

THE THEORY OF ECONOMETRICS

By

HAROLD T. DAVIS

NORTHWESTERN UNIVERSITY



THE PRINCIPIA PRESS, INC.
BLOOMINGTON, INDIANA

COPYRIGHT, 1941
By
THE PRINCIPIA PRESS, INC.

SET UP AND PRINTED
IN THE UNITED STATES OF AMERICA
BY
THE DENTAN PRINTING COMPANY
COLORADO SPRINGS, COLORADO

To My Friend

ALFRED COWLES

*This Book is Dedicated in Appreciation for
what he had Done for Econometrics*

TABLE OF CONTENTS

ECONOMIC STATICS

CHAPTER 1

PRELIMINARY CONCEPTS

	Page
1. Economics and Human Welfare - - - - -	1
2. Measurement in Economics - - - - -	2
3. The Role of Postulates in Economics - - - - -	4
4. Economic Statics - - - - -	6
5. Time Series - - - - -	9
6. Economic Dynamics - - - - -	11

CHAPTER 2

THE NATURE OF WEALTH AND INCOME

1. The Nature of Wealth - - - - -	17
2. The Nature of Income - - - - -	19
3. The Distribution of Incomes — Pareto's Law - - - - -	23
4. Income Data - - - - -	25
5. The Pareto Distribution - - - - -	28
6. The Statistical Verification of Pareto's Distribution - - - - -	30
7. Curves of Concentration - - - - -	32
8. The General Distribution Function - - - - -	35
9. Properties of the General Distribution Function - - - - -	39
10. Statistical Determination of the Distribution Function - - - - -	42
11. The Generalized Law of Inequality - - - - -	45
12. Conclusions - - - - -	50

CHAPTER 3

THE CONCEPT OF UTILITY

1. Historical Summary - - - - -	54
2. Equi-expectancy Curves - - - - -	59
3. The Utility of Money - - - - -	62
4. The Value of Money - - - - -	64
5. The Utility of Goods - - - - -	65
6. Indifference Surfaces and Lines of Preference - - - - -	69
7. The Budget Equation - - - - -	72
8. The Weber-Fechner Law and its Relationship to the Utility Concept - - - - -	74
9. The Indeterminacy of Indifference - - - - -	76
10. Utility as a Functional - - - - -	77

CHAPTER 4

SUPPLY AND DEMAND CURVES

1. Notation	86
2. The Concept of Demand	86
3. The Concept of Supply	87
4. The Concept of Price	88
5. The Elasticity of Demand	88
6. Cournot's Point	89
7. Relationship Between the Demand Curve and the Utility Function	92
8. Relationship Between the Supply Curve and the Utility Function	95
9. The Statistical Determination of Demand and Supply Curves	98
10. The Relationship Between Supply and Demand Functions and Time Series	102

CHAPTER 5

THE THEORY OF PURE EXCHANGE

1. The Theory of Exchange	109
2. The Bargaining Locus	109
3. The Bargaining Diagram	113
4. Relationship with Curves of Demand and Supply	116
5. Generalization of the Bargaining Locus	118
6. Competitive Bargaining in Space Economics	120

CHAPTER 6

THE THEORY OF MONOPOLY AND DUOPOLY

1. Total, Average, and Marginal Costs	125
2. Some Geometrical Aspects of Cost	127
3. Total, Average, and Marginal Revenue	129
4. The Problem of Monopoly	132
5. Monopolistic Competition	134
6. An Economic Example	137
7. Bilateral Monopoly	140
8. The Problem of Duopoly	143
9. Conjectural Variation	145
10. Concluding Summary	147

CHAPTER 7

PRODUCTION AND ALLIED FUNCTIONS

1. Factors of Production	149
2. Production as a Linear Homogeneous Function of the Factors of Production	150
3. The Economic Significance of the Assumption of a Linear Homogeneous Production Function	151
4. The Factors of Labor and Capital in Production	153
5. Marginal Productivity	155

CHAPTER 8

BUDGETS

1.	The Problem of Budgets	- - - - -	160
2.	Engel Curves	- - - - -	160
3.	The Data	- - - - -	162
4.	Engel Curves and the Utility Function	- - - - -	165
5.	The Functional Concept in the Theory of Budgets	- - - - -	170

CHAPTER 9

THE THEORY OF EQUILIBRIUM

1.	Introduction	- - - - -	178
2.	The Economic Variables	- - - - -	179
3.	Statistical Summary of the Variables	- - - - -	181
4.	The Equations of Economic Equilibrium	- - - - -	184
5.	Concluding Remarks	- - - - -	186

CHAPTER 10

TAXATION

1.	The General Problem	- - - - -	189
2.	Taxation and the Problem of Demand	- - - - -	190
3.	Comparison of Income with Excise Taxes	- - - - -	193
4.	The Edgeworth Paradox	- - - - -	195
5.	Critique of the Theory of Taxation	- - - - -	199
6.	Political Effects of High Income Taxes	- - - - -	200

