

AEB 7184
Production Economics

Purpose: The purpose of this course is to introduce students to the standard theoretical and empirical models used in the investigation of firm level production decisions.

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Office Hours: My office hours are Monday, Tuesday and Wednesday from 10:30 to 12:00 and 1:30 to 2:30. I will meet with students by appointment outside these hours if I receive a request by Email at least 24 hours in advance.

Overview: This class meets three times a week (MWF – 3 [9:35 to 10:25]). Course grades will be assigned based on weekly homework, three examinations, a research proposal and class participation. Homework will be due in a week increment. Each assignment will be handed out at the beginning of each increment and will involve topics covered over that time span. The research proposal is not intended to be a completed research product. Instead, I would like the student to propose an interesting problem that can be solved using of the techniques from this course.

Textbooks: There are two primary textbooks used in this course:

Chambers, Robert G. 1980. *Applied Production Analysis: A Dual Approach*. New York: Cambridge University Press.

Moss, Charles B. 2015. *Production Economics: An Empirical Approach* Draft textbook online at <http://www.charlesbmoss.com:8080/production.economics/ProductionBook.pdf> .

Other books referenced in this course include:

Beattie, Bruce R. and C. Robert Taylor. *The Economics of Production* (New York: John Wiley & Sons, 1985).

Coelli, Timothy J., Dodla Sai Prasada Rao, Christopher J. O'Donnell, and George Edward Battese. *An Introduction to Efficiency and Productivity Analysis* (Springer, 2nd Edition, 2005).

Cornes, Richard. *Duality and Modern Economics* (New York: Cambridge University Press, 1992).

Fare, Rolf and Daniel Primont. *Multi-Output Production and Duality: Theory and Applications* (Boston: Kluwer Academic Publishers, 1995).

Kumbhakar, Subal C. and C. A. Knox Lovell. *Stochastic Frontier Analysis* (New York: Cambridge University Press, 2003).

Shephard, Ronald W. *Theory of Cost and Production Functions* (Princeton, New Jersey: Princeton University Press, 1970).

Theil, Henri. *The System-Wide Approach to Microeconomics* (Chicago: Chicago University Press, 1980).

Background material can be found in:

Doll, John P. and Frank Orazem. *Production Economics: Theory with Applications* Second Edition (Malabar, Florida: Krieger Publishing Company, 1984).

Supplementary Material: Other materials such as lecture notes will be made available on the Internet at <http://www.charlesbmoss.com:8080/production.economics> .

Software and Computer Access: Often I will ask students to bring laptop computer to class. The primary numerical tool we will use is R which is publically available at (<http://www.r-project.org>). We will also be interested in code that provides analytical solutions. I suggest that students look into MathematicaTM. However, a free ware program that does several applications is Maxima (<http://maxima.sourceforge.net>).

Grading: Grades will be assigned based on the following weights:

Course Grade Weights		
Activity	Points	Percent of Grade
Test 3*100	300	60%
Research Proposal	100	20%
Homework	75	15%
Class Participation	25	5%
Total	500	100 %

Grading Scale *		
Grade	Percentage of Total Points	Numeric GPA
A	96-100	4.00
A-	92-96	3.67
B+	88-92	3.33
B	84-88	3.00
B-	80-84	2.67
C+	76-80	2.33
C	72-76	2.00
C-	68-72	1.67
D+	64-68	1.33
D	60-64	1.00
D-	56-60	0.67
E	<56	0

*I reserve the right to lower the scale for any grade level.

Attendance Policy: Attendance to all scheduled classes is required. Absence due to university approved activities (i.e., absences for other class activities or student participation in professional meetings) must be approved in advance. Students missing class due to illness must contact me as soon as possible. I reserve the privilege to request medical documentation for frequent or extended illnesses. Missed classwork (i.e., tests and homework) will only be rescheduled in the cases of approved absences or illness.

Academic Honesty, Software Use, UF Counseling Services, Services for Students with Disabilities

In 1995 the UF student body enacted a new honor code and voluntarily committed itself to the highest standards of honesty and integrity. When students enroll at the university, they commit themselves to the standard drafted and enacted by students.

In adopting this honor code, the students of the University of Florida recognize that academic honesty and integrity are fundamental values of the university community. Students who enroll at the university commit to holding themselves and their peers to the high standard of honor required by the honor code. Any individual who becomes aware of a violation of the honor code is bound by honor to take corrective action. The quality of a University of Florida education is dependent upon community acceptance and enforcement of the honor code.

The Honor Code: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.

On all work submitted for credit by students at the university, the following pledge is either required or implied: **“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”**

The university requires all members of its community to be honest in all endeavors. A fundamental principle is that the whole process of learning and pursuit of knowledge is diminished by cheating, plagiarism and other acts of academic dishonesty. In addition, every dishonest act in the academic environment affects other students adversely, from the skewing of the grading curve to giving unfair advantage for honors or for professional or graduate school admission. Therefore, the university will take severe action against dishonest students. Similarly, measures will be taken against faculty, staff and administrators who practice dishonest or demeaning behavior.

Students should report any condition that facilitates dishonesty to the instructor, department chair, college dean or Student Honor Court. (*Source: 2007-2008 Undergraduate Catalog*)

It is assumed all work will be completed independently unless the assignment is defined as a group project, in writing by the instructor.

This policy will be vigorously upheld at all times in this course.

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university’s counseling resources. Both the Counseling Center and Student Mental Health Services provide confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance. The Counseling Center is located at 301 Peabody Hall (next to Criser Hall). Student Mental Health Services is located on the second floor of the Student Health Care Center in the Infirmary.

