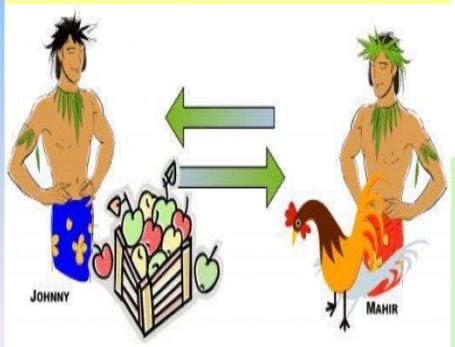
#### CHAPTER-03

Interdependence and the Gains from Trade





# PRINCIPLES OF ECONOMICS

N. Gregory Mankiw

#### **Basic questions answered in this chapter**

- What is the basis for trade?
  - What is absolute advantage?
  - What is comparative advantage?
- What is the pattern of trade?
  - Over which commodity each country will specialise?
  - Which commodity each country will export and import?
- What is the terms of trade?
  - What determines the price at which trade takes place?
- What are the gains from trade?
  - How are gains from trade generated?
  - How large are the gains?
  - How are they divided among the trading nations?

#### Interdependence

Every day you rely on many people from around the world, most of whom you do not know, to provide you with the goods and services you enjoy.



#### Interdependence

One of the Ten Principles of Economics from Chapter 1:

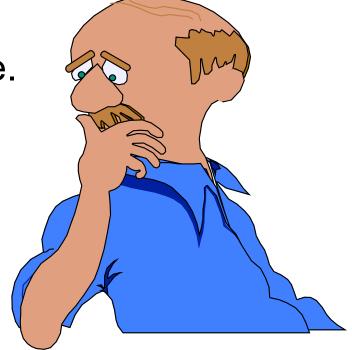
## Trade can make everyone better off.



We will now learn why people – and nations – choose to be interdependent, and how they gain from trade.

#### **Interdependence and the Gains from Trade**

- How do we satisfy our wants and needs in a global economy?
  - We can be economically self-sufficient.
  - We can specialize and trade with others, leading to economic interdependence.
  - Specialisation leads to higher production and because of higher production, trade makes both parties gain.



#### **Interdependence and the Gains from Trade...**

- Individuals and nations rely on specialized production and exchange as a way to address problems caused by <u>scarcity</u>.
- But this gives rise to two questions:
  - Why is interdependence the norm?
  - What determines production and trade?

#### Scarce:

The limited nature of societies resources

#### **Interdependence and the Gains from Trade...**

#### Why is interdependence the norm?

 Interdependence occurs because <u>people</u>, <u>individually and as a whole, are better off</u> when they specialize and trade with others.

#### What determines the <u>basis for trade</u>?

- Basis for trade refers to the forces that give rise to trade between two persons / nations.
- Patterns of production and trade are based basically upon two forces, i.e., absolute advantage and comparative advantage.

- When one nation is more efficient than another in the production of one commodity, i.e., country produces same amount of commodity utilising less inputs or produces more amount of the commodity utilising same inputs, it is said that the country enjoys <u>absolute advantage</u> in the production of that commodity.
- Absolute advantage can be analysed using
  - Input Structure,
  - Output Structure, or
  - Graph through Production Possibilities Frontier (PPF)

#### <u>Absolute Advantage (Input Structure)</u>

A country can produce a good relatively more efficiently than another country, i.e., employ less inputs to produce one unit of output in comparison to other country. (Input

matrix given)

Country	Labour hours (L) required to			
	produce one kg.			
	Soybeans Coffee			
Brazil	20	40		
Peru	50	25		

In our example, **Brazil** has the absolute advantage in the production of soybeans (20L<50L) and Peru has the absolute advantage in the production of coffee (25L<40L).

