

## CHAPTER 2

# LABOR PRODUCTIVITY AND COMPARATIVE ADVANTAGE: THE RICARDIAN MODEL

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# Comparative advantage

- Nobel laureate Paul Samuelson (1969) was once challenged by the mathematician Stanislaw Ulam to "name me one proposition in all of the social sciences which is both true and non-trivial." It was several years later than he thought of the correct response: **comparative advantage**. "That it is logically true need not be argued before a mathematician; that it is not trivial is attested by the thousands of important and intelligent men who have never been able to grasp the doctrine for themselves or to believe it after it was explained to them." 1/
- We'll go over several explanations (very important, hopefully one strikes you as intuitive)

1/ P.A. Samuelson (1969), "The Way of an Economist," in P.A. Samuelson, ed., *International Economic Relations: Proceedings of the Third Congress of the International Economic Association*, Macmillan: London, pp. 1-11.

# Comparative advantage

- Principle of comparative advantage (c.a.) is a simple matter of relative efficiency; although the logic is simple, it involves lines of thinking that most people are unfamiliar/uncomfortable with.
- Principle of c.a. states that all nations can gain if each tends to specialise in the production of goods that they are relatively efficient at producing. This, plus trade, allows them to export these goods in exchange for goods that they are relatively inefficient at producing.
- The source of the gains from trade is a more efficient allocation of each nation's productive resources.
  - All nations gain some, but the allocation of the gains from trade can vary according to many factors (postpone this discussion)
- The c.a. term is one of the most misunderstood ideas in economics; confusion often stems from mixing up absolute advantage and comparative advantage

# Comparative advantage in words

- Principle of comparative advantage = principle of “relative efficiency”
- If highly productive nations specialise in producing goods where their advantage is greatest, and less productive nations specialise in producing goods where their disadvantage is the lowest, then each nation will be able to consume (with the help of trade) more than it could if it had to make everything itself.
- To sum up both sector where advantage is greatest & sector where disadvantage is the lowest we say each nation’s ‘comparative advantage sector’.

# Comparative advantage in words

- The logic of comparative advantage is intricate.
- Best arrived at via a sequence of thought experiments:
- Consider two workers, Mr A and Mr B.
- Mr A is better at everything (i.e. can all things in less time)
- How do we allocate the time of A & B to maximise total output?
  - Have Mr A do everything and Mr B nothing?
  - Have Mr A and Mr B do some of everything?
  - Allocate Mr B to do things where his inferiority to A is the least marked, and Mr A to things where his superiority is most marked?

# More detailed example

- Relative efficiency principle in general:
- The example concerns two homeowners who live next door to each other--"My Neighbor" and "Me"--each of whom must perform two weekly tasks: 'mowing' and 'weeding' the lawn.
- Goal is to get yard work done in least time
- Technical efficiency of the two men:

<u>Task</u>	<u>My Neighbour</u>	<u>Me</u>
Mowing lawn	2 hours	3 hours
Weeding lawn	1 hour	4 hours

# Possible solutions

Solution	Hours for neighbor	Hours for me
<u>No trade</u> (each does his own)	3	7
<u>Trade option #1</u> : 'me' mows both lawns, neighbor weeds both lawns	2	6
<u>Trade option #2</u> : 'me' weeds both lawns, neighbor mows both lawns	4	8

# Magic time saving?

- Why was option #1 better than ‘no trade’?
- Consider relative efficiency of 2 in the two tasks

Task	My Neighbour/Me
Mowing lawn	2/3
Weeding lawn	1/4

- Me is worse at both tasks (absolute disadvantage in both)
- Me’s disadvantage is least in mowing.
- Neighbour’s advantage is in weeding.
- Comparative advantage is about relative efficiency.
  - NB: the two men would arrive at this solution while in pursuit of their own self interest; no need for coordination, the ‘market’ will arrive at the efficient outcome.
- By analogy, whenever nation’s have different relative efficiency, then mutual gains from trade are possible.
  - Free market will arrive at the efficient solution.



# Comparative advantage in life

- By inspection, you'll see that you use principle of comparative advantage frequently in life to improve efficiency of team work.
- Often team members have different ability levels and different specialties.
  - Often one team member will be the best at everything, or most things.
  - Efficient allocation requires using all team members' talents & relative efficiency is the common sense allocation rule used.
  - Allocate best member to task at which is edge is greatest; allocate other members' to tasks where their disadvantage is the least.

# Comp. Adv. & opportunity cost

- Krugman stresses the concept of ‘opportunity cost’ to explain comparative advantage.
  - If people/nations have different opportunity costs of doing things, they have different relative efficiencies, so same concept.
- Opportunity cost is extremely clear with only 2 goods, but is less clear when there are many goods.
- In example, opportunity cost of ‘me’ weeding my own lawn is mowing 1 & 1/3th yards.
- Opportunity cost of ‘neighbour’ weeding his lawn is mowing 1/2 yards
- Thus the opportunity cost of weeding for me is higher than it is for neighbour, so neighbour should do the weeding
- Opp.cost me mowing = 3/4<sup>th</sup> yard weeded & opp.cost of neighbour mowing = 2 yards weeded, so again, me should mow and neighbour should weed (min. opp. costs).

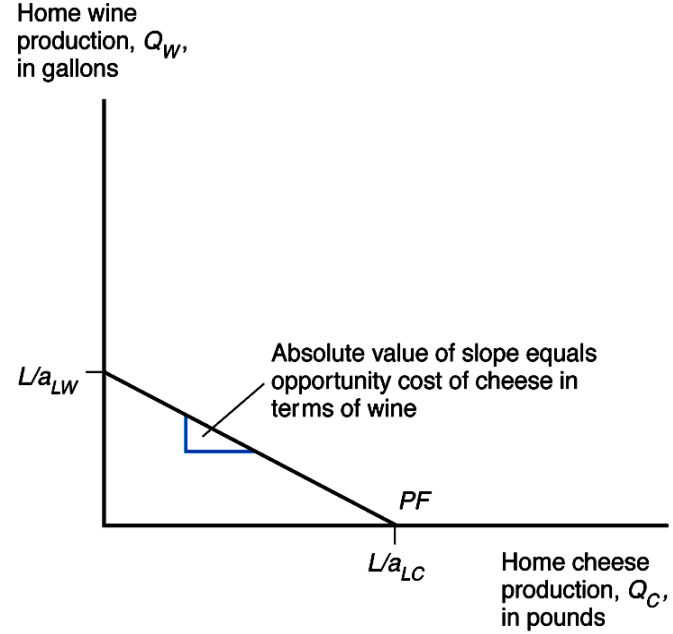
# Comp. Adv. & opportunity cost

- But what if 3 tasks? What is the opportunity cost of mowing, when could do either weeding, or watering?
  - Full answer only appears once the optimal distribution of tasks is decided.
- Using relative efficiency, i.e. look at ratio of efficiency for each task for two nation/people – called a c.a. chain – and then find the dividing line for the chain.

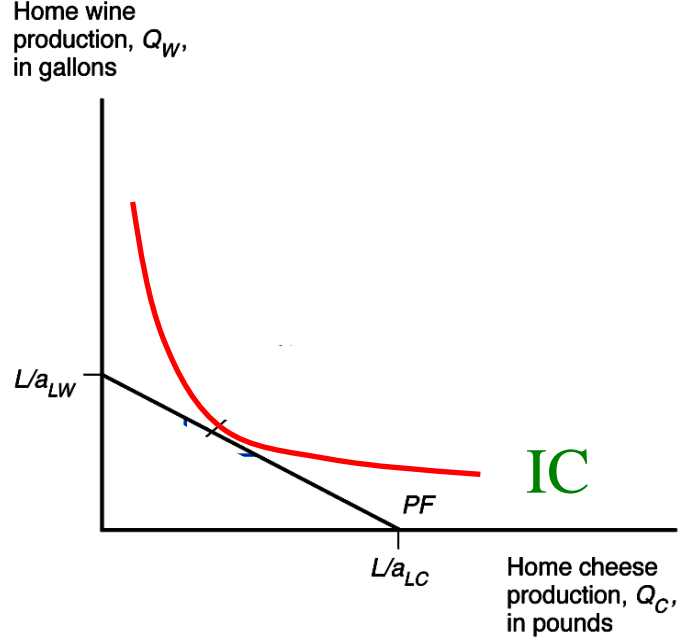
# Ricardian model of trade

- Aside on modelling: Cannonball & feather parable
- Comp. Adv. in a trade model (i.e. where goods prices, factor prices and trade patterns are endogenous)
  - Trade models are generally complex due to general equilibrium (G.E.) considerations
- Simplest trade model is Ricardian trade model
  - Assumes single factor of production (labour)
  - 2 nations, Home and Foreign
  - 2 goods, wine and cheese
  - Nation's have different relative efficiencies for producing wine & cheese (assume this is due to technological differences)
  - This difference, regardless of its nature, means both will gain from trade (due to comparative advantage)

