7	41.8	
Wheat.....	.0	.1	.1	.1	.3	.9	.5	.5	
Other small grains.....	.0	.1	.1	.1	.1	.1	.1	.0	
Diverted acres.....	1.2	.6	.9	.6	.9	.6	.8	.5	
All hay and pasture crops.....	.1	.3	.2	.2	.5	.4	.3	.2	
CROP YIELDS, bu. per acre									
Corn.....	130	128	130	130	132	129	130	130	
Soybeans.....	42	42	42	42	43	43	43	43	
Wheat.....	0	43	36	42	46	35	--	43	
Oats.....	0	70	58	45	45	49	52	10	

a/ Variations in totals are due to rounding to the nearest dollar. High soil ratings (86-100) include farms with nearly level well-drained prairie soils.

b/ Value of feed fed to livestock was less than one percent of feed and grain returns.

1 Reproduced from "1978 54th Annual Summary of Illinois Farm Business Records."

TABLE C.3
COSTS FOR CORN, CENTRAL ILLINOIS GRAIN FARMS

	1968-71	1972	1973	1974	1975	1976	1977	1978	1979	1980
CORN										
Non-land costs per acre										
Variable costs:										
Soil fertility.....	\$ 17	\$ 18	\$ 26	\$ 40	\$ 48	\$ 46	\$ 40	\$ 41	\$ 50	
Seed, crop, & drying.....	14	15	15	22	25	30	32	33	39	
Mchy. repair, fuel & hire	13	12	14	16	18	19	19	21	25	
Total variable.....	\$ 44	\$ 45	\$ 55	\$ 78	\$ 91	\$ 95	\$ 91	\$ 95	\$114	
Other non-land costs;										
Labor.....	\$ 14	\$ 18	\$ 18	\$ 19	\$ 21	\$ 24	\$ 25	\$ 26	\$ 27	
Building and storage.....	5	5	5	6	6	7	8	9	10	
Mchy. depreciation.....	11	14	15	18	21	24	26	27	30	
Non-land interest.....	11	13	14	21	25	29	31	28	37	
Overhead.....	4	4	5	6	7	8	9	9	10	
Total other.....	\$ 45	\$ 54	\$ 57	\$ 70	\$ 80	\$ 92	\$ 99	\$ 99	\$114	
Total non-land costs...	\$ 89	\$ 99	\$112	\$148	\$171	\$187	\$190	\$194	\$228	
Land costs per acre										
Taxes.....	\$ 10	\$ 12	\$ 12	\$ 12	\$ 13	\$ 14	\$ 16	\$ 18	\$ 18	
Adjusted net rent.....	28	38	43	58	70	87	94	96	103	
Total land cost.....	\$ 38	\$ 50	\$ 55	\$ 70	\$ 83	\$101	\$110	\$114	\$121	
Total, all costs per acre...	\$127	\$149	\$167	\$218	\$254	\$288	\$300	\$308	\$349	
Yield per acre, bushel.....	117	133	130	103	148	143	121	132	148	
Non-land costs per bushel...	\$.76	\$.74	\$.86	\$1.44	\$1.16	\$1.31	\$1.57	\$1.47	\$1.54	
All costs per bushel.....	1.09	1.12	1.28	2.11	1.72	2.01	2.48	2.33	2.36	
Prices received.....	1.14	1.12	1.55	2.73	2.79	2.54	2.10	2.09	2.33	

*Prepared in Department of Agricultural Economics, University of Illinois, from data summarized from records kept in cooperation with Illinois Farm Management Associations, March, 1980.

TABLE C.4

COSTS FOR SOYBEANS, CENTRAL ILLINOIS GRAIN FARMS

	1968-71	1972	1973	1974	1975	1976	1977	1978	1979	1980
SOYBEANS										
Non-land costs per acre										
Variable costs:										
Soil fertility.....	\$ 7	\$ 8	\$ 9	\$ 12	\$ 14	\$ 12	\$ 12	\$ 13	\$ 16	
Seed, crop, & drying.....	9	13	17	18	20	20	21	21	25	
Mchy. repair, fuel & hire	8	11	12	14	16	16	17	18	21	
Total variable.....	\$ 24	\$ 32	\$ 38	\$ 44	\$ 50	\$ 48	\$ 50	\$ 52	\$ 62	
Other non-land costs:										
Labor.....	\$ 14	\$ 18	\$ 18	\$ 19	\$ 20	\$ 23	\$ 24	\$ 26	\$ 27	
Building and storage.....	2	3	3	4	4	4	4	5	5	
Mchy. depreciation.....	10	12	13	16	18	20	22	23	25	
Non-land interest.....	8	10	11	19	24	27	29	26	33	
Overhead.....	4	4	5	6	6	8	8	9	10	
Total other.....	\$ 38	\$ 47	\$ 50	\$ 64	\$ 72	\$ 82	\$ 88	\$ 89	\$ 100	
Total non-land costs...	\$ 62	\$ 79	\$ 88	\$ 108	\$ 122	\$ 130	\$ 138	\$ 141	\$ 162	
Land costs per acre										
Taxes.....	\$ 10	\$ 12	\$ 12	\$ 12	\$ 13	\$ 14	\$ 16	\$ 18	\$ 18	
Adjusted net rent.....	28	38	43	53	70	87	94	96	103	
Total land cost.....	\$ 38	\$ 50	\$ 55	\$ 70	\$ 83	\$ 101	\$ 110	\$ 114	\$ 121	
Total, all costs per acre...	\$ 100	\$ 129	\$ 143	\$ 178	\$ 205	\$ 231	\$ 248	\$ 255	\$ 283	
Yield per acre, bushel.....	40	45	40	31	45	42	46	43	45	
Non-land costs per bushel...	\$ 1.55	\$ 1.76	\$ 2.20	\$ 3.48	\$ 2.71	\$ 3.10	\$ 3.00	\$ 3.28	\$ 3.60	
All costs per bushel.....	2.50	2.87	3.58	5.75	4.56	5.50	5.39	5.93	6.29	
Prices received.....	2.73	3.21	4.41	6.08	5.69	5.60	7.11	6.09	6.92	

*Prepared in Department of Agricultural Economics, University of Illinois, from data summarized from records kept in cooperation with Illinois Farm Management Associations, March, 1980.

APPENDIX D

LESS REVEALING MONTE CARLO SUMMARY TABLES

This Appendix contains Monte Carlo Summary Tables that are considered less revealing. The discussion of Tables D.1-D.10 appears in Chapter VI. Tables D.11-D.21 correspond to analyses that appear in Chapter VII.

