Economics Education and the Theory of Consumer Choice, Excerpts from Economics Textbook Materials Description of Syllabus and Projector Slides

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Abstract: Curtis Jr (2018) describes the objective of the university course, to convey intermediate and advanced concepts of consumer choice theory 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.

Reviewers of this paper include John C Ham, Ph.D. from Princeton University, Full/Tenured Professor & Provost, Advisor; Tenured Professor and Provost; Richard H Steckel, Ph.D. from The University of Chicago, Retired Full/Tenured Professor, Retired Member of the University Faculty Senate, Co-Advisor. 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.

1. INTRODUCTION


When markets are competitive and firms have all the same cost structure, a large number of firms and buyers in the market cause prices to be fixed at the additional cost to providing the good or service because information is fully available on alternative suppliers and customers. Furthermore, free entry and exit price markups, causing market prices to be at equilibrium and markets to be efficient—where voluntary participation in a market-oriented distribution of goods and services maximizes the net gains to producers and consumers.

However, when markets are less competitive, such as monopoly, prices are marked up over the additional cost to providing the good or service, based on consumers' responsiveness to price and the producer's share of the market. This leads to an amount of goods and services, which are bought and sold, that is below the competitive market outcome leading to inefficiencies and additional gains from government regulation. Moreover, when markets are less competitive, producers can price discriminate if they know the willingness and ability of individual consumers to purchase their good and services. While such practices are generally accepted and encouraged for goods such as senior and student movie theater tickets or lunch and dinner restaurant prices, price discrimination based on race is equivalent to statistical discrimination—making predictions about a person based on membership in a certain group (Stockton, 1999, p. 434) and using an individual's membership in a certain group as information on the individual's skill and productivity (Borjas, 2000, p.357). Offering an individual in a racial group a price that is different from a price offered to an individual in another racial group, such as mortgage rate, (holding all other variables constant), constitutes economic discrimination” (Curtis Jr, 2018).
2. THE CLASS DESCRIPTION

The goal of this paper is to provide class materials for studies in consumer economics, intertemporal consumption, and labor supply for individuals, irrespective of grouping, based on business equity/ownership, community/government/social planner responsibilities, education/schooling, ethnicity/race, gender, identity, income/wealth, and region/state/urban dwelling/immigration/migration.


3. THE CLASS MATERIALS


The following is the outline of the class materials

1. BUDGET CONSTRAINTS

- The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

- **Lecture Topics:**
  - Budget Constraint
  - Preferences & Axioms
  - Optimal Choice & Demand
    - Income & Substitution Effects
    - Income & Engel Curves
  - Applications:
    - Labor Supply
    - Intertemporal Consumption

- **Axiom 1: Feasibility**
  - The restriction the value of the goods consumed is less than or equal to the consumer’s income
  - To estimate the feasibility of a potential consumption bundle of goods, we use income or budget constraints

- **Budget constraint notation (example):**
  \[ I = p_{c}c + p_{b}b \]
  - *Number of economics textbooks purchased* = \( c \)
  - *Price of economics textbooks* = \( p_{c} \)
  - *Number of cups of coffee consumed* = \( b \)
  - *Price of cup of coffee* = \( p_{b} \)
  - *Monthly income* = \( I \)

- **Axiom 1.1: “No wasted resources”**
  - Assuming no resources are wasted, then:
  \[ I = p_{c}c + p_{b}b \]

- **The budget constraint depicts the combinations of goods and services you can consume based on market prices and your income**
  - Consumption possibilities frontier
  - People often consume less than they desire because most people do not have an unlimited amount of income

- **Graphing the budget constraint:**
  \[ I = p_{c}c + p_{b}b \]
  - Using cups of coffee as the y axis, solve for e:
    \[ c = I - p_{b}b \]
    \[ e = \frac{c}{p_{c}} - \frac{p_{c}}{p_{b}} \]
  - Plugging in \( p_{c} = 5, p_{b} = 100 \) and \( I = 500 \):
    \[ c = 500/5 = 100 \]
    \[ e = 100 - 29 \]
II. PREFERENCES AND AXIOMS