- Start by plotting the PPF
  - Why flat?
- Note opportunity cost for Home making cheese i.t.o. wine is minus the slope
  - Do units analysis

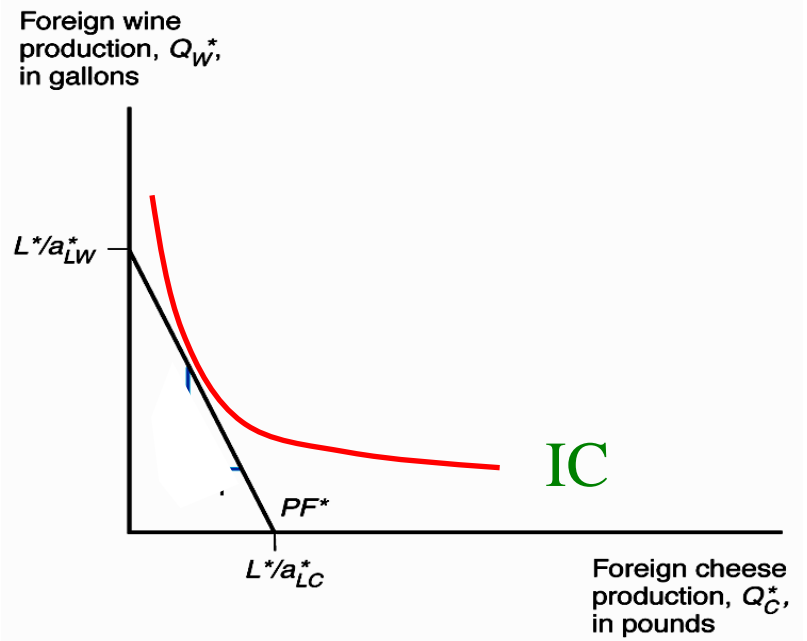
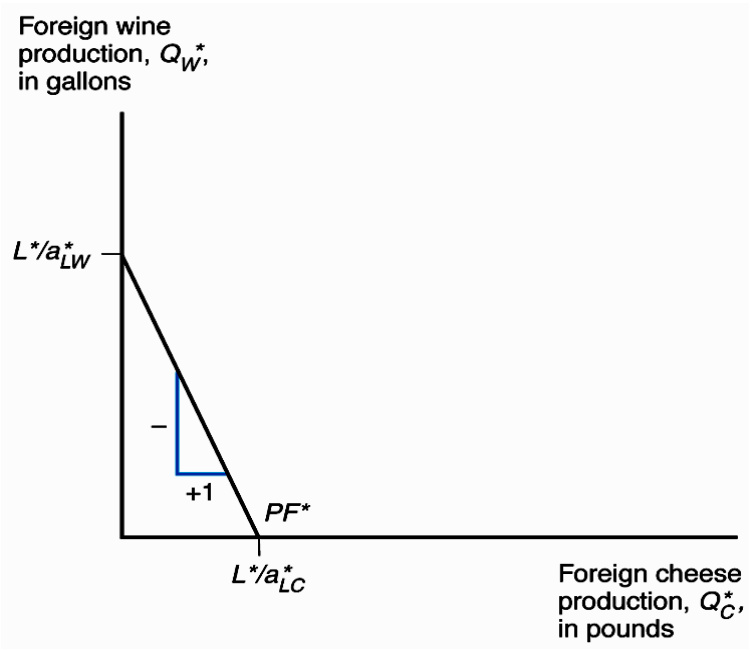


- In autarky, production and consumption are same
  - Why?
- Cons'n=prod'n determined by relative tastes (IC)
  - Tangency of IC & PPF



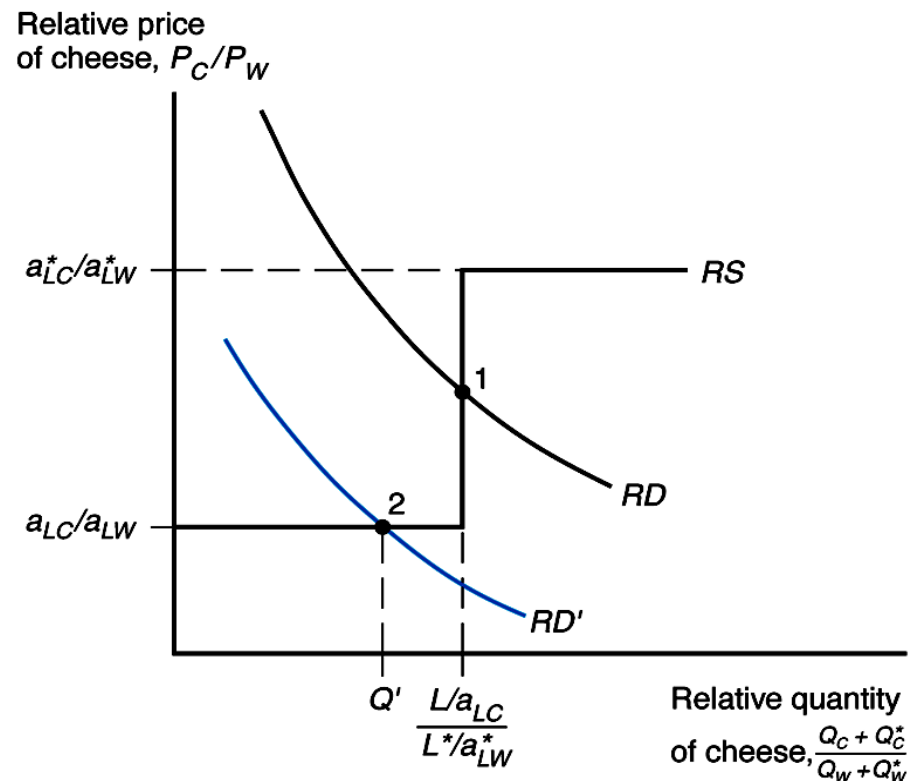
- Do same for Foreign
  - In autarky, production and consumption are same
  - Determined by relative tastes for wine & cheese (tangency)

- NB: Foreign produces=consumes relative more wine since its autarky relative price of wine is lower than Home's

