Elements of Macroeconomics TA Session 2: Assignment 1

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Slides on https://github.com/Haruki-Shibuya/TA

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Tips for learning (as a former freshman)

- Even smart ones can find it hard to learn effectively at university
- Tips:
- There is no single 'perfect' textbook/material/teacher for university-level learning. Everything has a different focus.
- It's much faster to find other resources when you don't get it
- In such a case, try looking for 3+ renowned textbooks & online resources (e.g., search 'PPF lecture note')
- Then extract info that is easiest for you/most detailed
- I don't recommend reading the same paragraph 100 times when you don't get it

Q1(a)

Question One

An economy consists of three workers: Joshua, Mavis, and Eric. Each works 10 hours a day and can produce two services: mowing lawns and washing cars. In an hour, Joshua can either mow one lawn or wash one car; Mavis can either mow one lawn or wash two cars; and Eric can either mow two lawns or wash one car.

a) Calculate how much of each service is produced under the following circumstances, which we label A, B, C, and D:

- All three spend all their time mowing lawns. (A)
- All three spend all their time washing cars. (B)
- All three spend half their time on each activity. (C)
- Joshua spends half his time on each activity, while Mavis only washes cars and Eric only mows lawns. (D)

Q1 (a)

- Define
- L : total loans mowed, C: total cars washed
- x_L, y_L, z_L: hours worked for mowing *lawns* by Joshua/Mavis/Eric

- x_C, y_C, z_C: hours worked for washing *cars* by Joshua/Mavis/Eric
- Then

$$L = x_L + y_L + 2z_L$$
$$C = x_C + 2y_C + z_C$$

Q1 (a)

- Scenario (A): $x_L = y_L = z_L = 10, x_C = y_C = z_C = 0 \Rightarrow (L, C) = (40{,}0)$
- Scenario (B): $x_L = y_L = z_L = 0, x_C = y_C = z_C = 10 \Rightarrow (L, C) = (0{,}40)$
- Scenario (C): $x_L = y_L = z_L = 5, x_C = y_C = z_C = 5 \Rightarrow (L, C) = (20{,}20)$
- Scenario (D): $x_L = x_C = 5, y_L = z_C = 0, y_C = z_L = 10 \Rightarrow (L, C) = (25{,}25)$

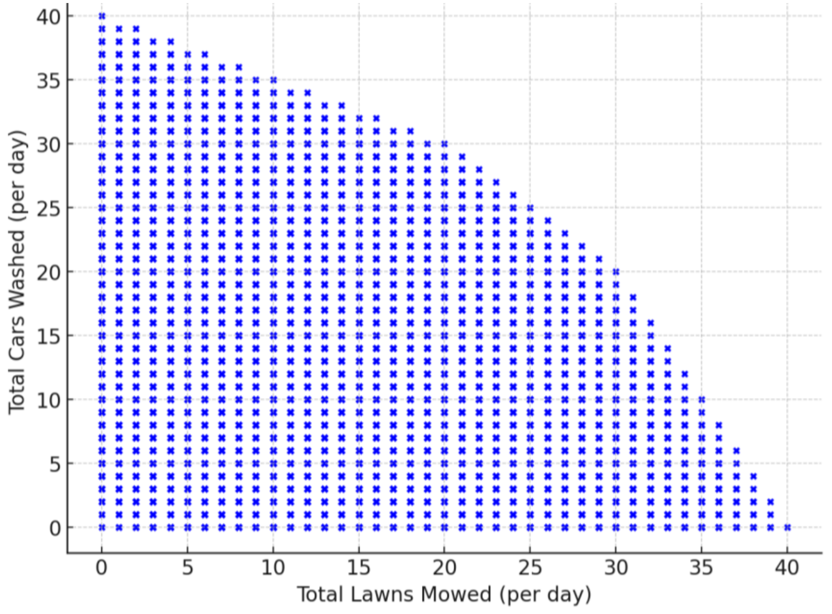
$$L = x_L + y_L + 2z_L$$
$$C = x_C + 2y_C + z_C$$

Q1 (b)

b) Graph the production possibilities frontier for this economy. Using your answers to part a), identify points A, B, C, and D on your graph.

Q1 (b)

- The **PPF (Production Possibility Frontier)** is the set of points (L,C) that shows the maximum possible production of one good (in this case, L or C) given the production of the other, subject to the constraints on resource use.