- A preference describes how individuals choose to consume one good over another
  - A preference ordering is a system of ranking all possible combinations of goods in the order of preference

- Utility is used to analyze preferences
  - Utility is the happiness or satisfaction you obtain from consuming a handle of goods
  - A utility function is a function of consumption goods which assigns a number that represents the satisfaction obtained from consuming the goods
    - If a set of goods (2 pizzas, 3 coffees) is preferred to another set (3 pizzas, 2 coffees), then the satisfaction from consuming (2 pizzas, 3 coffees) is greater than the satisfaction from consuming (3 pizzas, 2 coffees)

- Example 1: The perfect substitutes utility function
  - $U = 1/n$ where $n$ is the number of pencils
  - $U = 1$ if $n = 1$
  - $U = 0$ if $n > 1$

- The intercepts measure real income
  - Nominal income (I) measures money income ($300)
  - Real income ($/p) measures purchasing power in terms of consumption goods (100 cups of coffee or 5 textbooks)

- Case Study: Amazon.com vs. OSU Main Bookstore
  1. What changes are graphically showing?
  2. Explain how new competition from publicly-owned Internet book stores might impact your budget constraint using graphs and charts?
  3. What happens if income doubles and all prices double?

- The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences

- Lecture Topics
  - Budget Constraint
  - Preferences & Axioms

- Ordinal vs. Cardinal Preference Orderings
  - Ordinal ranking is a system of ranking preferences that puts bundles of goods in order of most preferred to least preferred
  - However, ordinal rankings do not indicate how much one bundle is preferred to another
  - A cardinal ranking is a system of ranking preferences by assigning magnitudes to quantifying bundles of goods
  - However, different methods lead to different cardinal rankings

- Utility function notation (example):
  - $b = \text{number of economics textbooks purchased}$
  - $c = \text{cups of coffee purchased}$
  - $U = \text{the utility you obtain from consuming textbooks and coffee}$

- Graphing the perfect substitutes utility function
  - $U = 1/n$ for $n > 1$
  - Using pencils as the y-axis, solve for $U$
  - $l = U + c$ where $l$ such that for $U = 0$, $l = 1$
  - $l = 1$, $U = 1$
  - $l = 2$, $U = 2$
  - $l = 3$, $U = 3$
  - $l = 4$, $U = 4$
  - $l = 5$, $U = 5$
  - $l = 6$, $U = 6$
  - $l = 7$, $U = 7$

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• An indifference curve is the graph of the utility function and shows all combos of pencils and pens which provide you the same level of utility, in which you are indifferent.

  - An indifference map is a graphical summation of preference orderings and is a sample of indifference curves that represents the complete set of the indifference curves.

• The slope of the indifference curve, or MRS, is also defined as the (negative) ratio of the marginal utility of pens to the marginal utility of pencils.

  - Marginal utility (MU) is the additional satisfaction obtained from consuming one additional pen (MU_P) or the additional satisfaction obtained from consuming one additional pencil (MU_P).

• Graphing the perfect complements indifference curve:

  - U = MIN(U_P)
  - Using left shoes as the y-axis, solve for l and r:

    \[ U = MU, l so such that for \quad l = 2, \quad U = 4 \]

• Example 3: The strictly convex utility function:

  - \( x \) = slices of Domino’s pizza
  - \( y \) = liters of Mountain Dew soda
  - \( U \) = the utility you obtain from consuming pizza and soda

  \[ U = U(x, y) = x^\alpha y^\beta \] (also known as Cobb-Douglas)

• Example 4: The “bads” utility function:

  - \( x \) = number of anchovies
  - \( y \) = number of pepperoni slices
  - \( U \) = the utility you obtain from consuming anchovies and pepperoni slices

  \[ U = U(x, y) = x - y \]

• Example 5: The neutral utility function:

  - \( x \) = pounds of cheese
  - \( y \) = slices of pepperoni
  - \( U \) = the utility you obtain from consuming cheese and pepperoni

  \[ U = U(x, y) = x \]

• The slope of the indifference curve equals the rate at which you are willing to give up pencils to consume one more pen.

