

# Specialization and Gain from Trade

Fei DING  
HKUST ECON

# Announcements

- Assigned Reading:

- Textbook, Chap 2, 3, 4

- Tutorial 1 covers basic math. review (Ch1 appendix).

- Problem Set 1

- Ch1: 5

- Ch2: 8-9, 11-17, 20-21

- Due date will be announced on CANVAS.

# Specialization – A model of exchange

- Why specialize?
- **Production Possibilities Frontier** provides a very good perspective to look into this.
  - Very simple setup, but can go deep.
  - What factors determine who specializes in what?
- **Exchange** is necessary to realize the gains generated from specialization.
  - Exchange ratio: How many X can be exchanged for Y?
  - Is a mutually acceptable exchange ratio for everyone possible?

# Do you grow your own vegetable?

- Nowadays, even farmers themselves have to buy vegetables of certain kinds for their consumption.
- Why “specialization”? Any economic reasons behind?
- First, what is “**Production**”?



# Primary Factors of Production

- “Primary factors of production” are provided by **households**, which include
  - Labor: work and effort from human beings;
  - Capital: capacity to produce goods & services;
  - Land: gifts from nature; and
  - Entrepreneurship: organization and risk-taking in production (residual claimant).
- Entrepreneur to distinguish between “labor effort” and “risk-taking behavior”
- Sometimes, labor and machine (one type of capital) can substitute for each other.

# Availability of “Labor”

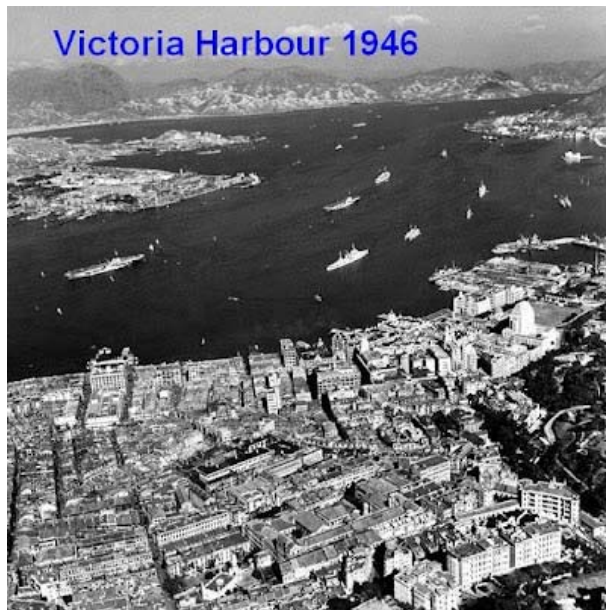
- Labor NOT EQUAL to “a person”, but **effort**
- “Labor” is MORE than “population”.
- “**Incentive**” is important to induce a person to work efficiently and effectively (i.e., levels of effort provided).
- Institution and rewarding system: The right for ones to choose the jobs they like, and to keep the reward from their effort.
- Example in the old US: Slaves were allowed to buy back their freedom if they work hard enough to accumulate enough money.

## Availability of “Labor”

- Besides correct incentives: Machinery or tools can improve the productivity of labor.
- In developed countries, we can usually observe correct incentive systems, and the amount of machinery stock is high (which can be measured by capital per capita).

# Availability of “Land”

- **Land (natural resources)** was regarded as fixed in the old days, but may not be true nowadays.



- Still, most **Land** is created by nature.



# Availability of “Capital”

- **Capital creation** (or formation) is an interesting and important process.
- An economic decision: Trade-off of current and future consumption.
- As mentioned, accumulation of capital is highly related to productivity and the level of living standard of an society.
- **EXAMPLE:** Fisherman

## EXAMPLE: Fisherman and Fishing

- Francis likes fish and does fishing for a living.
- At first, he can only do that by bare hands!
- Fish escapes easily, and he could only fish at shallow water.
- Tough life !!!



# Fisherman and Fishing

- To improve the situation:
  - Can buy a fishing net !!!
- He can do much better with it.



Yeah! Yeah! Yeah!



- Spending money for a net means a reduction in consumption today and wish for higher consumption in the future. **A trade-off!**

# Fisherman and Fishing

- Francis sacrificed some of his current consumption (*saving*) to buy the fish net (*capital*).
- With the fishing net, he can get enough to eat and to sell (*return to capital*).
- In this example, besides supplying his own labor, you can take Francis as an entrepreneur as well.
- Any profit or loss from the production is borne by Francis.

## Question (1)

- In the capital creation process, Francis will take into account:
  - 1) How much current consumption he has to sacrifice.
  - 2) How much future consumption is expected to gain.
  - 3) His patience on consumption across time.
  - 4) All of the above.

## Question (1)

3) is needed to be able to compare current and future consumption:  
in a country of high political instability, would citizens be more patient or  
many factors affect one's patience

# Production – Specialization

- **Production Possibilities Frontier** (PPF) is always used to illustrate the gains from specialization.
- Why and how specialization can increase total output.
- Also important: How the gains from specialization are divided between different people?
- PPF model is simple, yet provides many insights.

## Question (2)

- Under which of the following condition(s) would specialization between Person A and B lead to a larger total output for them?
- 1) Person A is good at producing X and B is good at producing Y.
  - 2) Person A is good at producing both X and Y.
  - 3) Person B is good at producing both X and Y.
  - 4) All of the above.
  - 5) None of the above.



4) is the correct answer

a person is good at X means he uses less resources in providing X (absolute advantage)

under 1), person A has absolute advantage on producing X and B on producing Y

under 2) and 3), one person has absolute advantage on both X and Y. However, differences in their marginal cost lead to comparative advantage

## Question (2)

INDIFFERENCE: no comparative advantage because both countries have the same marginal cost of doing something

# Production Possibilities Frontier

## PPF or PPC (curve) represents

- At a given amount of factors of production, how many goods can be produced.
- **EXAMPLE:** A Two-Good Case: Meat and Potatoes; Resources = 8 hours of labor.

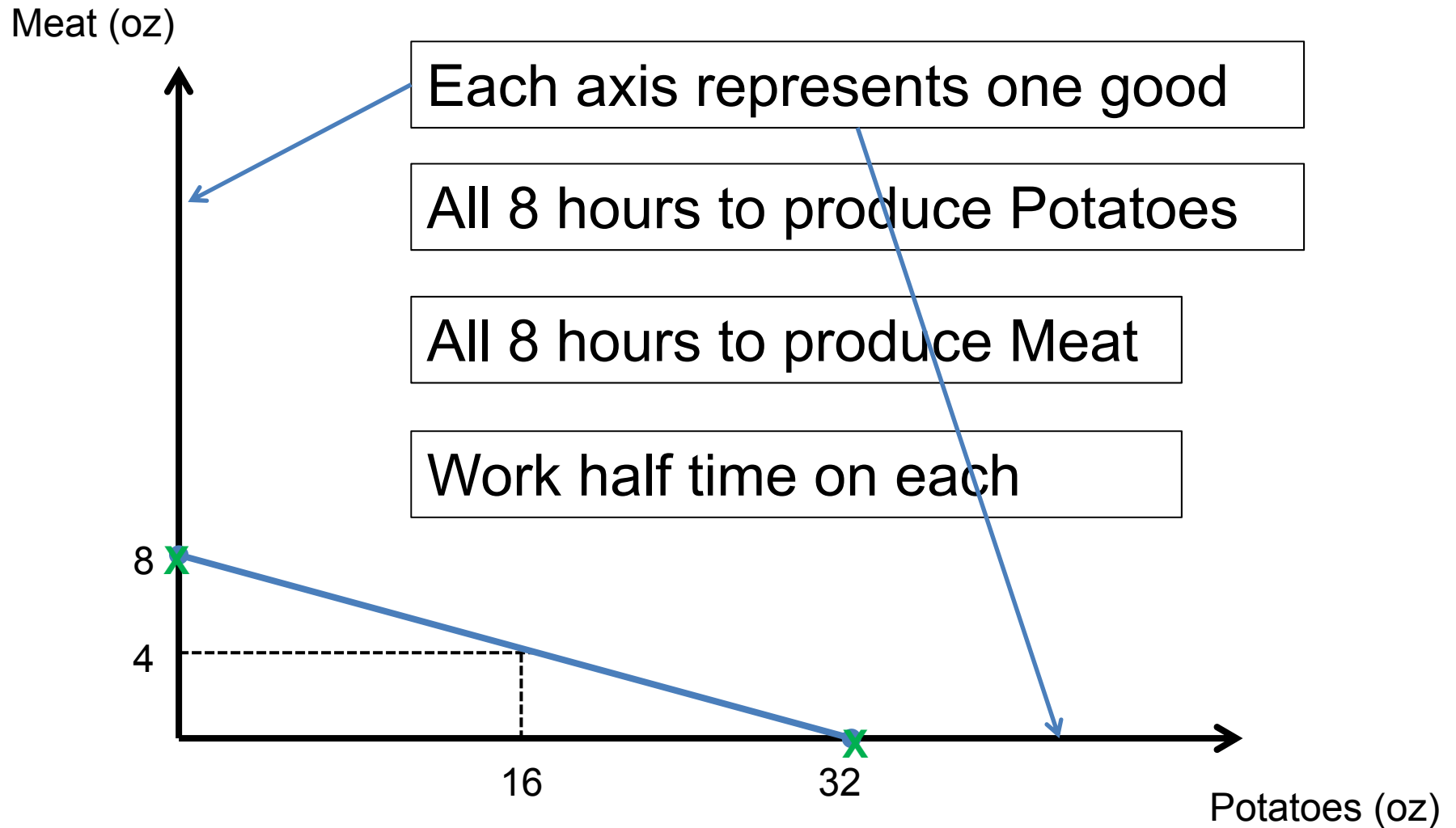
	Minutes needed		In 8 hours	
	Meat	Potatoes	Meat	Potatoes
Fei	60 min/oz	15 min/oz	8 oz	32oz
Siu Fai	20 min/oz	30 min/oz	24 oz	16oz