Q1 (b)

- Resource constraints:

$$x_L + x_C = 10 \qquad 0 \leq x_L, x_C \leq 10$$
$$y_L + y_C = 10 \qquad 0 \leq y_L, y_C \leq 10$$
$$z_L + z_C = 10 \qquad 0 \leq z_L, z_C \leq 10$$

- Eliminate x_L, y_L, z_L using equations to simplify:

$$L = x_L + y_L + 2z_L = 40 - x_C - y_C - 2z_C$$
$$C = x_C + 2y_C + z_C$$

Q1 (b)

- We want to derive a relationship between L and C
- →Eliminate one of x_C, y_C, z_C
- **Case (1)**: Eliminate x_C from

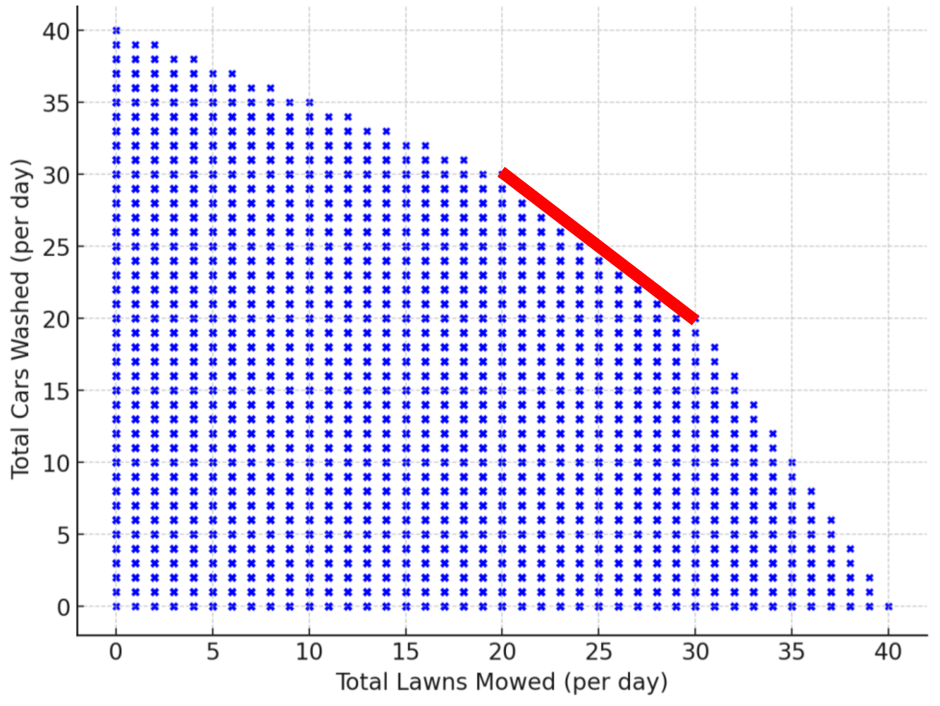
$$L = 40 - x_C - y_C - 2z_C$$
$$C = x_C + 2y_C + z_C$$

- $L + C = 40 + y_C - z_C \Rightarrow L = -C + 40 + y_C - z_C$
- Given any C, maximum L is achieved when $y_C = 10, z_C = 0$
- $L = -C + 50$
- But don't forget the constraints $0 \leq x_C \leq 10$

Q1 (b)

- We have $0 \leq x_C = C - 2y_C - z_C \leq 10$
- We confirmed $y_C = 10$ *and* $z_C = 0$ on the PPF
- Hence $0 \leq C - 20 \leq 10$
- i.e., $20 \leq C \leq 30$
- Thus, PPF part (1) is obtained as

$$L = -C + 50 \quad (20 \leq C \leq 30)$$



Q1 (b)

- We want to derive a relationship between L and C
- →Eliminate one of x_C, y_C, z_C
- **Case (2)**: Eliminate y_C from