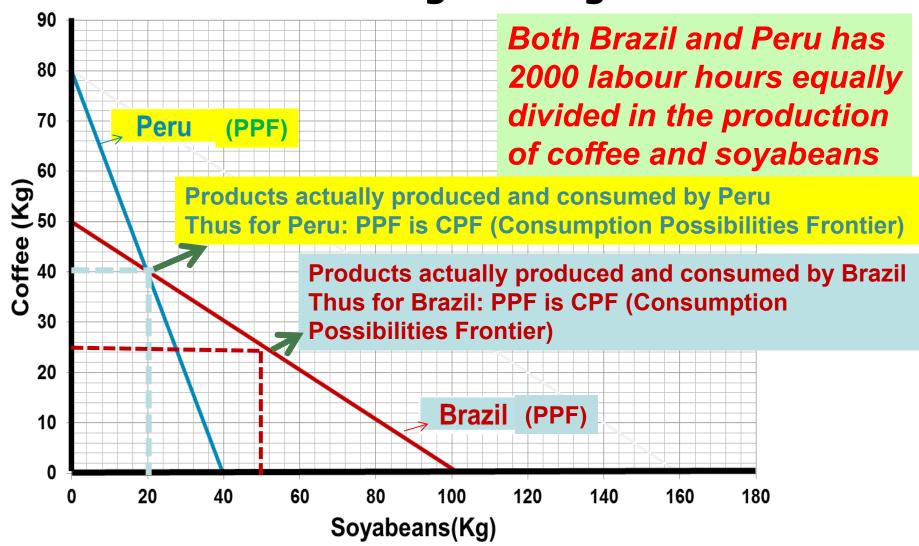
#### <u>Absolute Advantage (Output Structure)</u>

A country can produce a good relatively more efficiently than another country, i.e., produces more output utilising given input in comparison to the other country. (Output matrix given)

Country	Products pusing total	al 2000
	Soybeans (kg)	Coffee (kg)
Brazil	100	50
Peru	40	80

In our example, Brazil has the absolute advantage in the production of soybeans (100S>40S) and Peru has the absolute advantage in the production of coffee (80C>50C).

#### **Absolute Advantage through PPF**



#### **Basis for Trade:- Comparative Advantage**

#### Comparative Advantage (Output Structure)

A country has a comparative advantage in a good if it produces the good at lower opportunity cost per unit than other countries.

Country	Products produced in 2000 labour hour		Opportunity Cost per uni	
	Soybeans	Coffee	Soybeans	Coffee
Brazil	100	50	50/100=0.50C	100/50=2.00S
Peru	20	40	40/20 =2.00C	20/40=0.50\$

Brazil has the comparative advantage in the production of soybeans (0.50C < 2.00C) and Peru has the comparative advantage in the production of coffee (0.50S < 2.00S) on the basis of opportunity cost per unit.

### **Basis for Trade:- Comparative Advantage**Comparative Advantage (Input Structure)

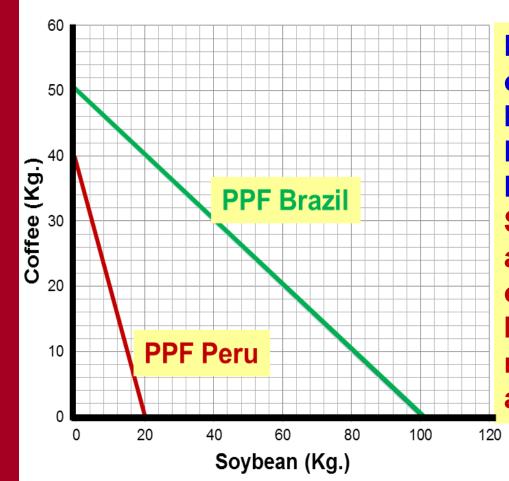
A country has a comparative advantage in a good if it produces the good at lower opportunity cost per unit (computed through input ratio) than other countries.

Count ry	Labour hour required for production of one kg of		Input Ratio	
	Soybeans	Coffee	Soybeans	Coffee
Brazil	20	40	20/40 = 0.50	40/20=2.00
Peru	100	50	100/50 = 2.00	50/100=0.50

Brazil has the comparative advantage in the production of soybeans (0.50 < 2.00) and Peru has the comparative advantage in the production of coffee (0.50 < 2.00) on the basis of lower input ratio (as stated above).

#### **Basis for Trade:- Comparative Advantage**

#### Comparative Advantage through PPF...



Brazil has absolute advantage over Peru in the production of both Soybeans & Coffee as Brazil's PPF is above Peru's PPF.

So Comparative cost advantage (by using opportunity cost per unit) is basis for trade, since trade is not possible on the basis of absolute advantage.

