



Table of Contents

Abstract.....	I
Kurzfassung	III
List of Figures	V
List of Tables.....	VII
List of Acronyms	IX
Acknowledgements	XIII
Table of Contents	XV
1 INTRODUCTION	1
1.1 COUNTRY BACKGROUND.....	3
1.1.1 <i>Geography and Climate</i>	3
1.1.2 <i>Population and Agricultural Land</i>	4
1.1.3 <i>Agriculture versus the Industrial Sector</i>	6
1.1.4 <i>Land Reforms and Farm Restructuring</i>	9
1.1.5 <i>Bonitation, State Order for Strategic Crops and Credit Policy</i>	11
1.2 RESEARCH PROBLEM.....	14
1.2.1 <i>The Inherited Unproductive Structure of Production</i>	14
1.2.2 <i>Inefficient Resource Use in Crop Production</i>	14
1.3 THE CONCEPT OF EFFICIENCY.....	16
1.4 MOTIVATION OF THE STUDY	18
1.5 ORGANIZATION OF THE STUDY	19
2 LITERATURE REVIEW.....	21
2.1 REVIEW OF EMPIRICAL EFFICIENCY STUDIES.....	21
2.1.1 <i>The Debate on Farm Size and Efficiency</i>	21
2.1.2 <i>Land Fertility, Water Availability and Technical Efficiency</i>	23
2.1.3 <i>Crop diversification, Production Characteristics and Efficiency</i>	25
2.1.4 <i>Socio-Economic and Demographic Determinants of Efficiency</i>	26



2.1.5	<i>Economic Efficiency and the Frontier</i>	29
2.2	REVIEW OF THE THEORETICAL CONCERNS IN EFFICIENCY ESTIMATIONS.....	30
2.2.1	<i>Consistency of Stochastic Frontier Production Models</i>	30
2.2.2	<i>The Conventional Two-Step Data Envelopment Analysis</i>	33
2.2.3	<i>Directional Measurement of Economic Inefficiency</i>	34
2.3	RESEARCH GAPS AND THE OBJECTIVES OF THE STUDY	35
3	THEORETICAL FRAMEWORK	37
3.1	A PRODUCTION FRONTIER – THE CONCEPT OF A ‘GOOD’ FARM	37
3.2	EFFICIENCY ESTIMATION TECHNIQUES.....	38
3.3	STOCHASTIC FRONTIER PRODUCTION MODEL	39
3.3.1	<i>Technical Efficiency Estimation in the Stochastic Frontier Analysis</i>	40
3.3.2	<i>Inefficiency Effects Model</i>	42
3.4	DATA ENVELOPMENT ANALYSIS	43
3.4.1	<i>Technical Efficiency</i>	44
3.4.2	<i>Scale Efficiency</i>	44
3.4.3	<i>Truncated Regression</i>	45
3.4.4	<i>Bootstrapping in DEA</i>	46
3.5	DIRECTIONAL TECHNOLOGY DISTANCE FUNCTION.....	46
3.5.1	<i>Technology</i>	47
3.5.2	<i>Directional Input Distance Function</i>	48
3.5.3	<i>Cost Function</i>	49
4	OVERVIEW OF STUDY AREA, CROP PRODUCTION AND SURVEY DATA	51
4.1	BRIEF PROFILE OF STUDY PROVINCES.....	51
4.1.1	<i>Khorezm Province</i>	51
4.1.2	<i>Fergana Province</i>	52
4.2	AGRICULTURAL CROP PRODUCTION	53



4.2.1	<i>Cropping Patterns and Production Levels</i>	53
4.2.2	<i>Intra-Provincial Distribution of Cropping Area and Productivity</i>	55
4.2.3	<i>Index Numbers of Crop Production</i>	57
4.2.4	<i>The Share of Individual Farms in the Cropping Pattern</i>	59
4.2.5	<i>Farm Size and Specialization</i>	64
4.3	PRODUCTION INPUTS.....	66
4.3.1	<i>Fertilizer market and consumption</i>	66
4.3.2	<i>Diesel</i>	68
4.3.3	<i>Water</i>	69
4.4	DATA	71
4.4.1	<i>Sampling Procedure</i>	71
4.4.2	<i>Data Collection</i>	73
5	ESTIMATION OF THE TECHNICAL EFFICIENCY OF COTTON PRODUCTION USING THE THEORETICALLY CONSISTENT STOCHASTIC FRONTIER MODEL	75
5.1	INTRODUCTION	75
5.2	THEORETICAL BACKGROUND	77
5.2.1	<i>Lau's Criteria and Choice of Functional Form</i>	77
5.2.2	<i>Translog Production Function and Theoretical Consistency</i>	78
5.3	METHODOLOGY.....	82
5.3.1	<i>Analytical Framework</i>	82
5.3.2	<i>Model specification</i>	83
5.4	EMPIRICAL RESULTS	90
5.4.1	<i>Unrestricted Translog Stochastic Frontier Model</i>	90
5.4.2	<i>Hypothesis Testing</i>	92
5.4.3	<i>Estimation of the Minimum Distance Model</i>	93
5.4.4	<i>Restricted Translog Stochastic Frontier Model</i>	94



5.5 DISCUSSION	98
5.6 CONCLUSIONS	107
6 THE TECHNICAL AND SCALE EFFICIENCY OF WHEAT, POTATO AND MELON PRODUCING FARMS IN UZBEKISTAN: AN APPLICATION OF THE DOUBLE BOOTSTRAPPING METHOD.....	109
6.1 INTRODUCTION	109
6.2 BACKGROUND	112
6.3 METHODOLOGICAL APPROACH	114
6.3.1 <i>Efficiency Measurement</i>	114
6.3.2 <i>Technical Efficiency and a Double Bootstrapping Procedure</i>	118
6.3.3 <i>Data Description</i>	120
6.4 RESULTS AND DISCUSSION.....	122
6.4.1 <i>Technical Efficiency Results</i>	122
6.4.2 <i>Scale Efficiency</i>	129
6.4.3 <i>Factors Explaining Differences in DEA Efficiency Scores</i>	130
6.5 CONCLUDING REMARKS	141
7 SHADOW PRICES AND ECONOMIC INEFFICIENCY IN VEGETABLE FARMING IN UZBEKISTAN.....	143
7.1 BACKGROUND	143
7.2 METHODOLOGY.....	146
7.2.1 <i>Introduction</i>	146
7.2.2 <i>Economic Inefficiency Model</i>	148
7.2.3 <i>Scale Inefficiency</i>	149
7.2.4 <i>Duality Theorem and Shadow Prices</i>	150
7.3 EMPIRICAL SPECIFICATION	154
7.3.1 <i>Specification of the Economic Inefficiency Model</i>	154
7.3.2 <i>Specification of the Shadow Price Model</i>	155



7.4 DATA AND EMPIRICAL RESULTS.....	158
7.4.1 <i>Data Description</i>	159
7.4.2 <i>Results from the Economic Inefficiency Model</i>	161
7.4.3 <i>Results from the Shadow Price Model</i>	164
7.5 CONCLUSIONS	172
8 CONCLUSIONS, POLICY RECOMMENDATIONS AND FUTURE RESEARCH	175
8.1 INTRODUCTION	175
8.2 CONCLUSIONS	176
8.3 POLICY RECOMMENDATIONS.....	178
8.4 FUTURE RESEARCH.....	181
9 APPENDICES	183
9.1 TABLES AND FIGURES.....	183
REFERENCES	195