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Economics Education and Teaching the Theory of the Firm Excerpts from Economics Textbook Materials

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Abstract

Curtis Jr (2018) describes the objective of the university course, to convey intermediate and advanced concepts of theory of the firm to students using explanatory, graphical and mathematical methods of analysis. The only prerequisite for this course is successful completion of Calculus, Principles of Microeconomics, or equivalent. After completing the requirements in this course, students should have a sufficient set of skills to thoroughly analyze interesting economic questions and to effectively participate in (*i*) advanced undergraduate economics courses, (*ii*) core graduate economic theory courses, and (*iii*) graduate courses in the school of business, including MBA programs. The emphasis of this paper is that economics is the study of the efficient choices made by individuals, including consumers, workers, owners of firms and social planners Policy writers. Students and wealthy philanthropists reading this paper might conclude that corporate board members, and higher education endowment strategists and budget executives, should focus on and enhance the effectiveness of the individual, conditional on the capacity and constraints, whether they are innate, financial or political.

Curtis Jr (2018) presents the teaching materials separately, attached to this document, presented in Microsoft Powerpoint slides, created by James Edward Curtis Jr (2001) and Microsoft Publisher slides, created by James Edward Curtis Jr (2014), for projector transparency presentation by university instructors, and created by James Edward Curtis Jr, for higher education student studies.

Reviewers include Dr. John C Ham, Ph.D. from Princeton University, Tenured Professor and Provost, and Former Advisor.

Keywords: theory of the firm

1. 2002 Curriculum Vita of James E Curtis, Jr.

1.1 Birth Information of James E Curtis, Jr.

February 14, 1973……Born Washington, District of Columbia, WDC

1.2 Education Information of James E Curtis, Jr.

1990 Mathematics Program, Summer Training Graduate, Calculus, University of the District of Columbia, WDC

1991-1994……Bachelor of Arts Program, Department of Economics, Rutgers University, Camden, NJ

1994……Summer Venture in Management Graduate, Harvard University, School of Business, Cambridge, MA

1996……Bachelor of Arts Degree, Department of Economics; Howard University, WDC

1996……Bachelor of Arts Degree, Department of Political Science, Howard University, WDC

1998……AEA Summer Program Graduate, Department of Economics, University of Texas, Austin, TX

1998……Master of Arts Degree, Department of Economics, the Ohio State University, OSU, Columbus, OH

2000……Dissertation, committee proposal, oral, Department of Economics, OSU

2000……Dissertation, committee proposal, written, Department of Economics, OSU

2001……Dissertation, oral defense, proxy, Department of Economics, OSU

2002……Dissertation, written defense, Department of Economics, OSU

1.3 Employment Information of James E Curtis, Jr.

1991……Laws & Economics Intern, USA, General Services Administration, WDC

1992-1996……Finance Intern, summer, Communication Satellite Corporation, COMSAT, Bethesda, MD

1996-1997……Economist Assistant, USA, Federal Deposit Insurance Corporation, WDC

1998-2001……Macroeconomics/Microeconomics, Money & Banking, TA, Department of Economics, OSU

1999…Economics Intern, Economic Development Division, Ohio Department of Development, Columbus, OH

2000-2001…Applied Econometrics Instructor, Department of Economics, Ohio Wesleyan University, Delaware, OH

2000-2001……Tutor, Department of Economics, OSU

2000-2001……Tutor, MBA. Education, School of Business, OSU

2000……Graduate Studies Committee Member, faculty/elected graduate student, Economics, OSU

2000-2002……Grant Recipient, *Journal of Money Banking & Credit*, OSU

Grant Recipient & Research Supervisor, Department of Economics OSU

Grant Recipient & Research Supervisor, Dissertation Grant, USA, National Science Foundation

2001……Graduate Foundations in Economics Instructor, School of Business, Executive Education, OSU

Intermediate Microeconomics Instructor, Department of Economics, OSU

2002……Econometrics TA, Econometrics, Department of Economics, University of Colorado, Denver, CO

Fundamentals of Graduate Econometrics, Graduate Teaching Assistant, AEA Summer Program

1.4 Employment Fields of Study and Research Fields of Competencies, Exams, Completed by James E Curtis, Jr.

Economic History, 1999, Ph.D. pass of field exam, faculty, Department of Economics, The Ohio State University

Economic Theory, Macroeconomics, 1998 M.A./Ph.D. pass of qualifier exam, faculty, Department of Economics, The Ohio State University

Economic Theory, Microeconomics, 1998 M.A. pass of qualifier exam, faculty, Department of Economics, The Ohio State University

Economic Theory, Microeconomics, 1999 Ph.D. pass of qualifier exam, faculty, Department of Economics, The Ohio State University

Macroeconomics/Monetary Economics, 1999 Ph.D. pass of field exam, faculty, Department of Economics, The Ohio State University

