PEPPERDINE UNIVERSITY
THE GEORGE L. GRAZIADIO
SCHOOL OF BUSINESS AND MANAGEMENT

PROFESSOR ALFRED J. HAGAN

MBFE 657.21

PRICES, PROFITS, AND THE MARKET ECONOMY

SUMMER 2004

MONDAYS

6:00 P.M. – 10:00 P.M.

WEST LOS ANGELES PLAZA

SYLLABUS
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NOTE: Any student missing the first class session without prior notice to the Professor will be automatically dropped.
COURSE DESCRIPTION

This course examines the domestic and global creation and distribution of goods and services as guided by the price system. In addition, the impact of the domestic and global economic environment, technological change on the behavior of business firms, and producer and consumer behavior in competitive and monopolistic markets is examined. Additional topics include gross domestic product and the business cycle, monetary and fiscal policy, comparative advantage for the firm, and global issues.

Objectives of the course include: To clarify the tools of economic analysis and to distinguish that analysis from social philosophy; to use these tools of analysis to evaluate current market factors and public policy; and, to enhance the manager's decision making ability within the context of those factors and policies.

COURSE PROCEDURES AND RECOMMENDATIONS

I. NOTE TAKING IS ESSENTIAL

   A. Take everything down no matter how insignificant it may seem at the time.

   B. It may be helpful to use two colors of ink to distinguish the "important" material -- as determined by you and your study group.

   C. Review once a week with at least one other student -- preferably before each class.
D. Tape recorders are permissible.
E. Occasionally, visual contact with the professor is essential to complete understanding of the material. At such times, you will be asked to put down your writing implements and give your undivided attention. If, at that moment (or any other), you need time to catch up with your notes, a short delay will always be granted upon request.
F. Feel free at all times to ask questions concerning any relevant material.

II. READING

A. *The Worldly Philosophers* (paperback) by Robert L. Heilbroner is an outstanding survey of the history of economic thought and analysis by one of the best authors in economics.

B. *Economath Primer* (paperback) by L. Wayne Gertmenian provides a review of the notations and mathematical tools commonly used in economics and is an outstanding review for graduate students irrespective of previous degree work.

C. *Essentials of Economics*, 5th edition (paperback) by Bradley R. Schiller, provides an easy to follow presentation of the essentials of economics. The elements presented in this text will be treated in greater depth in class lectures. The outstanding feature of this book is its development of Internet sources to assist in the understanding of the material presented. I encourage your use of the URLs made available through the publisher's web site as well as those included in each chapter to enliven the connection of economics to the real world.

NOTE: Students should recognize that the vast majority of books on the subject of microeconomics are virtually identical in general subject matter covered. Some will use a more "mathematics oriented" approach (lots of math), others will use a more graphical approach (lots of graphs), and still others will be very "chatty" in their approach. Some students may find that another text than that selected by the professor will be better able to shine light on the various topics of economics. Students, therefore, should feel free to browse through other economics texts for additional "light." Your professor is probably familiar with any text you may locate. If you feel that your text may do a better job for you than Schiller, so be it. The objective is for you to learn this material.

NOTE: All reading assignments given in the HOMEWORK are provided for course pacing and are not intended to specifically correlate with written assignments.
III. HOMEWORK

A. There are 20 points possible on each of ten assignments. The intent of the homework is to instill and maintain a high level of proficiency in the application of the elements of economics. Therefore, all work is to be submitted before the beginning of each class lecture. The first activity in each class will be collection of homework and passing out the weekly grade sheets.

B. Please type all work on 8.5” by 11” paper. Handwritten work will receive a 10% penalty. Math problems need not be typed -- BUT, all work must be shown.

C. Place your NAME, DAY OF WEEK class is held, and the ASSIGNMENT NUMBER (Homework Number, NOT Course Week Number, please) in the upper, left-hand corner of your work. (Do not use a cover page.) NUMBER YOUR ANSWERS!

<table>
<thead>
<tr>
<th>NAME:</th>
<th>Jane Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY OF WEEK:</td>
<td>Monday</td>
</tr>
<tr>
<td>ASSIGNMENT NUMBER:</td>
<td>Homework 1, etc.</td>
</tr>
</tbody>
</table>

D. Homework will not be returned to the student; make a duplicate before turning in your homework for your future reference and verification of errors.