#### **Analysing Trade - Assumptions**

- (1) Only two partners (nations or individuals) and two commodities with one factor input, i.e., Labor.
- (2) Open Economy (Free trade),
- (3) Competitive market
- (4) No transportation costs,
- (5) Barter mode of exchange (exchange of commodities against commodities), and
- (6) No technical change

#### **Our Example:-**

- Two countries: the Brazil and Peru
- Two goods: Soybeans and Coffee
- One factor of production: usually thought of as labour.
- Constant opportunity cost per unit
- Competitive market :
  - All markets clear (that is, supply = demand)
  - Production = Consumption
- Barter mode of exchange (goods are directly exchanged for goods without any medium of exchange)
- Zero transportation cost

Production Possibilities Frontier (PPF)= Consumption Possibilities Frontier (CPF)

#### **Trade on the basis of Absolute Advantage**

Basis of Trade: When one nation is more efficient than another in the production of one commodity, i.e., country produces same amount of commodity utilising less inputs or produces more of the commodity utilising same amount of inputs.

Pattern of Trade: Both nations can gain by each specializing in the production of the commodity of its absolute advantage and exchanging part of its output with the other nation for the commodity of its absolute disadvantage.

Gain from Trade: The resources of both nations are utilized most efficiently and the output of both commodities will rise. The increase in the output of both commodities measures the gains from specialization in production available to be shared between the two nations through trade.

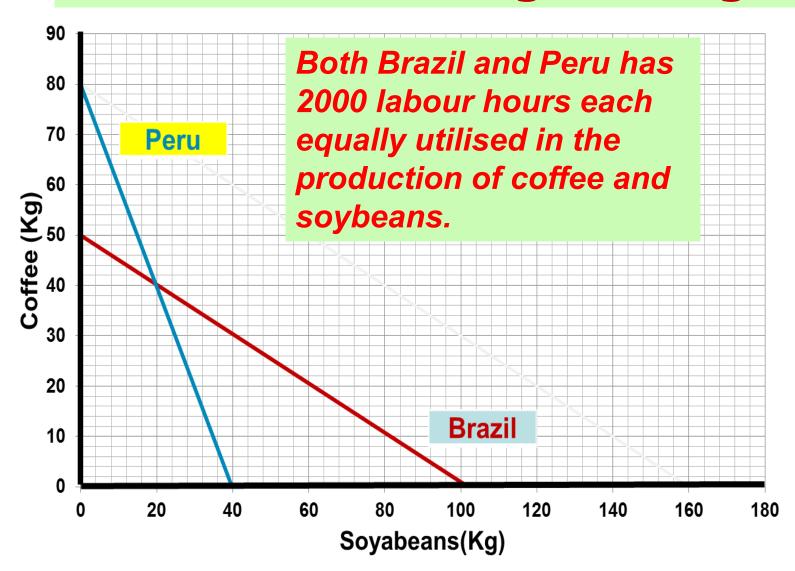
#### **Absolute Advantage: Concept...**

 A country can produce a good relatively more efficiently than another country, i.e., produces more output per unit of input in comparison to the other country. (Output matrix given)

Country	Products products labour h	
	Soybeans (kg)	Coffee (kg)
Brazil	100	50
Peru	40	80

• In our example, Brazil has the absolute advantage in the production of soybeans (100S>40S) and Peru has the absolute advantage in the production of coffee (80C>50C).

#### **Absolute Advantage through PPF**



#### **Absolute Advantage: Trade Pattern...**

Country	Production (kg)  before trade in 1000 labour hour each		Production (kg) after trade in 2000 labour hour (Complete Specialisation)	
	Soybeans	Coffee	Soybeans	Coffee
Brazil	50	25	100	
Peru	20	40		80

Production after trade: Since each country is completely specialising in the production of one commodity only, Brazil will produce 100 kg of Soybeans by utilising total 2000 labour hour and Peru will produce 80 kg of coffee by utilising all available 2000 labour.

Pattern of Trade: Brazil will export Soybeans to Peru and import Coffee from Peru. Alternatively, Peru will export Coffee to Brazil and import Soybeans from Brazil.

#### **Absolute Advantage: Terms of Trade**

- ❖ Logic tells that the seller of the activity will never voluntarily sell for a price below its opportunity cost, as it would lose money. Similarly, the buyer of an activity will never voluntarily pay a price higher than its opportunity cost, as it could just produce the activity itself at lower cost.
- ❖ The exchange price (the price of good X in terms of good Y) must lie somewhere between the opportunity costs (good X in terms of good Y) of the two traders. The exact exchange price will be assumed because it cannot be determined from the information given, i.e., from two opportunity costs.