1.5 Employment Fields of Study and Research Fields of Competencies, External, Approvals of James E Curtis, Jr.

Applied Econometrics, 2001, approved by Steven Cosslett, Ph.D., Econometrics faculty, Department of Economics

Applied Labor Economics, 2001, approved by Hajime Miyazaki, Ph.D., John C Ham, Ph.D., Labor Economics faculty, Department of Economics

Economics Education, 1998-2000 economics undergraduate education, approved by Belton Fleisher, Ph.D., Department of Economics

Economics Education, 2001 M.BA. education, approved by Ken Brevport, Ph.D. & admin, Executive Education, School of Business, OSU

Economics Education, 2002 econometrics graduate education, approved by Charles Becker, Ph.D., Department of Economics

2. Introduction

The goal of this paper is to provide course materials for studies in economics of theory of the firm. Students should obtain a copy of the required textbook and refer to the recommended textbooks for additional student resources.

Required Textbooks **(1)** Varian, Hal R. ***Intermediate Microeconomics: A Modern Approach***, Norton: New York, 1999.

Recommended Textbooks **(2)** Frank, Robert H. ***Microeconomics and Behavior***, Boston: McGraw-Hill, 2000; **(3)** Mankiw, N. Gregory, ***Principles of Microeconomics***, Fort Worth: Dryden, 1998; **(4)** Pindyck, Robert S. and Daniel Rubinfield, ***Microeconomics***, Macmillan: Simon & Schuster: New Jersey, 1995; **(5)** Stockman, Alan C. ***Introduction to Microeconomics***, Fort Worth: Dryden, 1999; and **(6)** Varian, Hal R. ***Microeconomic Analysis***, Norton: New York, 1992.

Several portions of this paper were originally written and presented by James Edward Curtis Jr. August 21, 2001; 2003; May 13, 2014, and July 31, 2017.

3. Outline

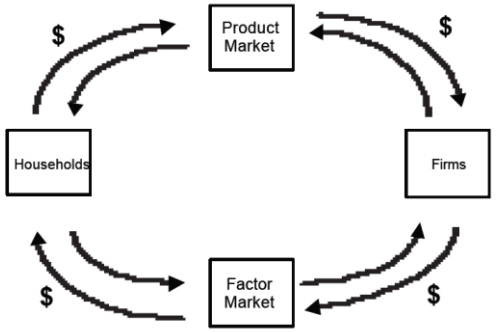
3.1 The Curriculum for Teaching the Theory of the Firm Is Divided into the Following Sections

3.2 Circular Flow of Goods and Services

Markets

- A market is
  - *A group of sellers that trade products and services for an agreed form of remuneration (which is often money today) with the buyers*
  - *In product markets*
    - *Firms sell products*
    - *Consumers buy products*
  - *In labor markets*
    - *Workers sell labor services*
    - *Firms buy labor services*

Circular Flow



Theory of the Firm

- The theory of the firm describes how owners of firms choose inputs to produce goods and services given market prices of inputs. Topics:
  - *Production function*
    - *Returns to Scale*
  - *Optimal Choice of Inputs*
    - *Profit Maximization*
    - *Cost Minimization*
      - *Returns to Scale*
  - *Optimal Choice of Output and Prices*
    - *Types of Markets*

Theory of the Firm

- The theory of the firm describes how owners of firms choose inputs to produce goods and services given market prices of inputs
  - *Production function*

3.3 Production

3.3.1 Production and Returns to Scale

Production

- The production function describes how firms transform inputs into outputs
  - *Types of inputs:*
    - *Land (N), Labor (L), Capital (K), Entrepreneurship (E) and Technology (T)*
  - *Long-Run vs. Short-Run*
    - *The short-run ends when a firm can alter the amount (or the contract on) any one input. An input is fixed only in the short run.*
    - *The long-run begins at the period of time when a firm can alter the amount of (or the contract on) every input. All inputs are variable in the long run.*

Production

- Production function notation (example):
  - L = *number of assembly workers*
  - K = *number of robots*
  - q = *the number of cars you produce from employing workers and machines*

$\Rightarrow q = q(L,K)$ *or some function of labor and workers*

- *The functional form of the production function depends your ability to transform workers, machines and raw materials into output*

Production

- Example 1: The perfect substitutes production function

  L = *number of assembly line workers or worker hours*

  K = *number of robots or robot hours*

  q = *the quantity of cars you obtain from employing assembly line workers and machines*

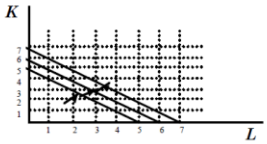
$q = q(L, K) = L + K$

Production

- Graphing the perfect substitutes production function:
  - $q = L + K$
  - *Using robots as the y-axis, solve for K:*

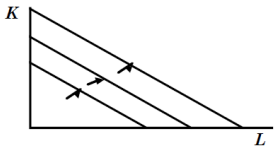
$\Rightarrow K = q + (-1)L$ *such that for* $q = 5$, $q = 6$, $q = 7$

