

Pablo Coto-Millan

Utility

Theory and Applications

With 10 Figures
and 13 Tables

Physica-Verlag

A Springer-Verlag Company

Table of Contents

Introduction

PART I: UTILITY AND CONSUMER DEMAND ANALYSIS

Theory of Utility and Consumer Behaviour: A Comprehensive Review of Concepts, Properties and the Most Significant Theorems	. 7
1.1 Theory of Utility • • - • • .	7
1.2 Preference, Choice and Indifference Concept and Utility Function Existence , 8	
1.3 Properties of the Utility Function • 10	
1.3.1 Additivity " " , 10	
1.3.2 Homogeneity • 10	
1.3.3 Homotheticity • 10	
1.3.4 Weak and Strong Separability • 11	
1.4 Basic Theory (Primal): Marshallian (or Walrasian) Demand Functions 11	
1.4.1 Properties of the Marshallian (or Walrasian) Demand Functions 12	
"1.5 Consumer Equilibrium (Dual): Hicksian (or Compensated) Demand Functions - 12	
1.5.1 Properties of the Hicksian (or Compensated) Demand Functions 13	
1.6 Indirect Utility Function . 13	
1.7 Expenditure Function . 14	
1.8 Restrictions of the Demand Systems 14	
1.8.1 Engel Aggregation Condition . 14	
1.8.2 Cournot Aggregation Condition . 15	
1.8.3 Homogeneity Condition . 16	
1.8.4 Symmetry"or Integrability Condition . 16	
1.8.5 Negativity Condition . 16	
1.9 Roy's Identity , 17	
1.10 Hotelling's Theorem (or Shephard's Lemma for Consumers) ' 18	
1.11 Relationships between the UMP and the EMP 19	
1.12 The Slutsky Equation • ' . 19	
1.13 Complementary and Substitutional Relationships 21	

Basic References	22	
References and Further Reading	22	
2 Main Forms of Utility Functions	25	
2.1 The Cobb-Douglas Utility Function	25	
2.1.1 Properties	25	
2.1.2 Marshallian or Ordinary Demands (Primal)	27	
2.1.3 The Indirect Utility Function	28	
2.1.4 Hicksian or Compensated Demands (Dual)	29	
2.1.5 The Expenditure Function	30	
2.1.6 Elasticities, Engel Curves and Expenditure Share Functions	31	
2.2 The Utility Function of the Constant Elasticity of Substitution (CES)	33	
2.2.1 Marshallian Demands	33	
2.2.2 The Indirect Utility Function	35	
2.2.3 Hicksian Demands'	36	
2.2.4 The Expenditure Function	36	
2.2.5 Application to the Particular CES Utility Function	36	
2.2.5.1 The Indirect Utility Function	37	
2.2.5.2 The Expenditure Function	37	
2.2.5.3 Hicksian Demands	37	
2.2.5.4 The Own, Cross and Income Elasticity of the CES Demand System	37	
2.2.5.5 Restrictions of CES Demand Systems	38	
2.3 The Quasi-linear Utility Functions	40	
2.3.1 Marshallian Demands	40	
2.3.2 The Indirect Utility Function	41	
2.3.3 The Expenditure Function	41	
2.3.4 Roy's Identity	42	
2.3.5 Hotelling's Theorem: Hicksian Demand Functions	42	
2.3.6 Application to the Particular Quasi-linear Utility Function	43	
2.3.6.1 The Marshallian Demand	43	
2.3.6.2 Restrictions of the Quasi-linear Demand System	43	
Recommended Reading	45	
3 Study of the Econometric Applications: Demand Functions and Systems	4	7
3.1 Demand Functions	47	
3.2 Application I for Demand Functions: Walrasian (or Marshallian) Demand Functions for Interurban Passenger Transport	48	
3.2.1 Model	49	
3.2.2 Data	50	
3.2.3 Walrasian (or Marshallian) Demands for Interurban Passenger Transport: Air and Road Transport	51	
3.2.3.1 Air Transport Demand	51	
3.2.3.2 Road Transport Demand	53	
3.2.4 Results of the Empirical Research	54	

3.3	Complete.Demand Systems	•	-	55
3.3.1	Linear Expenditure System (LES)		.	55
3.3.2	Almost Ideal Demand System		.	56
3.3.3	Diewert Demand Model	:	,	57
3.3.4	TraislogDemandModel		,	58
3.4	Application II for Demand Systems: Estimation of an Almost Ideal Demand System (AIDS): Particular Disaggregation for the Main Transport Services		.	59
3.4.1	Model: Almost Ideal Demand System		.	59
3.4.2	Data		N	61
3.4.3	Estimation of the Model		.	61
3.4.4	Conclusions		.	63
	Basic References		.	64
	References and Further Reading		.	64