TABLE D.1

BASE RUN WITH 50 SIMULATIONS

MONTE CARLO SUMMARY FOR 50 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18818.	29201.	31153.	29870.
DISPERSION=	5496.	11260.	14964.	19121.
MEASURE OF VAR=	.29	.39	.48	.64

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	9302.	16217.	16166.	13048.
DISPERSION=	3403.	7869.	10319.	13356.
MEASURE OF VAR=	.37	.49	.64	1.02

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1810.	3326.	3509.	3066.
DISPERSION=	1075.	2725.	2457.	1902.
MEASURE OF VAR=	.59	.82	.70	.62

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17086.	17633.	17735.	17368.
DISPERSION=	646.	1422.	1688.	1967.
MEASURE OF VAR=	.04	.08	.10	.11

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1088124.	2387250.	3654240.	5018888.
DISPERSION=	138121.	269690.	472614.	643867.
MEASURE OF VAR=	.13	.11	.13	.13

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0800	.1200	.14600	.6800
DISPERSION=	.4445	.4798	1.0144	1.3161
MEASURE OF VAR=	5.5558	3.9983	2.2052	1.9355

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0291	.0406	.0436	.0477
DISPERSION=	.0116	.0106	.0120	.0121
MEASURE OF VAR=	.3988	.2604	.2754	.2533

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1999	.2752	.2980	.2702
DISPERSION=	.1014	.0765	.0703	.0538
MEASURE OF VAR=	.5070	.2780	.2358	.1990

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	18.	129.	247.	333.
DISPERSION=	27.	44.	79.	85.
MEASURE OF VAR=	1.53	.35	.32	.26

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	311.	282.	277.	199.
DISPERSION=	237.	178.	172.	150.
MEASURE OF VAR=	.76	.63	.62	.76

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	629.	1010.	1424.	1732.
DISPERSION=	235.	177.	174.	131.
MEASURE OF VAR=	.37	.17	.12	.08

NUMBER OF BIDS ON LAND	115	263	296	277
PERCENT OF POSSIBLE BIDS	22	52	59	55
TOTAL PARCELS PURCHASED	17	81	122	151

TABLE D.2

BASE RUN WITH 100 SIMULATIONS

MONTE CARLO SUMMARY FOR 100 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	18529.	32609.	32405.
DISPERSION=	6021.	13239.	14626.
MEASURE OF VAR=	.32	.41	.45
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	9372.	17730.	16457.
DISPERSION=	3798.	9247.	9332.
MEASURE OF VAR=	.41	.52	.57
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-			
MEAN VALUES =	1926.	3777.	3352.
DISPERSION=	1235.	3435.	2405.
MEASURE OF VAR=	.64	.91	.72
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-			
MEAN VALUES =	17020.	17996.	17794.
DISPERSION=	841.	1469.	1752.
MEASURE OF VAR=	.05	.08	.10
ENDING NET WORTH -NOMINAL DOLLARS-			
MEAN VALUES =	1106036.	2442840.	3765526.
DISPERSION=	132965.	282111.	463370.
MEASURE OF VAR=	.12	.12	.12
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD			
MEAN VALUES =	.1200	.0700	.3700
DISPERSION=	.4981	.3555	.8367
MEASURE OF VAR=	4.1506	5.0782	2.2614
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)			
MEAN VALUES =	.0307	.0427	.0465
DISPERSION=	.0110	.0107	.0115
MEASURE OF VAR=	.3589	.2512	.2463
ENDING DEBT/ASSET RATIO			
MEAN VALUES =	.2024	.2719	.2958
DISPERSION=	.0980	.0778	.0705
MEASURE OF VAR=	.4844	.2862	.2383
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	21.	128.	258.
DISPERSION=	28.	47.	83.
MEASURE OF VAR=	1.33	.37	.32
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	274.	310.	248.
DISPERSION=	241.	180.	155.
MEASURE OF VAR=	.88	.58	.63
ENDING TOTAL TILLABLE ACRES CONTROLLED			
MEAN VALUES =	596.	1037.	1405.
DISPERSION=	236.	181.	159.
MEASURE OF VAR=	.40	.17	.11
NUMBER OF BIDS ON LAND			
PERCENT OF POSSIBLE BIDS	232	538	604
TOTAL PARCELS PURCHASED	41	53	60
		159	250
			554
			55
			299

TABLE D.3

EXISTING ACRES REQUIRED TO COVER A NEWLY
PURCHASED ACRE INCREASE TO 5

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	17765.	28260.	31197.	29698.
DISPERSION=	6323.	13210.	16224.	21511.
MEASURE OF VAR=	.36	.47	.52	.72

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	8684.	15963.	17285.	14130.
DISPERSION=	3505.	9329.	12582.	13638.
MEASURE OF VAR=	.40	.58	.73	.97

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1630.	3417.	3998.	3488.
DISPERSION=	945.	3251.	2880.	2497.
MEASURE OF VAR=	.58	.95	.72	.72

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16882.	17435.	17831.	17280.
DISPERSION=	773.	1619.	1750.	2188.
MEASURE OF VAR=	.05	.09	.10	.13

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1090782.	2382299.	3617030.	5009952.
DISPERSION=	146556.	293009.	503518.	718467.
MEASURE OF VAR=	.13	.12	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.1200	.2000	.5200	.6800
DISPERSION=	.6000	.6455	1.1225	1.2152
MEASURE OF VAR=	5.0000	3.2275	2.1586	1.7870

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0293	.0403	.0426	.0473
DISPERSION=	.0124	.0116	.0127	.0135
MEASURE OF VAR=	.4228	.2870	.2977	.2843

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2186	.2746	.3048	.2694
DISPERSION=	.0889	.0779	.0704	.0429
MEASURE OF VAR=	.4069	.2836	.2310	.1593

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	22.	131.	253.	334.
DISPERSION=	28.	45.	86.	72.
MEASURE OF VAR=	1.27	.35	.34	.22

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	320.	269.	262.	210.
DISPERSION=	242.	167.	172.	154.
MEASURE OF VAR=	.76	.62	.66	.74

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	642.	1000.	1415.	1744.
DISPERSION=	233.	160.	177.	129.
MEASURE OF VAR=	.36	.16	.12	.07

NUMBER OF BIDS ON LAND	65	135	156	143
PERCENT OF POSSIBLE BIDS	26	54	62	57
TOTAL PARCELS PURCHASED	11	37	66	76

TABLE D.4

INFLATING CONTROL VARIABLES AT 2 PERCENT PER YEAR

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES	
INITIAL NET WORTH= 332820	647431	958180	1261250	
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18000.	28774.	30326.	32155.
DISPERSION=	4204.	13208.	20155.	19554.
MEASURE OF VAR=	.23	.46	.66	.61
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	10012.	15856.	15700.	16297.
DISPERSION=	3484.	9133.	12147.	10577.
MEASURE OF VAR=	.35	.58	.77	.65
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	2211.	3331.	3710.	3567.
DISPERSION=	1325.	3111.	3065.	2520.
MEASURE OF VAR=	.60	.93	.83	.71
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16970.	17500.	17368.	17591.
DISPERSION=	539.	1349.	2161.	1892.
MEASURE OF VAR=	.03	.08	.12	.11
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1064992.	2370062.	3665298.	4989527.
DISPERSION=	145748.	270905.	534097.	711676.
MEASURE OF VAR=	.14	.11	.15	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0400	.2400	.6000	.4400
DISPERSION=	.2000	.8794	1.0801	.7118
MEASURE OF VAR=	5.0000	3.6641	1.8002	1.6177
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0270	.0399	.0437	.0470
DISPERSION=	.0124	.0107	.0135	.0132
MEASURE OF VAR=	.4575	.2687	.3095	.2811
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1683	.2735	.2704	.2693
DISPERSION=	.0891	.0726	.0600	.0516
MEASURE OF VAR=	.5291	.2654	.2219	.1918
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	14.	126.	226.	331.
DISPERSION=	28.	43.	80.	91.
MEASURE OF VAR=	1.94	.34	.35	.27
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	210.	325.	285.	242.
DISPERSION=	180.	217.	219.	199.
MEASURE OF VAR=	.86	.67	.77	.83
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	524.	1051.	1410.	1773.
DISPERSION=	183.	218.	203.	174.
MEASURE OF VAR=	.35	.21	.14	.10
NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	57	129	142	152
TOTAL PARCELS PURCHASED	22	51	56	60
	6	40	53	82