L	K	L	K	L	K
0	5	0	6	0	7
1	4	1	5	1	6
2	3	2	4	2	5
3	2	3	3	3	4
4	1	4	2	4	3
5	0	5	1	5	2



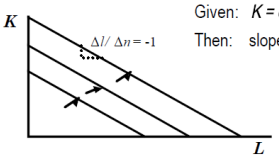
Production

- An isoquant curve is the graph of the production function and shows all combos of assembly line workers and machines that can be used to produce a car
  - *An isoquant map is a graphical summation of production relationships between two inputs and is a sample of isoquant curves that represents the complete set of the isoquant curves*



Production

- The slope of the isoquant curve equals the rate at which you are able to trade (an hour of work by) a machine for additional (hours of worker by) assembly line workers
  - *The slope of the isoquant curve is the marginal rate of technical substitution (MRTS): You are able to employ one additional (hour of work from an) assembly line worker by giving up (an hour of work by) a machine*

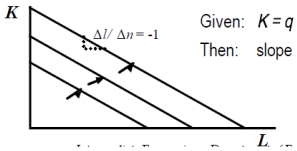


Given: $K = q + (-1)L$

Then: slope = rise/run = $\Delta K / \Delta L$ = MRS = -1

Production

- The slope of the isoquant curve, or MRTS, is also defined as the (negative) ratio of the marginal product of an hour of work by an assembly line worker to the marginal product of an hour of work by a machine
  - *Marginal product (MP) is the additional cars you obtain from employing one additional hour of a machine, or capital, (MP_K); and the additional cars you obtain from employing one additional hour of work from an assembly line worker, or labor (MP_L)*



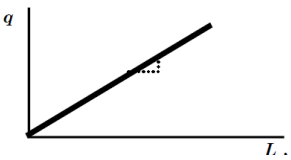
Given: $K = q + (-1)L$

Then: slope = MRTS = $- MP_L / MP_K = -1$

Production

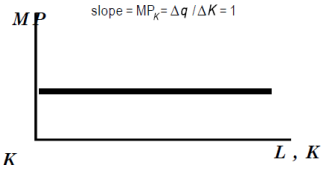
- The perfect substitutes production function (con't):
  - *Produces a constant marginal product.*
    - *It suggests that you always obtain the same additional portion of a car with each additional hour from a machine or assembly line worker*
    - *Which may be unrealistic*

Given: $q = K + L$



Then: slope = $MP_L = \Delta q / \Delta L = 1$

slope = $MP_K = \Delta q / \Delta K = 1$



Production

- Example 2: The perfect complements production function:

  L = *number of road-pavers*

  K = *number of road-paving machines*

  q = *the number of streets you pave from employing road-pavers and road-paving machines*

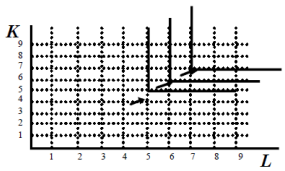
$q = q(L, K) = \text{MIN}(L, K)$

Production

- Graphing the perfect complements isoquant curve:
  - $q = \text{MIN}(L, K)$
  - *Using road-paving machines as the y-axis, solve for K:*

$\Rightarrow q = \text{MIN}(L, K)$ *such that for* $q = 5$, $q = 6$, $q = 7$

L	K	L	K	L	K
5	5	6	6	7	7
6	5	7	6	8	7
7	5	8	6	9	7
.	.	.	.	.	.
.	.	.	.	.	.
5	5	6	6	7	7
5	6	6	7	7	8
5	7	6	8	7	9
.	.	.	.	.	.
.	.	.	.	.	.



3.4 Optimization

Production

- Increasing Returns to Scale (IRS)
  - *Example 1:*
    - *Doubling your labor (2L) and doubling your capital (2K) triples your output (3q), which is more than doubles your output (2q)*
    - *i.e. $q(2L,2K) = 3q > 2q$.*
  - *Example 2:*
    - *In order triple your output (3q), you must less than triple your labor by doubling your labor (2L) and less than triple your capital by doubling your capital (2K)*
    - *i.e. $q(2L, 2K) = 3q$.*
  - *Cobb-Douglass production function (example):*

If $q = q(L, K) = aL^{1/4}K^{1/4}$,

Then $q(2L, 2K) = a(2L)^{1/4}(2K)^{1/4} = a2^{1/4}L^{1/4}2^{1/4}K^{1/4} = (2^{1/4+1/4})(aL^{1/4}K^{1/4})$

$= 2^{1/2}q = 2.38q > 2q$

Production

- Constant Returns to Scale (CRS)
  - *Example 1:*
    - *Doubling your labor (2L) and doubling your capital (2K) equals double your output (2q)*
    - *i.e. $q(2L,2K) = 2q$.*
  - *Example 2:*
    - *In order double your output (2q), you must exactly double your labor (2L) and exactly double capital (2K)*
    - *i.e. $q(2L, 2K) = 2q$.*
  - *Cobb-Douglass production function (example):*