#### **Absolute Advantage: Terms of Trade...**

Brazil could exchange 50S for 25C domestically (in the sense that both require 1 hour to produce), the Brazil, as a seller (exporter), would gain if it could exchange 50S for more than 25C from Peru.

On the other hand, in Peru 50S = 100C (in the sense that both require 2.5 hours to produce). Anything less than 100C that Peru, as a buyer (importer) must give up to obtain 50S from Brazil represents a gain from trade for Peru.

To summarize, the Brazil gains to the extent that it can exchange 50S for more than 25C from Peru. Peru gains to the extent that it can give up less than 100C for 50S from

Brazil.

Thus, the range for mutually advantageous trade is

25C ≤ 50S ≤ 100C or 0.5C ≤ 1S ≤ 2C

Both countries gain if 1S is exchanged in between 0.5C and 2C.

#### **Absolute Advantage: Terms of Trade...**

Country	Production before trade labour hou	Opportunity Cosper unit		
	Soybeans	Coffee	Soybeans	Coffee
Brazil	50	25	0.5C	2S
Peru	20	40	2C	0.5S

**Domestic Rate of Exchange:** Brazil: 50S = 25C or 1S=0.5C

Peru: 20S = 40C or 1S=2C

International Rate of Exchange: 0.5C ≤ 1S ≤ 2C

Similarly  $0.5S \le 1C \le 2S$ 

Both countries will gain if the <u>price of trade (terms of trade)</u> will vary between two opportunity cost per unit.

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## **Absolute Advantage : Gain from Trade Terms of Trade Given**

Country	Before Trade		After Trade					
		duction & imption (kg)	Production (kg)		Consumpti on (kg)		<b>Gain</b> (kg)	
	Soyb eans	Coffee	Soybe ans	Coff ee	Soyb eans	Coff ee	Soyb eans	Coff ee
Brazil	50	25	100	-	75	25	+25	0
Peru	20	40		80	25	55	+5	+15
World	70	65	100	80	100	80	+30	+15

#### TERMS OF TRADE GIVEN - 1S=1C

International Rate of Exchange should be :0.5C ≤ 1S ≤ 2C

Let the international exchange rate is 1S:1C

Now Brazil will export 25 kg of soybean in exchange of 25 kg of coffee. Peru will get 25 kg of soybean in exchange of 25 kg of coffee.

Gain to World: 100-70 = 30 kg of soybean and 80-65 = 15 kg of coffee.

Gain to Brazil: 75-50=25 kg of soybean and 25-25=0 kg of coffee.

Gain to Peru: 25-20=5 kg of soybean and 55 - 40=15 kg of coffee.

## **Absolute Advantage : Gain from Trade Terms of Trade not given**

Country	Before Trade		After Trade					
Production Consumption					Consumptio n (kg)		Gain (kg)	
	Soybeans	Coffee	Soybea ns	Coff ee	Soybe ans	Coff ee	Soybe ans	Coffe e
Brazil	50	25	100	-	80	25	+30	0
Peru	20	40		80	20	55	0	+15
World	70	65	100	80	100	80	+30	+15

#### TERMS OF TRADE NOT GIVEN -

After trade Brazil and Peru must require 25 kg of coffee and 20 kg of soybeans respectively. (Amount consumed before trade)

Now Brazil will export 20 kg of soybean in exchange of 25 kg of coffee. Peru will get 20kg of soybean in exchange of 25 kg of coffee.

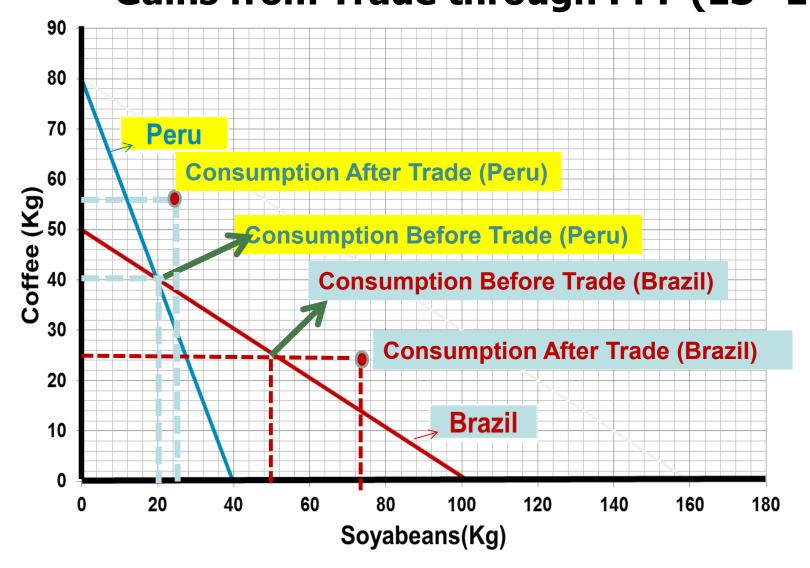
Gain to World: 100-70 = 30 kg of soybean and 80–65 =15 kg of coffee.