E. Each week a grade report will be given each individual. On that grade report, there will appear your grade for the previous week's homework as well as your cumulative grade to that week.

If you lost points and you do not understand why you lost points:

First - Review the material. You may have improved your understanding of the material in the intervening period.

Second - Check with your group -- use the phone and e-mail. Group members may be able to help you. This vastly improves group cohesion and learning.

Third - Check with me before/after class.

Do not bypass the opportunity to improve your understanding of the homework material. In one form or another, it will very likely appear on the next exam. Furthermore, it will be necessary for understanding of future material.

F. A 20% penalty (4 points) will be assessed for any assignment or part of an assignment that is submitted late. You may not submit an assignment twice. In no case will homework be accepted two weeks past the due date, nor will homework be accepted after the respective material has been covered on an exam.
G. Staple the homework together. Staplers are always available in the Center director's office area.

IV. EXAMINATIONS

Midterms take one-and-a-half hours and are followed by 2 hours of lecture. If, for any reason, you are unable to take a mid-term, please notify the instructor prior to the giving of the exam. Failure to do so will result in a 5% course grade penalty.

No make-up exams will be given. Scores for ALL other work will be pro-rated to compensate for a midterm not taken. Only one midterm may be missed. No pop quizzes.

The final exam will have no set time limit, although it generally takes about two hours. It is comprehensive but will concentrate on the material since the second midterm.

Exam format is generally short-answer essay and problems. Domination of graphical analysis in microeconomics is expected. Exam materials are provided (blue-books are not required). Answers must be given in dark ink, with proper spelling for names and foreign phrases.

Calculators are permitted with the following functions: Add, Subtract, Divide, Multiply, memory that cannot receive or reproduce letters of any alphabet. **NO others are allowed.**

V. GRADING

There will be a total of 800 points available:

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
<th>Class Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Homework</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>First Midterm Exam</td>
<td>(6th)</td>
</tr>
<tr>
<td>150</td>
<td>Second Midterm Exam</td>
<td>(11th)</td>
</tr>
<tr>
<td>100</td>
<td>Class Participation</td>
<td>(See Note VI, below)</td>
</tr>
<tr>
<td>200</td>
<td>Project</td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>
A university scale will be used, i.e.:

94%-100%  = A
90%-93.9% = A-
87%-89.9% = B+
84%-86.9% = B
80%-83.9% = B-
77%-79.9% = C+
74%-76.9% = C
70%-73.9% = C-
67%-69.9% = D+
64%-66.9% = D
60%-63.9% = D-
<60%    = F

A "class curve" will not be used to determine or affect grades.

VI. CLASS PARTICIPATION

Every class has a few leaders whose conduct is a positive force in establishing the attitude and learning environment of that class.

Unfortunately, there are also, on occasion, some students whose behavior is obstructive. Usually a class will "tilt" toward the dominant group and the subsequent difference in academic achievement can be dramatic. I request your cooperation in keeping the dominant mood positive for the benefit of enhanced learning.

Leaders come to class prepared, FORM STUDY GROUPS, assist their peers, look at education as an opportunity to expand their knowledge however it may be defined. Obstructionists reject learning what they don't already know and have an endless supply of complaints such as, "Why must we memorize for the exam? Why do we have to use a dark pen on exams? What does this subject have to do with my job? How come you didn't tell us what was going to be on the exam? It might have been in the readings but we didn't spend more than 15 minutes on it in class, why was it on the exam?"

Leaders light a candle; obstructionists curse the darkness.

At the end of the course, a sociogram will be completed by all students, thereby ranking each participant's influence on the class. The mean of the class's scores will be determined to obtain a class benchmark. Scores at, above, or below this average will be assigned according to a student's ranking in the sociogram using standard deviations as a distribution medium.

The professor reserves the option to abandon this procedure if, in his judgment, the scores are unfairly punitive.
VII. CLASS COURTESY

FOOD Many students complain about others eating in class. Issues of odor, noise from food packaging, chewing ice, etc., may seem petty, but can detract from students’ learning and cause student discomfort and conflict. Please demonstrate your respect for others by not eating in class.