PART 10 Production and Firm Supply Analysis 67

	theory of Production, Cost and Behaviour of the Firm: A Comprehensive Reformulation .			69
4.1	Theory of the Finn		.	70
4.2	Production Possibility Set and Existence of Production Function		.	72
4.3	Properties of Production Function		.	73
4.3.1	Efficiency		.	74
4.3.2	Differentiability and Continuity		.	74
4.3.3	Strict Quasi-concavity		.	74
4.4	The Finn's Equilibrium: Classic Demand, Profit and Direct Supply Functions		.	74
4.4.1	Profit Maximisation		.	74
4.4.2	Properties of Input Classic Demand and Output Direct Supply Functions		.	75
4.4.2.1	Decreasing		.	76
4.4.2.2	Existence		.	76
4.4.2.3	Homogeneity		.	76
4.4.2.4	Symmetry		,	76
4.4.2.5	Negativity		.	76
4.4.2.6	Positive Semi-definite		.	76
4.4.3	Profit-Function		.	76
4.4.4	Properties of the Profit Function: Hotelling's Theorem		.	77
4.4.4.1	Non-decreasing		.	77
4.4.4.2	Homogeneity		.	77
4.4.4.3	Convexity		,	77
4.4.4.4	Continuity		.	77
4.4.4.5	Hotelling's Theorem		.	77
4.5	The Finn's Equilibrium (Primal A)		.	78

Table of Contents

4.6	The Finn's Equilibrium (Primal B): Marshallian Demand and Indirect Supply Functions	78
4.6.1	Output Maximisation (Primal B)	79
4.6.2	Properties of the Input Marshallian Demand and Indirect Supply Functions	80
4.6.2.1	Decreasing	80
4.6.2.2	Existence	80
4.6.2.3	The Lagrange Coefficient (k)	80
4.6.2.4	Homogeneity	80
4.6.2.5	Negativity	80
4.6.2.6	Symmetry	80
4.6.2.7	Negative Semi-definite	81
4.6.2.8	Roy's Identity	81
4.7	The Finn's Equilibrium: Input Classic Demand and Output Direct Supply Functions	81
4.7.1	Loss Minimisation	81
4.7.2	Properties of Input Classic Demand and Output Direct Supply Functions	82
4.7.3	Loss and Input Classic Demand Functions: Holelling's Theorem	82
4.8	The Finn's Equilibrium (Dual A)	82
4.9	The Finn's Equilibrium (Dual B): Input Conditioned Demand and Cost Functions	83
4.9.1	Cost Minimisation (Dual B)	83
4.9.2	Properties of the Input Conditioned Demand	84
4.9.2.1	Non-decreasing	84
4.9.2.2	Existence	84
4.9.2.3	Homogeneity	84
4.9.2.4	The Lagrange Coefficient	84
4.9.2.5	Negativity	84
4.9.2.6	Symmetry	85
4.9.2.7	Negative Semi-definite	85
4.9.3	Properties of Cost Function: Shephard's Lemma	85
4.9.3.1	Increase	85
4.9.3.2	Homogeneity	85
4.9.3.3	Concavity	85
4.9.3.4	Continuity	85
4.9.3.5	Shephard's Lemma	85
4.10	Diagrammatic Representation of the Main Relationships	86
4.11	Joint Production	91
4.11.1	Income Maximisation	93
4.11.2	Input Minimisation	94
4.12	Short-Run	96
4.12.1	Short-Run and Single Production,	97
4.12.2	Short-Run and Joint Production	99
4.13	Reflections on the Main Relationships Designed	100
4.14	The Elasticity of Substitution	101
	Basic References	103

References and Further Reading	104
5 Main Forms of Production and Cost Functions	105
5.1 The Cobb-Douglas Production Function	105
5.1.1 Characterisation	105
5.1.2 The Marginal Rate of Technical Substitution (MRTS)	106
5.1.3 The Elasticity of Substitution	106
5.1.4 Returns to Scale	107
5.1.5 The Profit Function and Input Demand Functions	107
5.1.6 HotelHng's Theorem	110
5.1.7 The Cost Function and Input Conditioned Demand Functions	111
5.1.8 Shephard's Lemma	113
5.1.9 LRAC and LRMC Curves	114
5.1.10 Applying Duality	115
5.2 The CES Production Function	117
5.2.1 The Marginal Rate of Technical Substitution (MRTS)	117
5.2.2 Returns to Scale	118
5.2.3 The Elasticity of Substitution	118
5.2.4 The Output Supply Function and Input Demand Functions	119
5.2.5 The Cost Function and Input Conditioned Demand Functions	122
5.2.6 The LRAC and LRMC	124
5.2.7 Applying the Duality	125
Recommended Reading	128
6 Study on Econometric Applications: Production and Cost Functions	129
6.1 Production Functions	130
6.2 Application III for Production Functions: Analysis of the Returns to Scale, Elasticities of Substitution and Behaviour of Stopping Production	13]
6.2.1 The Model	131
6.2.2 Data	133
6.2.3 Empirical Results	133
6.3 Cost Function	135
6.4 Other Empirical Functions	136
6.5 Application IV for Cost Functions: Elasticities of Substitution and Behaviour of Shipping Production	138
6.5.1 The Model	138
6.5.2 Data	141
6.5.3 Empirical Results	141
6.5.4 Summary and Conclusions	144
Basic References	145
References and Further Reading	145