TABLE D.5

INFLATING CONTROL VARIABLES AT 5 PERCENT PER YEAR

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18638.	28812.	30323.	27858.
DISPERSION=	6272.	13862.	16015.	21466.
MEASURE OF VAR=	.34	.48	.53	.77

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8973.	16087.	16604.	13660.
DISPERSION=	3590.	9850.	12458.	13627.
MEASURE OF VAR=	.40	.61	.75	1.00

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1687.	3541.	3942.	3472.
DISPERSION=	974.	3377.	2831.	2500.
MEASURE OF VAR=	.58	.95	.72	.72

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17006.	17405.	17769.	17164.
DISPERSION=	723.	1633.	1786.	2173.
MEASURE OF VAR=	.04	.09	.10	.13

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1097674.	2384645.	3614913.	5006956.
DISPERSION=	149370.	290581.	506304.	712154.
MEASURE OF VAR=	.14	.12	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1600	.1600	.5600	.8000
DISPERSION=	.6245	.6245	1.1576	1.2910
MEASURE OF VAR=	3.9031	3.9031	2.0671	1.6137

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0299	.0404	.0425	.0473
DISPERSION=	.0126	.0114	.0128	.0133
MEASURE OF VAR=	.4236	.2822		2821

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1984	.2587	.3095	.2797
DISPERSION=	.0895	.0759	.0712	.0407
MEASURE OF VAR=	.4513	.2933	.2299	.1453

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	18.	122.	258.	350.
DISPERSION=	28.	44.	86.	67.
MEASURE OF VAR=	1.62	.36	.34	.19

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	338.	294.	243.	186.
DISPERSION=	243.	148.	178.	146.
MEASURE OF VAR=	.72	.50	.73	.79

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	655.	1016.	1401.	1736.
DISPERSION=	235.	143.	168.	134.
MEASURE OF VAR=	.36	.14	.12	.08

NUMBER OF BIDS ON LAND	59	130	156	141
PERCENT OF POSSIBLE BIDS	23	52	62	56
TOTAL PARCELS PURCHASED	8	36	66	79

TABLE D.6

ALLOWING MORE VARIABILITY IN FAMILY LIVING EXPENDITURES

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18393.	28535.	31996.	28134.
DISPERSION=	6153.	13111.	16683.	22018.
MEASURE OF VAR=	.33	.46	.52	.78
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8938.	15827.	17607.	12559.
DISPERSION=	3615.	9218.	12366.	17095.
MEASURE OF VAR=	.40	.58	.70	1.36
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1710.	3411.	3994.	3481.
DISPERSION=	1015.	3199.	2843.	2502.
MEASURE OF VAR=	.59	.94	.71	.72
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17162.	17743.	17980.	17408.
DISPERSION=	802.	1626.	1873.	2392.
MEASURE OF VAR=	.05	.09	.10	.14
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1086298.	2373524.	3622063.	5005447.
DISPERSION=	145924.	288395.	497969.	701301.
MEASURE OF VAR=	.13	.12	.14	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1600	.2400	.4800	.7600
DISPERSION=	.6245	.7234	.9626	1.3000
MEASURE OF VAR=	3.9031	3.0142	2.0055	1.7105
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0289	.0400	.0427	.0473
DISPERSION=	.0124	.0114	.0126	.0132
MEASURE OF VAR=	.4296	.2856	.2941	.2785
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2011	.2698	.2989	.2763
DISPERSION=	.0915	.0784	.0632	.0467
MEASURE OF VAR=	.4549	.2905	.2115	.1689
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	18.	126.	246.	344.
DISPERSION=	28.	39.	85.	75.
MEASURE OF VAR=	1.62	.31	.35	.22
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	322.	254.	256.	229.
DISPERSION=	252.	152.	165.	154.
MEASURE OF VAR=	.78	.60	.64	.67
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	639.	981.	1402.	1773.
DISPERSION=	245.	152.	169.	135.
MEASURE OF VAR=	.38	.15	.12	.08

NUMBER OF BIDS ON LAND	57	132	159	141
PERCENT OF POSSIBLE BIDS	22	52	63	56
TOTAL PARCELS PURCHASED	8	37	67	77

TABLE D.7

USING THE PREVIOUS YEAR TO DEVELOP PRICE EXPECTATIONS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	17616.	30032.	30506.	32979.
DISPERSION=	7127.	13929.	16706.	19246.
MEASURE OF VAR=	.40	.46	.55	.58

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	9093.	17354.	15272.	16987.
DISPERSION=	4777.	10587.	9728.	11725.
MEASURE OF VAR=	.53	.61	.64	.69

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1943.	4091.	3084.	3575.
DISPERSION=	1490.	3754.	2353.	3734.
MEASURE OF VAR=	.77	.92	.76	1.04

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16764.	17529.	17320.	17426.
DISPERSION=	1210.	1732.	2076.	1880.
MEASURE OF VAR=	.07	.10	.12	.11

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1075605.	2303232.	3675115.	4937547.
DISPERSION=	133309.	220996.	528079.	633283.
MEASURE OF VAR=	.12	.10	.14	.13

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.2400	.0800	.3200	.2800
DISPERSION=	.5972	.2769	.6272	.5416
MEASURE OF VAR=	2.4884	3.4611	1.9599	1.9343

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0281	.0373	.0440	.0461
DISPERSION=	.0114	.0090	.0133	.0122
MEASURE OF VAR=	.4043	.2421	.3031	.2636

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1767	.2543	.2561	.2546
DISPERSION=	.0899	.0834	.0677	.0664
MEASURE OF VAR=	.5087	.3279	.2644	.2607

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	14.	104.	214.	306.
DISPERSION=	26.	45.	95.	109.
MEASURE OF VAR=	1.77	.43	.44	.36

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	253.	338.	248.	222.
DISPERSION=	201.	205.	175.	172.
MEASURE OF VAR=	.79	.61	.71	.77

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	567.	1042.	1362.	1728.
DISPERSION=	191.	216.	183.	158.
MEASURE OF VAR=	.34	.21	.13	.09

NUMBER OF BIDS ON LAND	48	112	129	130
PERCENT OF POSSIBLE BIDS	19	44	51	52
TOTAL PARCELS PURCHASED	7	32	50	77

TABLE D.8

INFLATION UNDER CONTROL - 2 PERCENT PER YEAR
INITIAL DEBT/ASSET RATIO = .5

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES 600 ACRES 900 ACRES 1200 ACRES
INITIAL NET WORTH- 239690 465502 685373 900230