1. *University Counseling Center*, 301 Peabody Hall, 392-1575, www.counsel.ufl.edu
2. *Career Resource Center*, CR-100 JWRU, 392-1602, www.crc.ufl.edu/
3. *Student Mental Health Services*, Rm. 245 Student Health Care Center, 392-1171, www.shcc.ufl.edu/smhs/
 - Alcohol and Substance Abuse Program (ASAP)

- Center for Sexual Assault / Abuse Recovery & Education (CARE)
- Eating Disorders Program

Course Outline

I. Production Functions

- A. Lecture I: Basic Notions of Production Functions [Moss 1.1, Beattie and Taylor 2]
 - 1. The Single Input Production Function
 - 2. The Multiple Input Production Function
- B. Lecture II: Definition and Properties of the Production Function [Moss 1.2, Chambers 1.1 – 1.5]
 - 3. The Production Function Defined [Chambers 1.1]
 - 4. Properties of the Production Function [Chambers 1.2]
 - 5. Law of Variable Proportions [Chambers 1.4]
 - 6. Measure of Simultaneous Input Variation: Elasticity of Scale [Chambers 1.5].
- C. Lecture III: Substituting One Input for Another in Production [Moss 1.2, Chambers 1.6 – 1.8]
 - 1. Elasticity of Scale and Law of Variable Proportion
 - 2. Measures of Input Substitution
 - 3. Structure of Production Function

II. Some Simple Production Mechanics

- A. Lecture IV: Some Simple Production Mechanics [Moss 1.3]
 - 1. Profit Maximization
 - a. Expansion Path
 - b. Derived Demand
 - c. Supply
 - 2. Cost Minimization
 - a. Derived Demand (output conditional)
 - b. Cost Function
 - c. Marginal Cost

III. Estimation of the Primal Production Function

- A. Lecture V: Estimation of the Primal Production Function [Moss 2.1 – 2.2]
 - 1. Ordinary Least Squares
- B. Lecture VI: Simultaneity and Other “Simple” Problems [Moss 2.3]
 - 1. Simultaneity and sample selection
 - 2. Zeros and other data problems
 - 3. Nonparametric Surfaces
 - 4. Existence of Stage III
- C. Lecture VII: Stochastic Production Functions [Moss 2.4]
- D. Lecture VIII: Estimation of Production Functions: Fixed Effects in Panel Data [Moss 2.5]

- E. Lecture IX: Estimation of Production Functions: Random Effects in Panel Data [Moss 2.5]
- F. Lecture X: Stochastic Error Functions I: Another Composed Error [Moss 2.4]
- G. Lecture XI: Stochastic Error Functions II: Estimation of Stochastic Frontiers [Moss 2.4]
- H. Lecture XII: Empirical Applications of the Primal [Moss 3]

Test on Primal

IV. Cost Functions

- A. Lecture XIII: Definition and Properties of the Cost Function
 - 1. Definition of the Cost Function [Chambers 2.1]
 - 2. Properties of the Cost Function [Chambers 2.2]
- B. Lecture XIV: Comparative Statics and Duality of the Cost Function
 - 1. Comparative Statics of the Cost Function [Chambers 2.3]
 - 2. Duality between Cost and Production Functions [Chambers 2.4]
- C. Lecture XV: An Application of Duality
- D. Lecture XVI: Shephard's Duality Proof: Part I
- E. Lecture XVII: Shephard's Duality Proof: Part II

V. Estimation of Cost Functions

- A. Lecture XVIII: Cost Functions and the Estimation of Flexible Functional Forms
 - 1. Flexible Function Forms [Chambers 5.1 and 5.2]
 - 2. Fourier Function Forms
 - 3. Estimation of Seemingly Unrelated Regression Models
- B. Lecture XIX: Limitations, Aggregation, and Constraints
 - 1. Limitations to Flexible Functional Forms [Chambers 5.4]
 - 2. Aggregation Issues
 - 3. Imposing Restrictions
 - a. Homogeneity
 - b. Symmetry
 - c. Concavity
- C. Lecture XX: Subadditivity of Cost Functions

VI. Profit Functions

- A. Lecture XXI: Profit Functions
 - 1. Definition of the Profit Function [Chambers 4.2]
 - 2. Comparative Statics of the Profit Function [Chambers 4.3]
 - 3. The Profit Function and Duality [Chambers 4.4]

Test on Duality

VII. Technical Change and Efficiency: Theory and Measurement

- A. Lecture XXII: Measuring Changes in Productivity

1. Measurement of Technical Change from Indirect Objective Functions [Chambers 6.2]
 2. Divisia Indices and Technical Change [Chambers 6.3]
 3. Total Factor Productivity [Chambers 6.4]
- B. Lecture XXIII: Measuring Technical Efficiency
1. Technical Efficiency
 2. Data Envelope Analysis
 3. Directed Distance Functions
- C. Lecture XXIV: Factor Bias, Technical Change, and Valuing Research
1. Mathematical Model of Technical Change
 2. Valuing State Level Funding for Research: Results for Florida
- VIII. Differential Models of Supply**
- A. Lecture XXV: Differential Models of Production: The Single Product Firm [Moss 7.1]
- B. Lecture XXVI: Differential Models of Production: Change in the Marginal Cost and the Multi-Product Firm [Moss 7.2]
- IX. Review of Empirical Studies**
- A. Lecture XXVII: Applications in Production Economics

Final Examination – December 9 – 3:00-5:00 pm