Gain to Brazil: 80 -50=30 kg of soybean and 25-25=0 kg of coffee.

Gain to Peru: 20-20=0 kg of soybean and 55 - 40=15 kg of coffee.

The terms of trade for Peru is now 20S = 25C or 1S = 1.25C and the terms of trade for Brazil is now 25C = 20S or 1C = 0.8S

## **Basis for Trade:- Absolute Advantage**Gains from Trade through PPF (1S=1C)



## Trade on the basis of Comparative Advantage

Comparative Advantage: Even if one nation is less efficient than (has an absolute disadvantage with respect to) the other nation in the production of both commodities, there is still a basis, i.e., comparative advantage, for mutually beneficial trade.

Basis and Pattern of Trade: The first nation should specialize in the production of and export the commodity in which its absolute disadvantage is smaller (this is the commodity of its comparative advantage) and import the commodity in which its absolute disadvantage is greater (this is the commodity of its comparative disadvantage).

#### **Basis for Trade: Comparative Advantage**

 A country has a comparative advantage in a good if it produces the good at lower opportunity cost per unit than other countries.

Country	Input Str	ructure	Output Structure		
	Labour hour production o	The state of the s	Products produced in 1500 labour hour each		
	Soybeans	Coffee	Soybeans	Coffee	
Brazil	30	75	50	20	
Peru	100	75	15	20	

Brazil has absolute advantage in the production of both soybean and coffee

#### **Basis for Trade : Comparative Advantage...**

•A country has a comparative advantage in a good if it produces the good at lower opportunity cost per unit than other countries. (Output matrix is given)

Country	Products produced in 1500 labour hour		Opportunit ur	
	Soybeans	Coffee	Soybeans	Coffee
Brazil	50	20	20/50 = 0.40	50/20=2.50
Peru	15	20	20/15 = 1.33	15/20=0.75

Brazil has a comparative advantage in soybean - 0.40 is less than 1.33

Peru has a comparative advantage in coffee – 0.75 is less than 2.50

#### **Basis for Trade: Comparative Advantage...**

- A country has a comparative advantage in a good if it produces the good at lower opportunity cost per unit than other countries. (If output matrix is given)
- Opportunity Cost for Brazil
  - Soyabeans : 50S = 20C => 1S=0.4C
  - Coffee : 20C = 50S => 1C=2.5S
- Opportunity Cost for Peru
  - Soyabeans : 15S = 20C => 1S=1.33C
  - Coffee : 20C = 15S => 1C=0.75S

#### Comparative Advantage: Trade Pattern...

Country	Opportunity Cost per unit	
	Soybeans	Coffee
Brazil	0.40	2.50
Peru	1.33	0.75

Each nation will specialize in the production of the commodity of its comparative advantage and exchanging part of its output with the other nation for the commodity of its comparative disadvantage.

So Brazil will specialise in the production of Soybeans only and Peru will specialise in the production of Coffee only.

### Comparative Advantage: Trade Pattern (Complete Specialisation)

Country	Production trade in labour hou	1500	Production after trade in 3000 labour hour		
	Soybeans	Coffee	Soybeans	Coffee	
Brazil	50	20	100	-	
Peru	15	20		40	

Production after trade: Since each country is specialising in the production of one commodity only, Brazil will produce 100 kg of Soybeans by utilising total 3000 labour hour and Peru will produce 40 kg of coffee by utilising all available 3000 labour.

Pattern of Trade: Brazil will export Soybeans to Peru and import Coffee from Peru. Alternatively, Peru will export Coffee to Brazil and import Soybeans from Brazil.

