

**Think about the example of apples and computers again. Now we assume that for North, the numbers of workers, the productivity per worker in apples and computers are 200 workers, 180 apples per worker, and 18 computers per worker, respectively. For South, the three numbers are 600 workers, 120 apples per worker, and 2 computers per worker. For the preferences, we also assume that each worker spend half the budget on both goods. (Also: prices of apples and computers are 1 and p)**

**(a) For these two goods, who has the absolute advantages, and who has the comparative advantages? What do you think about which country should produce what and why?**

For both apples and computers, the North has the absolute advantage.

For apples, the South has the comparative advantage; while for computers, the North has the comparative advantage.

The North should produce the computer since she is much more productive in producing it; the South should produce the apple since she is relatively more productive in producing it.

**(b) Analyze the case of Autarky for these two countries. Please list the wages, prices, consumption bundles, the percentages of labor working in each sector, and the total productions of both goods for each country in one table.**

Autarky		
	North	South
Wage	180	120
Price	10	60
Consumption of apples per worker	90	60
Consumption of computers per worker	9	1
% of labor producing apples	50%	50%
% of labor producing computers	50%	50%
Total production of apples	18,000	36,000
Total production of computers	1,800	6,00

**(c) Now if we allow them to trade, please analyze the case of Free Trade for these two countries. Same as part (b), please list a table showing all information.**

**Discuss the changes in welfare for both North and South workers.**

Free Trade		
	North	South
Wage	360	120
Price	20	
Consumption of apples per worker	180	60
Consumption of computers per worker	9	3
% of labor producing apples	0	100%
% of labor producing computers	100%	0
Total production of apples	0	72,000
Total production of computers	3,600	0

As for the welfare, we find that both North and South workers are better off. (For each North worker, she can consume 90 more apples after trade; for each South worker, she can consume 2 more computers after trade.)

**(d) Now instead of Free Trade, we allow them to do Free Migration, please analyze the case of Free Trade for these two countries. Same as part (b), please list a table showing all information. Discuss the changes in welfare for both North and South workers.**

In the case of Free Migration, all workers in the South will migrate to the North cause the wage in the North is higher than that in the South under Autarky ( $180 > 120$ ). Therefore in the Free Migration case, there will be only one country – the North – since all workers will live in the North. That will bring us to the case of the North under Autarky. The table shows the results.

Free Migration		
	North	South
Wage	180	180
Price	10	
Consumption of apples per worker	90	90
Consumption of computers per worker	9	9
% of labor producing apples	50%	
% of labor producing computers	50%	
Total production of apples	72,000	
Total production of computers	7,200	

For the North workers, their welfare is unchanged; for the South workers, they are better off since now they can consume more of both goods.

- (e) Assume that South catches up and her productivity goes up to 12 computers per worker, predict what will happen to these two countries and why? What lesson does this case tell you?**

If the South catches up and her productivity goes up to 12 computers per worker, both countries have no comparative advantages in this situation. Under Autarky, the prices of computers in both countries are both 10. Then there will be no trade since there is no incentive for the traders to trade (notice that there is no incentive because there is potential gain from trade for these traders). You will find that after this change, the North workers will be worse off because they will get less wage ( $180 < 360$ ) and consume less ( $90 \text{ apples} < 180 \text{ apples}$ ) comparing to the case of Free Trade.

The lesson we learn from this question is: when the South catches up in her weak sector that leaves no comparative advantage to the North, then on the one hand there will be no trade, on the other hand the North will be worse off while the South will be better off.