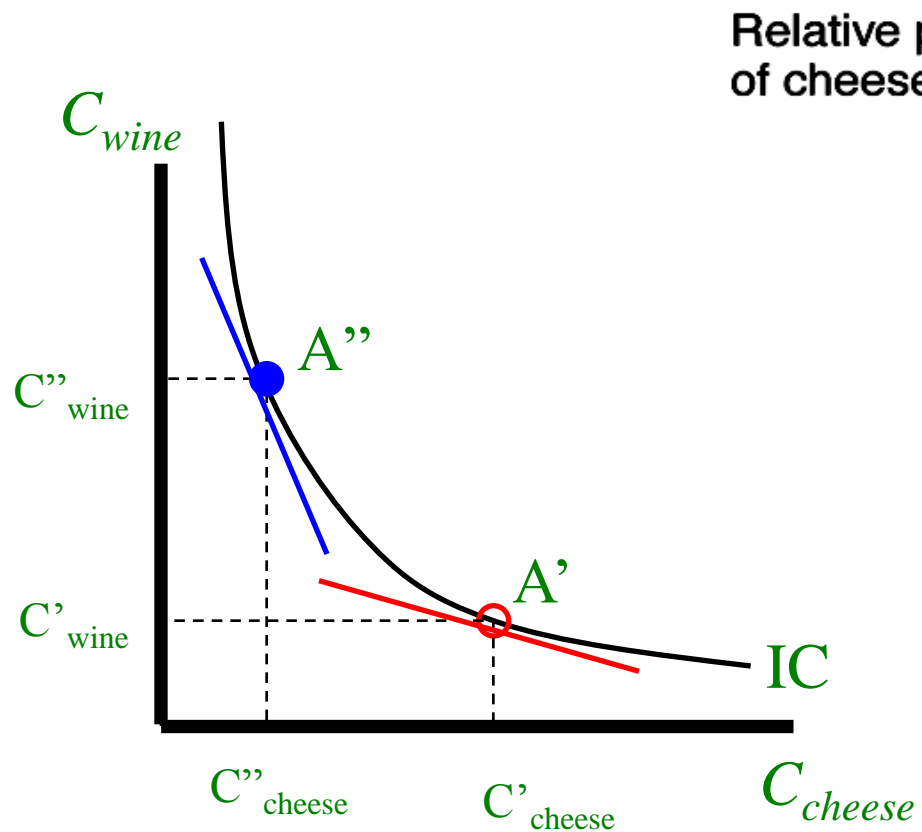


# Free trade

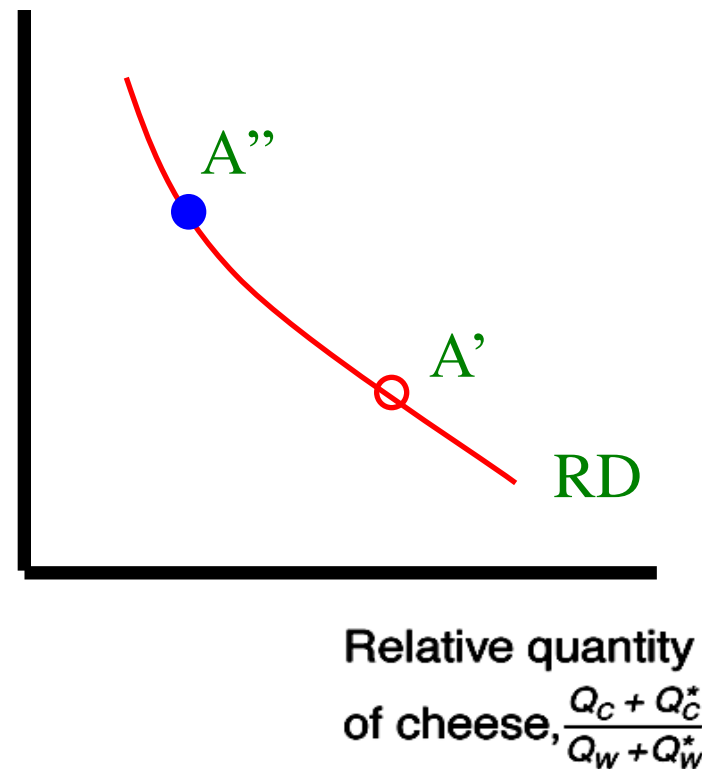
- Now, allow free trade. Questions:
  - Who makes what? What is the trade patten? What are international prices
- Intuition: In autarky, relative price of wine was lower in Foreign, AND relative price of cheese was lower in Home, so likely that Foreign exports wine & home cheese.
- More systematically, we construct Relative Supply and Relative Demand curves
- Relative Demand is easy
  - As relative price of cheese to wine rises, relative demand for cheese falls (move along IC)



# RD in detail

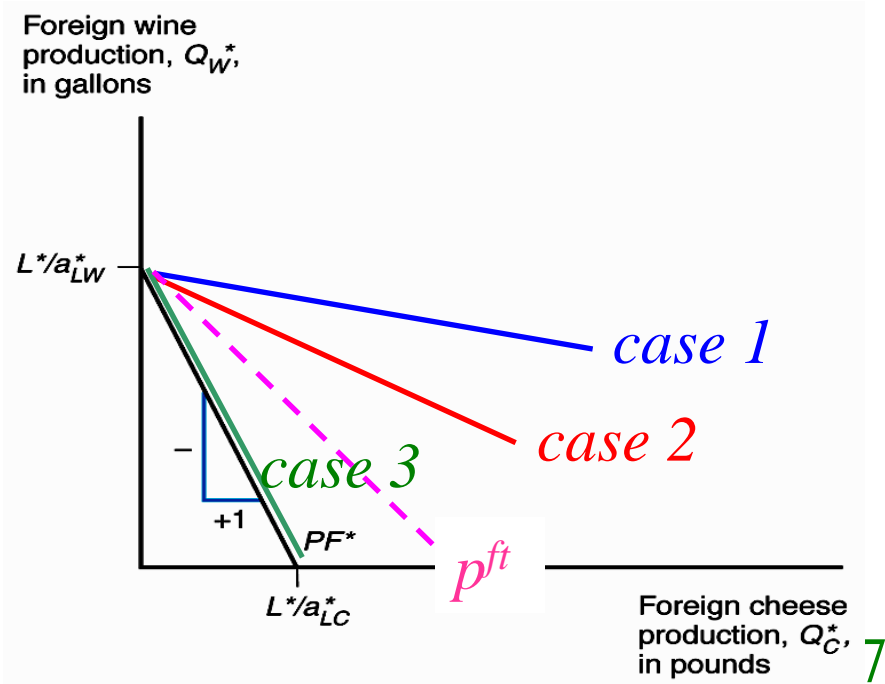
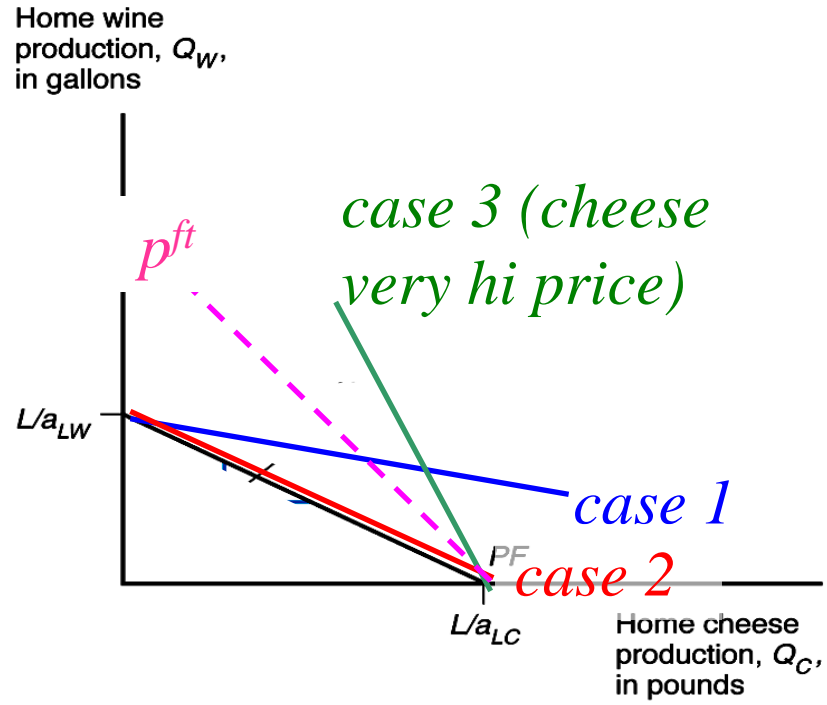