CELL PHONES, PAGERS, ETC. Please show your respect for other students by not causing interruptions in class through the use of phones and beepers during class time.

VIII. PROJECT

The general intent of the project is to give you the practice of applying the principles of macroeconomic theory to the real world. Therefore, there is a substantial part of the course grade assigned to this element of the course.

Please do not take the position that you will benefit from hiding the topic and its progress as long as possible. In the past, this frequently has produced disastrous results. As a currently active international researcher and consultant, I can be of significant help to you in "shaking out" your project. I am more than willing to provide all the assistance I can -- within the bounds of fair and equal treatment to all groups. Please take advantage of this resource.

A. Groups are required. A minimum of two -- but preferably three -- people is required. A maximum of four -- but preferably three -- people will be permitted.

B. Trial topics should be broad in scope, initially. The tendency will then be to narrow them down as more is learned about the area. Please consult with the professor on any changes. Last minute, unannounced changes will not be accepted.

C. The general theme of the project will be a forecast of international or foreign macroeconomic (including demographic) factors influencing the success of the firm. Adequate statistical materials and computer technology are available in the Center to complete the project.
D. The objective is to locate an area of macroeconomic theory that can be developed as a predictor of business success (parent company profits/sales) for the firm that you have in mind. Examples abound in the literature:

1. Forecast of economic/political risk factors based on macroeconomic data in foreign markets for the firm.

2. Forecast of balance of payments movements that can be identified as being useful for the firm.

3. Forecast of the firm's foreign sales potential, based on foreign, international, and global macroeconomic factors.

4. Forecast of the firm's foreign supply characteristics and cost of materials based on macroeconomic data.

The successful group will: (1) Select factors that make sense in terms of correlation; (2) Build a model of past factor growth; (3) Test the model with past data; (4) Forecast future outcome; and, (5) Explain the results on headquarter (dollar) profits in a manner useful to the firm's policy group.

IX. FORMAT GUIDE FOR PROJECT

The text of the paper, from the introduction to the conclusion, must not exceed 25 pages of double-spaced word processing with sensible margins. The paper also would probably not work well with fewer than 18 pages.

Any graphs, tables, or figures not essential to the profitable reading of the text but valuable to the understanding of the general content should be placed in an Appendix. Those tables, graphs, etc., included within the text should be on separate pages unless they are very short: One-quarter page or less. Tables and graphs on separate pages should be numbered as the previous page, with the addition of a letter; i.e., page 14-A, not page 15. Use graphs at every opportunity. They are much clearer than tables of the same material.

Computer printouts are a normal part of such projects. The useful elements of these printouts belong in an Appendix. All useful material learned through these computer runs and presented in the report must be analyzed and discussed in the text of the paper with data, theoretical and practical positions presented. You cannot expect that all members of the executive group to whom you are reporting will know what $R^2$ means or what a Durbin-Watson statistic is, nor is it their job to analyze your computer runs.

This project is designed to be a demonstration of how skilled you have become at helping supervisors understand what they will need to know to accurately assess the firm’s overseas potential with respect to their own industry or market and profitable
communication with foreign/international government or corporation officers. This is not supposed to be a "snow job."

This is a research paper and evidence of research is expected. Expect a substantial number of references. For the sources you reference in your paper, make an alphabetic list of their citations and place it at the end of the paper as a separate page entitled, “References.” Within the paper, where citation is required, reference the author, followed by a comma and the date of publication (#1). For direct quotes, add a page number to the citation, as follows (#2).

1. For a database-retrieved journal article:

   a. In your paper, following cited material, add the following parenthetical reference:

        (Fournier, deRidder, & Bensing, October, 2003)

   b. In your bibliography, provide the following citation:


2. For a chapter of a source with no author: (EIU Country Profile)

   a. In your paper, following quoted material, add this parenthetical reference.

        (External sector, 2003, p. 7)

   b. In your bibliography, provide the following citation:


Managers reading research reports may want to know your sources so that they can do some more research, cover themselves as they present your report, etc. Good references are a benefit, not a detriment. I would suggest that 15 to 20 sources would be normal for a paper of this type. It is pointless to simply list the various sources that might relate to the topic: They are probably endless. Please list only those sources that you have used in your paper. The number of references is a function of your needs in producing a useful paper, but should normally exceed the number of source items.