## Comparative Advantage: Terms of Trade

Country	Products produced in 1500 labour hour		Opportunity Cost per unit		
	Soybeans	Coffee	Soybeans	Coffee	
Brazil	50	20	20/50 = 0.40	50/25=2.50	
Peru	15	20	20/15 = 1.33	15/20=0.75	

**Domestic Rate of Exchange:** Brazil: 50S = 20C or 1S=0.4C

Peru: 15S = 20C or 1S=1.33

International Rate of Exchange: 0.40C ≤ 1S ≤ 1.33C

Similarly  $0.75S \le 1C \le 2.50S$ 

So the exchange rate for Soybean for Brazil will vary between 0.5 and 1.33 coffee for 1 unit of soybean.

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### Comparative Advantage: Gain from Trade (Terms of Trade Given)

Country	Before Trade Production & Consumption		After Trade					
			Production		Consumption		Gain	
	Soyb eans	Coffee	Soyb eans	Coffee	Soyb eans	Coffee	Soyb	Coffee
Brazil	50	20	100	-	80	20	+30	0
Peru	15	20	10,000	40	20	20	+5	0
World	65	40	100	40	100	40	+35	0

International Rate of Exchange should be :0.40C ≤ 1S ≤ 1.33C

Let the international exchange rate is 1S:1C

Now Brazil will export 20 kg of soybean in exchange of 20 kg of coffee.

Peru will get 20 kg of soybean in exchange of 20 kg of coffee.

Gain to World: 100-65 = 35 kg of soybean and 40–40 =0 kg of coffee.

Gain to Brazil: 80-50=30 kg of soybean and 20-20=0 kg of coffee.

Gain to Peru: 20-15=5 kg of soybean and 20-20=0 kg of coffee.

### Comparative Advantage: Gain from Trade (Terms of Trade Not Given)

Country	Before Trade		After Trade					
		ction & mption	Production		Consumption		Gain	
	Soyb eans	Coffee	Soyb eans	Coffee	Soyb eans	Coffee	Soybe ans	Coffee
Brazil	50	20	100	-	85	20	+35	0
Peru	15	20		40	15	20	0	0
World	65	40	100	40	100	40	+35	0

After trade Brazil and Peru must require 20kg of coffee and 15kg of soybeans respectively. (Amount consumed before trade)

So the terms of trade is now 15S = 20C or 1S = 1.33C

Now Brazil will export 15 kg of soybean in exchange of 20 kg of coffee. Peru will get 15 kg of soybean in exchange of 20 kg of coffee.

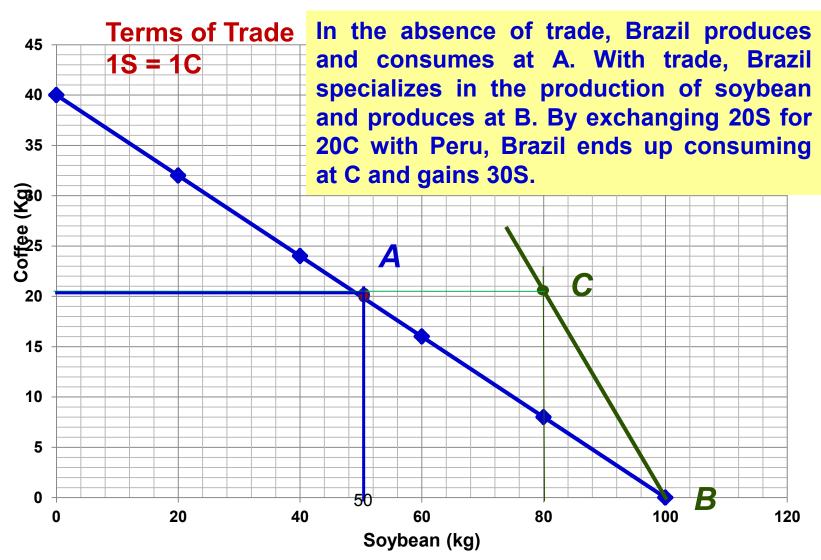
Gain to World: 100-65 = 35 kg of soybean and 40–40 =0 kg of coffee.

Gain to Brazil: 85-50=35 kg of soybean and 20-20=0 kg of coffee.