  - The slope of the indifference curve is the marginal rate of substitution (MRS). You are willing to give up one pencil to obtain one more pen.

• Graphing the “bads” indifference curve:

• Graphing the neutral indifference curve:

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Example 6: The quasi-linear utility function:

\[ n = \text{ironing boards} \]

\[ b = \text{leaves of bread} \]

\[ U = \text{the utility you obtain from consuming salt and bread} \]

\[ U = U(n, b) = n^{a} \cdot b \quad \text{for} \quad U(n, b) = \ln(n) + b \]

Example 7: The strictly concave utility function:

\[ v = \text{amount of anchovies consumed} \]

\[ c = \text{scoops of ice cream consumed} \]

\[ U = \text{the utility you obtain from consuming anchovies and ice cream} \]

\[ U = U(z, s) = v^{2} + c^{2} \]

The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

Lecture Topics:
- Budget Constraint
- Preferences & Axioms

Axiom 3: Monotonicity (More is better)

- As long as people can freely dispose of the pizza and soda they do not want, then more is preferred to less.
- Relates to upward sloping indifference curve, the case where two slices of pizza and two liters of soda might provide you the same satisfaction as one slice of pizza and one liter of soda.
- In terms of indifference curve analysis, Axiom 2 (more is better) implies that indifference curves are downward sloping.

The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

Lecture Topics (review):
- Budget Constraint

Graphing the budget constraint:

\[ b = 50 - \frac{1}{2} c \quad \text{such that} \]

Graphing the quasi-linear indifference curve:

\[ U(e, b) = n^{a} \cdot b \]

- Using bread as the y-axis, solve for b:
\[ b = \frac{U}{n^{a}} \]
- An increase in the non-change good does not increase utility linearly but at an increase in the linear good offers a “sufficient” amount of the non-linear good to be very concerned

Graphing the strictly concave indifference curve:

\[ U(e, b) = v^{2} + c^{2} \]

- Using anchovies as the y-axis, solve for v:
\[ v = \sqrt{U - c^{2}} \]
- Consumers prefer consuming all anchovies or all ice cream as a combination of these, combinations of anchovies and ice cream

Axiom 2: Completeness:

- Consumers are able to rank all possible combinations of pizza and soda:
  - Relate to feebie of Pareto's triangle: A hungry person was unable to choose between two holes of hay in front of a and carried to shade.
  - In terms of indifference curve analysis, Axiom 2 (completeness) implies very combination (or bundle) of pizza and soda is a point on the same or another indifference curve

Axiom 4: Transitivity

- If pizza special A is preferred to pizza special B and pizza special B is preferred to pizza special C, then pizza special A is preferred to pizza special C
- Relates to circular flow of preferences
- In terms of indifference curve analysis, Axiom 3 (transitivity) implies that your indifference curve cannot cross

Budget constraint notation (example):

\[ y \quad = \quad \text{number of economics textbooks} \]

\[ c \quad = \quad \text{cup of coffee} \]

\[ p_{y} \quad = \quad \text{price of economics textbooks (}$^{\$}$\text{)} \]

\[ p_{c} \quad = \quad \text{price of cup of coffee (}$^{\$}$\text{)} \]

\[ I \quad = \quad w \cdot c + p_{y} \cdot y \quad \text{value of coffee consumed} + \text{value of books consumed} \]

- Assuming “no wasted resources” then:
\[ I = p_{y} \cdot c + p_{c} \cdot y \]

The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

Lecture Topics (review):
- Budget Constraint
- Preferences & Axioms

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III. OPTIMAL CHOICE AND DEMAND

- The optimal choice is the optimal amount of textbooks and coffee that you consume given your preferences and budget constraint
  - You choose to consume textbooks and cups of coffee to maximize your utility, but your choice is limited by your budget constraint