# Production Possibilities Frontier

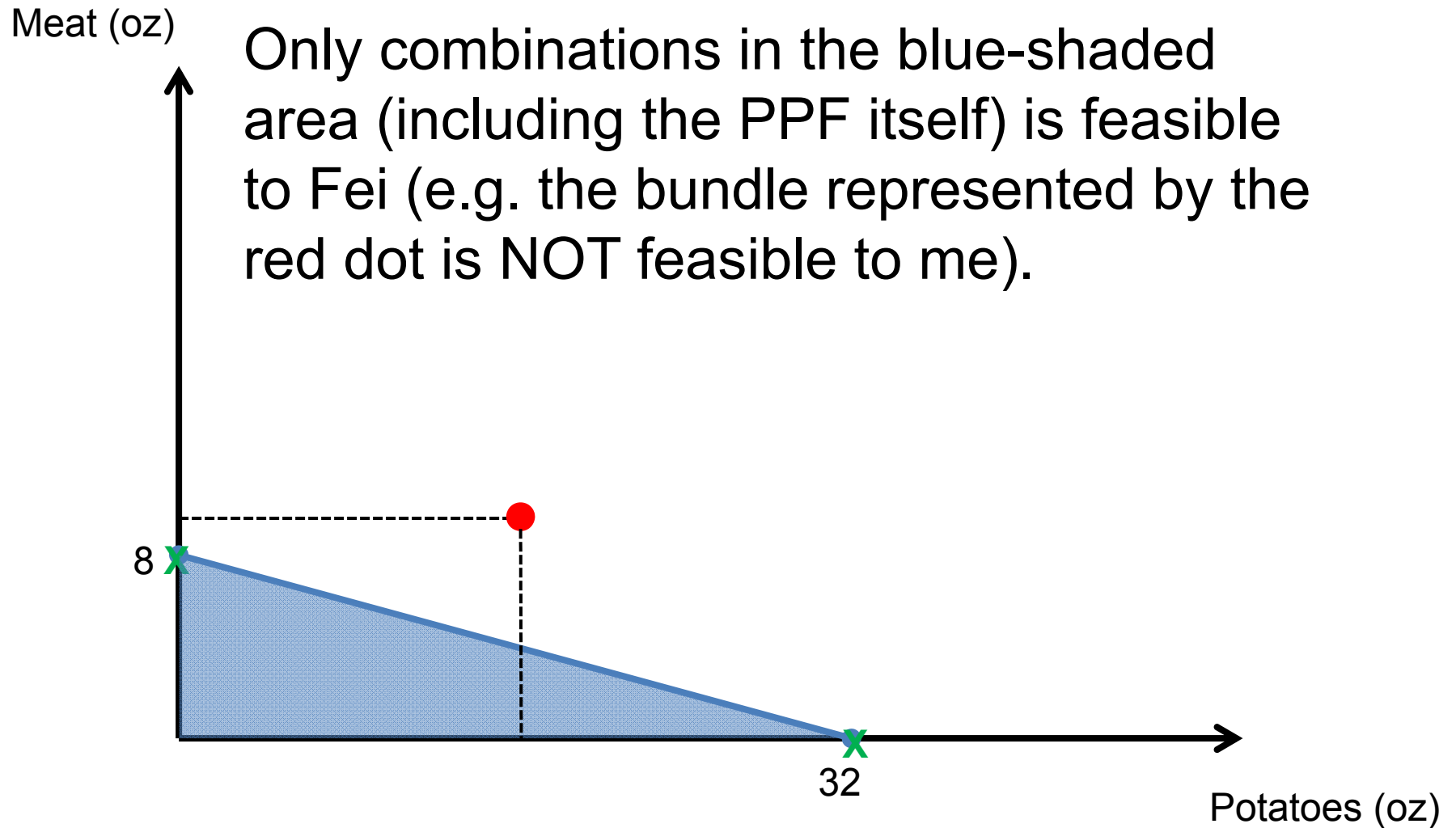
An example of a model:

- 2-goods case can be shown on a diagram, while 5-goods case can only be shown by math. equations.
- 1-goods case is too simple and provides no insight: No trade-off on what to produce and no way to show how specialization benefits.
- Learning: A good model stays as simple as possible, but with enough context/depth to provide explanations we want to obtain.

	Minutes needed		In 8 hours	
	Meat	Potatoes	Meat	Potatoes
Fei	60 min/oz	15 min/oz	8 oz	32oz



# PPF – Fei's

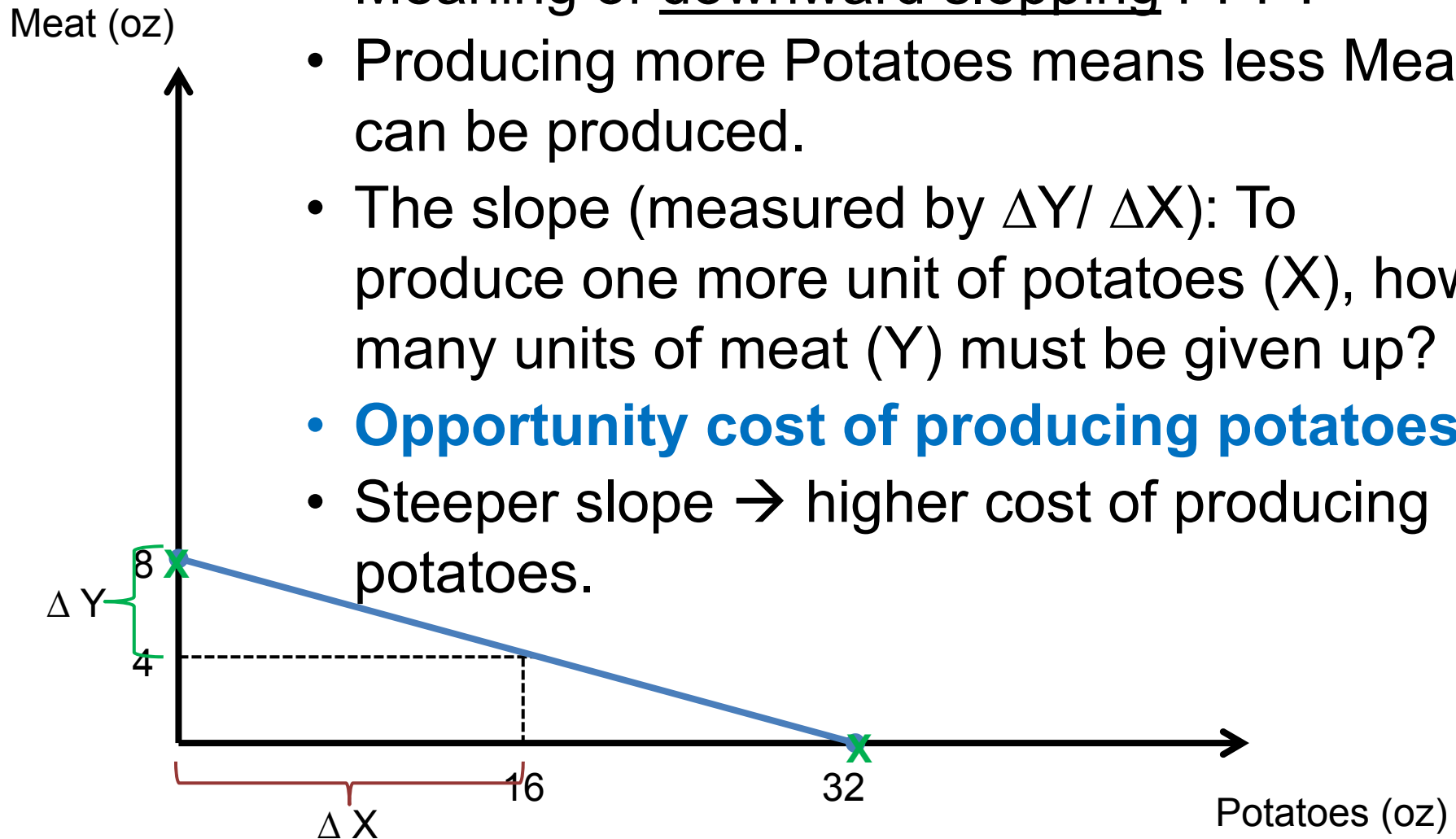


## PPF – Fei's

- Will Fei produce inside the blue-shaded area?
- To **maximize**: Fei should produce **ON** the curve/frontier **ONLY**.
- If inside, Fei is wasting factors of production or “**production inefficiency**” appears.
- Recall: Assumption of rationality means Fei will maximize.

