Chapter 2
A Pure Exchange Model of Trade

1. A Pure Exchange Model: Preliminaries

- Identify the key features of a simple pure exchange model.

Section Outline

- A pure exchange model is a very simple model that demonstrates several important features about trade between two individuals. It is a model in which production does not occur, and whose primary focus is the conditions and effects of trade.
- It is assumed there are two individuals who are the legitimate owners of exogenous (value determined outside of the model) endowments of goods
- Perfect information exists when individuals know everything they need to know about their preferences regarding all goods in the marketplace to make wise decisions.
- One reason why many businesses offer free samples or discounted services to consumers is because consumers oftentimes do not have perfect information about the products that are being offered in the market.

Key Takeaways

- A simple pure exchange model consists of two people endowed with two goods available to trade.
- This model assumes each type of good is homogeneous and that the individuals have perfect information about their preferences for the goods.

2. Indifference Curves

- Identify the two main assumptions made about an individual's preferences.
- Learn how to represent an individual's preferences using a set of indifference curves on a two-dimensional diagram.

Section Outline

- **Indifference Curve Example**
  - Consider Figure 2.1 "Consumption Bundle Utility Values " depicting all possible combinations of 10 apples and 10 oranges that an individual, like Smith, may consume.

- Imagine further that we can assign a number representing the utility value, or happiness level, that Smith attains by consuming each combination of apples and oranges. We imagine that every conceivable combination of oranges and apples has a utility value attached to it. Thus, at a point like 3 oranges and 7 apples, the utility value might be 5.5.
- A useful way to represent the utility values Smith obtains with different combinations is by drawing indifference curves on the diagram. An indifference curve is a line drawn through all combinations of oranges and apples (points on the graph) that give the same utility value. Smith would be indifferent in choosing between combinations that lie on the same line and wouldn't care which bundle he got.
- We can also assign a number to each indifference curve representing the level of utility attained for any orange-apple combination on the curve, with larger numbers representing higher utility levels.

- **Related Assumptions**
  - Indifference curves have the shape shown because of two basic assumptions:
    - First, we assume an individual gets greater utility from having more of either good (i.e. "More is Better"). This is why the indifference curves are negatively sloped and why utility is higher on a curve to the northeast of another.
    - Second, we assume that consumption of each good exhibits diminishing marginal utility. That means that successive units of a good provide a smaller and smaller increment of added utility. Diminishing marginal utility causes the indifference curves to curve inward toward the origin.
- **Real-World Application Challenges**
  - One of the most important concerns of economics is the well-being of individuals as realized through the consumption of goods and services.
    - It is rather curious that the well-being that is generated by consumption, what economists call utility, is something that we have no direct way to measure.
    - It is also curious that economists assume that individual consumers have a well-known set of preferences that can be represented with a family of indifference curves. If we can't even measure utility, how can we assume that consumers know the utility value they would get from every combination of goods and services they might conceivably purchase?
  - The assumption we are making here is a simplification that helps us to formalize the analysis and work with the issue mathematically and graphically. With these simplifying assumptions, we can display some important results in a simple way. Afterward, we'll reflect on how important the assumptions are to the results.

Key Takeaways

- The utility achieved is identical for every combination of goods along any one indifference curve.
- An indifference curve is a line connecting all bundles of goods that generate the same level of utility for a person.
- The standard assumptions about preferences are (a) that more goods are better than fewer, and (b) that consumption exhibits diminishing marginal utility.
- Indifference curves are negatively sloped curves and convex to the origin under the standard assumptions about individual preferences.
- Indifference curves that are in a “northeast” position have higher utility values compared to indifference curves that lie to the “southwest” (assuming the origin is in the lower left).
- There is a unique indifference curve for every utility value.
- Steeper indifference curves imply a stronger individual preference for the good on the horizontal axis compared to flatter indifference curves.