$$L = 40 - x_C - y_C - 2z_C$$

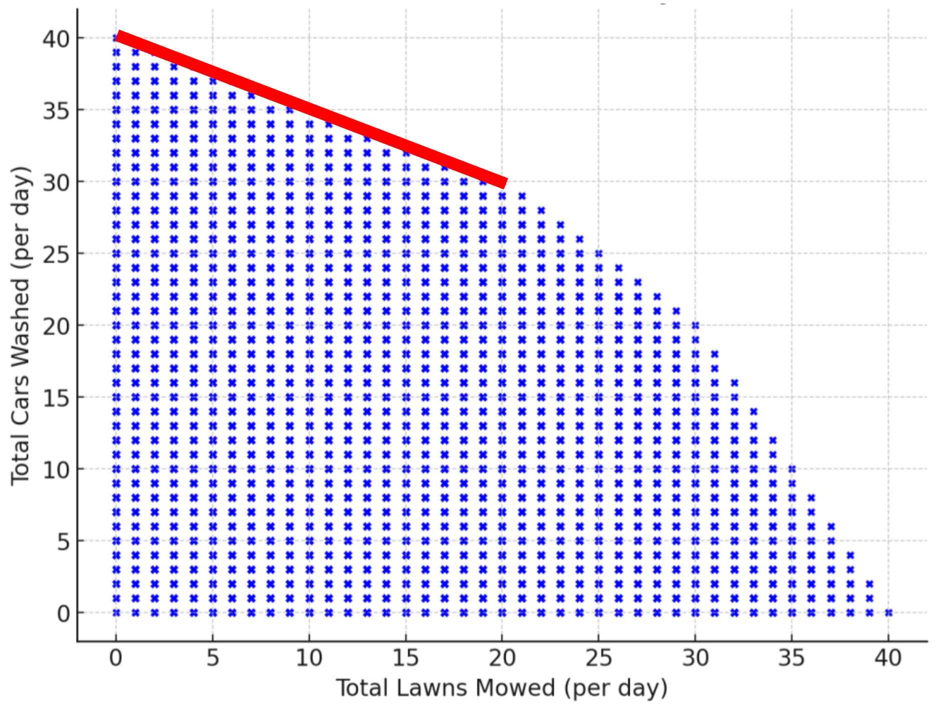
$$C = x_C + 2y_C + z_C$$

- $2L + C = 80 - x_C - 3z_C \Rightarrow L = -\frac{1}{2}C + 40 - \frac{1}{2}x_C - \frac{3}{2}z_C$
- Given any C, maximum L is achieved when $x_C = 0, z_C = 0$
- $L = -\frac{C}{2} + 40$
- But don't forget the constraints $0 \leq y_C \leq 10$

Q1 (b)

- We have $$0 \leq y_C = \frac{1}{2}(C - x_C - z_C) \leq 10$$
- We confirmed $x_C = 0$ and $z_C = 0$ on the PPF
- Hence $0 \leq \frac{C}{2} \leq 10$
- i.e., $0 \leq C \leq 20$
- Thus, PPF part (1) is obtained as

$$L = -\frac{1}{2}C + 40 \quad (0 \leq C \leq 20)$$



Q1 (b)

- We want to derive a relationship between L and C
- →Eliminate one of x_C, y_C, z_C
- **Case (3)**: Eliminate z_C from

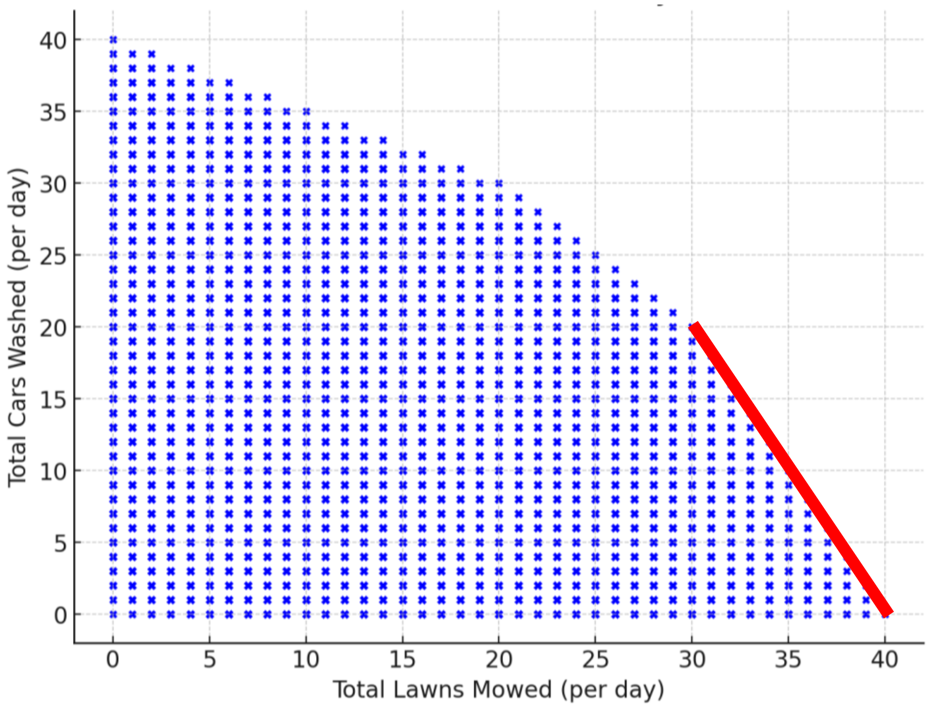
$$L = 40 - x_C - y_C - 2z_C$$
$$C = x_C + 2y_C + z_C$$