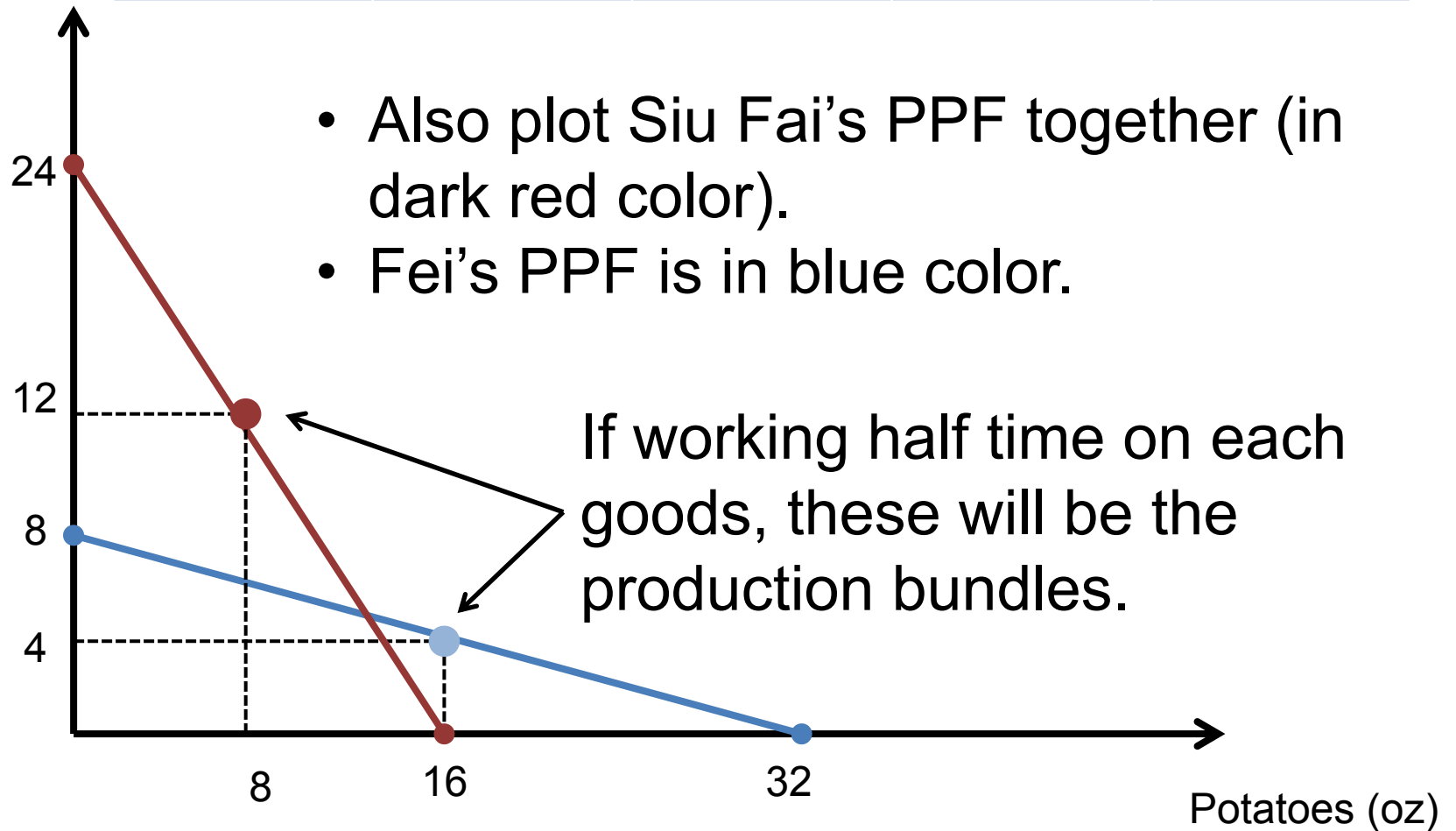
# PPF – Fei's

- Meaning of downward slopping PPF?
- Producing more Potatoes means less Meat can be produced.
- The slope (measured by  $\Delta Y / \Delta X$ ): To produce one more unit of potatoes (X), how many units of meat (Y) must be given up?
- **Opportunity cost of producing potatoes!**
- Steeper slope  $\rightarrow$  higher cost of producing potatoes.



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Meat (oz)



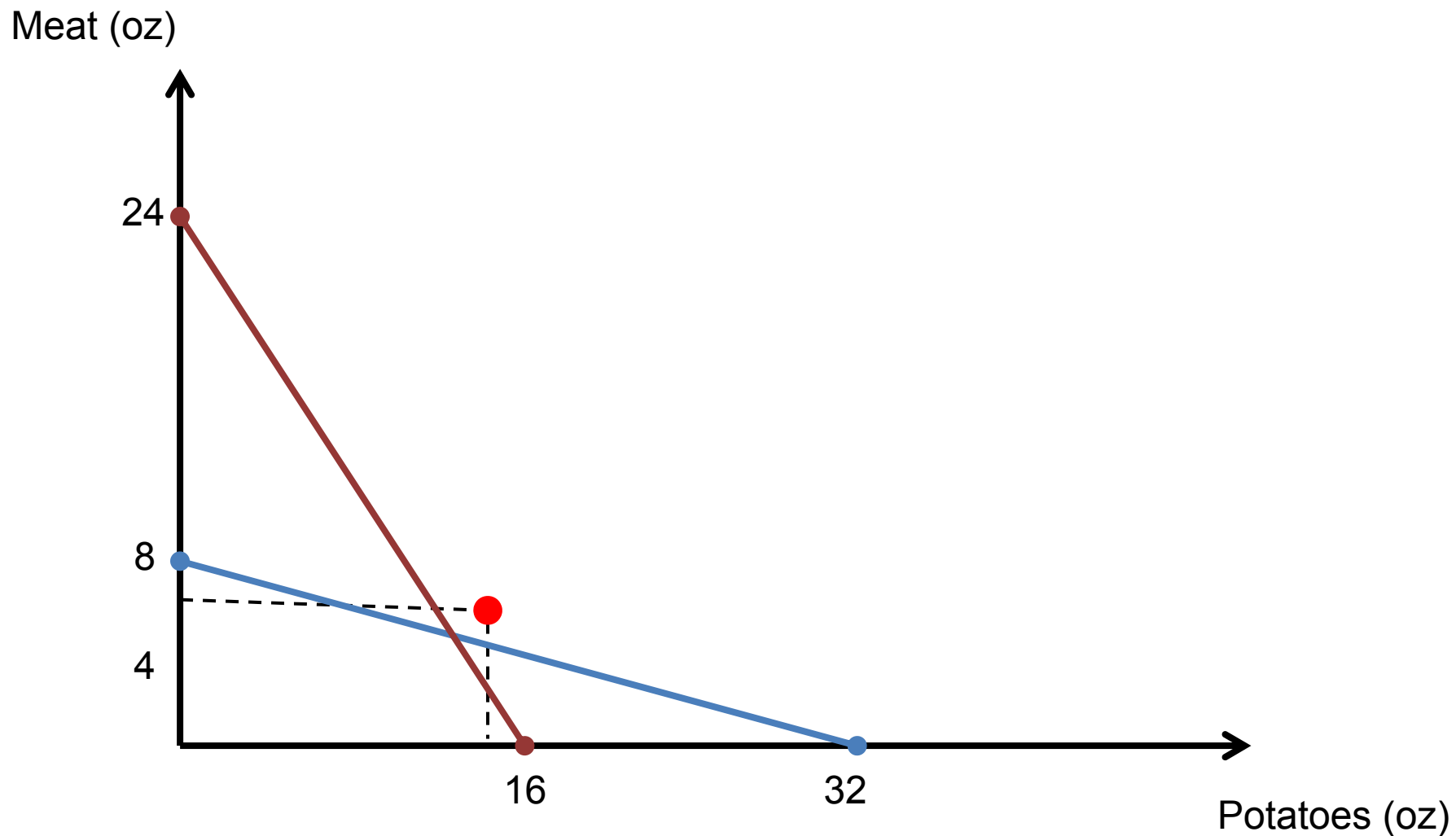


## Question (3)

■ A production bundle of 6 oz meat and 13 oz potatoes can be produced by

- 1) Siu Fai only
- 2) Fei only
- 3) Either Siu Fai or Fei
- 4) Neither Siu Fai nor Fei

# Production Possibilities ?



# Can We do better?

- What we can observe: Siu Fai and Fei have different strengths !!!