If $q = q(L, K) = aL^{1/2}K^{1/2}$,

Then $q(2L, 2K) = a(2L)^{1/2}(2K)^{1/2} = a2^{1/2}L^{1/2}2^{1/2}K^{1/2} = (2^{1/2+1/2})(aL^{1/2}K^{1/2})$

$= 2^{1}q = 2q$

Production

- Constant Returns to Scale (CRS)
  - *Example 1:*
    - *Doubling your labor (2L) and doubling your capital (2K) equals double your output (2q)*
    - *i.e. $q(2L,2K) = 2q$.*
  - *Example 2:*
    - *In order double your output (2q), you must exactly double your labor (2L) and exactly double capital (2K)*
    - *i.e. $q(2L, 2K) = 2q$.*
  - *Cobb-Douglass production function (example):*

If $q = q(L, K) = aL^{1/2}K^{1/2}$,

Then $q(2L, 2K) = a(2L)^{1/2}(2K)^{1/2} = a2^{1/2}L^{1/2}2^{1/2}K^{1/2} = (2^{1/2+1/2})(aL^{1/2}K^{1/2})$

$= 2^{1}q = 2q$

3.5 Profit Maxization

Profit Maximization

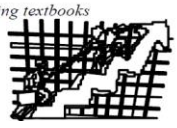
- Firms that make textbooks, for example, seek to maximize short-run profits subject to their ability to labor and machine work into textbooks
  - *Profits equals revenue from producing textbooks minus the costs of producing textbooks*
  - *Short run implies that one input is fixed*
  - *Assume perfectly competitive markets where firms sell their output at the market price (price takers)*

Profit Maximization

- Optimization problem notation (example)
  - *Strictly convex production function:*

b	= number of economics textbooks produced (* optimal)
l	= units of labor hours employed to make textbooks (* optimal)
k_o	= number of machines employed to make textbooks (fixed at 5)
p_b	= market price of economics textbooks ($100)
w	= market price of workers ($50)
r	= market price of machines ($40)
π	= the profit you obtain from producing textbooks

  - *Choose l^* and b^* to*
    Maximize $\pi = p_b b - (wl + rk_o)$
    Subject to $b = l^{1/2} k_o^{1/2}$

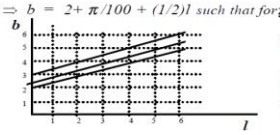


Profit Maximization

- Graphing the optimization problem (profit):
  - $\pi = p_b b - (wl + rk_o)$
  - *Using textbooks as the y-axis, solve for b:*
  - $p_b b = \pi + wl + rk_o$
  - $b = \pi/p_b + (w/p_b)l + (r/p_b)k_o$
  - *Plugging in p_b =100, w=50, r=40, and k=5*

$\Rightarrow b = \pi/100 + (50/100)l + (40/100)5$

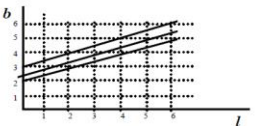
$\Rightarrow b = 2 + \pi/100 + (1/2)l$ such that for $\pi = 0$, $\pi = 50$, $\pi = 100$



l	b	l	b	l	b
0	2.0	0	2.5	0	3.0
1	2.5	1	3.0	1	3.5
2	3.0	2	3.5	2	4.0
3	3.5	3	4.0	3	4.5
4	4.0	4	4.5	4	5.0
5	4.5	5	5.0	5	5.5

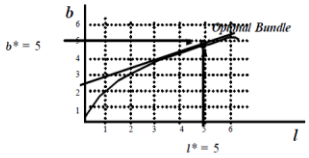
Profit Maximization

- The isoprofit curve is the graph of the profit function and shows all combinations of labor and textbooks which produces the same level of profit
  - *An isoprofit map is a graphical summation of profits at different combos of textbooks and labor, and is a sample of isoprofit curves that represents the complete set of the isoprofit curves*



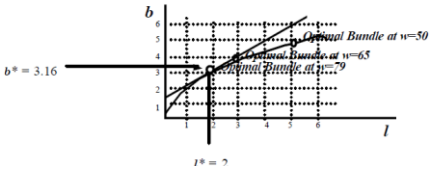
Profit Maximization

- The short-run individual labor demand curve is formed by the optimal choice of labor at different market wages, holding constant the market price of textbooks.
  - *The short-run individual labor demand curve is more technically derived using the value of the MP_l (= p_b*MP_l).*



Profit Maximization

- If the wage increases
  - *From $50 to $79*
  - *The isoprofit curve becomes steeper*