- $L + 2C = 40 + x_C + 3y_C \Rightarrow L = -2C + 40 + x_C + 3y_C$
- Given any C, maximum L is achieved when $x_C = 10, y_C = 10$
- $L = -2C + 80$
- But don't forget the constraints $0 \leq z_C \leq 10$

Q1 (b)

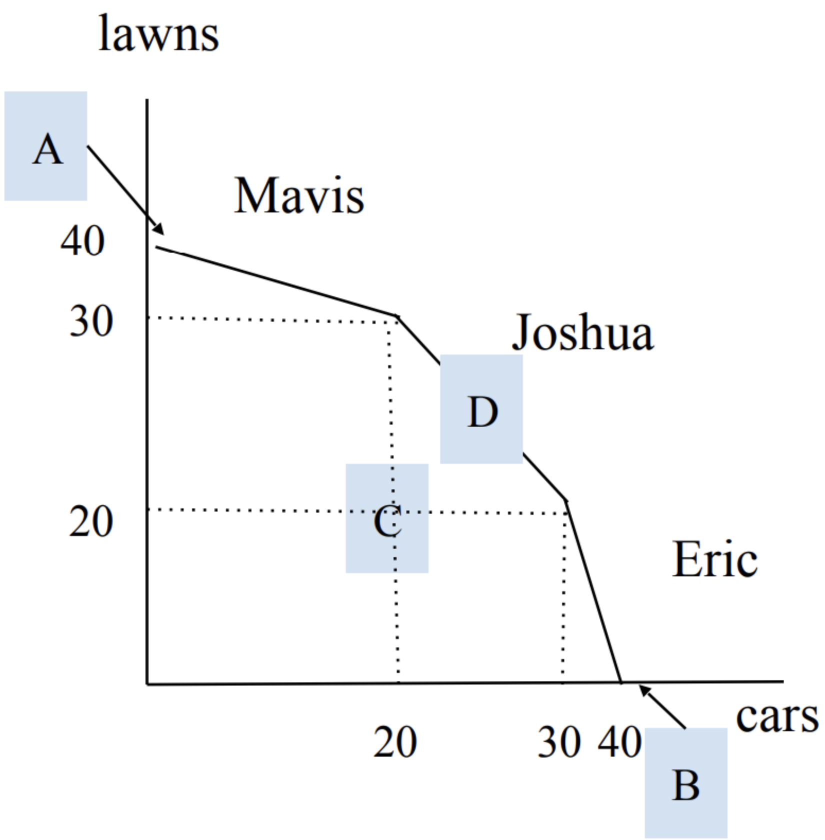
- We have $0 \leq z_C = C - x_C - 2y_C \leq 10$
- We confirmed $x_C = 10$ and $y_C = 10$ on the PPF
- Hence $0 \leq C - 30 \leq 10$
- i.e., $30 \leq C \leq 40$
- Thus, PPF part (1) is obtained as

$$L = -2C + 80 \quad (30 \leq C \leq 40)$$



Q1 (b)

- PPF & points ABCD:



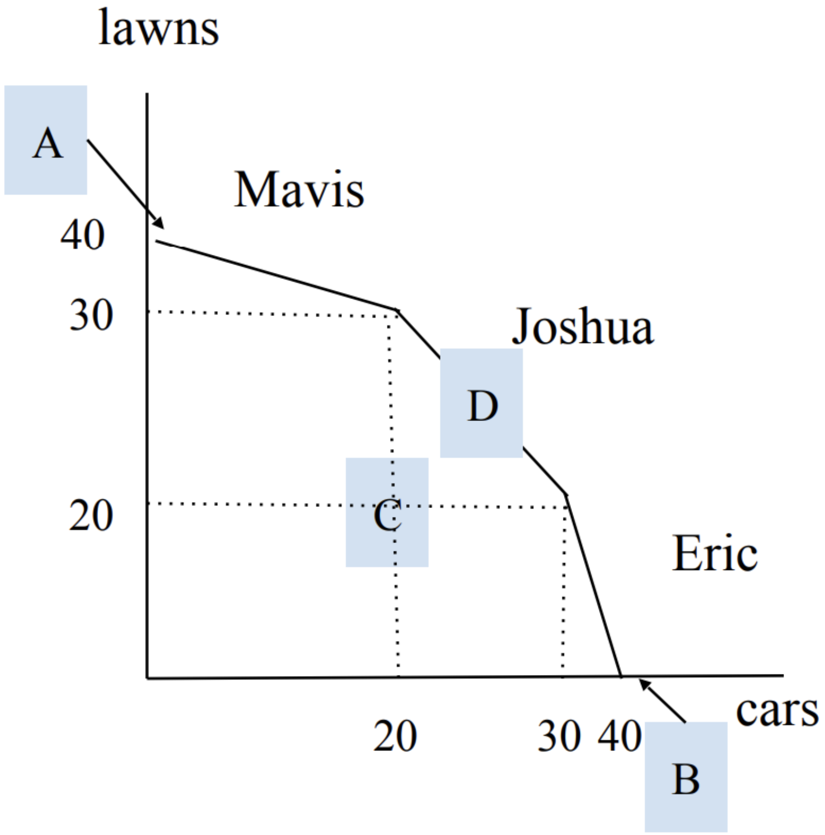
- All three spend all their time mowing lawns. (A)
- All three spend all their time washing cars. (B)
- All three spend half their time on each activity. (C)
- Joshua spends half his time on each activity, while Mavis only washes cars and Eric only mows lawns. (D)

Q1 (c)

- Why is PPF convex (bowed out)?
- In other words, why does D on PPF come northeast of C, where the latter is on line AB?
- Because

D: everyone focuses on a task with a less opportunity cost

C: everyone does both tasks regardless of skills



By focusing on what everyone is good at we have a more efficient result, hence bowed out.

$$L = x_L + y_L + 2z_L$$

$$C = x_C + 2y_C + z_C$$

Q1 (d)

d) Are any of the allocations calculated in part a) inefficient? Explain.

Yes, allocation C (20 lawns, 20 cars) is inefficient because it falls within the PPF. This means resources are wasted. As we can see in allocation D (25 lawns, 20 cars), it is possible to make more of both goods with the same amount of resources.

Cf., Pareto efficiency

Q2

Question Two

The following hypothetical production possibilities tables are for China and the United States. Assume that before specialization and trade the optimal product mix for China is alternative B and for the United States is alternative U.

China Production Possibilities

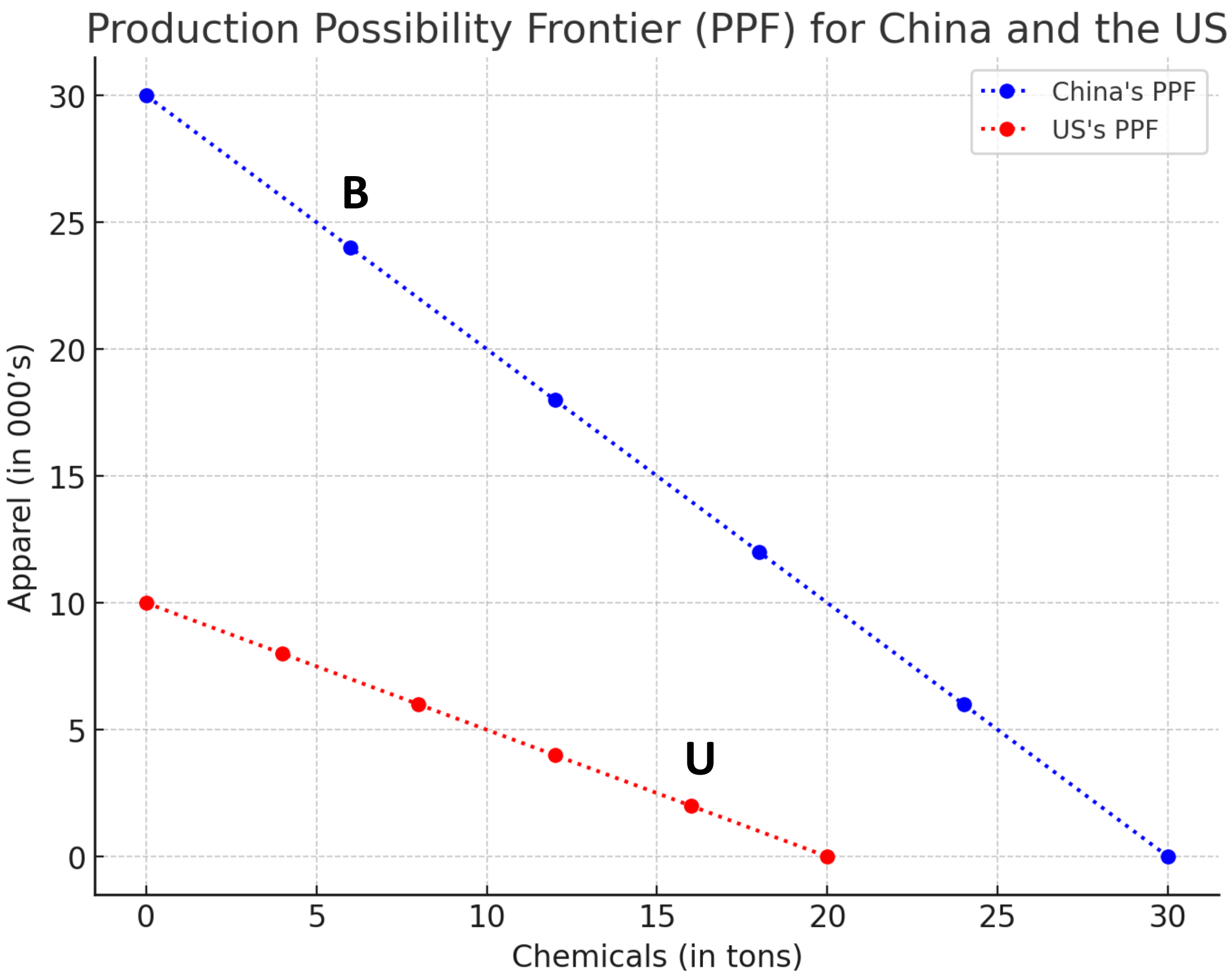
Product	A	B	C	D	E	F
Apparel (in 000's)	30	24	18	12	6	0
Chemicals (in tons)	0	6	12	18	24	30