	Minutes needed		In 8 hours	
	Meat	Potatoes	Meat	Potatoes
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- Siu Fai is better at producing Meat than Fei, and Fei at producing Potatoes than Siu Fai.
- Any chance for them to “cooperate” and benefit both?
  - For example, each can have 6 meat and 13 potatoes?

# Absolute Advantage

- A person has “**Absolute Advantage**” at a task over another person if the person needs less resources (time and/or other resources) to perform it.
  - Siu Fai has absolute advantage (uses less time than Fei) on Meat.
  - Fei has absolute advantage (uses less time than Siu Fai) on Potatoes.
- Should they SPECIALIZE?
  - Yes, why not! It brings benefit to both of them.

# Absolute vs. Comparative Advantage

- However, should “Absolute” Advantage be the condition to decide whether specialization is beneficial?

## Another Example

- Now, the situation changes into:

	Minutes needed		In 8 hours	
	Meat	Potatoes	Meat	Potatoes
Fei	60 min/oz	15 min/oz	8oz	32oz
Siu Fai	20 min/oz	10 min/oz	24oz	48oz

- Who has absolute advantage in Meat?
- Who has absolute advantage in Potatoes?
- Siu Fai is better in all aspects, any chance for specialization between Siu Fai and Fei?

# Comparative Advantage

- Although Siu Fai has Absolute Advantage over Fei on both Meat and Potatoes,
- Fei still has **Comparative Advantage** on Potatoes over Siu Fai – WHY???
- Comparative Advantage depends on the difference in **opportunity cost!!!**

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# Comparative Advantage

## ■ Opportunity cost of producing Potato (Meat)

- Fei uses 15 min to produce 1 oz. Potato, this 15 min is enough to produce 0.25 oz. Meat → **1 P to 0.25 M (1M to 4P).**
- Siu Fai use 10 min to produce 1 oz. Potato, this 10 min is enough to produce 0.5 oz. Meat → **1 P to 0.5 M (1M to 2P).**

## ■ Opportunity cost of producing Potatoes is represented by the steepness of the slope of one's PPT (with Potatoes on the x-axis).



# Comparative Advantage

- A person has “**Comparative Advantage**” over another person on a task, if the person’s “**Opportunity Cost**” of performing that task is “**lower**” than that of the other person.
- If Fei has CA on potatoes over Siu Fai, it also means that Siu Fai has CA on Meat over Fei.
- **Wisdom: Maybe you are not the best in EVERY aspect, but you can always find a spot for yourself (天生我材必有用)!!!**

## Question (4)

	Minutes needed		In 10 hours	
	Goods A	Goods B	Goods A	Goods B
Teresa	60 min/Unit	30 min/Unit	10 Unit	20 Unit
Astor	20 min/Unit	20 min/Unit	30 Unit	30 Unit

- Which of the following statement is correct?
- 1) Astor has AA in B & better specializes in B
  - 2) Astor has CA in B & better specializes in B
  - 3) Teresa has AA in B & better specialize in B
  - 4) Teresa has CA in B & better specialize in B

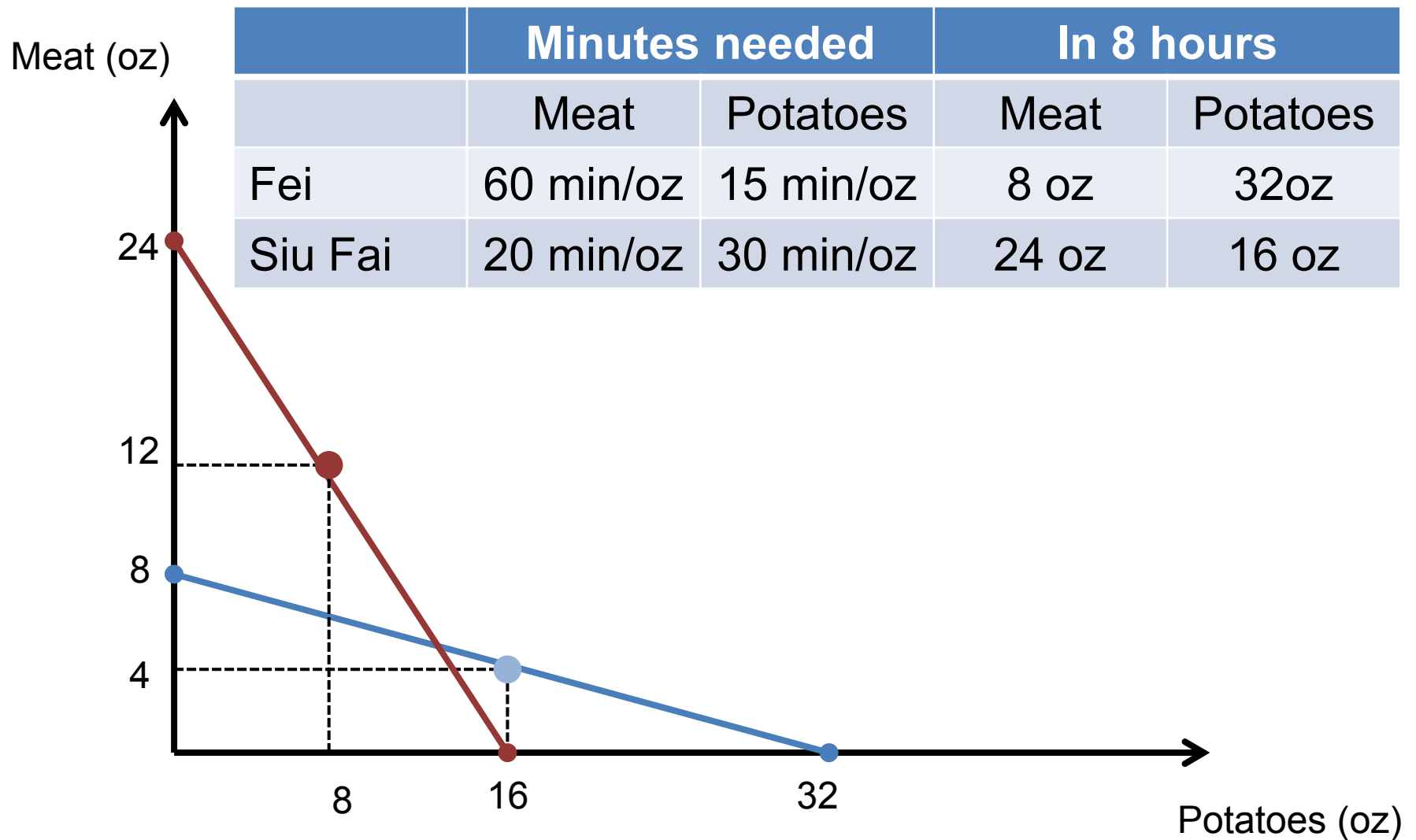
## Question (4)

	Minutes needed		In 10 hours	
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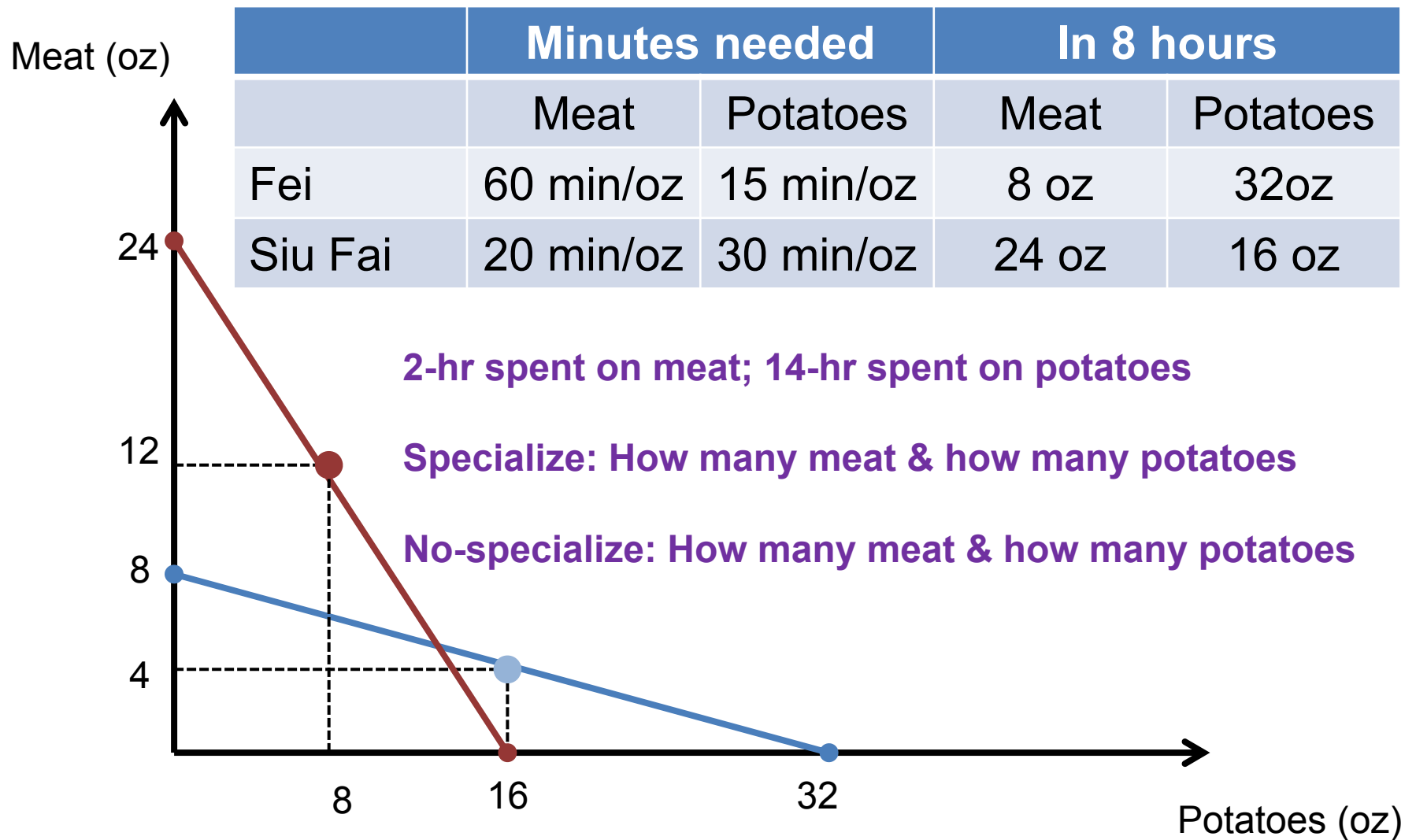
- Which of the following statement is correct?
- 1) Astor has AA in B & better specializes in B
  - 2) Astor has CA in B & better specializes in B
  - 3) Teresa has AA in B & better specialize in B
  - 4) Teresa has CA in B & better specialize in B