- Graphing the optimization problem (budget):
  \[ b = 50 - \frac{1}{2} c \]  
  such that

- Graphing the optimization problem (con't):
  - Combining utility and budget to obtain the optimal choices of textbooks and coffee

- Optimization problem notation (example 1)
  - Strictly convex preferences:
    - \( b \) = number of economics textbooks consumed (*optimal)
    - \( c \) = cups of coffee purchased (*optimal)
    - \( p_b \) = market price of economics textbooks (\$20)
    - \( p_c \) = market price of cup of coffee (\$10)
    - \( I \) = income ($1000)
    - \( U \) = the utility you obtain from consuming books & coffee
  - Choose \( b^* \) and \( c^* \) to
    Maximize \( U = b^* c^* \)
    Subject to \( I = p_b b + p_c c \)

- Graphing the optimization problem (utility):
  - Using number of textbooks as the y-axis, solve for \( b \):
    \[ b = \frac{U}{c} \]  
    such that for

- Graphing the optimization problem (con't):
  - Combining utility and budget to obtain the optimal choices of textbooks and coffee
The solution to the optimization problem

- The optimal choice of books and coffee where:
  - The budget constraint is tangent to the indifference curve.
  - The slopes are equal (where MRS = price ratio)

\[ b^* = 25 \]
\[ c^* = 100 \]

The solution to the optimization problem (con’t)

- The solution to the optimization problem (con’t)

- Dollar-spent analysis at 25 textbooks & 100 cups of coffee
  - Rearranging MRS = price ratio (0, 25):
    \[ \frac{MU_b}{MU_c} = \frac{P_c}{P_b} \]
    \[ \frac{MU_b}{P_c} = \frac{MU_b}{P_b} \]
  - The additional utility from a dollar spent on soda equals the additional utility from a dollar spent on textbooks.
    - If not, re-adjust consumption to obtain some marginal utility of a dollar spent.

Graphing the optimization problem (utility):

- Using pencils as the y-axis, solve for l:
  \[ l = U \pm (1)n \text{ such that for } U = 4, 5, 6 \]

Graphing the optimization problem (utility):

- Combining utility and budget to obtain the optimal choices of Buckeye pens and pencils

The solution to the optimization problem (con’t)

- Slope analysis at 3 pencils & 0 pens
  - MRS (1, 0) < price ratio (1, 25)
  - You were willing to give up one pen to obtain one pencil (MRS)
  - It cost you one and one-fourth pen to obtain one pencil, given your income and current market prices (price ratio)
  - Boundary or corner solution

The solution to the optimization problem (con’t)

- Slope analysis at 25 textbooks & 100 cups of coffee
  - MRS = price ratio (or relative prices) = 0.25:
    - You were willing to give up one cup of coffee to obtain one-fourth of a textbook (MRS)
    - It cost you one cup of coffee to obtain one-fourth of a textbook, given your income and current market prices (price ratio)
    - Interior Solution

Optimization problem notation (example 2)

- Perfect substitutes (convex preferences):
  \[ i = \text{ number of Buckeye pencil consumed } (* \text{ optimal}) \]
  \[ n = \text{ number of Buckeye pens purchased } (* \text{ optimal}) \]
  \[ p_i = \text{ market price of a Buckeye pencil } (120) \]
  \[ p_n = \text{ market price of a Buckeye pen } (25) \]
  \[ i = \text{ income } (100) \]
  \[ U = \text{ the utility you obtain from consuming books and coffee} \]

Choose l* and n* to:

Maximize \[ U = l + n \]
Subject to \[ l \leq p_i, l \leq p_n \]

Graphing the optimization problem (budget):

\[ I = 5 - (5/4)n \text{ such that } \]

Graphing the optimization problem (utility):

- Combining utility and budget to obtain the optimal choices of textbooks and coffee

The solution to the optimization problem (con’t)