3. The Edgeworth Box

- Learn how to construct an Edgeworth box by superimposing the endowment points and the utility maps of two individual traders.
- Learn how each point in an Edgeworth box diagram represents a potential allocation of oranges and apples between the two individuals.
- Learn that trade from the endowment allocation to some points in the Edgeworth box would raise utility for both and thus motivate the individuals to trade.
- Learn that a movement from the endowment allocation to some points in the Edgeworth box would not raise utility for both and could only be achieved involuntarily or by coercion.

Section Outline

- An Edgeworth box is formed by superimposing the endowment points of two individuals.
- **Edgeworth Box Example**
  - Imagine that Smith and Jones, each with well-defined and known preferences over all combinations of oranges and apples, come together in a market to discuss the possibility of a trade. Imagine that Smith’s preferences are represented in Figure 2.4 "Smith's Indifference Map ".
  - Suppose that Jones tends to look at everything upside down. (Perhaps he is a child of circus performers and does handstands all day long!) Let his preferences be depicted in Figure 2.5 "Jones' Indifference Map ".
  - In Figure 2.6 "An Edgeworth Box with Smith and Jones ", we assume that Smith measures the goods from the traditional origin in the lower left-hand corner, but Jones stands on his head and measures the goods from his origin in the upper right-hand corner.

- The endowment of 10 oranges for Smith and 10 apples for Jones corresponds to point E in the lower right corner of Figure 2.6 "An Edgeworth Box with Smith and Jones ". Notice that point E is on both Smith's and Jones's middle indifference curve labeled I2.
- Suppose Smith and Jones meet together in a market and discuss the possibility of trade. With knowledge of their own preferences, they would quickly discover that there are many potential trades that would serve to increase utility for both of them.
- ntuitively, the reason a one-for-one trade is beneficial for both Smith and Jones is because of diminishing marginal utility. Smith gets more utility from every additional apple and orange consumed, but he gets much more utility from his first orange than from his tenth orange consumed.
- The same is true for apples. Therefore, Smith is very happy to give away about one orange in trade to receive about one apple because the orange given away is his tenth (with low added value) but the apple received is his first (with high added value). The same is true for Jones. He is very happy to give away one apple in trade to receive one orange because the apple given away is his tenth (with low added value) but the orange received is his first (with high added value).
- Many of the potential trades are not beneficial for both individuals though. For example, if Smith trades 9 oranges for 3 apples with Jones, then they would move to point B in Figure 2.6 "An Edgeworth Box with Smith and Jones ". The same can be said for trades to points A and K.

Key Takeaways

- An Edgeworth box is constructed by superimposing the endowment points for two individuals drawn in the quantity space of two goods. One diagram must have the quantity origin in the lower left corner, while the other one is rotated with the origin in the upper right corner.
- Each point in an Edgeworth box represents an allocation of the two goods between the two traders such that the sum of the apples and oranges between the two equals the total initial endowment of apples and oranges.
- By drawing indifference curves through the endowment allocation in an Edgeworth box, one can identify the set of bundles of goods, formed by the lens between the two indifference curves, which if achieved via trade, will make both individuals better off.
- Points in the Edgeworth box that are external to the lens formed by the two indifference curves drawn through the endowment allocation, if realized, would make one trader better off and the other worse off relative to the endowment and thus could only be achieved involuntarily or by coercion.

Exercises

1. Answer the following questions by referring to Figure 2.6 "An Edgeworth Box with Smith and Jones " above. Suppose each bracketed combination refers to (# oranges, # apples)
    a. How many oranges and apples do Smith and Jones have at point C?
    b. How many oranges and apples do Smith and Jones have at point G?
    c. How many oranges and apples do Smith and Jones have at point K?
    d. How many oranges and apples do Smith and Jones have at point A?

4. The Terms of Trade

- Learn the definition of the terms of trade in the cases where two goods are being traded.
- Learn that the terms of trade can be represented and derived as the ratio of prices of the two goods being traded.