# **GAINS FROM SPECIALIZATION**

# Back to the 1<sup>st</sup> Example



# Back to the 1<sup>st</sup> Example



# Gains from specialization

- Non-specialize: doing the same task at the same time together (i.e., both producing meat for 1 hour and potatoes for 7 hours.)
- Specialization (**divide time differently**) increases total output, we can see in the “Joint PPF with Specialization” graphically.
- Siu Fai has CA (lower opportunity cost) in Meat, so he should produce Meat first, not Fei.
- However, if more Meat has to be produced after Siu Fai uses up his time, then it's Fei's turn.

# Joint PPF Worksheet

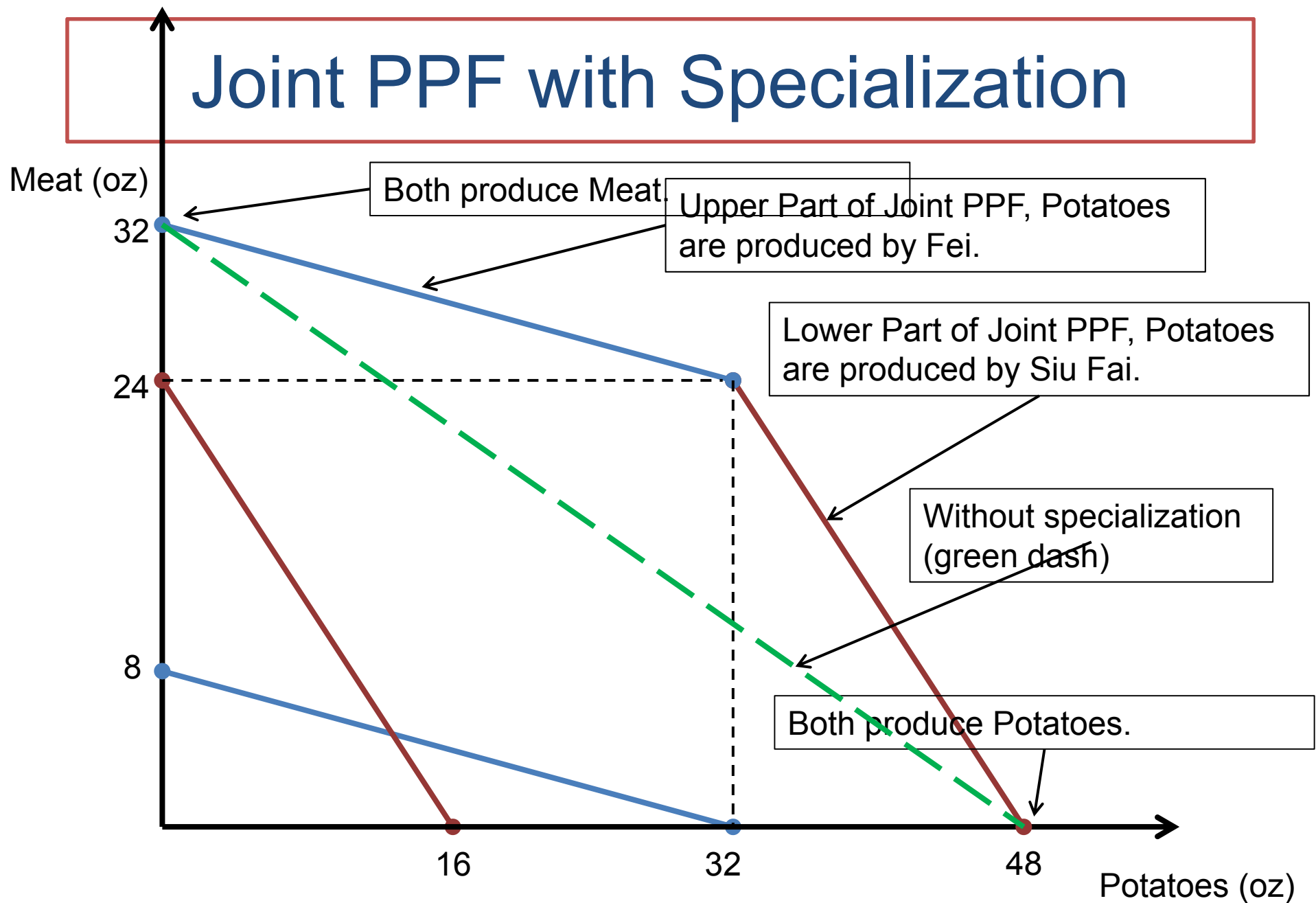
Resource (total 16 hours)		Outcome (meat, potatoes)		
Spent on meat	Spent on potatoes	Specialization	No specialization	
0	16	(? , ?)	(? , ?)	
2	14	(? , ?)	(? , ?)	
4	12	(? , ?)	(? , ?)	
6	10	(? , ?)	(? , ?)	
8	8	(? , ?)	(? , ?)	
10	6	(? , ?)	(? , ?)	
12	4			
14	2			
16	0			
			Minutes needed	
			Meat	Potatoes
		Fei	60 min/oz	15 min/oz
		Siu Fai	20 min/oz	30 min/oz



# Joint PPF Worksheet

Resource (total 16 hours)		Outcome (meat, potatoes)		
Spent on meat	Spent on potatoes	Specialization	No specialization	
0	16			
2	14			
4	12			
6	10			
8	8			
10	6			
12	4			
14	2			
16	0			
			Minutes needed	
			Meat	Potatoes
		Fei	60 min/oz	15 min/oz
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# Joint PPF with Specialization



## Additional Note

- Some classmates expressed their interests in calculating the slope of the Joint PPF without specialization (i.e., the green-dashed line).
- It is not the vertical sum of the two individual PPFs (vertical sum does not get you the 48 oz. Potatoes 😊).
- Hint: Instead, think if Siu Fai and Fei both spend an hour on producing potatoes vs. they both spend an hour on Meat.
- Try 😊 !