Autarky after the change		
	North	South
Wage	180	120
Price	10	10
Consumption of apples per worker	90	60
Consumption of computers per worker	9	6
% of labor producing apples	50%	50%
% of labor producing computers	50%	50%
Total production of apples	18,000	36,000
Total production of computers	1,800	36,00

- (f) Let's assume that originally these two countries are in the regime of Free Trade. Now suppose North people can charge an "entrance fee" to immigrants. Notice that this fee is charged on the South workers after the production but before the consumption decision (we might call this Ex Ante fee). Now consider moving from Free Trade to Free Migration. Find entrance fee (a certain amount of apples paid each period, after production occurs but before the consumption decision) that the North can charge so that workers in both the North and South**

**are made better off.**

Let's assume that the fee per South worker is E. Then for the South worker, each worker has 180-E after this fee while each North worker has  $180+(600E/200) = 180+3E$ .

For the consumptions of apples:

$$\text{North workers: } 1 * C_N^A = 0.5 * (180+3E) \rightarrow C_N^A = 90+1.5E \quad (1)$$

$$\text{South workers: } 1 * C_S^A = 0.5 * (180-E) \rightarrow C_S^A = 90-0.5E \quad (2)$$

For the consumption of computers:

$$\text{North workers: } 10 * C_N^C = 0.5 * (180+3E) \rightarrow C_N^C = 9+0.15E \quad (3)$$

$$\text{South workers: } 10 * C_S^C = 0.5 * (180-E) \rightarrow C_S^C = 9-0.05E \quad (4)$$

In order to stay in the regime of Free Migration (with fee), both workers should consume at least the same or more amounts of both goods than in the Free Trade regime. Therefore the four conditions above should satisfy:

$$C_N^A = 90+1.5E \geq 180 \rightarrow E \geq 60 \quad (1)$$

$$C_S^A = 90-0.5E \geq 60 \rightarrow E \leq 60 \quad (2)$$

$$C_N^C = 9+0.15E \geq 9 \rightarrow E \geq 0 \quad (3)$$

$$C_S^C = 9-0.05E \geq 3 \rightarrow E \leq 120 \quad (4)$$

The only number of E satisfying conditions (1) to (4) is  $E = 60$ . So the fee is 60 apples per South worker.

We can plug  $E = 60$  back to the consumption bundles of both workers and complete the table below. We find that both North and South workers are better off since they can now consume more than in the Free Trade case.

Free Migration with fee		
	North	South
Wage	180+3E	180-E
Price	10	
Consumption of apples per worker	180	60
Consumption of computers per worker	18	6
% of labor producing apples	50%	
% of labor producing computers	50%	
Total production of apples	72,000	
Total production of computers	7,200	

**(g) Now if the fee is charged on the South workers after the consumption decision (we might call this Ex Post fee, namely after South workers spend their wages on both goods, the North government asks them to give a fraction of their apples and computers to the North workers), find the fee under this kind of settings. Comparing with part (f), what are the changes in welfare of North and South workers?**

If the North people charge an Ex Post fee, then before the South people pay the fee, they work and get the wage of 180 apples and split this budget into half and half to buy both goods. This is the Free Migration (without fee) case and each South worker buy 90 apples and 9 computers. Now the North people charge the fee and ask the South people to pay a fraction of what they bought to the North people. In order to stay in the regime, each South person should at least consume 60 apples and 3 computers (this is the bundle in Free Trade case). That means they can at most pay 30 apples and 6 computers as the fee.

You could also compute how many more apples and computers one North worker can get after this fee. That is:

Apples:  $30 \cdot 600 / 200 = 90$ , Computers:  $6 \cdot 600 / 200 = 18$ .

So the total consumption bundle one North worker can consume is (180, 27) for apples and computers.

Free Migration with fee		
	North	South
Wage	180	180
Price	10	
Consumption of apples per worker	$90 + \text{fee} = 180$	$90 - \text{fee} = 60$
Consumption of computers per worker	$9 + \text{fee} = 27$	$9 - \text{fee} = 3$
% of labor producing apples	50%	
% of labor producing computers	50%	
Total production of apples	72,000	
Total production of computers	7,200	

Note: Fee (apples, computers) = (30 apples, 6 computers) per South worker

We find that the North workers are better off, while the welfare of South workers is unchanged.