Relative price  
of cheese,  $P_C/P_W$





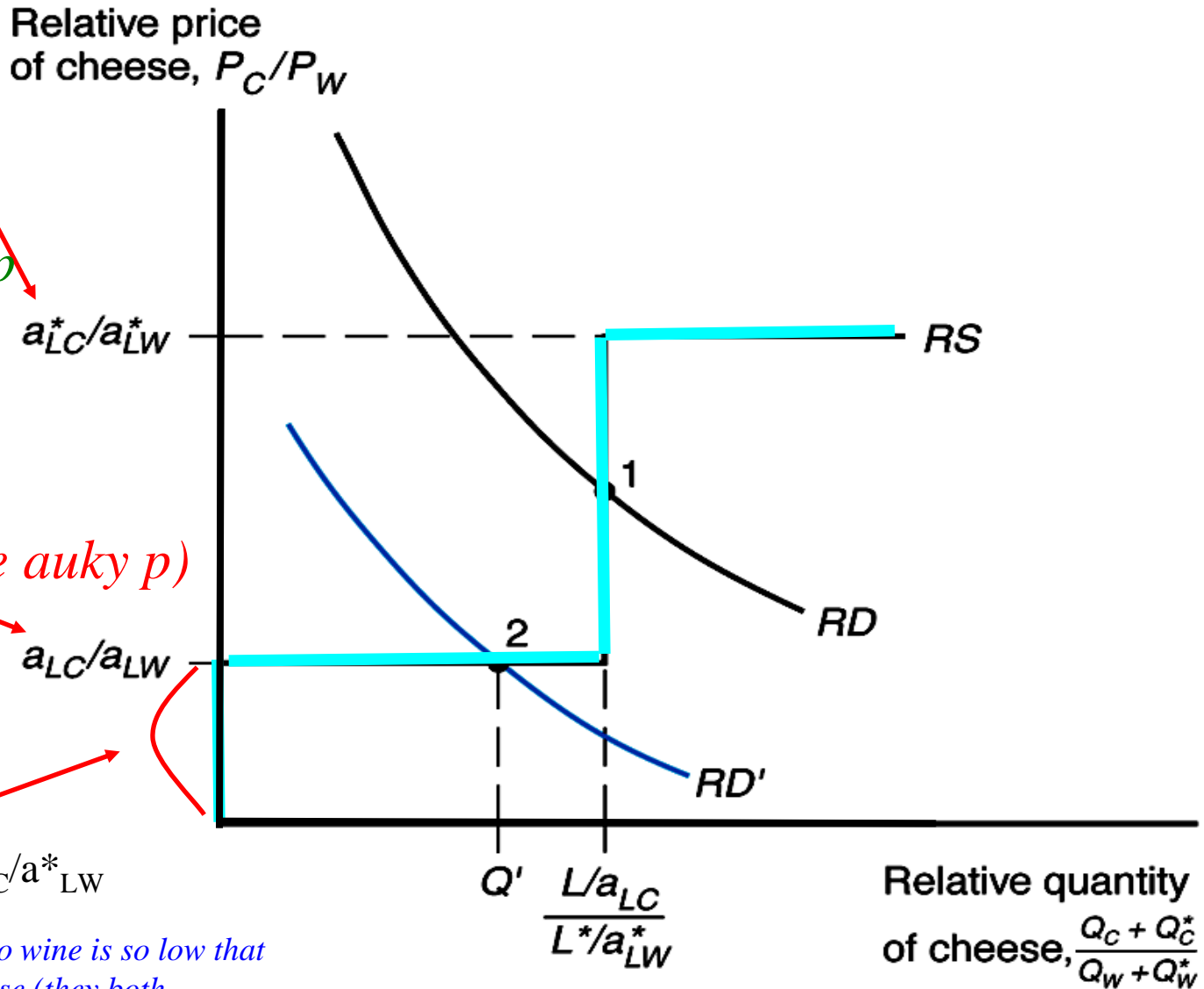
- Relative Supply also easy
- Start with *case 1*
  - $P_c/P_w < a_{LC}/a_{LW} < a^*_{LC}/a^*_{LW}$
  - At this price, no one produces cheese
- *case 2*: When  $P_c/P_w = a_{LC}/a_{LW}$ 
  - Home is indifferent to producing wine & cheese, but Foreign produces only wine
- *case 3*: When  $P_c/P_w = a^*_{LC}/a^*_{LW}$ 
  - Foreign is indifferent to producing wine & cheese, but Home produces only cheese



# Putting Relative supply together yields the RS-RD diagram (very useful)

- $P_c/P_w = a_{LC}^*/a_{LW}^*$

*case 3 (auk'y re.p  
In foreign)*



*case 2 (Home auky p)*

- $P_c/P_w = a_{LC}/a_{LW}$

*case 1*

- $P_c/P_w < a_{LC}/a_{LW} < a_{LC}^*/a_{LW}^*$

*The price of cheese relative to wine is so low that neither nation produces cheese (they both specialise in wine)*

# Putting Relative supply together yields the RS-RD diagram (very useful)

case 3:  $2: P_c/P_w = a_{LC}^*/a_{LW}^*$  (Foreign auk'y rel. price)

In foreign). Price of Cheese to wine is so high that Home is spec'd in cheese and foreign is indifferent to prod'ing wine cheese.

Relative price of cheese,  $P_c/P_w$

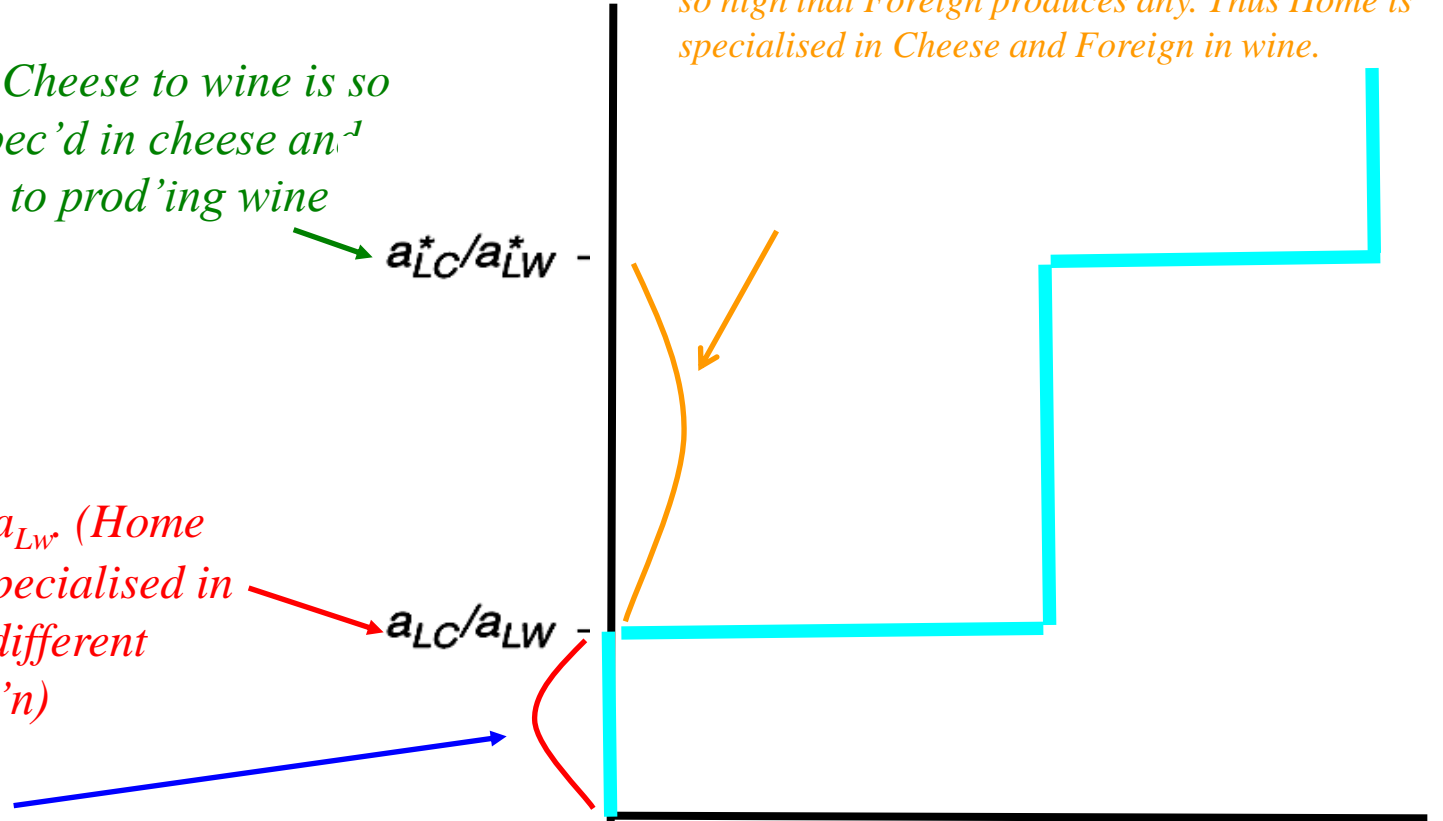
In this range of relative prices, the price of cheese is high enough so Home specialises in cheese, but not so high that Foreign produces any. Thus Home is specialised in Cheese and Foreign in wine.