- Dollar-spent analysis at 3 pencils & 0 pens
  - Rearranging MRS (1, 0) < price ratio (1, 25):
    \[ \frac{MU_b}{MU_c} < \frac{P_c}{P_b} \]
    \[ \frac{MU_b}{P_c} < \frac{MU_b}{P_b} \]
  - The additional utility from $1 spent on pencils is less than the additional utility from $1 spent on pens (1:65)

- Reducing (increasing) consumption of pens (pencils) decreases (increases) the marginal utility of a dollar spent on pen (pencils) due to constant MU and already consuming minimum pens (maximum pencils)
Case study: Jiffy vs. Welch’s

1. Solve the following optimization problem.
2. What is the impact on firms in these markets?
   - jars of Jiffy peanut butter consumed (optional)
   - jars of Welch’s grape jelly consumed (optional)
   - market price of Jiffy (15)
   - market price of Welch’s (15)
   - income ($1650)
   - the utility you obtain from consuming peanut butter & jelly

Choose n and j to
Maximize U = MIN(j,n)
Subject to 1 = p_d + p_j

The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

Lecture Topics:
- Actions
  - Budget Constraint
  - Preferences
- Optimal Choice
  - Taxes
  - Comparative Static Analysis
- Applications
  - Labor Supply
  - Interim Consumption

The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

Lecture Topics on Optimal Choice
- Taxes
- Comparative Static Analysis
  - Price Changes
    - Price Consumption & Demand Curve
  - Income Changes
    - Income Consumption & Engel Curve

The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

Lecture Topics on Optimal Choice
- Taxes
- Comparative Static Analysis
  - Price Changes
    - Price Consumption & Demand Curve

The solution to the optimization problem in example 1
- The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve

If the price of coffee increases:
- from $5 per cup to $10 per cup,
  - The budget constraint pivots inward
  - The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve

If the price of coffee increases:
- from $5 per cup to $20 per cup,
  - The budget constraint pivots inward even more
  - The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve
• “Demand” in the consumption goods space
  - The price-consumption curve, or the price offer curve, traces out the optimal combinations of goods and services demanded at different prices of one good.

• The individual demand curve for coffee, for example, is formed by your optimal choices of coffee at different market prices of coffee, holding your demand and market prices for textbooks and other goods constant.
  - The market demand curve is the sum of individual demand curves.

• The solution to the optimization problem in example 2
  - The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve.

• If the price of Buckeye pens decreases:
  - from $25 per cap to $15 per Buckeye pen,
    - The budget constraint moves outward even more.
    - The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve.

• Demand & Non-Strictly Convex Preferences
  - If we deviate from strictly convex preferences, we will obtain demand curves that are more difficult to analyze.
    - Strict convex preferences produce demand curves with a unique optimal quantity demanded at every price.
    - Non-strict convex preferences produce demand curves with more than one demanded at every price.
    - i.e., perfect substitutes and inelastic preferences.

• Demand
  - Your individual demand curve for Buckeye Pens is formed by your demand, or optimal choice, of Buckeye pens at different market prices.

• Demand (in the price-consumption space)
  - Your individual demand curve for coffee is formed by your demand, or optimal choice, of coffee at different market prices.

• Reconsider example 2 of the optimization problem
  - With perfect substitutes,
    - n = number of Buckeye pens consumed (°optimal)
    - P_b = market price of a Buckeye pen ($25)
    - U = utility you obtain from consuming books and coffee.
  - Choose n* and w* to
    - Maximize U = v - w
    - Subject to I = p_1 x + p_2 y

• If the price of Buckeye pens decreases:
  - from $25 per cap to $20 per Buckeye pen,
    - The budget constraint moves outward.
    - The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve.

• Consider the following optimization problem
  - With strictly concave preferences:
    - w = amount of onions consumed
    - v = amount of ice cream consumed
    - P_o = market price of onions
    - P_i = market price of ice cream
    - U = utility.
  - Choose v* and w* to
    - Maximize U = v^* + w^*
    - Subject to I = P_o v + P_i w.