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-
MEAN VALUES = 11958. 26014. 31496. 34608.
DISPERSION= 6526. 10599. 13963. 15823.
MEASURE OF VAR= .55 .41 .44 .46

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-
MEAN VALUES = 7119. 16391. 22862. 26801.
DISPERSION= 4130. 7762. 10545. 11871.
MEASURE OF VAR= .58 .47 .46 .44

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-
MEAN VALUES = 1067. 2556. 4044. 5102.
DISPERSION= 760. 1844. 2952. 3753.
MEASURE OF VAR= .71 .72 .73 .74

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-
MEAN VALUES = 17105. 18884. 19370. 19738.
DISPERSION= 1060. 1422. 1789. 1748.
MEASURE OF VAR= .06 .08 .09 .09

ENDING NET WORTH -NOMINAL DOLLARS-
MEAN VALUES = 328364. 729735. 1067169. 1389797.
DISPERSION= 87274. 152156. 222366. 294773.
MEASURE OF VAR= .27 .21 .21 .21

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD
MEAN VALUES = 1.9600 .2800 .6400 .6400
DISPERSION= 1.8367 .6137 1.1136 .9950
MEASURE OF VAR= .9371 2.1919 1.7399 1.5547

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)
MEAN VALUES = .0066 .0203 .0194 .0185
DISPERSION= .0227 .0192 .0199 .0197
MEASURE OF VAR= 3.4614 .9443 1.0274 1.0622

ENDING DEBT/ASSET RATIO
MEAN VALUES = .4287 .3949 .4421 .4553
DISPERSION= .0759 .0918 .0625 .0464
MEASURE OF VAR= .1771 .2325 .1413 .1019

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD
MEAN VALUES = 3. 32. 110. 168.
DISPERSION= 11. 37. 56. 60.
MEASURE OF VAR= 3.46 1.14 .50 .36

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD
MEAN VALUES = 283. 472. 200. 101.
DISPERSION= 181. 229. 172. 100.
MEASURE OF VAR= .64 .49 .86 .99

ENDING TOTAL TILLABLE ACRES CONTROLLED
MEAN VALUES = 586. 1104. 1210. 1469.
DISPERSION= 180. 208. 169. 107.
MEASURE OF VAR= .31 .19 .14 .07

NUMBER OF BIDS ON LAND 8 63 101 87
PERCENT OF POSSIBLE BIDS 3 25 40 34
TOTAL PARCELS PURCHASED 2 12 38 65

TABLE D.9

CHANGING THE LANDLORD'S THRESHOLD TO .9

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	18750.	30147.	31195.	28977.
DISPERSION=	5400.	11781.	16272.	22363.
MEASURE OF VAR=	.29	.39	.52	.77

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	9081.	16848.	16664.	13258.
DISPERSION=	3746.	8509.	12366.	15405.
MEASURE OF VAR=	.41	.51	.74	1.16

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1686.	3469.	4049.	3522.
DISPERSION=	1106.	3284.	2829.	2576.
MEASURE OF VAR=	.66	.95	.70	.73

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16928.	17658.	17862.	17225.
DISPERSION=	552.	1466.	1812.	2151.
MEASURE OF VAR=	.03	.08	.10	.12

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1097682.	2378210.	3601668.	5018722.
DISPERSION=	143861.	294267.	505369.	723667.
MEASURE OF VAR=	.13	.12	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.0400	.0000	.5600	.6400
DISPERSION=	.2000	0.0000	1.1210	1.3191
MEASURE OF VAR=	5.0000	0.0000	2.0018	2.0611

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0299	.0401	.0422	.0475
DISPERSION=	.0121	.0114	.0128	.0136
MEASURE OF VAR=	.4054	.2839	.3045	.2853

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2005	.2519	.3053	.2748
DISPERSION=	.0888	.0753	.0726	.0484
MEASURE OF VAR=	.4426	.2989	.2379	.1763

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	18.	115.	250.	344.
DISPERSION=	26.	44.	89.	72.
MEASURE OF VAR=	1.48	.38	.36	.21

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	342.	277.	240.	202.
DISPERSION=	220.	149.	158.	159.
MEASURE OF VAR=	.64	.54	.66	.79

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	660.	992.	1390.	1746.
DISPERSION=	218.	171.	183.	160.
MEASURE OF VAR=	.33	.17	.13	.09

NUMBER OF BIDS ON LAND	57	129	157	143
PERCENT OF POSSIBLE BIDS	22	51	62	57
TOTAL PARCELS PURCHASED	9	34	64	80

TABLE D.10

ALLOWING BETTER MARKETING BY LARGER FARMERS
(1 PERCENT PRICE DIFFERENTIAL BETWEEN FARMS)

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	17920.	28891.	35962.	33639.
DISPERSION=	5794.	13355.	16881.	23301.
MEASURE OF VAR=	.32	.46	.47	.69

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8208.	15935.	20300.	16896.
DISPERSION=	3164.	9305.	12521.	17162.
MEASURE OF VAR=	.39	.58	.62	1.02

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1419.	3391.	4743.	4754.
DISPERSION=	809.	3164.	3172.	3861.
MEASURE OF VAR=	.57	.93	.67	.81

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16855.	17435.	18232.	17737.
DISPERSION=	687.	1625.	1766.	2152.
MEASURE OF VAR=	.04	.09	.10	.12

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1080411.	2385566.	3676561.	5160464.
DISPERSION=	146673.	287330.	508424.	702741.
MEASURE OF VAR=	.14	.12	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0400	.1200	.4000	.6800
DISPERSION=	.2000	.6000	.9129	1.1804
MEASURE OF VAR=	5.0000	5.0000	2.2822	1.7359

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0286	.0404	.0440	.0499
DISPERSION=	.0126	.0113	.0126	.0129
MEASURE OF VAR=	.4388	.2788	.2869	.2576

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2012	.2535	.2875	.2865
DISPERSION=	.0822	.0730	.0698	.0506
MEASURE OF VAR=	.4086	.2879	.2429	.1766

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	14.	118.	242.	379.
DISPERSION=	26.	42.	84.	83.
MEASURE OF VAR=	1.77	.36	.35	.22

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	358.	280.	227.	195.
DISPERSION=	243.	138.	173.	151.
MEASURE OF VAR=	.68	.49	.76	.77

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	673.	998.	1369.	1774.
DISPERSION=	234.	137.	175.	164.
MEASURE OF VAR=	.35	.14	.13	.09

NUMBER OF BIDS ON LAND	57	127	164	146
PERCENT OF POSSIBLE BIDS	22	50	65	58
TOTAL PARCELS PURCHASED	7	34	68	82

TABLE D.11

BASE RUN WITH HIGHER COMMODITY PRICES

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH= 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	25038.	45463.	54315.	59291.
DISPERSION=	7154.	14810.	17070.	23334.
MEASURE OF VAR=	.29	.33	.31	.39

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	13406.	28104.	31321.	32008.
DISPERSION=	4706.	12152.	12753.	15710.
MEASURE OF VAR=	.35	.43	.41	.49

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	3051.	8010.	8420.	8705.
DISPERSION=	1868.	5800.	5489.	6731.
MEASURE OF VAR=	.61	.72	.65	.77