In a research paper, you are not supposed to be writing something entirely new; this is not a creative writing exercise. The point is to inform your reader -- your supervisor -- as to what is going on regarding the topic that would be useful to the firm as background for discussion with foreign national leaders or businessmen.
Please remember that this is the culmination of the course. Your efforts here really tie together any loose ends that have not been tied through class and group efforts. Toward that end, I am available at any time for your questions. I will give you my general schedule and e-mail address when we first meet. Please leave e-mail messages if you can't find me and I will reply. **Please use E-MAIL, not the telephone. E-mail avoids playing phone tag with each other and gives each of us a record of what went on.**

Do not wait until the last minute to do your research! This paper should require approximately one month of effort from topic selection to final draft. You can't possibly do it right in a week -- no matter how much help you get from me or anyone else.

Papers must be submitted in a format that guarantees the reader that they will not come apart in the reading. No elaborate binding is required or desired. **No three-ring binders, please.**
X. COURSE OUTLINE

PART ONE: INTRODUCTION

I. Definitions. At the outset, such basic words as "methodology," "externality," "marginality," and other common terms will be given a prima facie treatment.

   A. Economics
   B. Problems of Choice
   C. Theory
   D. Emotionalism and Ignorance
   E. Common Terms
      1. Economy (minimum inputs) vs. Efficiency (maximum output)
      2. Economic Rent vs. Quasi Rent
      3. Production vs. Productivity
      4. Gross Domestic Product (GDP)
      5. Marginality
      6. Externalities
      7. Normative Ambiguity

II. History of Economic Thought. It is helpful if the student can acquire a learning matrix within which to "stuff" and subsequently locate the great number and range of economic theories. For this reason, time is taken at this juncture to briefly review the contributions of the people and movements that have greatly influenced economic thought.

   A. Pre-Classical Period
      1. Religion
      2. Ancient Philosophers
         a. Confucius
         b. Mencius
         c. Plato
         d. Aristotle
      3. Scholastics - St. Thomas Aquinas
      4. Mercantilists
      5. Physiocrats - François Quesney
   
   B. Classical Economists
      1. David Hume
      2. Adam Smith
      3. Thomas Robert Malthus
      4. David Ricardo
      5. John Stuart Mill
      6. Karl Heinrich Marx
C. Neo-Classical Economists
1. Leon Walras
2. Alfred Marshall
3. Vilfredo Pareto
4. Francis Ysidro Edgeworth
5. Joseph Alois Schumpeter
6. John Maynard Keynes

D. Modern Economists
1. John Kenneth Galbraith
2. Milton Friedman
3. Paul Anthony Samuelson

III. Mathematical Economics. Economics is both a "hard" and a "soft" science. Indeed, neither philosophic concepts nor mathematical tools can, alone, adequately teach the essential lessons of the course. Therefore, a brief review of critical algebraic and geometric concepts will be given.

A. Common Notations ("Note" references are in Gertmenian)
1. Specific Economic Usage (see Note A)
2. General Mathematical Use (see Note C)

B. Common Terms and Operations
1. Algebra (see Note D)
2. Geometry (see Note E)

C. Concept of Slope
1. Graphical Analysis (see Note F)
2. Differentiation (see Note G)
3. Economic Applications (see Note H)

PART TWO: MICROECONOMICS

I. Consumer Behavior: We will begin by explaining how the conduct of a consumer (his demand for a good or service) is generated by the utility he receives from the use of a given product. The consumer's responsiveness to a price change (elasticity of demand) will be an essential part of the student's understanding.