• The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

• Lecture Topics on Optimal Choice
  - Taxes
  - Comparative Static Analysis
    - Price Changes:
      - Price Consumption & Demand Curve
      - Income & Substitution Effects.
III.i Income and Substitution Effects

- Reconsider example 1 of the optimization problem
  - With strictly convex preferences:
    - \( b^* \) = number of economics textbooks consumed (*optimal)
    - \( c^* \) = cups of coffee purchased (*optimal)
    - \( p_b \) = market price of one economics textbook (*10)
    - \( p_c \) = market price of cup of coffee (*3)
    - \( I \) = income (*1000)
    - \( U \) = the utility you obtain from consuming books & coffee
  - Choose \( b^* \) and \( c^* \) to
    Maximize \( U = b^* c^* \)
  - Subject to \( I = p_b b + p_c c \)

- If the price of coffee increases:
  - from $3 per cup to $4 per cup.
    - The budget constraint pivots inward
    - The substitution effect of books and coffee where the budget constraint is tangent to the indifference curve
    - \( b^* = 6 \)
    - \( c^* = 15 \)
  - The total effect of an increase (decrease) in the price of a good leads to a lower (higher) quantity demanded and can be divided up into the following effects:
    - The substitution effect is the component of the total effect that leads to a new combination of goods consumed because of substitution away from the higher priced good and substitution to the lower priced good with a constant price
    - The Hicksian substitution effect shows the quantity demanded and income needed to keep the original utility constant with a change in price
    - The Slutsky substitution effect shows the quantity demanded and income needed to affect the original optimal choice of consumption goods with a change in price
    - The income effect is the component of the total effect that due to a loss in purchasing power (real income)

- If the price of coffee increases:
  - The solution to the optimization problem in example 1
    - The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve
  - To graph the substitution and income effects, consider a hypothetical budget constraint:
    - Hicksian substitution effect is shown by a tangency to the old indifference curve at the new price ratio
    - Slutsky substitution effect is shown by a line through the old optimal consumption bundle at the new price ratio
    - Hicks and Slutsky are identical with an infinitesimal (small) changes in price

- Reconsider the following optimization problem
  - Perfect complements
    - \( n \) = jars of jelly peanut butter consumed (*optimal)
    - \( j \) = jars of Welch’s grape jelly consumed (*optimal)
    - \( p_n \) = market price of jelly (*5)
    - \( p_j \) = market price of Welch’s (*3)
    - \( I \) = income (*1000)
    - \( U \) = the utility you obtain from consuming Peanut butter & jelly
  - Choose \( n \) and \( j \)
  - Maximize \( U = \min(n, j) \)
  - Subject to \( I = p_n n + p_j j \)

- If the price of jelly increases:
III.iii. Income and Engel Curves

- Reconsider the following optimization problem
  - Perfect substitutes (convex preferences):
    \[ \begin{align*}
    l & = \text{number of books purchased} \quad (* \text{optimal}) \\
    n & = \text{number of coffee cups purchased} \quad (* \text{optimal}) \\
    p_l & = \text{price of a book} \quad ( \$ 10 ) \\
    p_n & = \text{price of coffee} \quad ( \$ 5 ) \\
    I & = \text{income} \quad ( \$ 100 ) \\
    U & = \text{utility from consuming books & coffee}
    \end{align*} \]
  - Choose \( l^* \) and \( n^* \)

Maximize \( U = I + n \)
Subject to \( I = p_l l^* + p_n n^* \)

- If the price of pencils increases:

- The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

IV. APPLICATIONS

- Reconsider example 1 of the optimization problem
  - With strictly convex preferences:
    \[ \begin{align*}
    b & = \text{number of economics textbooks purchased} \quad (* \text{optimal}) \\
    c & = \text{cups of coffee purchased} \quad (* \text{optimal}) \\
    p_b & = \text{price of economics textbook} \quad ( \$ 20 ) \\
    p_c & = \text{price of cup of coffee} \quad ( \$ 10 ) \\
    I & = \text{income} \quad ( \$ 100 ) \\
    U & = \text{utility from consuming books & coffee}
    \end{align*} \]
  - Choose \( b^* \) and \( c^* \)

Maximize \( U = b^* + c^* \)
Subject to \( I = p_b b^* + p_c c^* \)

- If your income increases:
  - from $1000 to $1200.
    - The budget constraint shifts outward.
    - The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve.