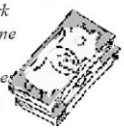


3.6 Cost Minimization

3.6.1 Cost Minimization and Returns to Scale

Cost Minimization

- Firms that produce textbooks, for example, seek to minimize long-run costs based on their ability to transform paper, labor and machines into textbooks
  - *Cost minimization equals profit maximization in perfectly competitive markets (p_b is given)*
  - *Cost minimization implies minimizing economic costs by choosing inputs based on their marginal costs*
    - *Accounting Costs are actual costs (C) , such as labor (l) and capital (k) costs of producing textbooks: C=wl+rk*
    - *Economic Costs are opportunity costs or foregone profit from other production opportunities*
    - *Sunk Costs are unrecoverable (previous) expenses*
    - *Marginal Costs are additional (future) expenses*

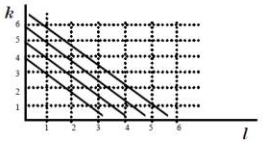


Cost Minimization

- Optimization problem notation (example)
  - *Strictly convex production function:*
    - *b = number of economics textbooks produced (fixed at 3.16)*
    - *l = units of labor hours employed to make textbooks (* optimal)*
    - *k = number of machines employed to make textbooks (* optimal)*
    - *w = market price of workers ($50)*
    - *r = market price of machines ($40)*
    - *C = the labor and capital costs you pay to produce textbooks*
  - *Choose l^* and k^* to*
    Minimize $C = wl + rk$
    Subject to $b = l^{½} k^{½}$

Cost Minimization

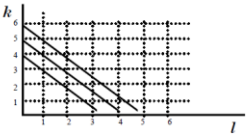
- Graphing the optimization problem (costs):
  - *$C = wl + rk$*
  - *Using capital as the y-axis, solve for k:*
  - *$rk = C - wl$*
  - *$k = C/r - (w/r)l$*
  - *Plugging in w=50 and r=40*
  - *$\Rightarrow k = C/40 - (50/40)l$ such that for* ***C = 160 C = 200 C = 240***



l	k	l	k	l	k
0	4.00	0	5.00	0	6.00
1	2.75	1	3.75	1	4.75
2	1.50	2	2.50	2	3.50
3	0.25	3	1.25	3	2.25
		4	0.00	4	1.00

Cost Minimization

- The isocost curve is the graph of the cost function and shows all combinations of labor and capital which have the same total cost
  - *An isocost map is a graphical summation of costs at different combos of capital and labor, and is a sample of isocost curves that represents the complete set of the isocost curves*

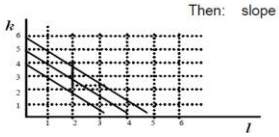


Cost Minimization

- The slope of the isocost curve is the factor price ratio
  - *The factor price ratio measures the amount of capital you must give up to obtain an additional unit of labor*
    - *You must give up one and one-fourth units of capital to obtain an additional unit of labor*

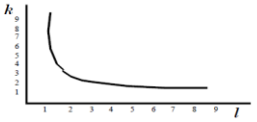
Given: $k = C/40 - 1.25l$

Then: slope = rise / run = $\Delta k / \Delta l = -w/r = -1.25$



Cost Minimization

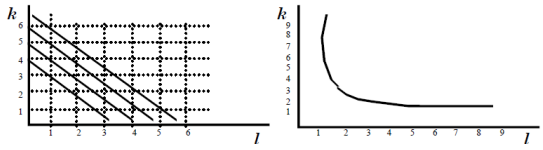
- Graphing the optimization problem (isoquant):
  - *$b = l^{½} k^{½}$*
  - *Using number of machines as the y-axis, solve for K:*
  - *$\Rightarrow k^{½} = b / l^{½}$*
  - *Plugging in b =3.16:*
  - *$k = 3.16^2 / l$ such that for b = 3.16*



l	k
0.50	19.97
1.00	9.99
2.00	4.99
3.00	3.33
4.00	2.50
8.00	1.25

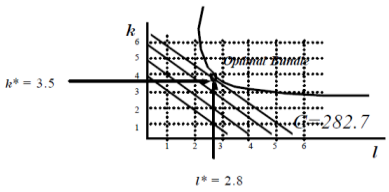
Cost Minimization

- Graphing the optimization problem (*con't*):
  - *Combining cost function and production function to obtain the optimal choices of labor and capital*



Cost Minimization

- The solution to the optimization problem:
  - *The optimal choice of capital and labor occurs where:*
    - *The isocost curve is tangent to the isoquant curve*
    - *The slopes are equal (where MRTS = w/r)*



3.7 Types of Markets

3.7.1 Types of Markets and Perfect Competition

Perfect Competition

- Characteristics of Perfectly Competitive Markets
  - *Many firms in the market*
  - *Many buyers in the market*
  - *Identical products*
  - *Free entry*
    - *No barriers to entering the market*
  - *Free exit*
    - *No costs to leaving the market*
  - *Perfect Information*
    - *Sellers and buyers are fully aware of competitors and other market opportunities*