ECONOMIC DYNAMICS

CHAPTER 11

THE GROWTH OF POPULATION AND INDUSTRY

1.	The Phenomenon of Growth	- - - - -	209
2.	Mathematical Characteristics of the Logistic Curve	- - - - -	212
3.	Methods of Adjusting the Logistic Curve to Data	- - - - -	215
4.	The Pearl-Reed Method of Least Square Approximation	- - - - -	216
5.	The Method of the Rate of Increase	- - - - -	222
6.	The Biological Basis for the Logistic	- - - - -	224
7.	The Logistic of Population	- - - - -	228
8.	The Growth of Production	- - - - -	233

CHAPTER 12

THE EQUATION OF EXCHANGE

1.	Historical Note	- - - - -	242
2.	The Variables in the Equation of Exchange	- - - - -	244

	Page
3. Circulating Money (M)	245
4. Circulating Deposits (M')	248
5. The Velocity of Circulating Deposits (V')	251
6. The Velocity of Circulating Money (V)	256
7. Price (P)	259
8. Trade (T)	264
9. Snyder's Theory of Price	269
10. The Statistical Test of Snyder's Theory	270
11. Gold and Silver and Their Relationship to the Level of Prices	275
12. Summary	276

CHAPTER 13

INTEREST AND INVESTMENT

1. Definitions	281
2. The Variability of the Interest Rate	285
3. Discount	290
4. Annuities	292
5. The Present Value of an Annuity	295
6. Perpetuities	297
7. Capitalized Cost	298
8. Bonds	300
9. Evaluating a Bond	301
10. Depreciation	303
11. The Evaluation of a Machine	305
12. The Composite Life of Factors of Production	306

CHAPTER 14

INSURANCE — EXPECTATION

1. The Origins of Insurance	309
2. The Mortality Table	311
3. Life Annuities	313
4. Life Insurance	316
5. Types of Life Insurance	318
6. The Loading Factor	321
7. Terminal R	322

CHAPTER 15

INDEX NUMBERS FROM THE ECONOMIC POINT OF VIEW

1. The Problem of Index Numbers	324
2. Types of Index Numbers and their Properties	325
3. Differential Derivation of Index Numbers	330
4. Index Numbers and the Utility Surface	333
5. Conclusion	335

CHAPTER 16

TIME SERIES AND THEIR CORRELATION

1. Time Series	338
2. Trends	340
3. Fitting Linear Trends to Time Series	341
4. The Harmonic Analysis of Time Series	346
5. Serial Correlation	354
6. Inverse Serial Correlation	356
7. The Concept of Hysteresis	362
8. Hysteresis with Damping	365
9. The Standard Error of Trends — Forecasting	368

CHAPTER 17

DYNAMIC CONCEPTS OF SUPPLY AND DEMAND

1. Demand as a Function of Time	377
2. Supply as a Function of Time	378
3. Profits under Dynamic Prices	380
4. Excursus on the Calculus of Variations	381
5. Maximizing Profits under Dynamic Prices	387
6. Extensions of the Elementary Problem of the Calculus of Variations	388
7. Integral Demand and Supply Curves	391
8. Maximizing Profits with Demand Dominated by an External Variable	393
9. The Dynamics of Automobile Demand	396

CHAPTER 18

THE DYNAMICS OF ECONOMIC TIME SERIES

1. Historical Introduction	400
2. The Erratic-Shock Theory of Time Series	402
3. Formulation of the Fundamental Integral	404
4. The Resonance Theory of Crises	408
5. The Macrodynamic Theory of Production	412
6. Other Theories	414

CHAPTER 19

THE THEORY OF BUSINESS CYCLES

1. History of Business Cycles	420
2. Types of Cycles	421
3. The Significance of Cycles	427
4. Business Cycles and the Distribution of Incomes	429
5. The Economic Theory of History	433
6. The Role of Cycles in American History	441
7. Conclusion	445

CHAPTER 20

INTERNATIONAL EXCHANGE

1. Historical Note	449
2. The Problem of International Exchange	451
3. International Exchange and Internal Prices	455
4. The Equations of the Rates of Exchange	457
5. Concluding Remarks	461

TABLES

TABLE I. $s_n = (1 + i)^n$. (AMOUNT OF 1 AT COMPOUND INTEREST).

TABLE II. $v^n = (1 + i)^{-n}$. (PRESENT VALUE OF 1 AT COMPOUND INTEREST).

TABLE III. $s_{\overline{n}|} = \frac{(1 + i)^n - 1}{i}$. (AMOUNT OF AN ANNUITY OF 1).

TABLE IV. $a_{\overline{n}|} = \frac{1 - v^n}{i}$. (PRESENT VALUE OF AN ANNUITY OF 1).

TABLE V. AMERICAN EXPERIENCE TABLE OF MORTALITY.

TABLE VI. COMMUTATION COLUMNS (American Experience — Interest = 3½%).

TABLE VII. COEFFICIENTS FOR FITTING A STRAIGHT LINE TO DATA.

INDEX OF NAMES — INDEX OF SUBJECTS