US Production Possibilities

Product	R	S	T	U	V	W
Apparel (in 000's)	10	8	6	4	2	0
Chemicals (in tons)	0	4	8	12	16	20

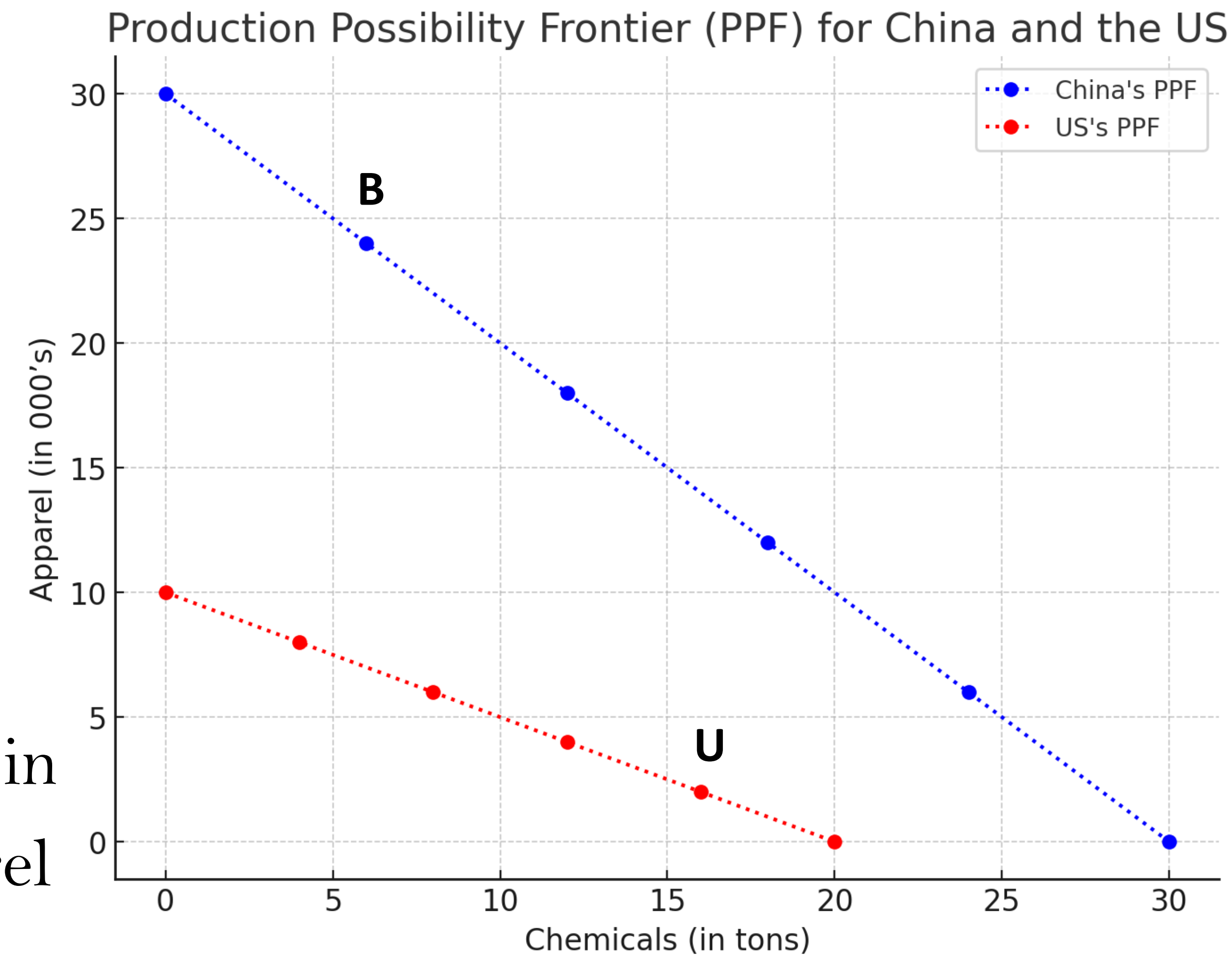
Q2 (a)