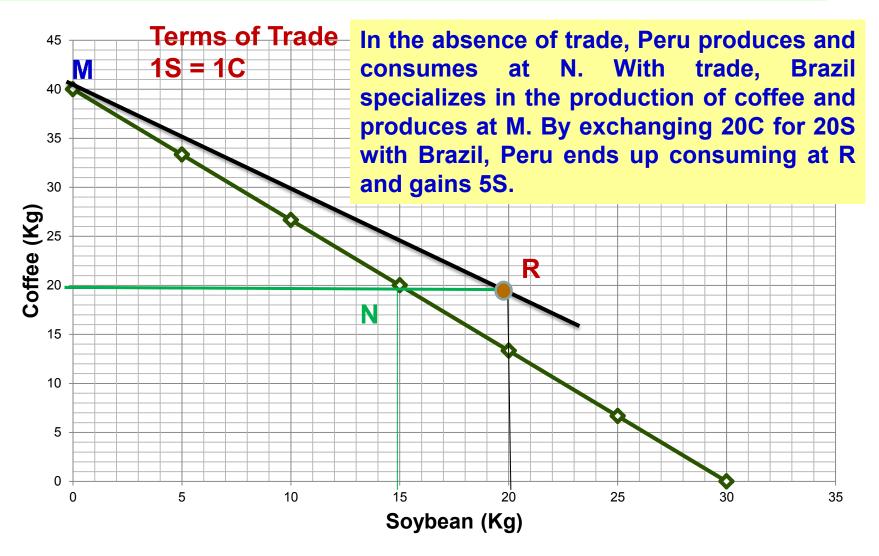
Gain to Peru: 15-15=0 kg of soybean and 20-20=0 kg of coffee.

Since Peru is not gaining in this terms of trade with complete specialisation, Peru will not go for trade. To Gain from trade each country will go for partial specialisation or terms of trade will base on 0.40C < 1S < 1.33C.

## **Comparative Advantage: Gains from Trade (Brazil)**



# **Comparative Advantage: Gains from Trade (Peru)**



# Comparative Advantage: No Complete Specialisation (Partial Specialisation)

Country	Input N	/latrix	Output Matrix		
	Labour hour production		Products produced in 100 labour hour each		
	Laptop	Mobile	Laptop	Mobile	
China	20	5	5	20	
USA	25	10	4	10	

CHINA has absolute advantage in the production of both laptop and mobile

### **Basis for Trade: Comparative Advantage**

•A country has a comparative advantage in a good if it produces the good at lower opportunity cost per unit than other countries. (Output matrix is given)

Country	Products p		Opportunity Cost per unit		
Laptop Mobile		Laptop	Mobile		
China	5	20	20/5 = 4.00	5/20=0.25	
USA	4	10	10/4 = 2.50	4/10=0.40	

USA has a comparative advantage in Laptop - 2.50 is less than 4.00

China has a comparative advantage in Mobile – 0.25 is less than 0.40

## **Basis for Trade: Comparative Advantage**

•A country has a comparative advantage in a good if it produces the good at lower input (price) ratio than other countries. (input matrix is given)

Country	Labour hour production(o		Price Ratio		
	Laptop	Mobile	Laptop	Mobile	
China	20	5	20/5 = 4.00	5/20=0.25	
USA	25	10	25/10 = 2.5	10/25=0.40	

USA has a comparative advantage in Laptop - 2.50 is less than 4.00

China has a comparative advantage in Mobile – 0.25 is less than 0.40

### Comparative Advantage: Trade Pattern

Country	Opportunity Cost per unit				
	Laptop Mobile				
China	4.00	0.25			
USA	2.5	0.40			

So, one can advocate, basing on complete specialistion that USA will specialise in the production of Laptop, (produce Laptop only and no Mobile) and China will completely specialise in the production of Mobile, (produce Mobile only and no Laptop).

But this makes trade unprofitable because total production of Laptop will be less, if USA completely specialise in the production of Laptop.

# Comparative Advantage: Trade Pattern...

Country	Production be in 100 labour		Production after trade in 200 labour hour		
	Laptop	Mobile	Laptop	Mobile	
China	5	20		40	
USA	4	10	8		
World	9	30	8	40	

If both USA and China produce only Laptop and Mobile respectively, then with 200 labour hours USA will produce 8 laptops which is less than 9 laptops produced by both countries before trade.

So each country will not completely specialise in one commodity only (not produce one commodity only).