Perfect Competition

- Key Questions:
  1. *How does market demand and market supply determine price (p*) and market output (Q*) ?*
  2. *How do individual firms in the market choose output (q*) ?*
     (Using output prices & cost curves instead of isoprofit & production curves)
  3. *How are maximum profits (π^*) determined for individual firms ?*
     (Using output prices & cost curves instead of isoprofit & production curves)
  4. *How do changes in market demand impact individual firm profit (π^*) ?*
  5. *How do changes in market supply impact individual firm profits (π^*) ?*

Perfect Competition

- Key Questions:
  1. *How does market demand and market supply determine price (p*) and market output (Q*) ?*

Perfect Competition

1. How does market demand and market supply determine price (p*) and market output (Q*) ?
   - *Remember the consumer's optimization problem using strictly convex preferences:*
     - b = *number of economics textbooks consumed (* optimal)*
     - c = *cups of coffee purchased (* optimal)*
     - p_b = *market price of used economics textbooks ($20)*
     - p_c = *market price of cup of coffee ($5)*
     - I = *income ($1000)*
     - U = *the utility you obtain from consuming books & coffee*
   - *The consumer chooses b^* and c^* to*
     Maximize $U = b^{½} c^{½}$
     Subject to $I = p_c c + p_b b$

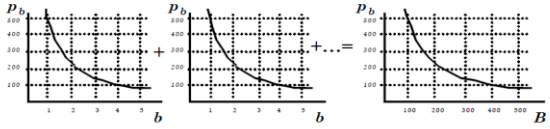
Perfect Competition

1. How does market demand and market supply determine price (p*) and market output (Q*) ?
   - *An individual's demand for books is determined by:*
     $b^* = [a/(a+b)](I/p_b)$
     $= [½/(½+½)](1000/p_b)$
     $= ½(1000/p_b)$
     $= 500/p_b$
   - *The market demand is the sum of individual demands*
     - *To obtain market demand (B_D), consider 100 other consumers with the same preferences, budget constraint and demand for books*

     $B_D = 100b^*$
     $= 50{,}000/p_b$

Perfect Competition

1. How does market demand and market supply determine price (p*) and market output (Q*) ?
   - *Graphing the individual and market demand curves:*
     Individual 1 + *Individual 2* +...= *Market Demand*
     $b^* (= 500/p_b)$ + $b^* (= 500/p_b)$ +...= $B_D (= 50{,}000/p_b)$



Perfect Competition

1. How does market demand and market supply determine price (p*) and market output (Q*) ?
   - *Remember the firm's short-run optimization problem using a strictly convex production function:*
     b_o = number of economics textbooks produced (fixed)
     l = units of labor hours employed to make textbooks (* optimal)
     k_o = number of machines employed to make textbooks (fixed at 5)
     w = market price of workers ($50)
     r = market price of machines ($40)
     C = the labor and capital costs you pay to produce textbooks
   - *The firm chooses l^* to*
     Minimize $C = wl + rk_o$
     Subject to $b = l^{½} k_o^{½}$

Perfect Competition

1. How does market demand and market supply determine price (p*) and market output (Q*) ?
   - *An individual firm's supply curve is determined by its marginal cost*
     $C = w\,l^* + rk_o$ *where* $l^* = b^2 / k_o$
     $= 50\,l^* + 40(5)$
     $MC = \partial C/\partial b$
     $= 2wb / k_o = 2\,(50)\,b / 5$
     $= 20\,b$
   - *Market supply is the sum of supply from individual firms*
     - *To obtain market supply (B_s), consider 100 other firms with the same input costs, technologies and marginal cost of books*

     $B_s = 100\,b = 100\,[(1/20)\,MC]$
     $= 5\,MC$

3.7.2 Types of Markets and Monopoly

Types of Markets

- The type of market determines how firms choose the optimal level of output and price
  - *Many firms selling identical goods*
    - *Perfect Competition*
  - *One firm*
    - *Monopoly*

Monopoly

- Characteristics of Markets with Monopolies
  - *One firm in the market*
  - *Many buyers in the market*
  - *Identical products*
  - *Barriers to entry*
    - *Government copyrights and patents prevent firms from entering market*
      - *Intellectual property such as new methods in social science research and new pharmaceutical drug formulas*
    - *Laws regulate limited/sole providers of some goods*
      - *Electricity*
    - *Increasing returns to scale technology makes entry inefficient*
      - *Natural monopolies: cheaper for one firm to produce rather two or more*

Monopoly

- Key Questions:
  1. *How does market demand and market supply determine market output (Q*) and price (p*)?*
  2. *How are maximum profits (π^*) determined ?*
  3. *How is efficiency determined ?*

Monopoly

- Key Questions:
  1. *How does market demand and market supply determine market output (Q*) and price (p*)?*

Monopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Remember the consumer's optimization problem using strictly convex preferences:*
     b = number of economics textbooks consumed (* optimal)
     c = cups of coffee purchased (* optimal)
     p_b = market price of used economics textbooks ($20)
     p_c = market price of cup of coffee ($5)
     I = income ($1000)
     U = the utility you obtain from consuming books & coffee
   - *The consumer chooses b^* and c^* to*
     Maximize $U = b^{½} c^{½}$
     Subject to $I = p_c c + p_b b$

Monopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Consider the following linear approximation of the individual's demand for books:*
     $b^* = I - [(a + b) / a]^* p_b$
     $= 1000 - [(½ + ½) / ½] p_b$
     $= 1000 - 2\,p_b$
   - *The market demand is the sum of individual linear demands*
     - *To obtain market demand (B_D), consider 100 other consumers with the same preferences, budget constraint and demand for books*

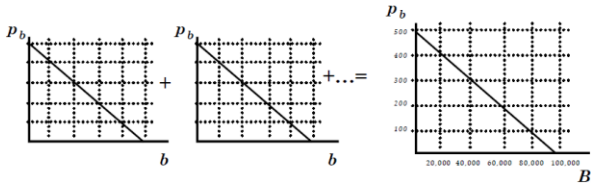
     $B_D = 100\,b^*$
     $= 100{,}000 - 200\,p_b$

Monopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Graphing the individual and market demand curves:*

Individual 1 + *Individual 2* +…= *Market Demand*

$b^* (= 1{,}000 - 2p_b)$ + $b^* (= 1{,}000 - 2p_b)$ +…= $B_D (= 1{,}000{,}000 - 200\,p_b)$



Monopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Graphing the market marginal revenue (MR) curves:*

Given: $B = 100{,}000 - 200\,p_b$, *then* $p_b = 500 - 1/200\,B$

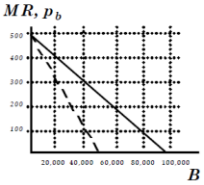
then $TR = p_b B = 500\,B - 1/200\,B^2$

Then: $MR = \partial TR / \partial Q$

$= \partial (p_b B) / \partial B$

$= 500 - (1/100)\,B$

- *The market marginal revenue curve is steeper and below the demand curve*



Monopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Case 1: Using CRS technology to determine MC & ATC*
   - *Remember the firm's short-run optimization problem using a strictly convex production function:*

B = number of economics textbooks produced (fixed)

l = units of labor hours employed to make textbooks (* optimal)

k_o = number of machines employed to make textbooks (fixed at 10,000)

w = market price of workers (\$50)

r = market price of machines (\$40)

C = the labor and capital costs you pay to produce textbooks

   - *The firm chooses* l^* *to: Minimize* $C = wl + rk_o$

Subject to $B = l^{1/2} k_o^{1/2}$

Monopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Graphing the market supply curve:*

$C = w\,l^* + rk_o$ *where* $l^* = B^2 / k_o$

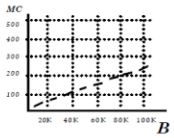
$= 50\,l^* + 40\,(40{,}000)$

$MC = \partial C / \partial B$

$= 2wB / k_o = 2\,(50)\,B / 40{,}000$

$= (1/400)\,B$

$B_s = 400\,MC$



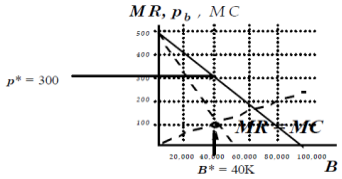
Monopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *B* and p* occurs where MR = MC*

B	$p_b = 500 - 1/200\,B$	$TR = p_b B$	AR	MR	$l^* = B/k_o$	$TC = 50l + 40k_o$	ATC	MC
0	500	0	-	-	0	1.6M	-	0
20K	400	8M	400	300	10K	2.1M	105	50
40K	300	12M	300	100	40K	3.6M	90	100
60K	200	12M	200	-100	90K	6.1M	102	150
80K	100	8M	100	-300	160K	9.6M	120	200
100K	0	0	-	-500	250K	14.1M	141	250

Monopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Combining demand, marginal revenue and marginal cost*



Monopoly

- Key Questions:
  1. *How does market demand and market supply determine price (p*) and market output (Q*) ?*
  2. *How are maximum profits (π*) determined ?*

Monopoly

2. How are maximum profits (π*) determined ?
   - *B*, p* and maximum profits occur where MR = MC*

B	$p_b = 500 - 1/200\,B$	$TR = p_b B$	AR	MR	$l^* = B/k_o$	$TC = 50l + 40k_o$	ATC	MC	Profit
0	500	0	-	-	0	1.6M	-	0	-1.6M
20K	400	8M	400	300	10K	2.1M	105	50	5.9M
40K	300	12M	300	100	40K	3.6M	90	100	8.4M
60K	200	12M	200	-100	90K	6.1M	102	150	5.9M
80K	100	8M	100	-300	160K	9.6M	120	200	-1.6M
100K	0	0	-	-500	250K	14.1M	141	250	-14.1M