Section Outline

- The terms of trade is defined as the amount of one good that trades for another. It is typically presented as a ratio between the two goods.
    - Thus, in the Edgeworth box example, if Smith and Jones were to trade 5 apples for 5 oranges and move from point E to point H in the diagram, the terms of trade would be 5 apples for 5 oranges, or to simplify, 1 apple/orange.
- There is one additional relationship we will need later. The terms of trade measured as apples per orange also corresponds to the ratio of dollar prices between oranges and apples.
    - In other words, we can write the terms of trade as PO/PA, where PO is the price of oranges measured as $/orange and PA is the price of apples measured as $/apple. Note that if we take the ratio of the units we get, ($/orange) / ($/apple) = ($) / (orange) × (apple) / ($) = (apple/orange)

Key Takeaways

- The terms of trade is defined as the amount of apples that a person trades for an amount of oranges. It can be measured either as a quantity of apples per a quantity of oranges or as a quantity of oranges per a quantity of apples.
- The term of trade between two goods is determined as the ratio of the prices of the two goods.

Exercises

1. Answer the following questions by referring to Figure 2.5 "Jones' Indifference Map ":
    a. What would the terms of trade be if Smith and Jones trade from the endowment point E to the point J?
    b. What would the terms of trade be if Smith and Jones trade from the endowment point E to the point B?
    c. What would the terms of trade be if Smith and Jones trade from the endowment point J to the point G?

2. Answer the following questions by referring to Figure 2.6 "An Edgeworth Box with Smith and Jones ". Assume the initial endowment is (10,0) for Smith. Suppose each bracketed combination refers to (# oranges, # apples).
    a. Which trade pattern is most likely to be best for Smith: 3 oranges for 5 apples, 5 oranges for 3 apples, 7 oranges for 5 apples, or 9 oranges for 6 apples?
    b. Which trade pattern is most likely to be best for Jones: 3 oranges for 5 apples, 4 oranges for 6 apples, 6 oranges for 3 apples, or 8 oranges for 8 apples?

5. Evaluating the Gains from Trade

- Learn how every transaction everywhere creates surplus value, or happiness bursts.
- Recognize that the distribution of the surplus value created out of voluntary trade can vary substantially across different potential trade outcomes.

Section Outline

- **Surplus Value**
    - The extra utility that Smith and Jones achieve after trade is sometimes referred to as surplus value. These gains arise because of trade and accrue to both parties in the trade. But don’t lose sight that this “surplus” or these “gains” are real increases in happiness. Smith and Jones are both happier after trade than they were before. This is why I like to refer to the surplus value as extra “bursts of happiness.”
- **Generalizing to the Real World**
    - A skeptic might say, “OK sure, this is all well and good, but how often do two people come together and trade apples for oranges?" However, this critique misses an important generalization.
    - Gains from trade occur anytime mutually voluntary exchange occurs, no matter what the two traded items are. More common everyday trades involve the trade of money for goods or services.

- This process of voluntary exchange occurs every minute of every day in every city and town everywhere in the world. There may be billions or trillions of these occurring every day. And in every case, happiness bursts are created for both parties of the exchange.
- It is a simple truth then that if the average value of the happiness bursts in every transaction is fixed, then the greater the number of transactions that occur, the greater the overall surplus value that is generated. Quite simply, more trade means more happiness. We can never be sure whether the distribution of the gains from trade was equal or unequal. Instead we can only know that voluntary trade led to some degree of improvement for both.

Key Takeaways

- More trade means more happiness.
- Every voluntary transaction in the world generates extra happiness for both parties to the trade.
- Billions of transactions occur every day around the world, and each one generates mutual happiness.
- Some mutually beneficial trades can result in one trader becoming substantially more happy while the second trader is only slightly happier. The distribution of the surplus value depends on the terms of trade that are agreed to.