# Comparative Advantage: Trade Pattern...

Each country will benefit if production is based on partial specialisation, i.e., devote more of resource in the production of that commodity over which it has comparative advantage (less opportunity cost per unit) and less resource over which it has comparative disadvantage (higher opportunity cost per unit).

#### **Assume**

China will devote 70% of labour hour (140) for production of Mobile and rest 30% (60) for production of Laptop.

Let USA devote 75% of labour hour (150) for production of Laptop and rest 25% (50) for production of Mobile.

### Comparative Advantage: Trade Pattern...

Country	Production before trade in 100 labour hour each		Labour ho	ours used	Production after trade in 200 labour hour	
	Laptop	Mobile	Laptop Mobile		Laptop	Mobile
China	5	20	30% = 60	70%=140	60/20=3	140/5=28
USA	4	10	75%=150	25%=50	150/25= 6	50/10=5
World	9	30			9	33

**Production after trade**: USA will produce 6 laptops by utilising 75% of 200 available labour, i.e. 150 hr and 5 mobile with the rest 50 hr.

Similarly, China will produce 28 mobiles with 70% of available (200) labour hours, i.e., 140 hr and 5 laptop utilising rest 30% of labour, i.e., 60 hours.

Pattern of Trade: USA will export Laptop to China and import Mobile from China. Alternatively, China will export Mobile to USA and import Laptops from USA.

### Comparative Advantage: Trade Pattern...

Country	Products p in 100 labo		Opportunity Cost per unit		
	Laptop	Mobile	Laptop	Mobile	
China	5	20	20/5 = 4.00	5/20=0.25	
USA	4	10	10/4 = 2.50	4/10=0.40	

International Rate of Exchange: 0.25L ≤ 1M ≤ 0.40L

Similarly  $2.50M \le 1L \le 4.00M$ 

So the exchange rate for Laptop will vary between 2.5 and 4.0 Mobile for 1 unit of Laptop.

So the exchange rate for Mobile will vary between 0.25 and 0.40 Laptop for 1 unit of Mobile.

### **Comparative Advantage: Gain from Trade**

	Before Trade		After Trade						
Country	Production & Consumption		Production		Consumption		Gain		
γ	Laptop	Mobile	Laptop	Mobile	Laptop	Mobile	Laptop	Mobile	
China	5	20	3	28	3+2=5	28-6=22	0	+2	
USA	4	10	6	5	6-2=4	5+6=11	0	+1	
World	9	30	9	33	9	33	0	+3	

International Rate of Exchange should be :2.50M ≤ 1L ≤ 4.00M

Let the international exchange rate is 1L:3M

Now USA will export 2 Laptop in exchange of 6 Mobile.

China will get 2 Laptops in exchange of 6 Mobile.

Gain to World: 33-30 = 3 Mobiles and 9-9 = 0 Laptop.

Gain to USA: 11 - 10 = 1 Mobile and 4-4=0 Laptop.

Gain to China: 22-20=2 Mobile and 5-5=0 Laptop.

# ACTIVE LEARNING Absolute & comparative advantage

USA and UK each have 10,000 hours of labor per month, and the following technologies:

#### <u>USA</u>

- producing one kg coffee requires 4 hours
- producing one kg of wheat requires 2 hours

#### <u>UK</u>

- producing one kg coffee requires 5 hour
- producing one kg wheat requires 1 hours

Which country has an absolute advantage in the production of coffee? Which country has a comparative advantage in the production of wine? Which country will produce which product if there is a trade? What is the gain from trade to each trading country and to the World, if World comprises two countries?<sub>46</sub>

### ACTIVE LEARNING Answers

Brazil has an absolute advantage in coffee:

 Producing a pound of coffee requires only one labor-hour in Brazil, but two in Argentina.

Argentina has a comparative advantage in wine:

- Argentina's opp. cost of wine is two pounds of coffee, because the four labor-hours required to produce a bottle of wine could instead produce two pounds of coffee.
- Brazil's opp. cost of wine is five pounds of coffee.

#### CHAPTER SUMMARY.....

- Interdependence and trade allow everyone to enjoy a greater quantity and variety of goods & services.
- Absolute advantage means being able to produce a good with fewer inputs.
- Comparative advantage means being able to produce a good at a lower opportunity cost per unit.
- When people or countries specialize in the goods, complete or partial, in which they have a comparative advantage or absolute advantage, the economic "pie" grows and trade can make everyone better off.