A. Utility
1. Introduction
   a. Price is an equilibrium
   b. Supply is a derivative of cost
   c. Demand is a derivative of utility
   d. Two methods of measuring utility
2. Cardinal Utility  
   a. Total utility  
   b. Marginal utility (Walras)  
   c. Law of Diminishing Marginal Utility  
   d. Derived demand  
   e. Consumer surplus (Marshall)  
3. Ordinal Utility  
   a. Indifference curves  
   b. Budget constraints  
   c. Indifference curve map  
   d. Derived demand  

B. Demand  
1. Introduction  
   a. Effective demand  
   b. Demand shift  
2. Law of Downward Sloping Demand  
   a. Normal goods  
   b. Conspicuous consumption (Thorstein Veblen)  
   c. Inferior goods (Sir Robert Giffen)  
3. Elasticity (see Note O)  
4. Revenue (see Note P)  

II. Producer Behavior: Production cost is the vantage point from which we will evaluate the elements of Supply Theory.  
A. Cost  
1. Total Costs = Fixed Costs + Variable Costs  
   a. Fixed Costs  
   b. Variable Costs  
   c. Total Costs  
2. Marginal Costs  
   a. Slope of Total Costs  
   b. Diminishing Returns  
3. Average Costs  
   a. Average Fixed Costs  
   b. Average Total Costs  
   c. Minimum Average Costs  
B. Supply  
1. Introduction  
   a. Supply is a Derivative of Marginal Cost  
   b. Aggregate Supply  
   c. Elasticity of Supply
2. Supply Curves
   a. Increasing Costs
   b. Decreasing Costs
   c. Constant Costs
   d. Fixed Supply

3. Time Period
   a. Long-Run
   b. Short-Run
   c. Momentary

III. Supply and Demand Equilibrium: Theoretically, the market price will equate the quantity supplied with the quantity demanded. Price equilibrium will be considered with reference to auctions, sales taxes, interdependent markets, and government restrictions.

A. Tax Incidence
   1. Introduction
      a. Concept of Ultimate Burden
      b. Elasticity of Supply and Demand
      c. Graphical Analysis
   2. Extreme Conditions
      a. Totally Elastic Supply
      b. Totally Elastic Demand
      c. Totally Inelastic Supply
      d. Totally Inelastic Demand
   3. Special Cases
      a. Tariffs
      b. Superstars
      c. Subsidies

B. Interdependent Markets
   1. Introduction
      a. Equilibrium
      b. Dynamics
   2. Comparative Statics
      a. Substitution Goods
      b. Complementary Goods
      c. Factor Goods
      d. Graphical Analysis

C. Government Interaction
   1. Introduction
      a. Caveat Emptor
      b. Government Paternalism
      c. Black Markets
      d. Income Redistribution
2. Wage and Price Controls
   a. Minimum Wages
   b. Rent Ceilings

IV. Profit Maximizing in a Competitive Market: The "Theory of the Firm," as this subject is generally called, represents the culmination of our Price Theory Analysis; i.e., the interaction between the consumer and the producer in their independent efforts to maximize utility and profit is the central theme. A rather restrictive set of assumptions make the theory something less than realistic, but its predictive ability and contribution to the student's ultimate understanding of Price Theory and the operation of the whole fabric of economic behavior as it applies to the modern firm recommend it highly as a worthwhile subject.

A. Assumptions of Perfect Competition
   1. Market Price
      a. The Single Firm
      b. Collusion
      c. Totally Elastic Demand
   2. Homogeneous Product
      a. Standardized Commodities
      b. Differentiated Products
   3. Free Market
      a. Free Entry
      b. Free Exit

B. Decision Points
   1. Shut-Down Point
      a. Total Revenue = Variable Costs
      b. Graphical Analysis
   2. Break-Even Point
      a. Total Revenue = Total Cost
      b. Graphical Analysis

C. Perfect Competition Model
   1. Applicable Functions
      a. Marginal Cost
      b. Average Cost
      c. Demand
      d. Average Revenue
      e. Marginal Revenue
   2. Equilibrium
      a. Price and Quantity
      b. Excess Profit
      c. Long-Run Equilibrium

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V. Non-Competitive Markets: We will examine monopoly, price discrimination, and oligopolies.

