

## Problem Sets 1: Micro Review

1. On the island of Crusoe, Robinson struggles to survive: He must work 100 hours (L) per week hunting fish (H) and gathering nuts (G). Derive the production possibilities frontier (PPF) for Robinson Crusoe's island economy, given his productivity or production functions below.

- 1) Hunting: 10 hours per H unit; Gathering: 5 hours per G unit. Draw the PPF
- 2) Hunting:  $H=\sqrt{L}$ ; Gathering:  $G=2\sqrt{L}$ . Draw the PPF.
- 3) Hunting:  $H=L^2$ ; Gathering:  $G=L^2/4$ . Draw the PPF.

2. In an autarky (self-sufficient) economy, Biwei can choose to produce either apple, banana, or cherry. His hourly productivity is shown in the table below.

Products	Productivity (units per hour)	Opportunity Cost (minutes)
Apple	10	
Banana	20	
Cherry	4	

- 1) Suppose Biwei works for one hour and produces a combination of apples and bananas. What is the opportunity cost of one apple in term of bananas? Draw this PPF in a graph.
- 2) Suppose Biwei only works for one hour and produces a combination of apples and cherries. What is the opportunity cost of one apple in term of cherries? Draw this PPF in a graph.
- 3) Suppose Biwei would like to consume a combination of (5a, 10b, 2c), what is the amount of time he must sacrifice for this production bundle?
- 4) What is the opportunity cost of each good measured in term of time? Fill in the table above
- 5) Suppose the price of an apple  $P_a=\$10$ , with a combination of (5a, 10b, 2c) produced, given the opportunity cost of an apple in terms of bananas or cherries calculated in (1) and (2), what would be the price of a banana and the price of a cherry? What is the total market value of this bundle?
- 6) Suppose next year Biwei's productivity in apple increases to 12 units per hour while productivity in banana and cherry remains the same, what is the new opportunity cost of an apple in terms of bananas? And the new opportunity cost of an apple in terms of cherries?
- 7) With the productivity in apples increasing to 12 units per hour while others remain the same, Biwei divides one hour and a half (or 90 minutes) equally to the production of three goods, what is the production bundle he can obtain?
- 8) With the production bundle achieved in (7) and  $P_a=\$10$  for an apple, what is the corresponding price of a banana? And the corresponding price of a cherry?
- 9) Is money necessary in Biwei's economy? If not necessary, why do the goods have prices?
- 10) Why does the apple price remain the same even though there is an increase in its productivity?

3. A society of four individuals, A, B, C, and D, each characterized by his demand for automobiles, as given in the table. Assume that all automobiles are identical. The demand schedules for each person and for the group conform to the law of demand. [Optional: 0.5 Extra Credit]

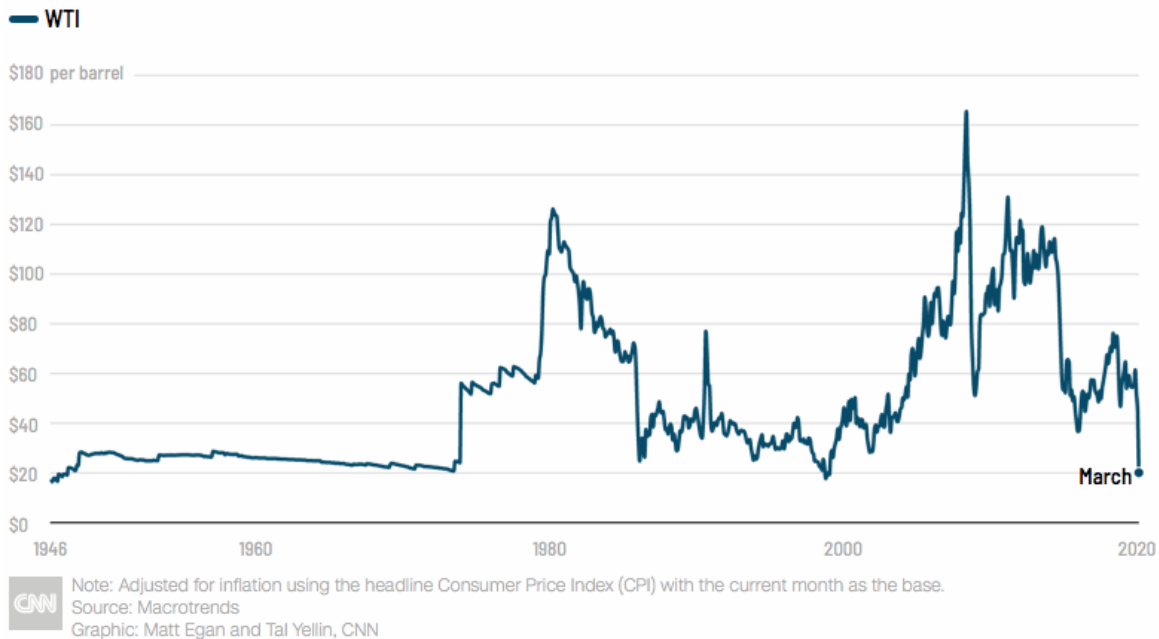
**Car-ownership demands of A, B, C, and D**