- China gives up 30 chemicals to produce 30 apparel
- Opportunity cost of producing 1 apparel in terms of chemicals for China is $OC_{\{China,A\}} = \frac{30}{30} = 1$



Q2 (a)

- US gives up 20 chemicals to produce 10 apparel. Similarly,
- $OC_{\{US,A\}} = \frac{20}{10} = 2$

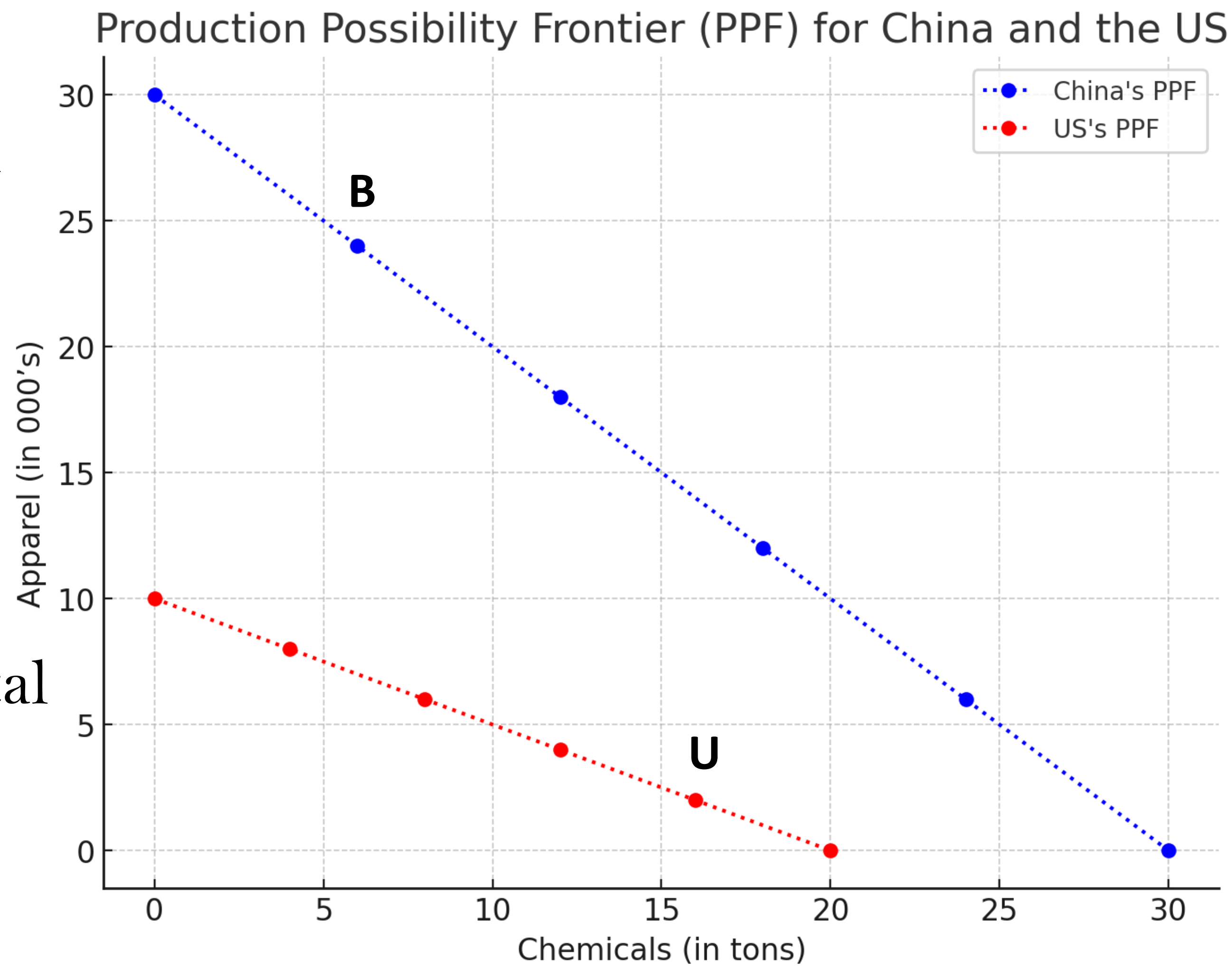


- $OC_{\{China,A\}} < OC_{\{US,A\}}$
- China has comparative advantage in apparel→US: chemicals, CN: apparel

Q2 (b)

- US: chemicals, China: apparel
- Specialization would yield 30 apparel and 20 chemicals
- B and U yield 4+24=28 apparel and 6+12=18 chemicals

- Specialization gives 2 more apparel and 2 more chemicals than (B,U) in total



Q2 (c)

The **terms of trade (TOT)** is a measure that reflects the relative prices at which two countries trade goods. It shows how much of one good a country must give up to obtain a unit of another good from a trading partner.

The **terms of trade** is defined as:

$$TOT = \frac{P_{\text{exports}}}{P_{\text{imports}}} \times 100$$

We omit 100 hereafter.

Q2 (c)

$$TOT = \frac{P_{\text{exports}}}{P_{\text{imports}}}$$

- Remember the specialization   US: chemicals, China: apparel
- US exports chemicals and imports apparel
- $OC_{\{US,A\}} < TOT_{\{US\}} < OC_{\{China,A\}}$ should hold
- Why?
- $TOT_{\{US\}} \leq OC_{\{US,A\}}$ wouldn't be beneficial for US

  because in that case US would be better off making apparel by itself
- $OC_{\{China,A\}} \leq TOT_{\{US\}}$ wouldn't be beneficial for China

  because in that case China would be better off making chemicals by itself

Q2 (c)

$$TOT = \frac{P_{\text{exports}}}{P_{\text{imports}}}$$

- Hence $1 < TOT_{\{US\}} < 2$
- By the same token, $½ < TOT_{\{China\}} < 1$

Q2 (d)

$$TOT = \frac{P_{\text{exports}}}{P_{\text{imports}}}$$