# Joint PPF with Specialization

Meat (oz)

32

24

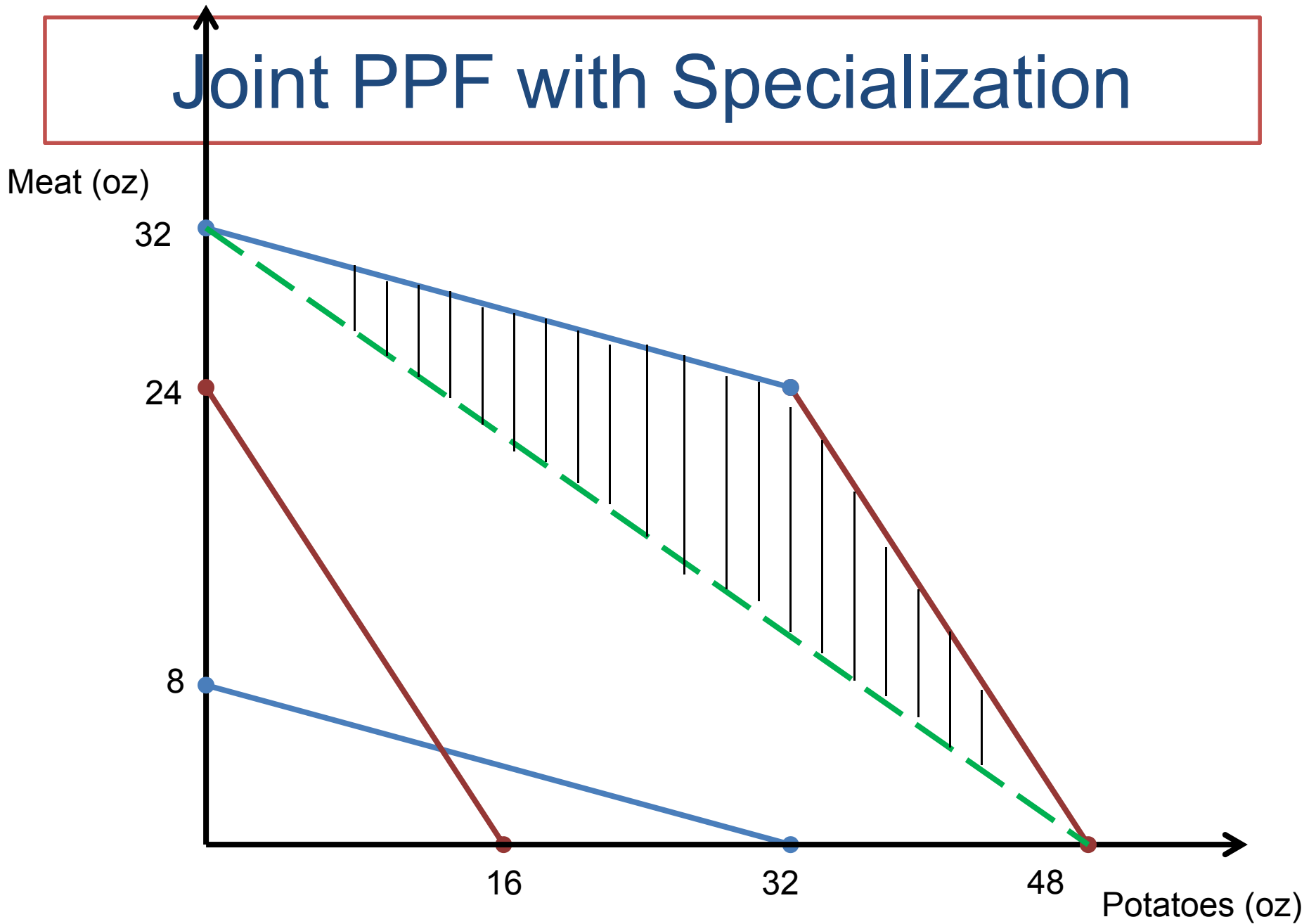
8

16

32

48

Potatoes (oz)



# Sharing gains from specialization

- Specialization (in the right way) provides the **largest** Joint “Production Possibilities Set”.
  - A “larger cake” is available for Siu Fai & Fei together.
  - Gains from specialization: Black-shaded area in the following diagram.
- **However**, how should the cake (additional output/gain from specialization) be divided?
  - It is important because if there is no mutually acceptable way to divide the cake, specialization may not happen!

## Question (1)

- Siu Fai has to give up 1.5 units of meat to produce 1 unit of potato by himself.
- If 1 potato can be exchanged for 1 Meat in the “market”,
  - 1) He refuses exchange and chooses self-sufficiency.
  - 2) He likes exchange and specializes in Meat.
  - 3) He likes exchange and specializes in Potato.
  - 4) None of the above.

## Question (1)

	Minutes needed		In 8 hours	
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- 1) He refuses exchange and chooses self-sufficiency.
- 2) He likes exchange and specializes in Meat.
- 3) He likes exchange and specializes in Potato.
- 4) None of the above.

## Exchange Ratio

- Siu Fai has to give up 1.5 units of meat to produce 1 unit of potato by himself.
- If 1 unit of potato can be exchanged by 1 unit of meat (in the market), will Siu Fai produce potato by himself?
- **No!** “Cheaper” for him to produce meat and use the meat to exchange for potatoes.
- He will be better-off by 0.5 unit of meat under this exchange ratio (1 Meat for 1 Potato).



## Exchange Ratio

- Fei has to give up 4 units of Potatoes to produce 1 unit of Meat by herself.
- If 1 unit of Potato can be exchanged by 1 unit of Meat, will Fei still produce meat by herself?
- **No!** “Cheaper” for Fei to produce Potato and use Potatoes to exchange for Meat.
- She will be better-off by 3 units of Potatoes under this exchange ratio (1 Meat for 1 Potato).

# Exchange Ratio

**Therefore, we can see:**

- The exchange ratio: 1 unit Potato for 1 unit Meat, makes both Siu Fai and Fei happy.
- They will specialize and use the goods produced to exchange for the other one that they don't produce.
- Besides 1 unit Potato for 1 unit Meat, any other ratio(s) would make both Siu Fai and Fei happy?

## Exchange Ratio

Siu Fai specializes in Meat (1.5 M to 1 P).

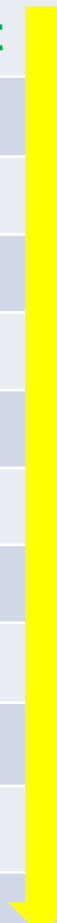
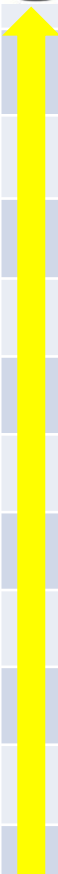
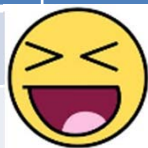
■ If 1 unit potato to 1.1 unit meat,

■ If 1 unit potato to 1.2 unit meat,

■ If 1 unit Potato to 1.5 unit meat,

■ If 1 unit Potato to 1.6 unit meat,

	Siu Fai	Fei
1 unit potato to how many units of meat		
0.1	Yes	What?
0.2	Yes	What?
0.25	Yes	Indifferent
0.4	Yes	Yes
0.6	Yes	Yes
0.8	Yes	Yes
1	Yes	Yes
1.1	Yes	Yes
1.2	Yes	Yes
1.3	Yes	Yes
1.4	Yes	Yes
1.5	Indifferent	Yes
1.6	What?	Yes
1.7	What?	Yes
...	What?	Yes



# Exchange Ratio

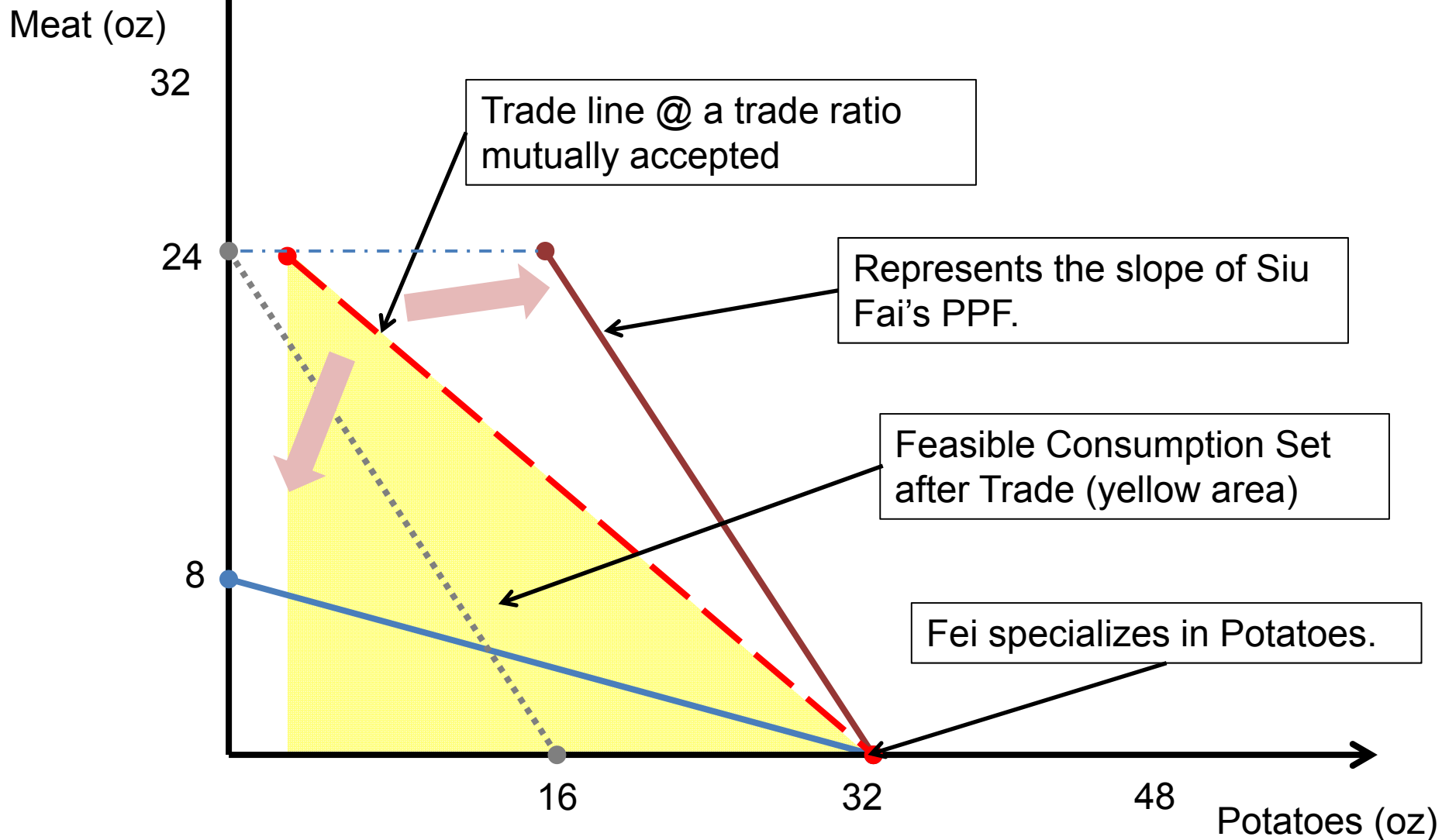
- To be mutually acceptable/beneficial, the exchange ratio for 1 unit of Potato to how many units of Meat must be

$$1.5 \geq \text{exchange ratio} \geq 0.25$$

➤ The “gap” between Siu Fai and Fei’s costs!