A. Monopoly (Single Seller)
   1. Introduction
      a. Greek Root: Monos
      b. No Close Substitutes
      c. Continuum of Econ Activity: Perfect Comp vs. Monopoly
   2. Profit Maximization
      a. Equilibrium
      b. Welfare Effects
   3. Government Regulation
      a. Major Legislation
      b. Utility Commissions and Essential Services

B. Monopolistic Competition
   1. Introduction
      a. Definition
      b. Oligopolistic Industries (Few Sellers)
   2. Oligopoly Model
      a. Price Stability
      b. Discontinuous Marginal Revenue Function
   3. Collusion
      a. Merger (Explicit)
      b. Cartel (Explicit)
      c. Implicit Collusion

C. Price Discrimination (Joan Robinson)
   1. First Degree (Perfect Price Discrimination)
      a. Elasticity of Demand
      b. Consumer Surplus
   2. Second Degree (Quantity Discounts)
   3. Third Degree (Market Separation)
      a. Time
      b. Geographic
      c. Labeling

PART THREE: MACROECONOMICS

I. Distribution: Factor Pricing will be introduced with specific emphasis given to Labor and Capital Theory and related topics, including minimum wages, monopoly rents, and interest rates.

A. Factor Pricing
B. Monopsony and Oligopoly
C. Supply of Labor
II. Government Intervention
   A. Market Failure
   B. Public Goods
   C. Externalities
   D. Market Power
   E. Equity
   F. Macro Instability

III. The Business Cycle
   A. Assessing Macro Performance
   B. GDP Growth
   C. Unemployment
   D. Inflation

IV. Aggregate Supply and Demand
   A. A Macro View
   B. Stable or Unstable
   C. The Aggregate Supply and Demand Model
   D. Macro Failure
   E. Competing Theories of Short-Run Instability
   F. Policy Options

V. Fiscal Policy
   A. Components of Aggregate Demands
   B. The Nature of Fiscal Policy
   C. Fiscal Stimulus
   D. Fiscal Restraint

VI. Money and Banks
   A. The Uses of Money
   B. The Money Supply
   C. Creation of Money
   D. The Money Multiplier
   E. The Macro Role of Banks

VII. Monetary Policy
   A. The Federal Reserve System
   B. Monetary Tools
   C. Shifting Aggregate Demand
   D. Price vs. Output Effects

IV. International Trade: We will study classical trade theory, the role of common markets, the impact of tariffs and the development of the Multinational Firm.

   A Theory of Comparative Advantage
      1. Ricardo's Basic Concept
         a. Definition
b. Example

2. Classical Case Study
   a. The UK and Portugal
   b. The Advantages of Trade
   c. Monetary Comparison

3. Equilibrium
   a. Limits of Trade
   b. Terms of Trade (Raúl Prebisch)

B. Tariffs
   1. Tariff Implications
      a. Economic Growth and Development
      b. Production Possibilities and Efficiency
      c. Welfare Effects
   2. Protection Arguments
      a. National Security
      b. Economic Diversification
      c. Infant Industries
      d. Retaliation
      e. Scientific and Effective Tariffs
      f. Balance of Payments
      g. Wages, Tax Revenue, and Unemployment

C. Non-Tariff Barriers
   1. Import Limitations
      a. Quotas
      b. Import Licenses
      c. Exchange Controls
   2. Cultural
      a. Language and Customs
      b. Labeling Laws
      c. Buy-American Campaigns
   3. Cost Differences
      a. Subsidies
      b. Transportation
      c. Unions

D. Trading Partners
   1. Free Trade Associations
      a. Characteristics
      b. Examples
   2. Customs Union
      a. Characteristics
      b. Examples
   3. Common Markets
      a. Characteristics
      b. Examples
XI. NOTE 1: ACCOUNTING EQUATIONS

The Fundamental Accounting Rule:

\[
\text{ASSETS} - \text{LIABILITIES} = \text{NET WORTH}
\]

A. Balance Sheet:

(1) Assets:

- Current Assets (Cash, Inventories, Accounts Receivable)
- Fixed Assets (Land, Buildings, Equipment)
- Intangible Assets (Patents, Copyrights, Goodwill)

**NOTE:** Goodwill refers to Location, Reputation, and Executive Talent.

(2) Liabilities:

- Current Liabilities (Accounts Payable)
- Long-Term Debt (Bonds, Notes Payable)

(3) Net Worth (Book Value or Owner's Equity)

**NOTE:** Sometimes, Net Worth is referred to as the Capital Account, the Stock Account, or the Proprietorship Account.

B. Income Statement:

\[
\text{SALES} - \text{EXPENSES} = \text{PROFIT}
\]

(1) Sales (Revenue from sales of goods and services)

(2) Expenses (Costs):

a. Cost of Goods Sold = Initial Inventory + Purchases - Final Inventory

**NOTE:**

b. Sales less Cost of Goods Sold = Gross Profit

Operating Expenses:

- Payroll (Wages, Salaries, Transfer Payments)
- Rent, Depreciation, Depletion, Utilities (Water, Power, Telephone)
- Supplies
- Automotive (Transportation)
- Insurance
- Interest on Debt, etc.