case 2:  $P_c/P_w = a_{LC}/a_{LW}$  (Home auky p); Foreign is specialised in wine and Home is indifferent between W & C prod'n)

case 1

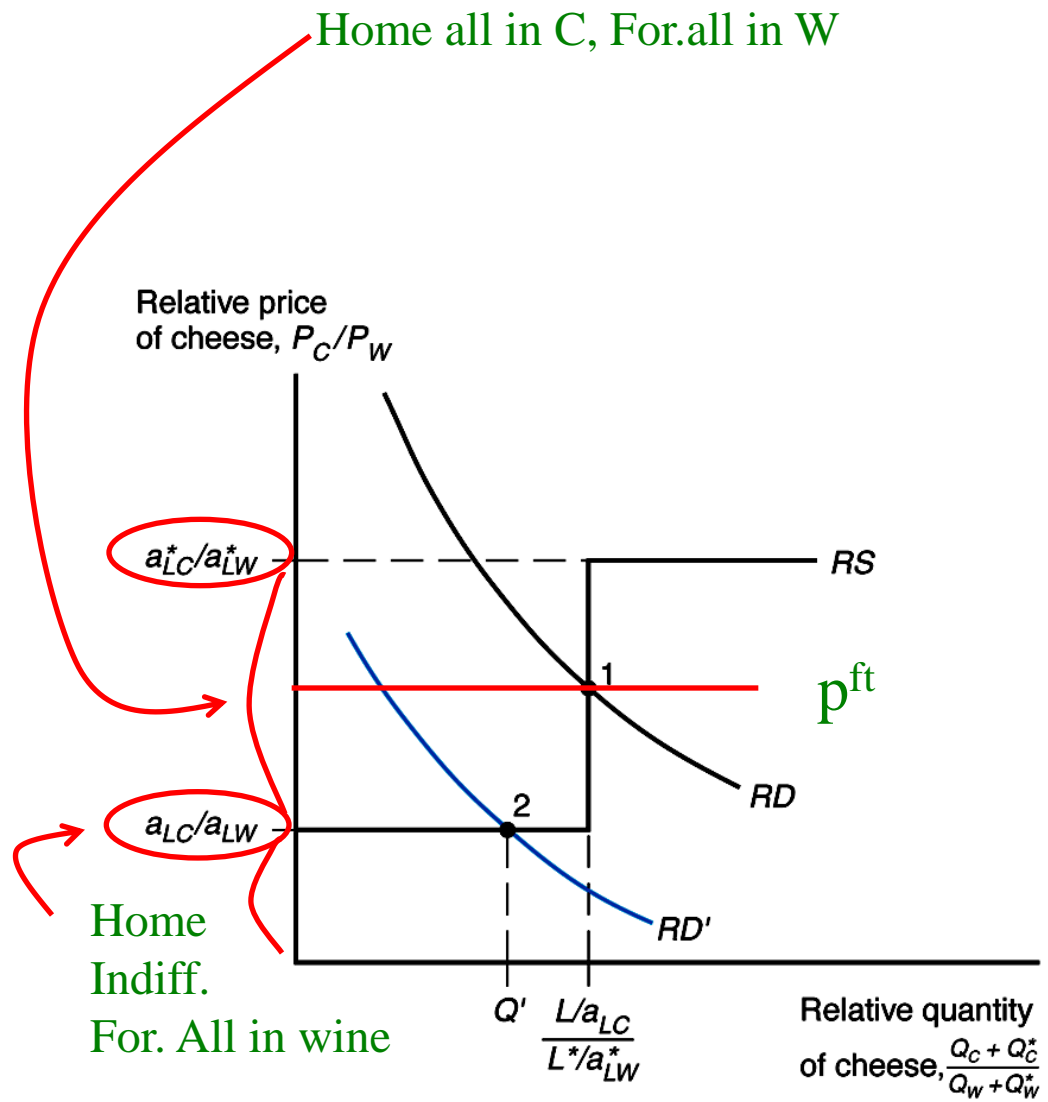
$$- P_c/P_w < a_{LC}/a_{LW} < a_{LC}^*/a_{LW}^*$$

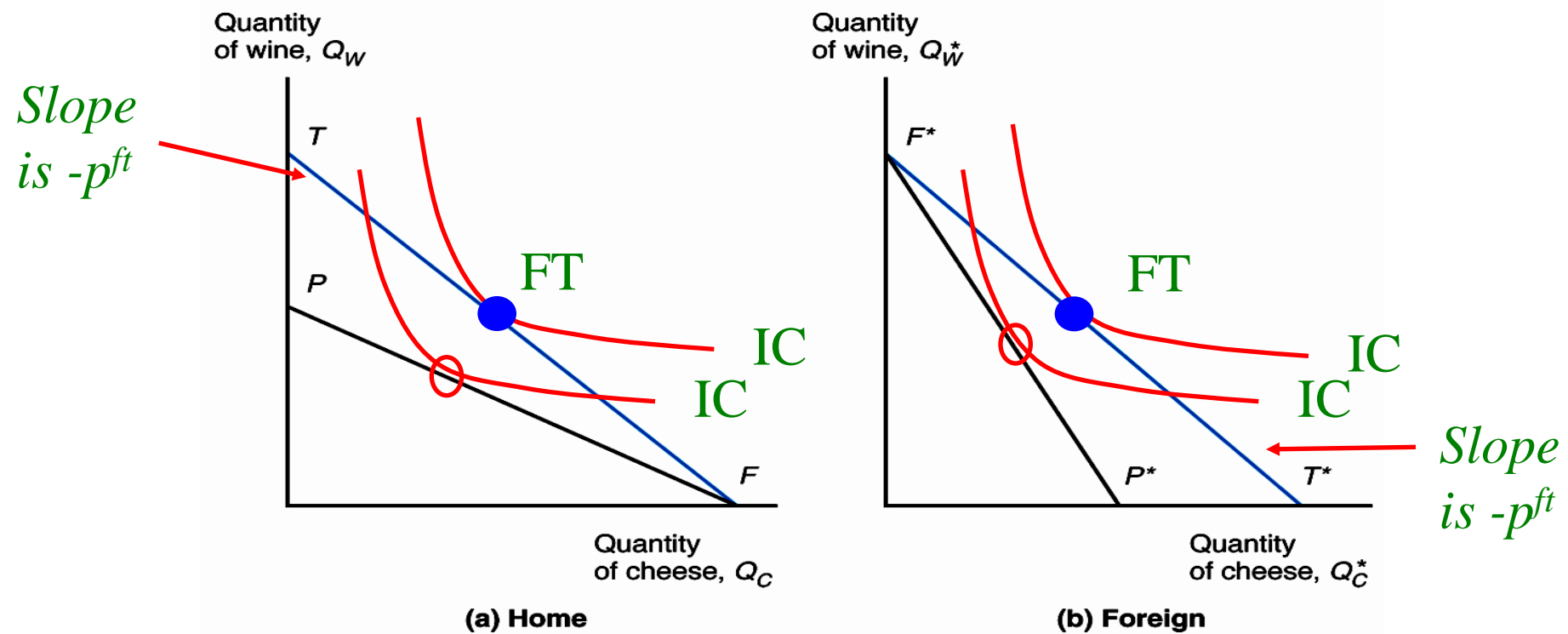
The price of cheese relative to wine is so low that neither nation produces cheese (they both specialise in wine); thus the relative supply ratio is  $zero / (L/a_{LW} + L^*/a_{LW}^*)$



Relative quantity of cheese,  $\frac{Q_c + Q_c^*}{Q_w + Q_w^*}$

- What is the free trade price?
- Typically, the free trade price will be somewhere between the 2 autarky prices
  - i.e. between  $a_{LC}/a_{LW}$  &  $a^*_{LC}/a^*_{LW}$
  - Except when one nation is much larger than the other
- Say, it RD & RS meet at point 1, so free trade relative price is  $p^{ft}$ 
  - Home spec'd in cheese, Foreign in wine
  - Trade pattern?





- Gains from trade (GFT) for both nations
- Like autarky + technological improvement in both nations
- NB: this would work as long as Home and Foreign have difference relative efficiencies in producing the 2 goods
  - Absolute positions of PPF's (abs.adv.) doesn't matter for GFT

# Wages in Home & Foreign

- Home specialises in cheese
  - ⊖ Home wage i.t.o. cheese is same as in autarky,
    - Namely,  $1/a_{LC}$  per hour (Do unit analysis)
  - ⊖ Home wage i.t.o. wine has risen.
    - It is  $(1/a_{LC})$  times  $p^{ft}$ , since this is the free trade price of wine i.t.o. cheese and wine is cheaper in Home with trade.
- Foreign specialises in wine
  - ⊖ Foreign wage i.t.o. wine is same as in autarky,
    - $1/a^*_{LW}$  per hour
  - ⊖ Foreign wage i.t.o. cheese has risen.
    - Cheese is cheaper in Foreign with trade.