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17795.	19128.	19602.	19723.
DISPERSION=	658.	1379.	1660.	2030.
MEASURE OF VAR=	.04	.07	.08	.10

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1257826.	2609066.	4149635.	5691960.
DISPERSION=	199507.	260228.	450827.	692591.
MEASURE OF VAR=	.16	.10	.11	.12

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0800	.0000	.0400	.0800
DISPERSION=	.2769	0.0000	.2000	.2769
MEASURE OF VAR=	3.4611	0.0000	5.0000	3.4611

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0415	.0483	.0551	.0590
DISPERSION=	.0143	.0094	.0103	.0116
MEASURE OF VAR=	.3448	.1940	.1863	.1964

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2136	.2208	.2918	.2723
DISPERSION=	.1129	.0922	.0541	.0654
MEASURE OF VAR=	.5287	.4177	.1854	.2401

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	35.	117.	285.	400.
DISPERSION=	35.	62.	70.	110.
MEASURE OF VAR=	1.00	.53	.24	.28

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	338.	290.	237.	197.
DISPERSION=	261.	100.	140.	146.
MEASURE OF VAR=	.77	.35	.59	.74

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	673.	1006.	1422.	1797.
DISPERSION=	250.	112.	176.	162.
MEASURE OF VAR=	.37	.11	.12	.09

NUMBER OF BIDS ON LAND	78	157	182	179
PERCENT OF POSSIBLE BIDS	31	62	72	71
TOTAL PARCELS PURCHASED	14	33	71	90

TABLE D.12

NO LAND EXPANSION AND NO FEDERAL TAXES

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	19207.	43991.	65574.	88062.
DISPERSION=	3357.	6569.	9823.	13138.
MEASURE OF VAR=	.17	.15	.15	.15

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	13668.	33337.	49647.	66682.
DISPERSION=	2954.	5752.	8557.	11394.
MEASURE OF VAR=	.22	.17	.17	.17

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1474.	2415.	2923.	3391.
DISPERSION=	226.	216.	268.	341.
MEASURE OF VAR=	.15	.09	.09	.10

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	17552.	20147.	21859.	23465.
DISPERSION=	481.	775.	1044.	1283.
MEASURE OF VAR=	.03	.04	.05	.05

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1038695.	2260048.	3454679.	4668274.
DISPERSION=	97648.	209654.	320039.	433426.
MEASURE OF VAR=	.09	.09	.09	.09

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.0000	.0000	.0000	.0000
DISPERSION=	0.0000	0.0000	0.0000	0.0000
MEASURE OF VAR=	0.0000	0.0000	0.0000	0.0000

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0251	.0353	.0382	.0404
DISPERSION=	.0086	.0086	.0086	.0087
MEASURE OF VAR=	.3443	.2438	.2260	.2148

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.0497	.0036	.0016	.0015
DISPERSION=	.0342	.0044	.0003	.0003
MEASURE OF VAR=	.6877	1.2251	.1617	.1807

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	0.	0.	0.	0.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	0.	0.	0.	0.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	300.	600.	900.	1200.
DISPERSION=	0.	0.	0.	0.
MEASURE OF VAR=	0.00	0.00	0.00	0.00

NUMBER OF BIDS ON LAND	0	0	0	0
PERCENT OF POSSIBLE BIDS	0	0	0	0
TOTAL PARCELS PURCHASED	0	0	0	0

TABLE D.13

BASE GROWTH AND NO FEDERAL TAXES

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	16683.	29846.	33251.	27671.
DISPERSION=	6444.	17198.	17810.	22274.
MEASURE OF VAR=	.39	.58	.54	.80

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	8789.	16711.	18687.	11207.
DISPERSION=	4639.	10926.	11603.	17005.
MEASURE OF VAR=	.53	.65	.62	1.52

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	1036.	1525.	1659.	1557.
DISPERSION=	363.	473.	469.	450.
MEASURE OF VAR=	.35	.31	.28	.29

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	16800.	17892.	18227.	17454.
DISPERSION=	1189.	1937.	1936.	2208.
MEASURE OF VAR=	.07	.11	.11	.13

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	1090696.	2407519.	3711911.	5072627.
DISPERSION=	137601.	320739.	527578.	736758.
MEASURE OF VAR=	.13	.13	.14	.15

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	.3200	.4400	.5200	.9600
DISPERSION=	1.2490	1.1576	.9183	1.5406
MEASURE OF VAR=	3.9031	2.6309	1.7660	1.6048

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0294	.0409	.0445	.0478
DISPERSION=	.0116	.0125	.0131	.0135
MEASURE OF VAR=	.3949	.3053	.2935	.2816

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.1746	.2700	.2858	.2663
DISPERSION=	.0987	.1184	.0694	.0589
MEASURE OF VAR=	.5654	.4387	.2429	.2212

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	19.	130.	246.	342.
DISPERSION=	31.	60.	94.	92.
MEASURE OF VAR=	1.60	.47	.38	.27

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	219.	390.	307.	144.
DISPERSION=	230.	226.	186.	124.
MEASURE OF VAR=	1.05	.58	.60	.86

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	538.	1120.	1454.	1686.
DISPERSION=	224.	216.	164.	115.
MEASURE OF VAR=	.42	.19	.11	.07

NUMBER OF BIDS ON LAND	61	139	151	134
PERCENT OF POSSIBLE BIDS	24	55	60	53
TOTAL PARCELS PURCHASED	8	30	56	91

TABLE D.14

PRESIDENT REAGAN'S 10 PERCENT TAX CUT
BASE FARMS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18151.	27979.	31954.	29233.
DISPERSION=	7429.	13981.	16618.	21285.
MEASURE OF VAR=	.41	.50	.52	.73

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8819.	15743.	17436.	14226.
DISPERSION=	4607.	9571.	12694.	13403.
MEASURE OF VAR=	.52	.61	.73	.94

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1333.	2638.	3077.	2827.
DISPERSION=	688.	2135.	1765.	1442.
MEASURE OF VAR=	.52	.81	.57	.51

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16979.	17524.	17919.	17305.
DISPERSION=	969.	1736.	1865.	2259.
MEASURE OF VAR=	.06	.10	.10	.13

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1099291.	2394285.	3640110.	5023853.
DISPERSION=	147589.	312129.	517293.	722995.
MEASURE OF VAR=	.13	.13	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.3600	.3600	.4800	.6400
DISPERSION=	1.3191	.9074	1.1225	1.2207
MEASURE OF VAR=	3.6641	2.5205	2.3385	1.9073

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0300	.0407	.0431	.0476
DISPERSION=	.0124	.0123	.0129	.0135
MEASURE OF VAR=	.4117	.3018	.2991	.2835

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1803	.2719	.2914	.2734
DISPERSION=	.0947	.0774	.0665	.0418
MEASURE OF VAR=	.5253	.2848	.2283	.1528

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	16.	131.	242.	342.
DISPERSION=	28.	47.	85.	72.
MEASURE OF VAR=	1.77	.36	.35	.21

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	307.	267.	258.	229.
DISPERSION=	253.	142.	158.	181.
MEASURE OF VAR=	.82	.53	.61	.79