Price (\$)	Quantity of Automobiles				
	A	B	C	D	Total
1,000	2	0	1	1	
900	2	0	1	1	
800	2	0	1	2	
700	2	0	1	2	
600	3	0	1	2	
500	3	1	1	2	
400	3	1	2	2	
300	3	1	2	3	
200	3	1	2	4	
100	4	2	2	4	

- 1) Fill in the last column and draw the market demand curve for automobiles.
- 2) Compare A's demand schedule with B's, can we infer that B is wealthier than A? Why?
- 3) Suppose there are seven cars in this community, what is the equilibrium price?
- 4) Suppose all seven cars are owned by A, others have none. If A would like to sell some of his cars at the price of \$800 per unit, who will be the buyers? How many cars will be sold?
- 5) At \$800, how many cars would A like to own? How many cars would he actually own?
- 6) At \$800, is quantity demanded equal to quantity supplied? Is the market in equilibrium?
- 7) At \$800, how would A maximize his net benefit and what is the corresponding net benefit?
- 8) Suppose all seven cars are owned by B while others have none. What would be the market equilibrium? What would be the total market welfare?

4. Global oil price has never in history collapsed as precipitously as it had in 2020. The historical WTI oil price is shown. Watch a video linked: 20200416 How the Oil Bust Could Reshape Global Markets | WSJ 4:17 [\[Link\]](#) Apply the market equilibrium model and production theory to questions below.

Over the last 75 years, inflation-adjusted oil prices have very rarely been cheaper than today.



- 1) What are the specific demand and supply (D-S) factors that caused the most recent oil price crash?
- 2) Apply the D-S model to (1). Graph the initial equilibrium as point A and new equilibrium point B.
- 3) Which factor (D or S) is more crucial in slashing oil prices? What data are needed to verify the factor?
- 4) How would these factors affect consumer surplus and producer surplus? Explain with a graph.
- 5) When the oil price drops below \$40 per barrel, a large number of US shale oil companies will shut down temporarily and some may close down for good. Apply the production cost functions to explaining the firm's shut-down and exit decisions in the oil market. Be specific about the relationship between firms' cost structure and their shut-down and exit sequence. Which type of firm is the first to shut down?
- 6) According to the U.S. Energy Information Administration, the United States, Saudi Arabia, and Russia together accounted for more than 40% of the global oil production in 2019. While the U.S. is the largest oil producer in the world, its production does not have much cost advantage and must import oil from outside to meet its domestic demand. Apply the duopoly or oligopoly model to explaining the oil price crash from the supply shock resulting from the geopolitical conflicts between Saudi Arabia and Russia.
- 7) Net U.S. energy imports have decreased every year since 2016. Last year's change in net energy trade (crude oil, natural gas, coal, and petroleum products) in the US—from 3.6 quads of net imports in 2018 to 0.8 quads of net exports in 2019—was the largest change in U.S. energy trade since 1980. How would the low oil price affect the U.S. crude oil trade (import and export) in 2020? Apply the D-S model.
- 8) To help domestic oil producers, including a large number of shale companies, survive this economic downturn, the U.S. government can provide loans (subsidies) or impose higher tariff on oil imports. Apply the D-S Model to analyzing the welfare effects of two different policies on the U.S. oil market separately.