# Wages in Home & Foreign

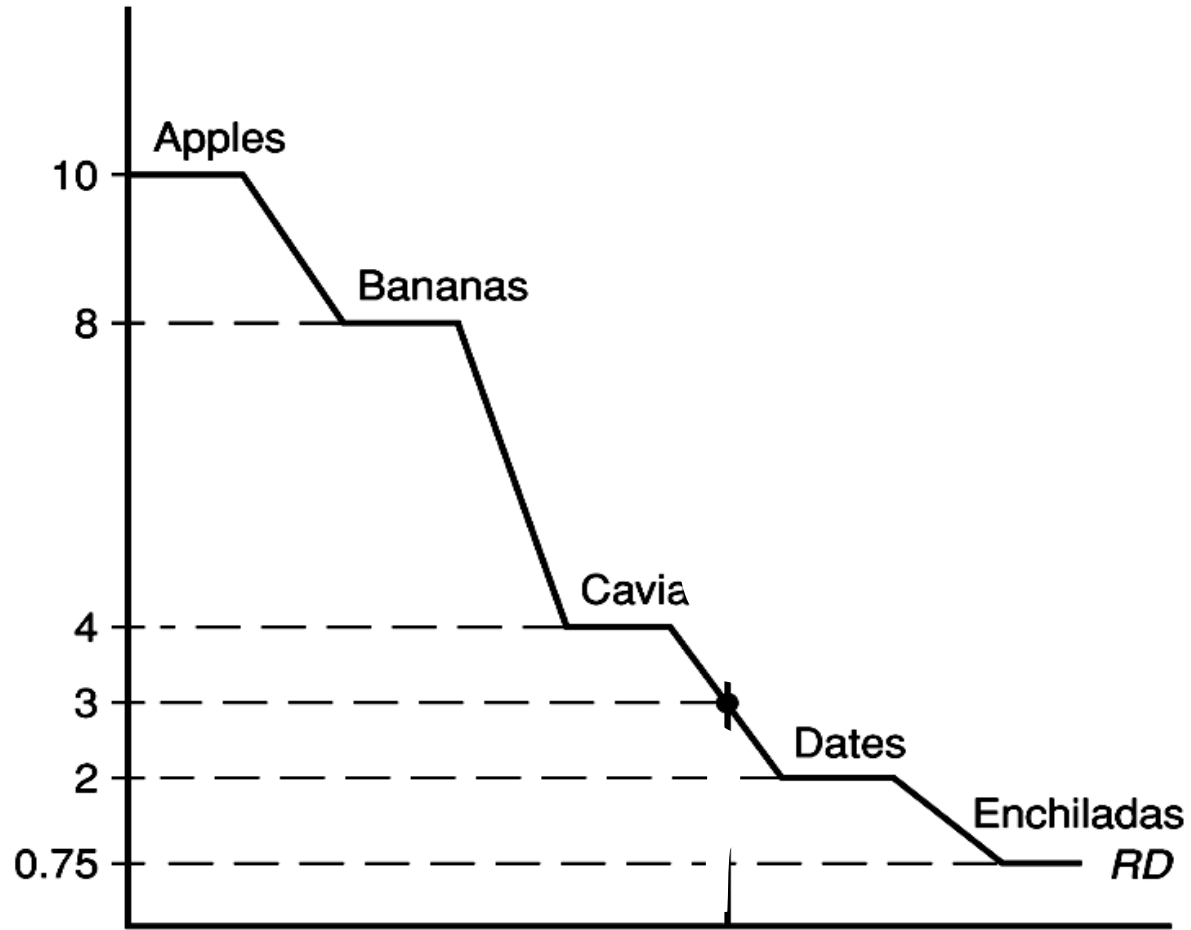
- Take Krugman's numerical example
- $1 = a_{LC}$  hour per pound,  $2 = a_{LW}$  per gallon
- $6 = a^*_{LC}$  hour per pound,  $3 = a^*_{LW}$  per gallon
- So if pound of cheese = \$12 and gallon of wine = \$12, then with free trade
  - Foreign wage = \$4 per hour ( $=12/3$ )
  - Home wage = \$12 per hour ( $=12/1$ )
- NB: Nation's wages are primarily determined by their productivity levels
  - Wages are low in nations with low productivity
  - Wages are high in nations with hi productivity
- In Ricardian model, wages are pinned down by nation's productivity in its comparative advantage sector

# C.A. with multiple goods

- Notion of opportunity cost is less clear when there are many goods
- To define c.a. in this situation look at ratio of a's for each good
  - Step 1: take ratio of Foreign/Home a's for each good, i.e.  $a^*_{Li}/a_{Li}$  for all N goods
  - Step 2: arrange this in order from lowest ratio to highest and number the goods accordingly
    - i.e.  $a^*_{L1}/a_{L1} > a^*_{L2}/a_{L2} > \dots > a^*_{LN}/a_{LN}$ .
      - NB: ratio is inverted in K&O, but we need it this way to match Fig 2-5
    - This is the ranking of sectors by Home's comparative advantage,
      - i.e. Home's strongest comparative advantage is in good 1, then 2, ...
    - Also, ranking of Foreign's comparative disadvantage



# Example of the c.a. ranking (apples=gd 1, banans=gd2, etc)



# Who produces & exports what?

- To see who exports which goods, we need relative wages
- Home makes gd 1 if:  $w^*a_{L1}^* > wa_{L1}$ 
  - Since perf.comp. means  $p_{L1}^* = w^*a_{L1}^*$  &  $p_{L1} = wa_{L1}$
  - Etc. for all goods
- This means Home produces all goods where
  - $a_{Li}^*/a_{Li} > w/w^*$
- Foreign produces all goods where
  - $a_{Lj}^*/a_{Lj} < w/w^*$
- BUT how do we find  $w/w^*???$

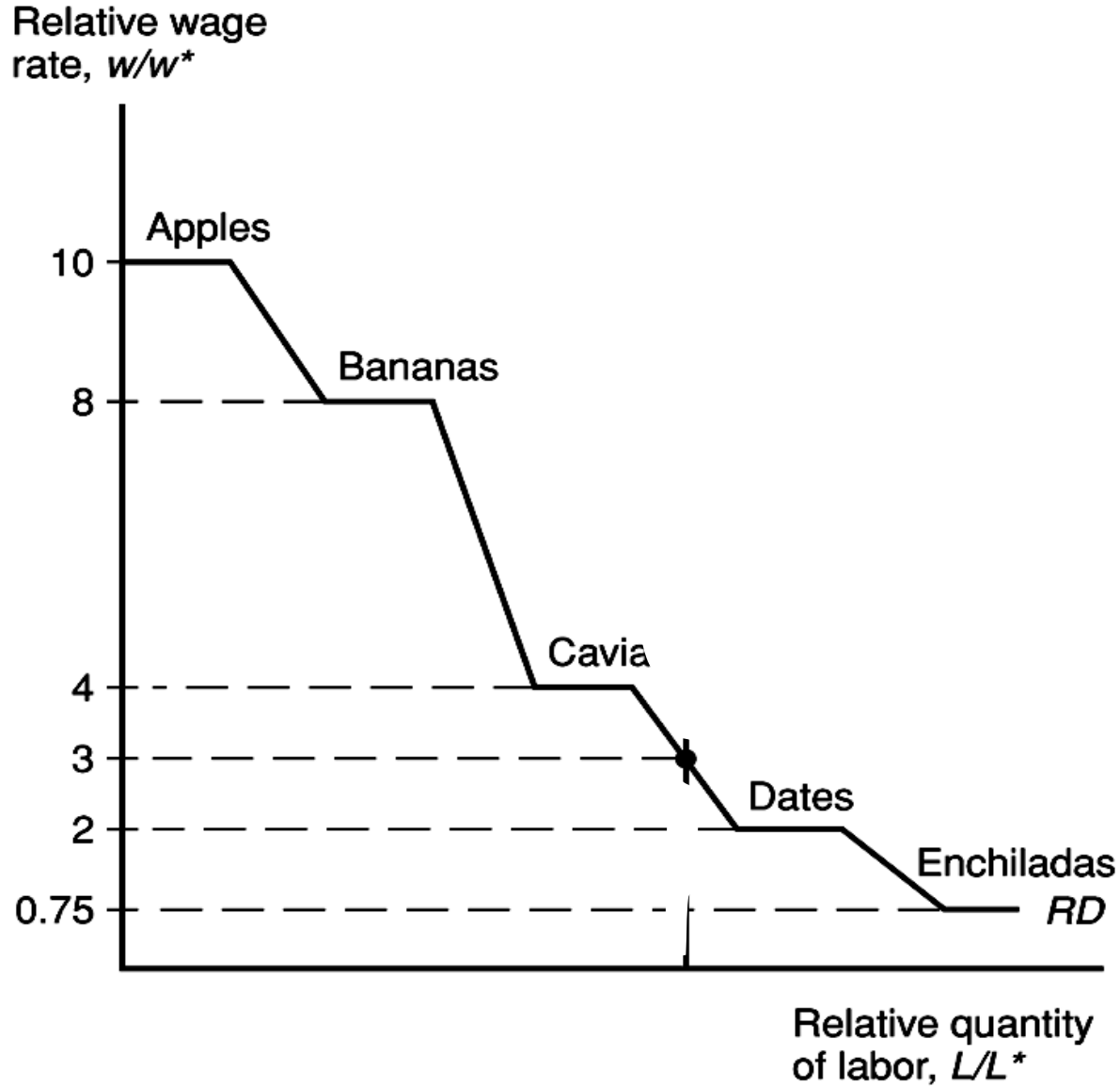
# Determining wages

- $w/w^*$  will be determined by the relative demand for Home and Foreign labour & the relative supply (fixed).
- How does the relative demand (RD) for Home labour change as  $w/w^*$  falls?
  - As  $w/w^*$  falls, Home goods become more competitive relative to Foreign goods, so demand for Home labour rises relatively
    - Given Ricardian technology, the RD is downward sloped, but has flat parts