Exercises

1. Estimate the number of transactions, or trades, you have made during the past 24 hours.
    a. Suppose you make one-fifth the world average number of trades per day per economic unit. If there are 6 billion people in the world, 500 million businesses, and 50 million government jurisdictions, then how many trades take place in the world every day?
    b. Suppose the average surplus value created in each transaction is 50 cents. How much surplus value is created in the world every day?
2. This section's reading states, “If the average value of the happiness bursts in every transaction is fixed, then the greater the number of transactions that occur, the greater the overall surplus value that is generated.“ Suppose the average value is not fixed. Explain why this change in the assumption can change the conclusion.

6. Achieving a Unique Solution

- Learn why the assumption that both traders maximize utility assures that the final trade allocation is unique.
- Learn the equilibrium conditions that must be satisfied when both individuals are simultaneously maximizing utility.

- Identify the set of Pareto optimal allocations in an Edgeworth box.
- Identify the utility maximizing allocation in an Edgeworth box diagram.

Section Outline

- **$MU_O/P_O = MU_A/P_A$ Formula**
  - The left-hand side of the expression is defined as a terms of trade. It represents the amount of apples traded per orange and corresponds to the slope of the line drawn from the endowment point to the final allocation after trade.
  - The right-hand side of the expression is the ratio of marginal utilities and is also known as the marginal rate of substitution (MRS).
  - The expression implies that when an individual is maximizing his utility, the terms of trade must equal the slope of his indifference curve. Since there are two traders and both are assumed to be maximizing utility, the condition must be true for both simultaneously. Under some additional assumptions about the nature of the trader's preferences (not to be discussed here), these conditions are satisfied only at one point.
- **Reconsidering Assumptions**
  - We assume that individuals have well-defined preferences, that utility rises at a diminishing rate with increases in consumption, that they know their preferences fully and completely, and they both trade so as to maximize their individual utility.
  - The first assumption is about the nature and form of preferences (utility increases at a diminishing rate). The second assumption is about information (people have perfect information about their preferences). The third assumption is about behavior (individuals seek and achieve maximum utility).
  - That utility rises at a decreasing rate is probably valid for most people and for most goods and services. Perfect information about one's preferences is probably true for commonly purchased items, but most consumers are often unaware and uninformed about a vast range of products available for sale in the marketplace. Finally, with respect to utility maximization, it seems unlikely that individuals know enough about all of the potential trade outcomes and what one's own utility will be at each of those combinations to guarantee that one will maximize utility.
  - If the assumptions we make are not valid in the real world with real individuals, then how valid are the results that we predict? In this case, we should break down the result into two categories, the first being the mutual benefits that arise from trade and the second being the equilibrium outcome that arises when utility maximization occurs.

- **Real World Application**
    - The result of mutual gains from trade must almost certainly be valid in almost all circumstances.
    - Occasionally people do make poor trades. Sometimes a consumer is made worse off after trade.
    - The strong likelihood that information is imperfect may mean that people do not always achieve the maximization of utility or the particular trade pattern and prices predicted by this economic model. Nonetheless, failure to achieve the maximum does not mean that trade does not usually result in mutual benefits.
    - Lastly, it is worth noting that even if consumers do not achieve the maximum utility, it can be very useful to assume that they do.

Key Takeaways

- A unique equilibrium allocation of goods and a unique terms of trade can be derived by including the assumption that both traders act to maximize their individual utility.
- The utility maximizing equilibrium condition that must hold at the final allocation for each person is either (a) $MU_O/P_O = MU_A/P_A$,or (b)

$$P_O/P_A = MU_O/MU_A$$

where MU represents the marginal utility and

$$MU_O/MU_A$$

is the marginal rate of substitution between oranges and apples.
A Pareto optimum is any allocation of goods for which it is impossible via additional trade to raise, and/or maintain, the utility of both individuals.

- Graphically, the equilibrium allocation is depicted as the point in an Edgeworth box where both traders' indifference curves are tangent to the line drawn between it and the original endowment point.