3.7.3 Types of Markets and Oligopoly

Types of Markets

- The type of market determines how firms choose the optimal level of output and price
  - *Many firms selling identical goods*
    - *Perfect Competition*
  - *One firm*
    - *Monopoly*
  - *Few firms*
    - *Oligopoly*

Oligopoly

- Characteristics of Markets with Oligopolies
  - *Few firms in the market*
  - *Many buyers in the market*
  - *Identical products*
  - *Output is interdependent on other firms in the market*

Oligopoly

- Key Questions:
  1. *How does market demand and market supply determine market output (Q*) and price (p*)?*
  2. *How are maximum profits (π^*) determined ?*

Oligopoly

- Key Questions:
  1. *How does market demand and market supply determine market output (Q*) and price (p*)?*

Oligopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Remember the consumer's optimization problem using strictly convex preferences:*

b	= number of economics textbooks consumed (* optimal)
c	= cups of coffee purchased (* optimal)
p_b	= market price of used economics textbooks ($20)
p_c	= market price of cup of coffee ($5)
I	= income ($1000)
U	= the utility you obtain from consuming books & coffee

   - *The consumer chooses b^* and c^* to*
     Maximize $U = b^{½} c^{½}$
     Subject to $I = p_c c + p_b b$

Oligopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Consider the following linear approximation of the individual's demand for books:*
     $b^* = I - [(a + b) / a]^* p_b$
     $= 1000 - [(½ + ½) / ½] p_b$
     $= 1000 - 2 p_b$
   - *The market demand is the sum of individual linear demands*
     - *To obtain market demand (B_D), consider 100 other consumers with the same preferences, budget constraint and demand for books*

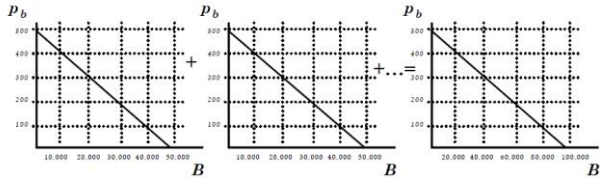
     $B_D = 100\, b^* = 1{,}000{,}000 - 200\, p_b$
   - *If two firms decide to split the market demand (duopoly), then: $B_D = 50{,}000 - 100 p_b$*

Oligopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Graphing the individual and market demand curves:*

Firm 1's Demand + *Firm 2's Demand* = *Market Demand*

$b^* (=50{,}000 - 100 p_b)$ + $b^* (=50{,}000 - 100 p_b)$ = $B_D (=100{,}000 - 200 p_b)$



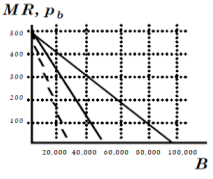
Oligopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Graphing the individual marginal revenue (MR) curve:*

Given: $B = 50{,}000 - 100\, p_b$, *then* $p_b = 500 - 1/100\, B$

then $TR = p_b B = 500\, B - 1/100\, B^2$

Then: $MR = \partial TR / \partial Q$
$= \partial (p_b B) / \partial B$
$= 500 - (1/50)\, B$



- *The market marginal revenue curve is steeper and below the demand curve*

Oligopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Using CRS technology to determine short-run MC & ATC*
   - *Remember the firm's short-run optimization problem using a strictly convex production function:*
     B = number of economics textbooks produced (fixed)
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     k_o = number of machines employed to make textbooks (fixed at 10,000)
     w = market price of workers ($50)
     r = market price of machines ($40)
     C = the labor and capital costs you pay to produce textbooks
   - *The firm chooses l^* to: Minimize $C = wl + rk_o$*
     Subject to $B = l^{½} k_o^{½}$

Oligopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Graphing the market supply curve:*

$C = w l^* + rk_o$ where $l^* = B^2 / k_o$

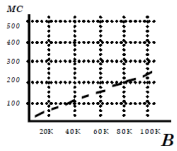
$= 50 l^* + 40 (40{,}000)$

$MC = \partial C / \partial B$

$= 2wB / k_o = 2 (50) B / 40{,}000$

$= (1/400) B$

$B_s = 400 MC$



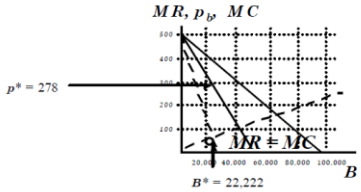
Oligopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *B* and p* occurs where MR = MC*

B	p = 500-1/200B	TR=pB	AR	MR	$l^* = B/k_o$	TC = 50wl+40rk	ATC	MC
0	500	0	-	-	0	1.6M	-	0
20K	400	8M	400	300	10K	2.1M	105	50
40K	300	12M	300	100	40K	3.6M	90	100
60K	200	12M	200	-100	90K	6.1M	102	150
80K	100	8M	100	-300	160K	9.6M	120	200
100K	0	0	-	-500	250K	14.1M	141	250

Oligopoly

1. How does market demand and market supply determine market output (Q*) and price (p*)?
   - *Combining demand, marginal revenue and marginal cost*



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