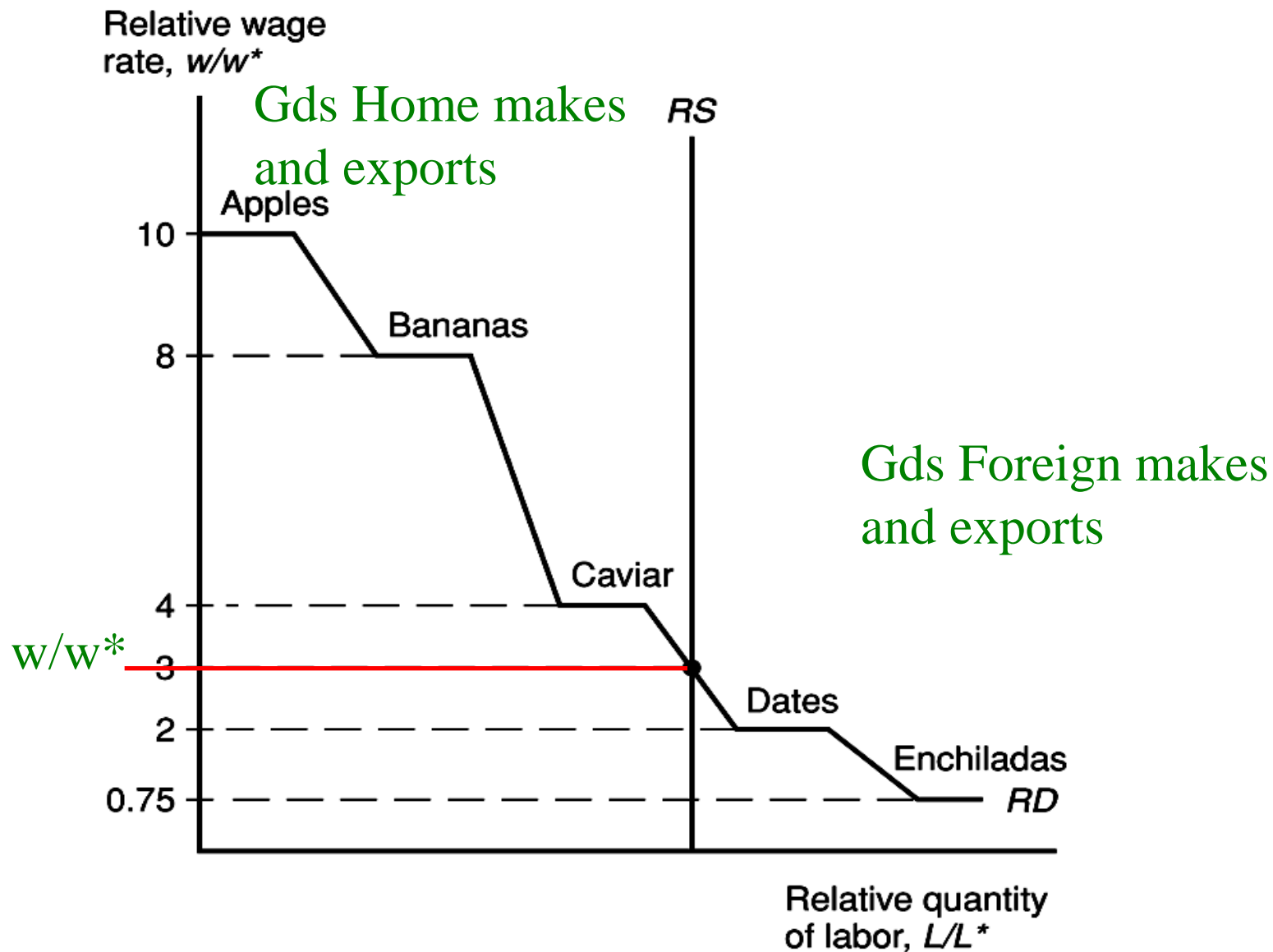
# Determining wages

- For example, if  $w/w^*$  is really low
  - $a_{L1}^*/a_{L1} > a_{L2}^*/a_{L2} > \dots > a_{LN}^*/a_{LN} > w/w^*$
- Then Home would produce everything, Foreign nothing
- This cannot be the eq'm  $w/w^*$  since Foreign labour is unemployed, i.e.  $w^*$  would adjust downward
- As  $w/w^*$  starts to rise, Home becomes uncompetitive in more sectors
  - First the N sector, then the N-1 sector, etc.
  - $a_{L1}^*/a_{L1} > a_{L2}^*/a_{L2} > w/w^* > a_{LN-1}^*/a_{LN-1} > \dots > a_{LN}^*/a_{LN}$
- This lowers the relative demand for Home labour
- In the diagram ...

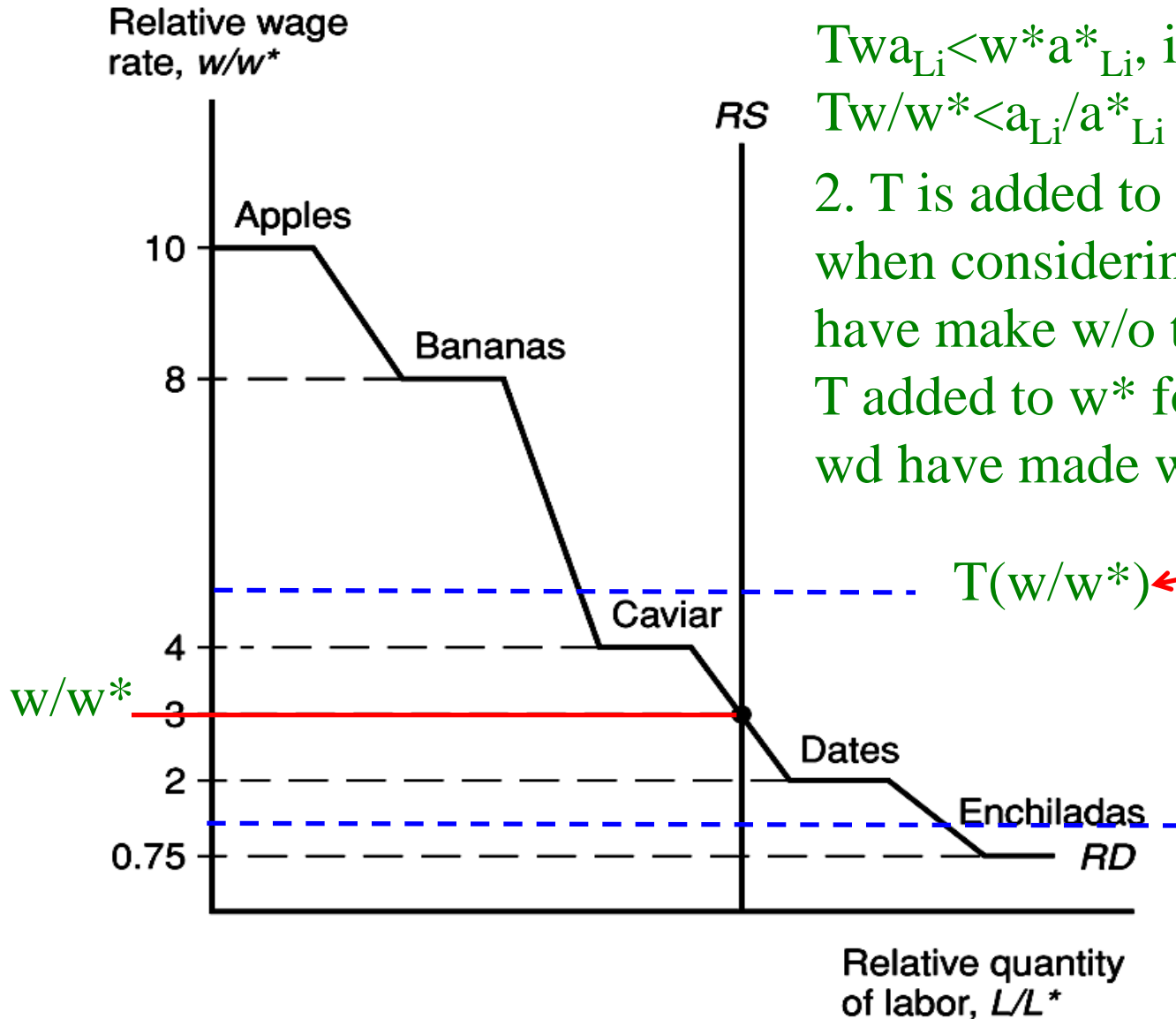
# Relative wage and RD for Home labour



Now we add in the relative supply of Home/Foreign labour (endowments)



# Transport costs & non-traded gds



1. The test is now whether  $Twa_{Li} < w^*a^*_{Li}$ , i.e.  $Tw/w^* < a_{Li}/a^*_{Li}$
2.  $T$  is added to Home wage when considering gds Home wd have make w/o transp.costs.  $T$  added to  $w^*$  for gds Foreign wd have made w/o  $T$ .