- A utility maximizing allocation is always Pareto optimal.

- A Pareto optimum does not necessarily satisfy the utility maximizing conditions for both individuals.

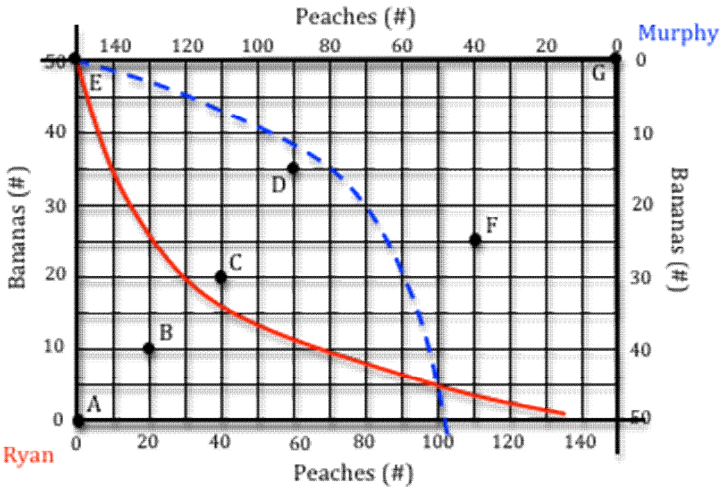
- In most cases, mutually voluntary exchange assures utility rises for both traders, even when utility is not strictly maximized by both traders.

Exercises

1. Answer the following questions by referring to Figure 2.6 "An Edgeworth Box with Smith and Jones". Assume the initial endowment is (10,0) for Smith. Suppose each bracketed combination refers to (# oranges, # apples).
    a. Briefly explain why the trade 3 oranges for 7 apples achieves a Pareto optimum.
    b. Briefly explain why the trade 3 oranges for 7 apples is not the utility maximizing solut
    c. ion for the traders.

Additional Exercises

1. Answer the following questions based on the Edgeworth Box diagram below. Suppose the diagram describes two farmers, Ryan and Murphy. Ryan is initially endowed with 50 bananas and zero peaches and Murphy is endowed with zero bananas and 150 peaches. Suppose the solid line is one of Ryan's indifference curves while the dotted line is one of Murphy's indifference curves.
    a. Which point on the graph corresponds to Ryan and Murphy's endowment?
    b. If Ryan and Murphy meet in a market and Murphy is motivated by self-interest, or greed, what consumption point, among those labeled, would raise his welfare to the highest level possible?
    c. If the consumption point that you identified in part (B) above were realized, state what happens to Ryan's welfare?
    d. If the consumption point that you identified in part (B) above were realized without Ryan's consent, what word(s) might observers use to describe the change?
    e. If Ryan and Murphy meet in a market and both Ryan and Murphy are motivated by self-interest, or greed, and they trade mutually voluntarily, what consumption point, among those labeled, is best for Ryan?
    f. If the consumption point that you identified in part (E) above were realized, state what happens to Murphy's welfare?



2. Answer the following questions based on the Edgeworth Box diagram below using the labeled points A – I as needed. Suppose the diagram describes two individuals, Chris and Dana. Dana's origin is located at the lower left and Chris's at the upper right. Let Dana and Chris's initial endowment be at point D in the diagram. Suppose the solid lines are Dana's indifference curves while the dotted lines are Chris's indifference curves.
    a. What is the total amount of peanuts and beer in this two-person economy?
    b. Which labeled point or points would make Dana worse off than at the original endowment?
    c. If Chris and Dana make a mutually voluntary trade, which good does Dana receive from Chris?
    d. Write an after trade allocation of peanuts and beer for Dana, [for example (# bags, # bottles)], that would be mutually beneficial.
    e. Which labeled point or points could the endowment be at, instead of D, to reverse the pattern of trade compared to point D?
    f. Which labeled point, or points, are surely Pareto Optimal?