**NOTE:**

c. Gross Profit less Operating Expenses = Net Profit

(3) Net Profit (Earnings)

\[
\text{Net Profit (Earnings) Less Taxes & Dividends} = \text{Retained Earnings (Internal Financing)}
\]
XII. NOTE 2: PARTIAL DIFFERENTIATION IN ECONOMICS

To date we have assumed that the dependent variable is a function of only one independent variable: \( Y = f(X) \). This was handy in aiding those who needed a refresher period to get back up to speed with elementary calculus. Now, we will drop the single independent variable assumption and move closer to reality by working with two independent variables. While this may seem to be not very much closer to reality than working with a single variable, it must be remembered that the same rules will apply to any number of additional independent variables. That is to say, working with two independent variables is mathematically the same as working with "N" variables. Furthermore, two independents can be graphed easily while more than two cannot.

If we take a football and slice it in half, placing the top half in a corner of a large box, we can get an idea of how this is going to work.

Imagine the height of the box is an axis (the Z axis) and that the width of the box is an axis (the X axis) and that the rear-to-front of the box is an axis (the Y axis). To discover the rate at which the height of the football (Z) changes with respect to the length (X) and the width of the football (Y), we only need to differentiate Z with respect to both X and Y. Therefore, the height of the football above the floor of the box is expressed as \( Z = f(X, Y) \).

To see this visually, we can view the football as having been composed of many slices of slabs stuck together. We may assume that the length of the football is made up of five slabs. The slabs at the outer limits of the width of the football are the lowest while the slab in the middle is the highest with the slabs on each side of the one in the middle filling in the gaps. (See Fig. #1).

To view the change in height (Z) of the football as a result of changes in length (X) alone, we have to hold width (Y) constant. If we select \( Y = 3 \) as the slab whose height we want to determine, then any change in height (Z) is a result of changes in length (X) only.

The process of determining the change in height with respect to changes in length is called the partial differentiation of Z with respect to X. This may be written as \( \frac{dZ}{dX} \). Similarly, \( \frac{dZ}{dY} \) is the expression for the partial derivative of Z with respect to Y and will show the change in height (Z) with respect to changes in width (Y).

To illustrate the mathematics of this, assume we are given a formula for this football's shape that is as follows:

\[
Z = 3X^3 - 4XY - Y^2 + X
\]

To find \( \frac{dZ}{dX} \), Y must be treated as a constant:

\[
Z = 3X^3 - 4XY - Y^2 + X
\]

\[
\frac{dZ}{dX} = 9X^2 - 4Y + 0 + 1 = 9X^2 - 4Y + 1
\]
Notice that when we differentiated \(-4XY\) with respect to \(X\), \(4Y\) is constant. This means that \(d(-4XY)/dX = -4Y\). Likewise, \(d(-Y)/dX = 0\).

To find \(dZ/dY\) or, the change in height given a change in width, we must treat \(X\) (length) as a constant:

\[
Z = 3X^3 - 4XY - Y^2 + X
\]

\[
dZ/dY = 0 - 4X - 2Y + 0
\]

\[
dZ/dY = -4X - 2Y
\]

The second partial derivatives are determined as follows:

(Y is constant) \[d^2Z/dX^2 = 18X\]

(X is constant) \[d^2Z/dYdX = -4\]

(X is constant) \[d^2Z/dY^2 = -2\]

(Y is constant) \[d^2Z/dXdY = -4\]

Suppose that we want to find the highest point on this football in the \(X\) direction and the \(Y\) direction simultaneously. What must be done is to find the highest slab through this football in both the \(X\) and the \(Y\) direction?