- The income consumption curve
  - Illustrates the combinations of goods and services that are demanded at different levels of income in the consumption good space
  - Also income offer curve or income expansion path

- If the price of pencils increases:

- The solution to the optimization problem in example 1
  - The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve

- If your income increases:
  - from $1000 to $1200,
    - The budget constraint shifts outward even more.
    - The optimal choice of books and coffee where the budget constraint is tangent to the indifference curve

- The Engel Curve
  - Illustrates the demand for one good or service changes by holding prices constant.
IV.i. Labor Supply

- Theory of consumer choice can be applied to understand how individuals supply their labor to the labor market.

- Graphing the optimization problem (budget):
  \[ p_b h + v = p_c c \text{ where } T = \text{time endowment}, h = t \]
  - Using consumption as the y-axis, solve for c:
    \[ p_c c = p_b (T-h) + v \]
    \[ c = \frac{p_b T + v - p_b h}{p_c} \]
  - Plugging in \( T = 24, p = 1, p_b = 20 \) and \( v = 480 \):
    \[ c = \frac{20 \times 24 + 480}{1} = 960 \]
  - Graphing the optimization problem (utility):
    \[ U = 1 / c^2 \]
    - Using consumption as the y-axis, solve for c:
      \[ c = U^{1/2} / 1^{1/2} \]

- The individual labor supply curve is equivalent to the individual demand curve.
  - The labor supply curve is formed by your optimal choices of labor supplied at different market prices (wages), holding your demand and market prices for consumption goods constant.
  - The market labor supply is the sum of individual labor supply curves.

- Optimization problem notation (labor example)
  - Strictly convex preferences:
    - \( T \) = number of labor hours \( t \) optimal.
    - \( h \) = number of labor hours supplied \( h \) optimal.
    - \( c \) = consumption of food, shelter, etc. \( c \) optimal.
    - \( p_b \) = market price of labor supplied \( p_b \) \( p_b \)
    - \( p_c \) = market price of food, shelter, etc. \( p_c \)
    - \( v \) = non-labor income \( v \)
    - \( U \) = the utility you obtain from consuming & working
  - Choose \( l \) and \( c \) to
    - Maximize \( U = 1 / c^2 \)
    - Subject to \( p_b h + v = p_c c \)

- The solution to the optimization problem
  - The optimal choice of hours and coffee, where:
    - The budget constraint is tangent to the indifference curve.
    - The slopes are equal (where MRS = wage).

- The solution to the optimization problem
  - The optimal choice of consumption and labor supplied occurs where the budget constraint is tangent to the indifference curve.
• If wages increase from $20 per hour to $30 per hour, the budget constraint pivots outward.

- The substitution effect is the substitution away from (more expensive) leisure in favor of (higher return to) working with an increase in wages.
- The Hicksian substitution effect shows the leisure demanded (or labor supplied) and income needed to keep the original utility constant with a change in wages.
- The Slutsky substitution effect shows the leisure demanded (or labor supplied) and income needed to offset the original optimally chosen leisure and consumption goods with a change in wages.
- The income effect is the increase in nominal income with an increase in wages.

• If the wage increases:

- The theory of consumer choice explains how you choose goods & services to consume by analyzing your budget and preferences.

• Lecture Topics:
  - Actions
    - Budget Constraint
    - Preferences
  - Optimal Choice
    - Taxes
    - Comparative Static Analysis
  - Applications:
    - Labor Supply
    - Intertemporal Consumption

• If wages increase from $20 per hour to $40 per hour, the budget constraint pivots outward.