d) Suppose that the actual terms of trade are 1 unit of apparel for 1.5 units of chemicals and that 4 units of apparel are exchanged for 6 units of chemicals. What are the gains from specialization and trade for each nation?

- US: chemicals, China: apparel
- Specialization yields 30 apparel and 20 chemicals
- The trade results in
- US: (4 apparel, 14 chemicals) and China: (26 apparel, 6 chemicals)
- US gets two more chemicals compared to point U
- China gets two more apparel compared to point B

Q3(a)

Question Three

Suppose that the current Canadian dollar (CAD) to U.S. dollar exchange rate is $.85 CAD = $1 US and that the U.S. dollar price of an Apple iPhone is $300.

a) What is the Canadian dollar price of an iPhone?

0.85 * 300 = 255 CAD

Q3(a)

b) Next, suppose that the CAD to U.S. dollar exchange rate moves to \$.96 CAD = \$1 US. What is the new Canadian dollar price of an iPhone? Other things equal, would you expect Canada to import more or fewer iPhones at the new exchange rate?

The new price will be $0.96 * 300 = 288$

The phone has become relatively more expensive due to the change in exchange rate. All other things equal, we will expect Canada to import fewer iPhones.

Q4(a)

Question Four

a) A computer systems engineer could paint his house, but it makes more sense for him to hire a painter to do it. Explain why.

It makes more sense to hire a painter because the painter most likely will have the comparative advantage (lower opportunity cost).

Q4(b)

b) What is the difference between microeconomics and macroeconomics?
Study of individuals, households, and firms vs the whole economy of a country.

Q4(c)

c) What would be another example of a “system” in the real world that could serve as a metaphor for micro and macroeconomics?

Some examples:
Study of earth, vs the study of the solar system.
Study of frogs vs study of amphebians