In general, if \(Z = f(X,Y)\) and it is apparent that a maximum or a minimum exists, we can determine these maxima (minima) as follows:

1. \(dZ/dX\). Find the partial derivative of \(Z\) with respect to \(X\) by differentiating as though \(Y\) were constant.

2. \(dZ/dY\). Find the partial derivative of \(Z\) with respect to \(Y\) by differentiating as though \(X\) were constant.

3. \(dZ/dX = 0;\ dZ/dY = 0\). Set each partial derivative equal to zero and solve the two resultant equations simultaneously for the values of \(X\) and \(Y\).

4. Perform second derivative tests as shown below utilizing the results obtained in step #3:
   a. \(d^2Z/dX^2\). Find the second partial derivative of \(Z\) with respect to \(X\) by differentiating the result of step #1 as though \(Y\) were constant.
   b. \(d^2Z/dYdX\). Find the second partial derivative of \(Z\) with respect to \(X\), then \(Y\), by differentiating the result of step #1 as though \(X\) were constant. This is called the second cross partial derivative.
   c. \(d^2Z/dY^2\). Find the second partial derivative of \(Z\) with respect to \(Y\), by differentiating the result of step #2 as though \(X\) were constant.
d. \( \frac{d^2Z}{dXdY} \). This step is not necessary as the result is the same as step #4(b).

e. The extreme point is a maximum if:
\[
d^2Z/dX^2 < 0; d^2Z/dY^2 < 0 \text{ and } d^2Z/dX^2(d^2Z/dY^2) - (d^2Z/dXdY)^2 > 0
\]
   and is a minimum if:
\[
d^2Z/dX^2 > 0; d^2Z/dY^2 > 0 \text{ and } d^2Z/dX^2(d^2Z/dY^2) - (d^2Z/dXdY)^2 > 0
\]

An illustration may be appropriate here:
\[
Z = - 3X^2 - 2Y^2 + 68X + 52Y - 4XY
\]

Determine this function's extreme points.

Step 1. \( dZ/dX = -6X + 68 - 4Y \)

Step 2. \( dZ/dY = -4X + 52 - 4Y \)

Step 3. 
   \[
   -6X + 68 - 4Y = 0
   -4X + 52 - 4Y = 0
   -2X + 16 = 0
   \]
   \( X = 8; \ Y = 5 \)

Step 4. 
   a. \( d^2Z/dX^2 = -6 \)
   b. \( d^2Z/dYdX = -4 \)
   c. \( d^2Z/dY^2 = -4 \)
   d. \( d^2Z/dYdX = -4 \)
   e. Since 4(a) above is < 0,
   \[
d^2Z/dX^2(d^2Z/dY^2) - (d^2Z/dXdY)^2 > 0
   \]
   then, when \( X = 8 \) and \( Y = 5 \),
   \( Z \) achieves its maximum value of 402.

\[
Z = - 3X^2 - 2Y^2 + 68X + 52Y - 4XY
\]

\[
Z = - 3(8)^2 - 2(5)^2 + 68(8) + 52(5) - 4(8)(5)
\]

\[
Z = 402
\]

Hence, this three-dimensional figure (whether a football or a profit function or a revenue function) reaches its maximum height at coordinates, \( X = 8, \ Y = 5 \). This height is 402.
COURSE SCHEDULE      Mondays

The course will be scheduled around the homework and exam schedules. Please review the homework assignment schedule a week in advance. Lectures and class participation should closely follow these assignments.

Texts:  Gertmenian (G),  Hagan (Hagan),  Heilbroner (H),  Schiller (S)

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Homework #3 due

5 31 May MEMORIAL DAY HOLIDAY - EXAM NEXT WEEK

| 6    | 7 June | FIRST EXAM (H): All + (S): Chapters 1 - 6                              |
|      |        | Homework #4 due                                                         |

7 14 June Monopoly and the Labor Market

(S) Chapters: 7 Monopoly

Homework #5 due

8 21 June Government Intervention and the Business Cycle

The Aggregate Economy and Fiscal Policy

(S) Chapters: 9 Government Intervention

Homework #6 due AND Homework #7 due

9 28 June Banking and Monetary Policy

(S) Chapters: 13 Money and Banks

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