# Non traded goods

- Most services and many gds are non-traded.
  - Typical rich nation something like 50% to 70% of expenditure is on non-traded gds.
  - e.g. almost all govt services are non-traded, ditto medical, professional, retail, & most transport, etc.
- Bigger nations tend to have smaller share of expenditure on traded gds
  - US & Jpn have low  $X/GDP$  ratios
  - Switzerland, Costa Rica hi ratios.



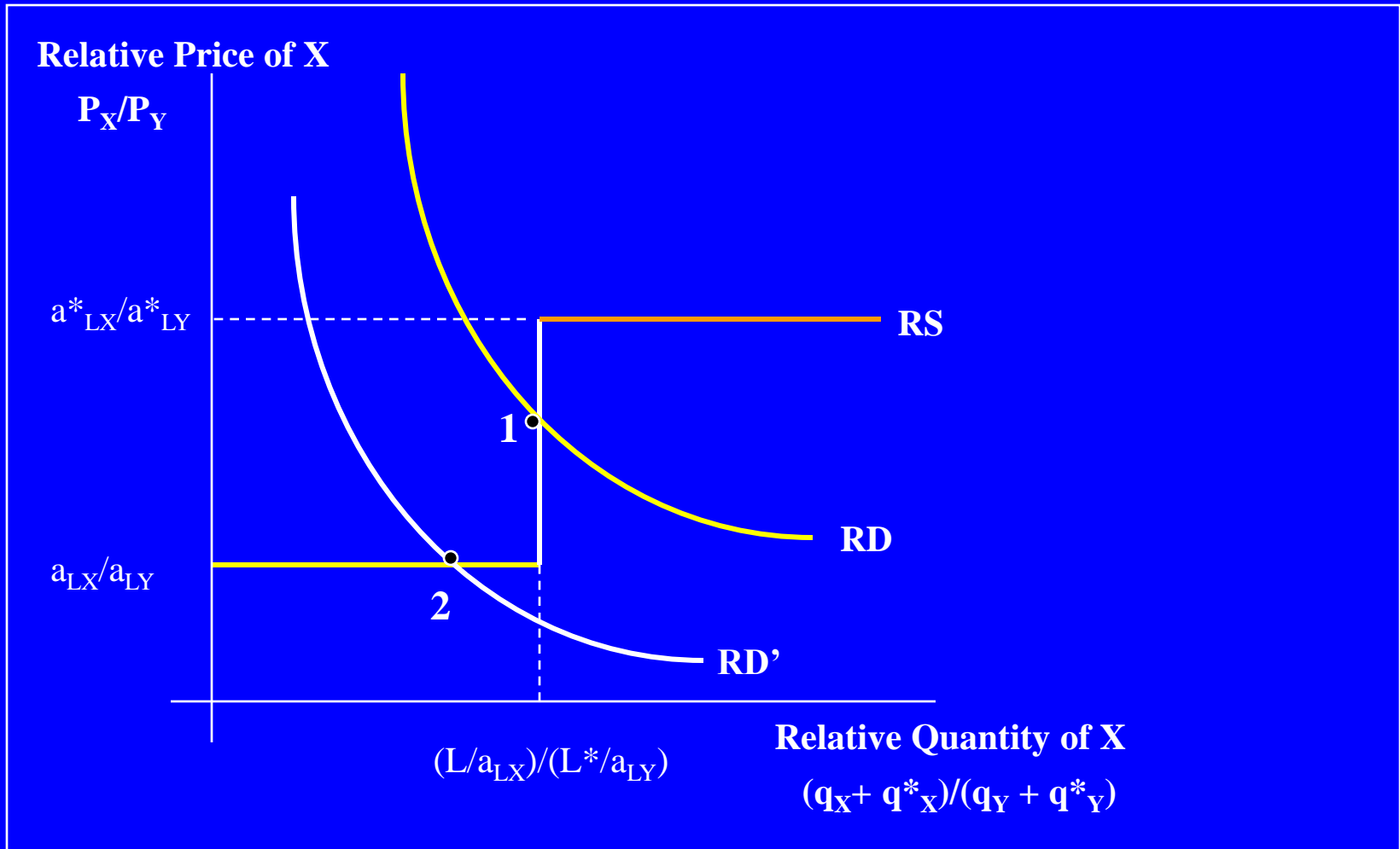
# C.A. Myths

- Do in exercises.
  - Read K&O first.
  - Read various essays on my “Comparative Advantage Myths” page.
    - [www.hei.unige.ch/baldwin/CompAdvMythsFrame.htm](http://www.hei.unige.ch/baldwin/CompAdvMythsFrame.htm)

- Veitch slides from UC Berkeley

- How can we determine exactly what the relative price will be in equilibrium with trade?
- Terms of trade for a country:
  - Ratio of the price of its export commodity to the price of its import commodity.
  - In our example, terms of trade for Home are  $P_X/P_Y$ , and  $P_Y/P_X$  for Foreign.
- Number of analytical tools to determine the equilibrium relative price ratio with trade.
- K&O focus on Relative Demand and Supply analysis.

- Relative analysis focuses on ratio of prices  $P_X/P_Y$  & ratio of total quantities  $(q_X + q_X^*)/(q_Y + q_Y^*)$ .
- Relative Demand:
  - Rise in  $P_X/P_Y$  makes  $X$  more expensive relative to  $Y$ .
  - Substitution away from  $X$  towards  $Y$ , leads to downward-sloping Relative Demand Curve, RD.
- Relative Supply:
  - If  $P_X/P_Y < a_{LX}/a_{LY}$ : no Good  $X$  produced.
  - If  $P_X/P_Y = a_{LX}/a_{LY}$ : Home produces  $X$  as demanded.
  - If  $a_{LX}^*/a_{LY}^* > P_X/P_Y > a_{LX}/a_{LY}$ : Home specializes in  $X$ .
  - If  $P_X/P_Y > a_{LX}^*/a_{LY}^*$ : Both Home & Foreign produce  $X$ .



## Relative

Cloth	Wine	Bread	Wages	Cheese	Tools	Pots
$a_{LC}^*/a_{LC} >$	$a_{LW}^*/a_{LW} >$	$a_{LB}^*/a_{LB} >$	$[W_e/W^*] >$	$a_{LCh}^*/a_{LCh} >$	$a_{LT}^*/a_{LT} >$	$a_{LP}^*/a_{LP}$
Home Exports				Home Imports		
Foreign Imports				Foreign Exports		

- Pattern of trade in multi-commodity world depends on relative labor requirements versus ratio of relative wages.
- Also can see effects of change in exchange rate or relative wages on the pattern of trade.
- Finally trade flows equalized by changes in relative wage rates due to flows of gold or exchange rate changes.

# Effects of Change in Relative Wages

Cloth	Wine	Relative Wages	Bread	Cheese	Tools	Pots
$a^*_{LC}/a_{LC} >$	$a^*_{Lw}/a_{Lw} >$	$[W_e/W^*] >$	$a^*_{LB}/a_{LB} >$	$a^*_{LCh}/a_{LCh} >$	$a^*_{LT}/a_{LT} >$	$a^*_{LP}/a_{LP}$
Home Exports			Home Imports			
Foreign Imports			Foreign Exports			

- ➡ Increase in Home wage rate, decrease in Foreign wage rate, or rise in exchange rate (home currency more valuable)
- ➡ Makes home country goods more expensive, reduces the number of goods exported by the home country.
- ➡ Again any imbalance in trade flows will be equalized by changes in relative wage rates due to flows of gold or exchange rate changes.