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	623.	998.	1399.	1771.
DISPERSION=	247.	136.	155.	153.
MEASURE OF VAR=	.40	.14	.11	.09

NUMBER OF BIDS ON LAND	58	130	155	140
PERCENT OF POSSIBLE BIDS	23	52	61	55
TOTAL PARCELS PURCHASED	7	38	65	77

TABLE D.15

PRESIDENT REAGAN'S 10 PERCENT TAX CUT
INITIAL DEBT/ASSET RATIO = .5

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH--	239690	465502	685373	900230

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-

MEAN VALUES =	11294.	26463.	27477.	25431.
DISPERSION=	4914.	11726.	14400.	15319.
MEASURE OF VAR=	.44	.44	.52	.60

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-

MEAN VALUES =	4762.	12358.	14041.	12505.
DISPERSION=	2979.	7523.	9680.	8933.
MEASURE OF VAR=	.63	.61	.69	.71

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-

MEAN VALUES =	669.	1500.	1865.	1873.
DISPERSION=	410.	1093.	2065.	1748.
MEASURE OF VAR=	.61	.73	1.11	.93

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-

MEAN VALUES =	15779.	17024.	16563.	16233.
DISPERSION=	852.	1505.	1564.	1543.
MEASURE OF VAR=	.05	.09	.09	.10

ENDING NET WORTH -NOMINAL DOLLARS-

MEAN VALUES =	872230.	1922650.	2945353.	3989969.
DISPERSION=	118904.	256588.	407265.	565467.
MEASURE OF VAR=	.14	.13	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD

MEAN VALUES =	1.2800	.2000	.1600	.6800
DISPERSION=	1.6713	.4082	.3742	.9452
MEASURE OF VAR=	1.3057	2.0412	2.3385	1.3899

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)

MEAN VALUES =	.0391	.0512	.0549	.0578
DISPERSION=	.0126	.0126	.0130	.0135
MEASURE OF VAR=	.3221	.2460	.2371	.2326

ENDING DEBT/ASSET RATIO

MEAN VALUES =	.2398	.2731	.2893	.3018
DISPERSION=	.0594	.0934	.0668	.0646
MEASURE OF VAR=	.2476	.3420	.2308	.2140

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	5.	53.	131.	219.
DISPERSION=	13.	40.	64.	95.
MEASURE OF VAR=	2.76	.75	.49	.43

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD

MEAN VALUES =	186.	394.	264.	218.
DISPERSION=	173.	217.	158.	177.
MEASURE OF VAR=	.93	.55	.60	.81

ENDING TOTAL TILLABLE ACRES CONTROLLED

MEAN VALUES =	490.	1046.	1295.	1637.
DISPERSION=	169.	205.	160.	145.
MEASURE OF VAR=	.34	.20	.12	.09

NUMBER OF BIDS ON LAND	12	83	104	98
PERCENT OF POSSIBLE BIDS	4	33	41	39
TOTAL PARCELS PURCHASED	3	19	41	69

TABLE D.16

PRESIDENT REAGAN'S 10 PERCENT TAX CUT
67 PERCENT LAND TENURE

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES 600 ACRES 900 ACRES 1200 ACRES
INITIAL NET WORTH- 569074 1109237 1646143 2167300

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-
MEAN VALUES = 17984. 33804. 41172. 47906.
DISPERSION= 10474. 18651. 26845. 24029.
MEASURE OF VAR= .58 .55 .65 .50

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-
MEAN VALUES = 9697. 18674. 22524. 24598.
DISPERSION= 7910. 14053. 18218. 12910.
MEASURE OF VAR= .82 .75 .81 .52

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-
MEAN VALUES = 1855. 3574. 4880. 4868.
DISPERSION= 1284. 2852. 4024. 2627.
MEASURE OF VAR= .69 .80 .82 .54

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-
MEAN VALUES = 16776. 18059. 18601. 18780.
DISPERSION= 1794. 1727. 2183. 2167.
MEASURE OF VAR= .11 .10 .12 .12

ENDING NET WORTH -NOMINAL DOLLARS-
MEAN VALUES = 1944539. 4107653. 6367058. 8561401.
DISPERSION= 215261. 391478. 670711. 1061565.
MEASURE OF VAR= .11 .10 .11 .12

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD
MEAN VALUES = .8800 .5200 .7600 .3600
DISPERSION= 2.1276 1.5308 1.3317 .7572
MEASURE OF VAR= 2.4177 2.9438 1.7522 2.1033

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)
MEAN VALUES = .0334 .0411 .0452 .0470
DISPERSION= .0101 .0089 .0099 .0116
MEASURE OF VAR= .3017 .2175 .2184 .2457

ENDING DEBT/ASSET RATIO
MEAN VALUES = .1723 .2403 .2285 .2065
DISPERSION= .0996 .0706 .0543 .0372
MEASURE OF VAR= .5778 .2937 .2375 .1802

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD
MEAN VALUES = 43. 176. 301. 374.
DISPERSION= 45. 75. 111. 117.
MEASURE OF VAR= 1.03 .43 .37 .31

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD
MEAN VALUES = 176. 341. 266. 277.
DISPERSION= 185. 209. 149. 212.
MEASURE OF VAR= 1.05 .61 .56 .77

ENDING TOTAL TILLABLE ACRES CONTROLLED
MEAN VALUES = 519. 1118. 1466. 1851.
DISPERSION= 198. 199. 154. 173.
MEASURE OF VAR= .38 .18 .10 .09

NUMBER OF BIDS ON LAND 96 168 162 162
PERCENT OF POSSIBLE BIDS 38 67 64 64
TOTAL PARCELS PURCHASED 15 45 57 85

TABLE D.17

EXTENDING PRESIDENT REAGAN'S TAX PLAN TO
INCLUDE LESS YEARS FOR DEPRECIATION

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	15996.	31907.	30780.
DISPERSION=	6922.	15311.	19207.
MEASURE OF VAR=	.43	.48	.62
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-			
MEAN VALUES =	6962.	14694.	13733.
DISPERSION=	4593.	9806.	13417.
MEASURE OF VAR=	.66	.67	.98
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-			
MEAN VALUES =	1103.	2093.	2310.
DISPERSION=	798.	1955.	2373.
MEASURE OF VAR=	.72	.93	1.03
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-			
MEAN VALUES =	16761.	18065.	17754.
DISPERSION=	1021.	1752.	2107.
MEASURE OF VAR=	.06	.10	.12
ENDING NET WORTH -NOMINAL DOLLARS-			
MEAN VALUES =	1095418.	2383238.	3663171.
DISPERSION=	140582.	278774.	495416.
MEASURE OF VAR=	.13	.12	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD			
MEAN VALUES =	.4000	.2400	.5200
DISPERSION=	1.1902	1.0116	.9183
MEASURE OF VAR=	2.9756	4.2150	1.7660
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)			
MEAN VALUES =	.0295	.0399	.0431
DISPERSION=	.0118	.0109	.0127
MEASURE OF VAR=	.4001	.2733	.2942
ENDING DEBT/ASSET RATIO			
MEAN VALUES =	.1838	.2631	.2640
DISPERSION=	.0927	.0849	.0744
MEASURE OF VAR=	.5045	.3228	.2819
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	24.	118.	227.
DISPERSION=	33.	51.	85.
MEASURE OF VAR=	1.36	.43	.38
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD			
MEAN VALUES =	198.	378.	243.
DISPERSION=	197.	222.	194.
MEASURE OF VAR=	.99	.59	.80
ENDING TOTAL TILLABLE ACRES CONTROLLED			
MEAN VALUES =	522.	1096.	1370.
DISPERSION=	190.	217.	185.
MEASURE OF VAR=	.36	.20	.14
NUMBER OF BIDS ON LAND			
PERCENT OF POSSIBLE BIDS	62	136	144
TOTAL PARCELS PURCHASED	24	54	57
	10	36	56