- The substitution effect is a tangency to the old indifference curve at the new wage rate.
- Slutsky substitution effect is shown by a line through the old optimal consumption bundle at the new wage rates.
- Hicks and Slutsky are identical with an infinitesimal (small) changes in wages.

• If the wage increases:
  (i) from $20 to $40 or (ii) from $40 to $50 +
IV.ii. Intertemporal Consumption

- **Intertemporal choice** analyzes your consumption choices over time subject to your intertemporal budget constraint, i.e.,
  - **Your consumption this period and next period**
    - Same as the optimal choice of textbooks and coffee
  - But now the x-axis might show textbooks purchased this year and the y-axis might show textbooks purchased next year
  - **Your housing consumption this decade and next decade**

- **Future value of the intertemporal budget constraint**:
  - Given:
    \[ I = p_1 c_1 + p_2 c_2 \]
    \[ I = p_1 I_1 + p_2 I_2 \]
  - Let: \( I_1 = 1^{r+1}\) or interest rate paid next period:
    \[ I_1 = 1^{r+1} \]
  - \( I_2 = 1^{r+1} \)
  - **Optimization problem notation** (intertemporal example)
    - Subject to: \( c_1, c_2 \leq I_1, I_2 \)
    - **Graphing the optimization problem (budget)**:
      - Plugging in \( r = 0, I_1 = 50,000, \) and \( I_2 = 50,000 \):
        \[ c_1 = 50,000 \times (1+1/100) \]
        \[ c_2 = 50,000 \times (1+1/100) \]
        - **Graphing the optimization problem (utility)**:
          - Using housing next year as the y-axis, solve for: \( b \)
          - Such that for:
            \[ U = 40 \]
            \[ U = 50 \]
            \[ U = 60 \]

- **The intertemporal budget constraint**
  - Shows the value of consumption this period plus the value of consumption next period is less than or equal to value of your intertemporal income: \( I = p_1 c_1 + p_2 c_2 \leq I_1 \)
    - **Intertemporal income** is value of income endowment this period plus the value of your income endowment next period:
      \[ I = p_1 I_1 + p_2 I_2 \]
    - The intertemporal budget constraint can be written as:
      - Present value notation
      - Future value notation

- **Present value of the intertemporal budget constraint**:
  - Given:
    \[ I = p_1 c_1 + p_2 c_2 \]
    \[ I = p_1 I_1 + p_2 I_2 \]
  - Let: \( I_1 = 1^{r+1} \) or interest rate paid next period:
    \[ I_1 = 1^{r+1} \]
  - **Interpreting the intertemporal budget constraint**:
    - Given:
      \[ c_1 = [1/(1+r)] \]
      \[ c_2 = [1/(1+r)] I_1 \]
      \[ I_1 = I_2 + c_2 \]
    - **Next period consumption = next period income plus the net return to this period’s savings (or income minus consumption)**

- The slope of the intertemporal budget constraint is the (negative) net interest rate
  - Given: \( h_{	ext{norm}} = 100,000 \times (1-1) \)
  - When the interest rate is zero, it costs one unit housing this period to obtain one additional unit of housing next period

- The slope of the intertemporal indifference curve is the marginal rate of time preference (MRTP)
  - MRT is slope of an intertemporal indifference curve
  - The willingness to give up one housing unit this year to obtain additional housing units next year
    - MRTP = 1 (neutral preferences)
    - MRTP > 1 (preferences for future housing)
    - MRTP < 1 (preferences for current housing)
OTHER ACKNOWLEDGEMENTS

The Closing I believe that it would inappropriate for me to credit anything that I have attained to my family, friends or personal investments in education, professional training or associations. The credit should go to God. In the Old Testament of the Bible, Job (7:17) once asks God, ‘What is man that you should set your heart upon him?’ If you are also seeking the answer to this question, simply know that “God created man in his own image” (Genesis 1:27). Based on this fact alone, you should have the will to persevere and “Let patience have her perfect work.” (James 1:4).

For, I pray that the glory of God manifests itself throughout his kingdom in a manner that achieves his good and perfect will.

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