

The Supply and Demand Game – Carbon Tax & Cap and Trade

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Background (taken in entirety from Investopedia)

Supply and demand is perhaps one of the most fundamental concepts of economics and it is the backbone of a market economy. [Demand](#) refers to how much (quantity) of a product or service is desired by buyers. The quantity demanded is the amount of a product people are willing to buy at a certain price; the relationship between price and quantity demanded is known as the demand relationship. [Supply](#) represents how much the market can offer. The quantity supplied refers to the amount of a certain good producers are willing to supply when receiving a certain price. The correlation between price and how much of a good or service is supplied to the market is known as the supply relationship. Price, therefore, is a reflection of supply and demand.

The relationship between demand and supply underlie the forces behind the allocation of resources. In [market economy](#) theories, demand and supply theory will allocate resources in the most efficient way possible. How? Let us take a closer look at the law of demand and the law of supply.

The **law of demand** states that, if all other factors remain equal, the higher the price of a good, the less people will demand that good. In other words, the higher the price, the lower the quantity demanded. This occurs because as the price rises, the **opportunity cost**, or the value of the best forgone alternative, is higher. As a result, people will naturally avoid buying a product that will force them to forgo the consumption of something else they value more. The chart below shows that the curve is a downward slope.

Like the law of demand, the **law of supply** demonstrates the quantities that will be sold at a certain price. But unlike the law of demand, the supply relationship shows an upward slope. This means that the higher the price, the higher the quantity supplied. Producers supply more at a higher price because selling a higher quantity at a higher price increases revenue.

When supply and demand are equal (i.e. when the supply function and demand function intersect) the economy is said to be at **equilibrium**. At this point, the allocation of goods is at its most efficient because the amount of goods being supplied is exactly the same as the amount of goods being demanded. Thus, everyone (individuals, firms, or countries) is satisfied with the current economic condition. At the given price, suppliers are selling all the goods that they have produced and consumers are getting all the goods that they are demanding.

In the real market place equilibrium can only ever be reached in theory, so the prices of goods and services are constantly changing in relation to fluctuations in demand and supply.

Objectives

Students will be able to:

- Describe the general shape of the supply curve and the demand curve.
- Understand that we pay for goods and services, but they occasionally have **externalities**.
- List mechanisms that limit externalities through a) a carbon tax and b) a cap and trade system and describe the effects of these mechanisms on trade.

Materials Needed

- Deck of standard 52 cards
- Two types of tokens (poker chips, pieces of candy, board game pieces, etc). One will represent Pollution Tokens, one will represent Permit Tokens.

- Fake money (e.g., from a board game such as Monopoly or Life)
- Bowl or other container (to symbolize the negative externality, pollution).
- Prizes (optional, but will likely help the experiment turn out correctly).

Safety Concerns

None.

Vocabulary

- Externality: A byproduct (either good or bad) that is not accounted for when doing the transaction or trade. For example, a negative externality would be pollution, while a positive externality would be improved public education.
- Carbon tax: A method to reduce greenhouse gases where a tax is placed on carbon dioxide and other greenhouse gases (thus leading to a fixed price on greenhouse gases). Proposed taxes include a tax on amount of fossil fuel burned, the amount of greenhouse gases emitted directly, and the amount of greenhouse gases emitted before product acquisition.
- Cap and trade: A method to reduce greenhouse gases where permits are issued to emit greenhouse gases (thus leading to a fixed amount of greenhouse gases emitted). Permits can be purchased, awarded gradually to help traditionally high polluters become accustomed to the prices, or awarded for good behavior.
- Surplus value: For the buyer, the difference between the transaction price and the maximum bid price. For the seller, the difference between the transaction price and the minimum bid price.

Experiment

Note, this game was first created by EH Chamberlin at Harvard in the 1940s. Then one of his students, Vernon Smith, later made some modifications to it, and later Cyril Morong shared “The Supply and Demand Game” online: <http://thedangerouseconomist.blogspot.com/2012/09/the-supply-and-demand-game.html>. This game is an adaptation of Morong's work.

Time	Activity	Description	Supplies
10 minutes	Setup	<ol style="list-style-type: none"> 1. Set aside a large stock of money and Pollution Tokens. These should never run out. 2. Setup cards and Permit Tokens <ol style="list-style-type: none"> a. Count the number of students participating in trading. Round up to a multiple of 4 (e.g., 20, 24, 28, 32, 36). This will be the total number of cards in the experiment. b. Find the total number of cards on the list below. Use the corresponding numbered 	Deck of standard 52 cards , Pollution Tokens, fake money, bowl, prizes