TABLE D.18

ELIMINATING INCOME AVERAGING
BASE CONDITIONS

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18208.	27964.	31021.	29484.
DISPERSION=	6191.	13305.	16170.	21405.
MEASURE OF VAR=	.34	.48	.52	.73

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	8897.	15764.	17147.	14205.
DISPERSION=	3649.	9294.	12586.	13749.
MEASURE OF VAR=	.41	.59	.73	.97

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	1876.	3742.	4440.	3774.
DISPERSION=	1192.	3444.	3292.	3043.
MEASURE OF VAR=	.64	.92	.74	.81

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16950.	17321.	17784.	17253.
DISPERSION=	715.	1586.	1726.	2165.
MEASURE OF VAR=	.04	.09	.10	.13

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1086616.	2377107.	3606533.	4998137.
DISPERSION=	146554.	293977.	501251.	705321.
MEASURE OF VAR=	.13	.12	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1600	.2400	.5600	.6800
DISPERSION=	.6245	.7234	1.1210	1.2152
MEASURE OF VAR=	3.9031	3.0142	2.0018	1.7870

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0289	.0401	.0423	.0471
DISPERSION=	.0125	.0116	.0127	.0133
MEASURE OF VAR=	.4313	.2902	.2994	.2814

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2110	.2696	.3045	.2724
DISPERSION=	.1031	.0762	.0706	.0415
MEASURE OF VAR=	.4888	.2826	.2320	.1522

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	21.	128.	251.	338.
DISPERSION=	31.	43.	88.	75.
MEASURE OF VAR=	1.48	.34	.35	.22

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	322.	266.	266.	208.
DISPERSION=	242.	167.	174.	155.
MEASURE OF VAR=	.75	.63	.65	.75

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	642.	994.	1417.	1746.
DISPERSION=	237.	164.	179.	129.
MEASURE OF VAR=	.37	.16	.13	.07

NUMBER OF BIDS ON LAND	58	130	155	142
PERCENT OF POSSIBLE BIDS	23	52	61	56
TOTAL PARCELS PURCHASED	10	37	65	77

TABLE D.19

REDUCING INVESTMENT TAX CREDITS TO 5 PERCENT

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH- 332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18181.	27787.	30496.	29820.
DISPERSION=	6144.	13433.	17325.	19192.
MEASURE OF VAR=	.34	.48	.57	.64

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	9048.	15648.	16680.	15073.
DISPERSION=	3564.	9398.	13173.	12077.
MEASURE OF VAR=	.39	.60	.79	.80

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	2116.	3974.	4740.	4181.
DISPERSION=	1216.	3534.	3274.	3041.
MEASURE OF VAR=	.57	.89	.69	.73

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16920.	17265.	17610.	17168.
DISPERSION=	707.	1589.	1899.	2045.
MEASURE OF VAR=	.04	.09	.11	.12

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1081611.	2371866.	3595162.	4986677.
DISPERSION=	147655.	290318.	499579.	705419.
MEASURE OF VAR=	.14	.12	.14	.14

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.1600	.2800	.6000	.5600
DISPERSION=	.6245	.8907	1.1547	.9609
MEASURE OF VAR=	3.9031	3.1810	1.9245	1.7159

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0285	.0400	.0421	.0471
DISPERSION=	.0127	.0115	.0127	.0133
MEASURE OF VAR=	.4439	.2872	.3006	.2821

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.2100	.2701	.2965	.2751
DISPERSION=	.1039	.0751	.0661	.0451
MEASURE OF VAR=	.4947	.2778	.2229	.1639

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	21.	128.	242.	341.
DISPERSION=	31.	43.	87.	81.
MEASURE OF VAR=	1.48	.34	.36	.24

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	310.	264.	275.	211.
DISPERSION=	248.	169.	183.	159.
MEASURE OF VAR=	.80	.64	.67	.75

ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	631.	992.	1417.	1752.
DISPERSION=	244.	165.	176.	123.
MEASURE OF VAR=	.39	.17	.12	.07

NUMBER OF BIDS ON LAND	57	130	149	142
PERCENT OF POSSIBLE BIDS	22	52	59	56
TOTAL PARCELS PURCHASED	10	38	62	78

TABLE D.20

TAXING CAPITAL GAINS AS ORDINARY INCOME

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON				
INITIAL SIZE -- 300 ACRES	600 ACRES	900 ACRES	1200 ACRES	
INITIAL NET WORTH-	332820	647431	958180	1261250
ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	20439.	38707.	45197.	48335.
DISPERSION=	5590.	12229.	16067.	18575.
MEASURE OF VAR=	.27	.32	.36	.38
ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	11389.	22144.	24145.	25304.
DISPERSION=	4306.	8559.	11009.	11433.
MEASURE OF VAR=	.38	.39	.46	.45
ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	2597.	5146.	5292.	5570.
DISPERSION=	1526.	3484.	4652.	4302.
MEASURE OF VAR=	.59	.68	.88	.77
ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	17282.	18544.	18652.	18742.
DISPERSION=	650.	1386.	1774.	1732.
MEASURE OF VAR=	.04	.07	.10	.09
ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	655606.	1439889.	2121782.	2775326.
DISPERSION=	98095.	169317.	296886.	381869.
MEASURE OF VAR=	.15	.12	.14	.14
FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0000	.0000	.0000	.0000
DISPERSION=	0.0000	0.0000	0.0000	0.0000
MEASURE OF VAR=	0.0000	0.0000	0.0000	0.0000
ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	-.0015	.0127	.0130	.0127
DISPERSION=	.0132	.0110	.0130	.0129
MEASURE OF VAR=	-8.6747	.8710	1.0016	1.0119
ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1270	.1518	.1895	.2068
DISPERSION=	.0513	.0681	.0547	.0401
MEASURE OF VAR=	.4041	.4485	.2886	.1937
PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	3.	66.	147.	238.
DISPERSION=	11.	55.	49.	56.
MEASURE OF VAR=	3.46	.84	.33	.23
LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	278.	336.	261.	186.
DISPERSION=	236.	183.	169.	185.
MEASURE OF VAR=	.85	.54	.65	1.00
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	582.	1002.	1308.	1624.
DISPERSION=	238.	151.	162.	173.
MEASURE OF VAR=	.41	.15	.12	.11
NUMBER OF BIDS ON LAND				
PERCENT OF POSSIBLE BIDS	41	106	123	137
TOTAL PARCELS PURCHASED	16	42	49	54
	2	24	46	71