- Then, you may ask: Which exchange ratio will actually be used by Siu Fai and Fei?

# PPF after Trade/Exchange



# Summary

- Specialization increases total output.
  - We want varieties in consumption, but specialization leads to having one goods ONLY.
- Mutually acceptable exchange ratios must exist.
  - Mutually beneficial trade can happen.
- Specialization and trade together improve the welfare of Siu Fai and Fei.
  - Can you see from the diagram the consumption bundle beyond blue line is achievable by Fei?

# What does a trade war look like?



**Donald J. Trump** ✓

@realDonaldTrump

Follow



When a country (USA) is losing many billions of dollars on trade with virtually every country it does business with, trade wars are good, and easy to win. Example, when we are down \$100 billion with a certain country and they get cute, don't trade anymore-we win big. It's easy!

2:50 AM - 2 Mar 2018

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# **MORE NOTES ON PPF**

## Question (2)

Assume for the United States that the opportunity cost of each airplane is 100 cars. Which of these pairs of points could be on the United States' PPF?

- 1) (200 airplanes, 10000 cars) and (150 airplanes, 20000 cars)
- 2) (300 airplanes, 15000 cars) and (200 airplanes, 25000 cars)
- 3) (200 airplanes, 5000 cars) and (150 airplanes, 4000 cars)
- 4) (300 airplanes, 25000 cars) and (200 airplanes, 40000 cars)

## Question (2)

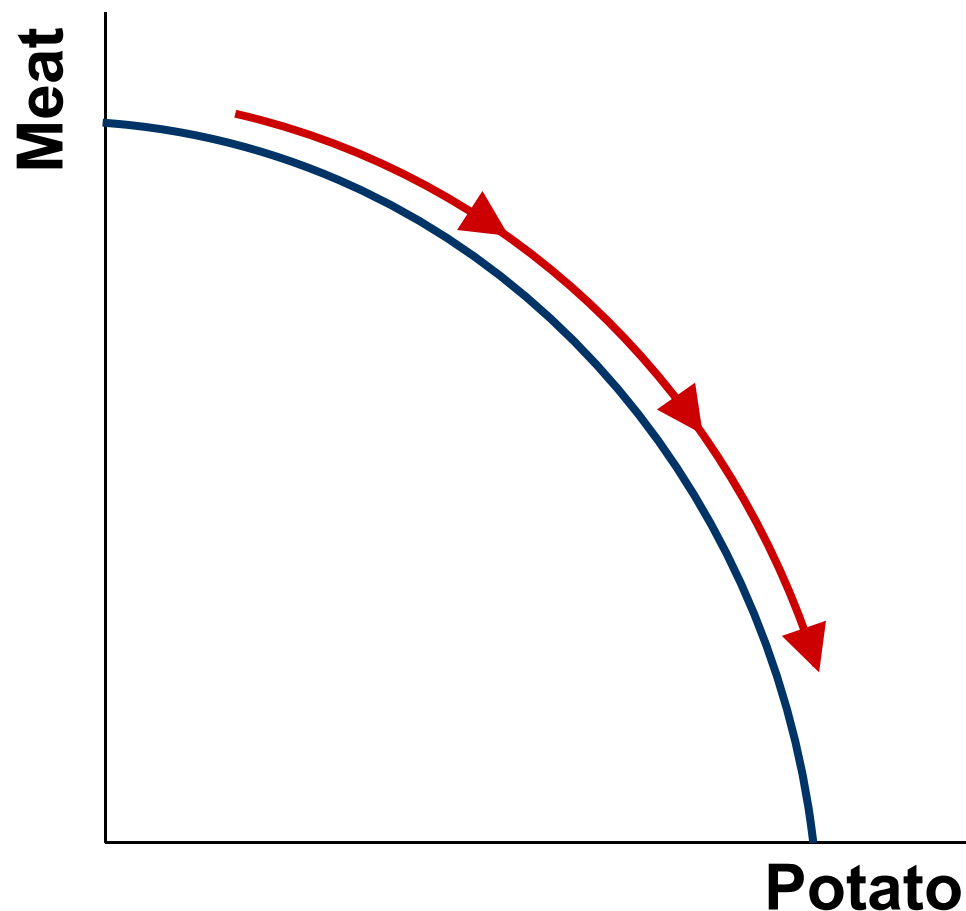
# Shape of PPF – Cost of Production

- Cost of production usually changes when more of a goods is produced.
  - If cost remains constant, PPF is a straight line.
  - In the previous example, cost of Meat is always 4 Potatoes for Fei.
- If cost of a goods rises as the economy produces more of the goods, PPF is bow-shaped. Why?

# Shape of PPF – Cost of Production

As the economy shifts resources from Meat to Potatoes:

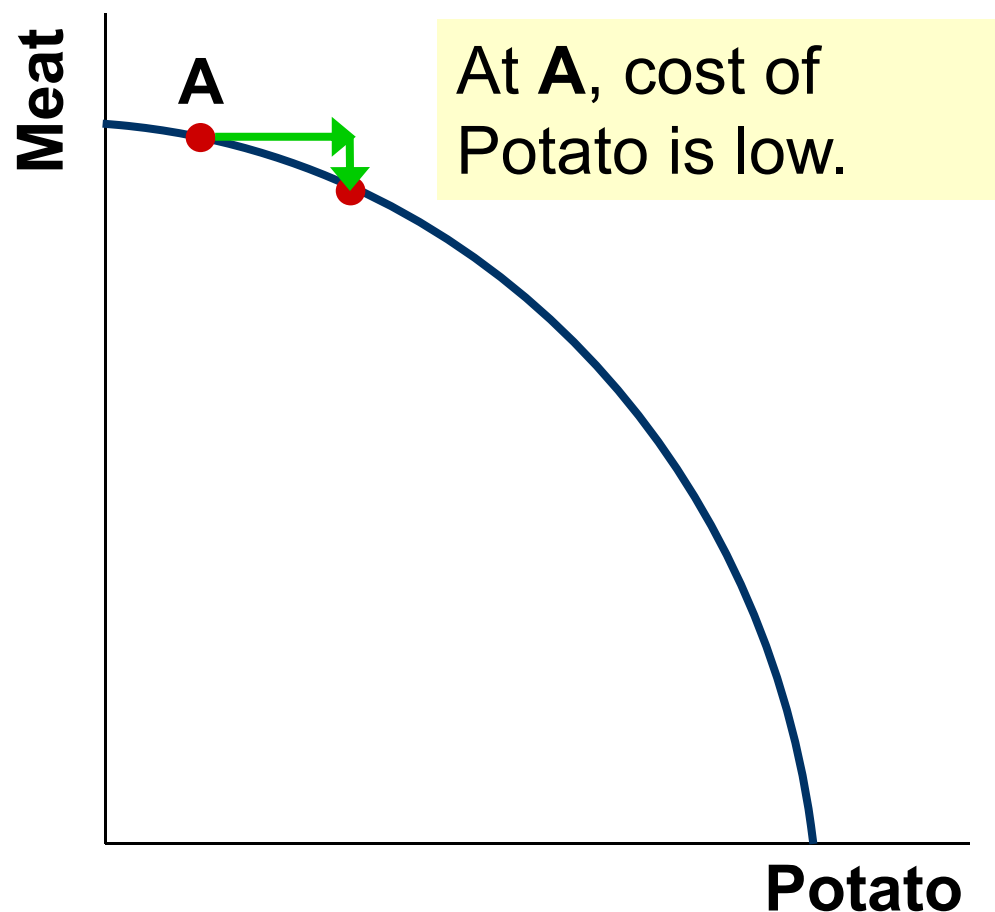
- PPF becomes steeper.
- Cost of Potato increases.



# Shape of PPF – Cost of Production

At point **A**, most resources are producing Meat, even for those who are better suited at producing Potatoes.