		<p>cards in the black (Spades and Clubs) and red (Diamonds and Hearts) suits. Note, there will be an equal number of cards in each suit.</p> <ul style="list-style-type: none"> i. 20 Cards = Black 2-6, Red 6-10 ii. 24 Cards = Black 2-7, Red 5-10 iii. 28 Cards = Black 2-8, Red 4-10 iv. 32 Cards = Black 2-9, Red 3-10 v. 36 Cards = Black 2-10, Red 2-10 <p>3. Designate a banker (likely the teacher). Set the Fake Money and the bowl (symbolizing pollution) in front of the teacher.</p> <p>4. Discuss Game Play</p> <ul style="list-style-type: none"> a. The object of the game is to have the most money at the end of three rounds. (The teacher may wish to provide prizes that would incentivize the students to maximize their earnings, otherwise the experiment will likely not work). b. Each student will receive \$10 only once, at the beginning of the first round. c. Identity Phase - Each student will receive a new card at the beginning of each round. Students with red cards are sellers. They are willing to sell their unit of energy for at least the face value of their card. Students with black cards are buyers. They are willing to buy their unit of energy for no more than the face value of their card. d. Insider Trading Phase - Gather sellers on one side of the room and buyers on the other side of the room. Groups will be given 2 minutes to trade amongst themselves in any way they wish. This may involve money changing hands, but will not result in additional money from the bank or Pollution Tokens. e. Market Phase – Gather sellers and buyers in the middle of the room for 5 minutes. Students make offers between themselves involving exactly one seller and one buyer. When a price is agreed upon, the students turn in their cards to the banker. The banker checks that the deal can be made (the agreed upon price is at least the seller’s minimum price and no more than the buyer’s maximum price). If the deal 	
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		<p>can be made, the banker takes the cards and pays each player his/her surplus value.</p> <ul style="list-style-type: none"> f. The teacher records trade values in real time on a supply/demand plot. Each trade will be a single point with number of transactions (x axis) and average price (y axis). g. For each successful trade using Diamonds, two Pollution Tokens are placed in the bowl. For each successful trade using Hearts, one Pollution Token is placed in the bowl. h. After each game, the teacher will calculate and display the average price and quantity and graph this point. They will also list the number of Pollution Tokens in the bowl and then empty the bowl. i. After three rounds, the game ends. The teacher calculates the overall average price and average quantity and graphs this point. They will also list the average number of Pollution Tokens in the bowl per round. 	
<p>30 minutes</p>	<p>Trading game 1: Supply and Demand</p>	<p>First students will play the game with no restrictions such that they can explore the laws of supply and demand.</p> <ol style="list-style-type: none"> 1. Repeat 3 times: <ul style="list-style-type: none"> a. Give each student a card at random. b. Allow sellers to trade cards with other sellers if they wish. Allow buyers to trade cards with other buyers if they wish. c. Commence trading. 2. Buy prizes, return all game pieces back to bank. 3. Group discussion <ul style="list-style-type: none"> a. In general, what was your goal? Students find the object of the game was for buyers to make a deal for the lowest possible price and for sellers to make a deal for the highest possible price. b. Why was this important? Because the average price and quantity came very close to the equilibrium. c. Why was the Insider Trading Phase important? d. Did students care about the Pollution Tokens? 	<p>Deck of standard 52 cards , Pollution Tokens, fake money, bowl, prizes</p>

<p>30 minutes</p>	<p>Trading Game 2: Carbon Tax</p>	<p>Next students will play the game with a carbon tax such that they can explore the laws of supply and demand.</p> <ol style="list-style-type: none"> 1. Repeat 3 times: <ol style="list-style-type: none"> a. Give each student a card at random. b. Commence trading as in Trading Game 1 with a new rule: During Market Phase, for each transaction recall there will be either one or two Pollution Tokens placed in the bowl. For each transaction, both the buyer and seller must pay \$1 to the bank per Pollution Token placed in the bowl. 2. Buy prizes, return all game pieces back to bank. 3. Group discussion <ol style="list-style-type: none"> a. What was the effect of a Pollution Tax? Discuss the carbon tax, and how most European countries have a carbon tax. The market will find an “equitable price of carbon”, and the amount of pollution will go down, but it is not limited to a certain amount. b. What might make the Pollution Tax more fair? On sellers only? On buyers only? 	<p>Deck of standard 52 cards , Pollution tokens, fake money, bowl, prizes</p>
<p>30 minutes</p>	<p>Trading Game 3: Cap and Trade</p>	<p>Next students will play the game with a carbon tax such that they can explore the laws of supply and demand.</p> <ol style="list-style-type: none"> 1. Repeat 3 times: <ol style="list-style-type: none"> a. Give each student a card at random. b. Distribute the following number of Permit Token to sellers. Feel free to experiment with different distributions. If you would like an equitable distribution, give 2/3 of Permit Tokens to highest valued Diamonds, and 1/3 of Permit Tokens to the highest calued Hearts. <ol style="list-style-type: none"> i. 20 Cards = 10 PermitTokens ii. 24 Cards = 12 PermitTokens iii. 28 Cards = 14 PermitTokens iv. 32 Cards = 16 PermitTokens v. 36 Cards = 18 PermitTokens c. Commence trading as in Trading Game 1 with a new rule: During Market Phase, for each transaction recall the banker had placed either one (for Hearts) or two (for Diamonds) Pollution Tokens in the bowl. Now, this is changed. For each transaction, the seller must place either one (for Hearts) or two (for Diamonds) Permit Tokens in the bowl. 2. Buy prizes, return all game pieces back to bank. 	<p>Deck of standard 52 cards , Pollution Tokens, Permit Tokens, fake money, bowl, prizes</p>

		<p>3. Group discussion</p> <ul style="list-style-type: none">a. What was the effect of the permits? Discuss permits trading, such as the SO₂ tradable permits in the 90s . This limits the amount of pollution that can occurb. What might make the Permit Tokens more fair? On sellers only? On buyers only?	
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Additional Resources

Reputable

Economics Basics: Supply and Demand | Investopedia. URL [Last accessed: August 25, 2013]. <http://www.investopedia.com/university/economics/economics3.asp>

Opinion / Newspaper

Economics | Youtube. URL [Last accessed: August 25, 2013]. https://www.youtube.com/playlist?list=PLRd6RHFjV_HJUgoiZxoIbPNLH_ivEg5Ak

Supply and Demand | Wikipedia. URL [Last accessed: August 25, 2013]. http://en.wikipedia.org/wiki/Supply_and_demand

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