TABLE D.21

FIRST THREE FARMS USING STRAIGHT LINE DEPRECIATION,
FOURTH FARM USING MORE RAPID DEPRECIATION

MONTE CARLO SUMMARY FOR 25 SIMULATIONS WITH 10 YEAR HORIZON

INITIAL SIZE --	300 ACRES	600 ACRES	900 ACRES	1200 ACRES
INITIAL NET WORTH-	332820	647431	958180	1261250

ANNUAL ACCRUAL FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	18243.	26619.	29114.	33080.
DISPERSION=	5177.	12825.	19177.	21485.
MEASURE OF VAR=	.28	.48	.66	.65

ANNUAL TAXABLE FARM INCOME -1979 DOLLARS-				
MEAN VALUES =	12096.	18037.	19382.	18188.
DISPERSION=	3684.	8871.	11672.	13725.
MEASURE OF VAR=	.30	.49	.60	.75

ANNUAL TAX AND SOCIAL SECURITY PAYMENTS -1979 DOLLARS-				
MEAN VALUES =	2630.	4012.	4498.	4444.
DISPERSION=	1416.	3219.	4036.	3576.
MEASURE OF VAR=	.54	.80	.90	.80

ANNUAL FAMILY LIVING EXPENDITURES -1979 DOLLARS-				
MEAN VALUES =	16897.	17150.	17122.	17719.
DISPERSION=	674.	1459.	1840.	1967.
MEASURE OF VAR=	.04	.09	.11	.11

ENDING NET WORTH -NOMINAL DOLLARS-				
MEAN VALUES =	1058759.	2354829.	3654725.	4942157.
DISPERSION=	134961.	291425.	499328.	642136.
MEASURE OF VAR=	.13	.12	.14	.13

FREQUENCY OF REFINANCING LAND OVER EACH PERIOD				
MEAN VALUES =	.0400	.4800	.6400	.4400
DISPERSION=	.2000	1.2949	.9950	1.0832
MEASURE OF VAR=	5.0000	2.6976	1.5547	2.4618

ANNUAL REAL GROWTH IN NET WORTH (I.E., .01 = 1 PERCENT)				
MEAN VALUES =	.0266	.0392	.0435	.0462
DISPERSION=	.0116	.0116	.0129	.0121
MEASURE OF VAR=	.4378	.2947	.2959	.2622

ENDING DEBT/ASSET RATIO				
MEAN VALUES =	.1803	.2844	.2814	.2835
DISPERSION=	.0830	.0818	.0636	.0648
MEASURE OF VAR=	.4602	.2876	.2260	.2286

PURCHASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	13.	133.	234.	346.
DISPERSION=	25.	49.	78.	97.
MEASURE OF VAR=	1.96	.37	.33	.28

LEASED ACRES OBTAINED OVER THE PLANNING PERIOD				
MEAN VALUES =	256.	283.	312.	210.
DISPERSION=	197.	200.	185.	199.
MEASURE OF VAR=	.77	.71	.59	.95

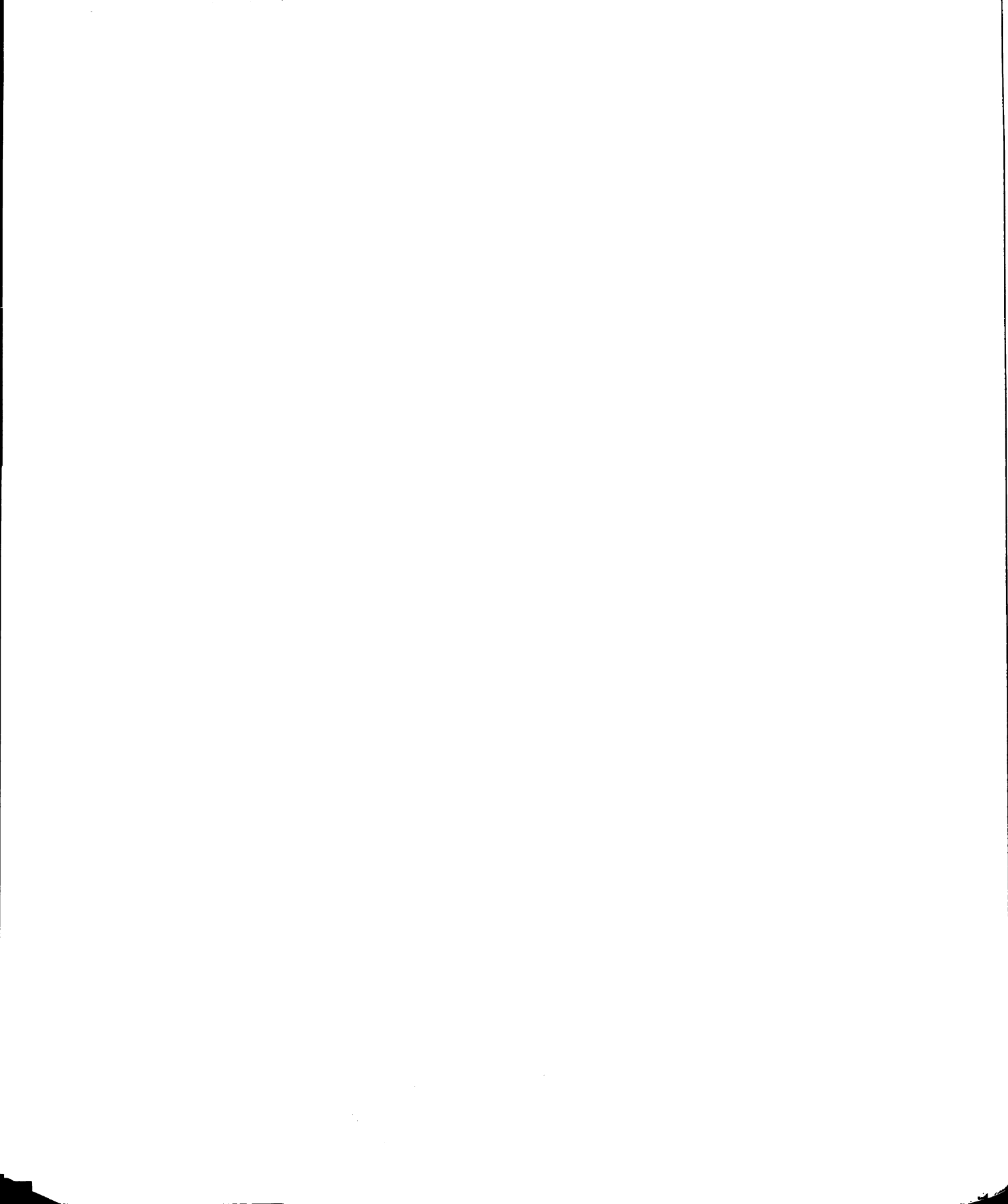
ENDING TOTAL TILLABLE ACRES CONTROLLED				
MEAN VALUES =	569.	1016.	1446.	1755.
DISPERSION=	192.	199.	177.	195.
MEASURE OF VAR=	.34	.20	.12	.11

NUMBER OF BIDS ON LAND	56	125	142	158
PERCENT OF POSSIBLE BIDS	22	50	56	63
TOTAL PARCELS PURCHASED	6	38	59	83

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