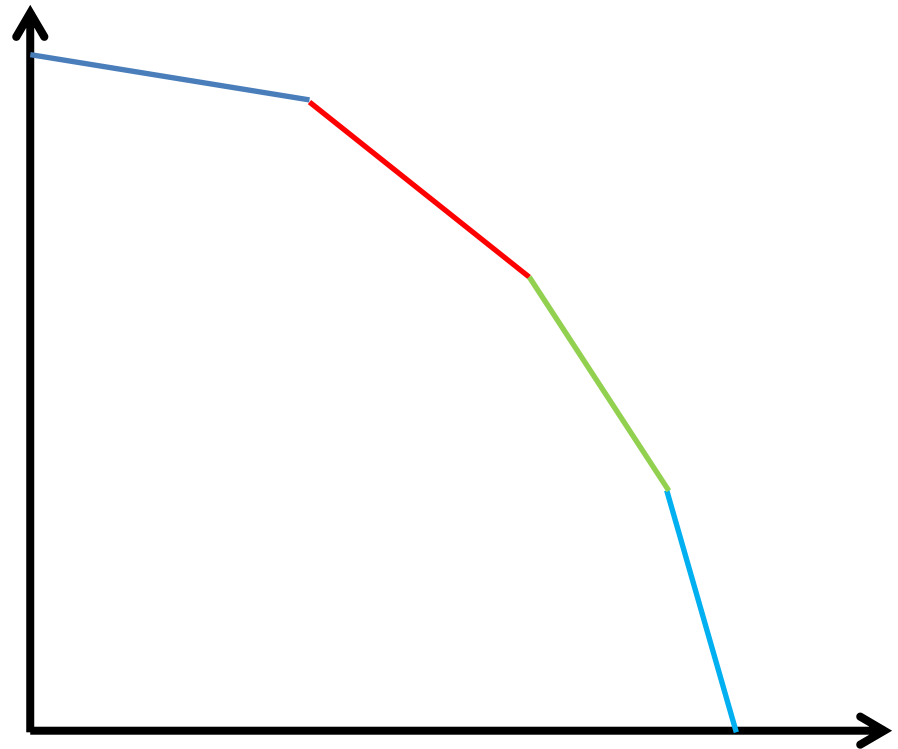
So, we do not have to give up much Meat to get more Potatoes.



# Cost of Production – Society Perspective

## ■ Recall – Joint PPF

- Siu Fai produces Meat first and then Fei.
  - What is the shape?
- ## ■ Imagine if we have many people in the society and each of them has different skills.
- Different opportunity costs of producing one goods
  - Best to 2<sup>nd</sup> best to 3<sup>rd</sup> best ... → Cost increases.



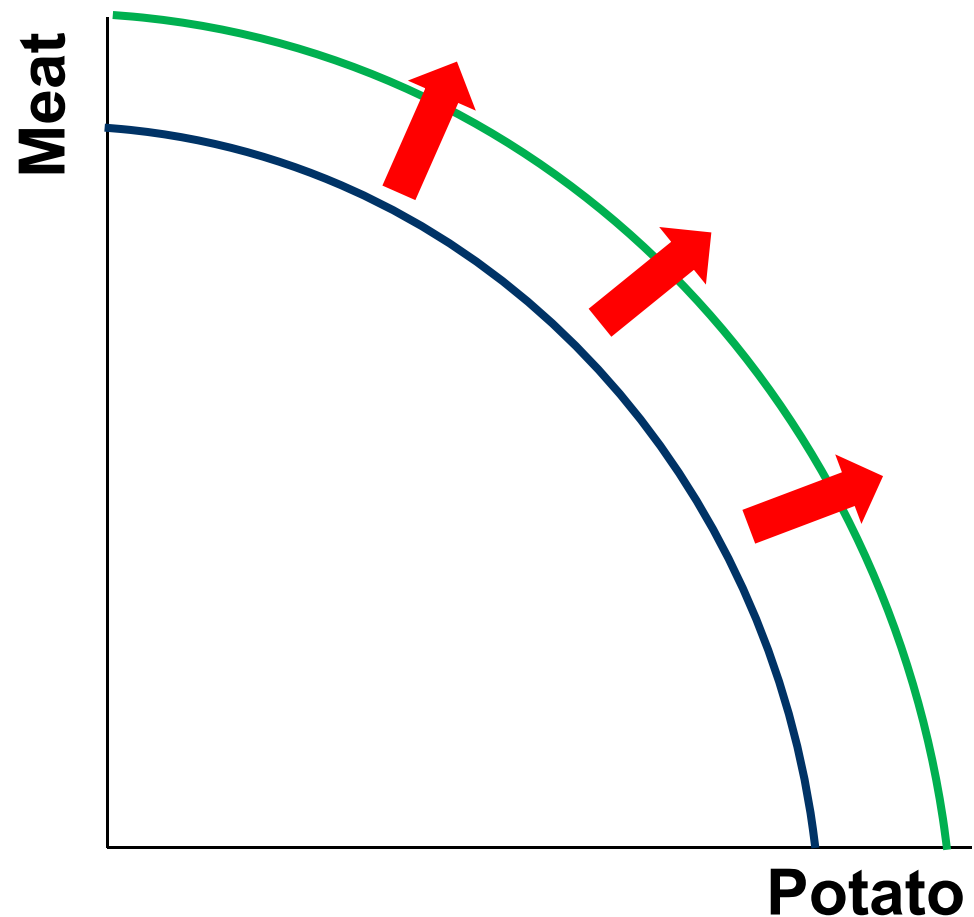
# Allocative Efficiency

- Production efficiency: When we cannot produce more of any one goods without giving up some other goods.
  - Any point on the PPF is production efficient.
- Among production bundles on the PPF, if we produce at the point where we value the most, we have achieved allocation efficiency.
  - Must take into account the value of buyers.
  - Refer to textbook P.74-75 for more details.



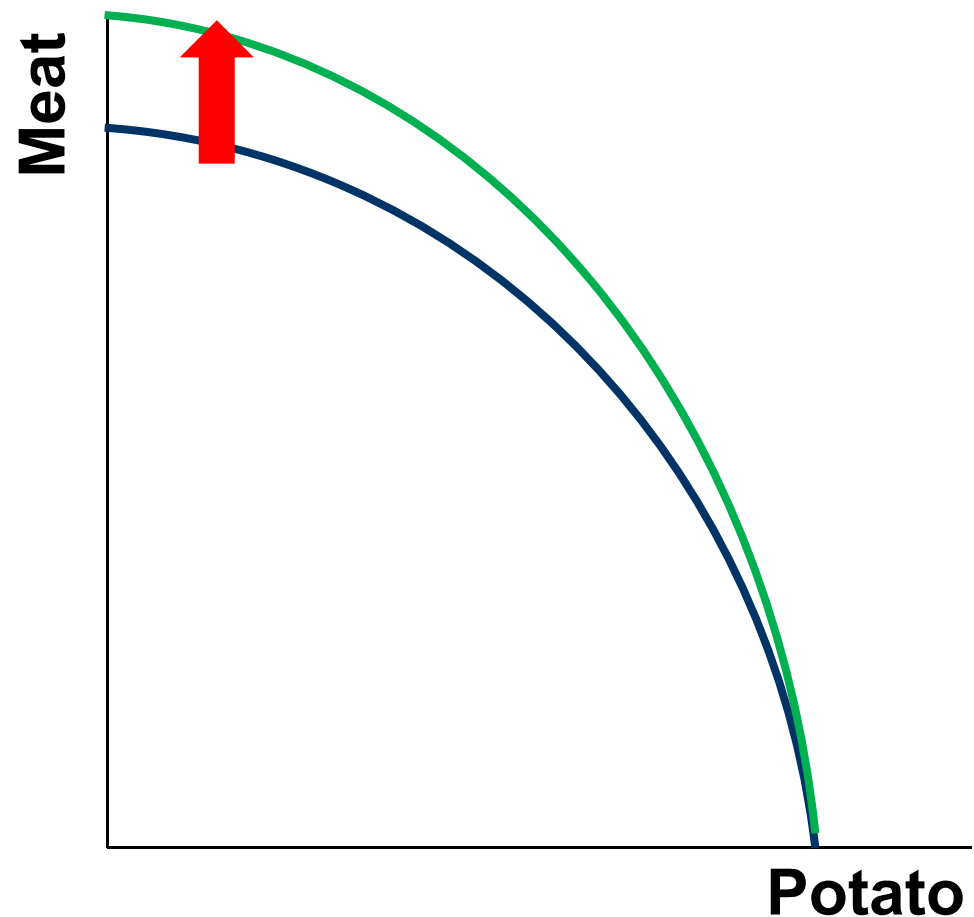
# Growth and PPF

With additional resources or an improvement in technology, the economy can produce more Meat and Potatoes or any combination in between.



# Growth and PPF

- However, technology improvement can be biased.
- In the graph, the technology improvement is biased to the Meat Production.



Thank you very much  
End for today 😊  
See you next time !