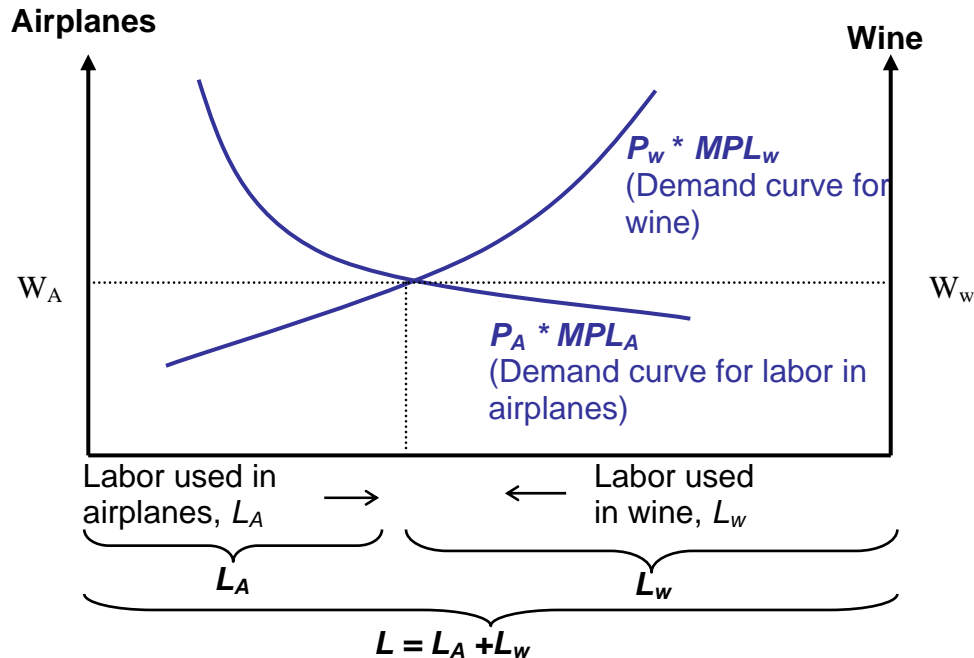


Setup: France can produce 2 goods (airplanes and wine) using labor (L) that is mobile between the 2 sectors. Capital machinery (K) is specific to producing airplanes. Vineyards (V) are specific to producing wine.

1. Use a bucket diagram to show how French labor (L) is allocated between airplanes and wine.



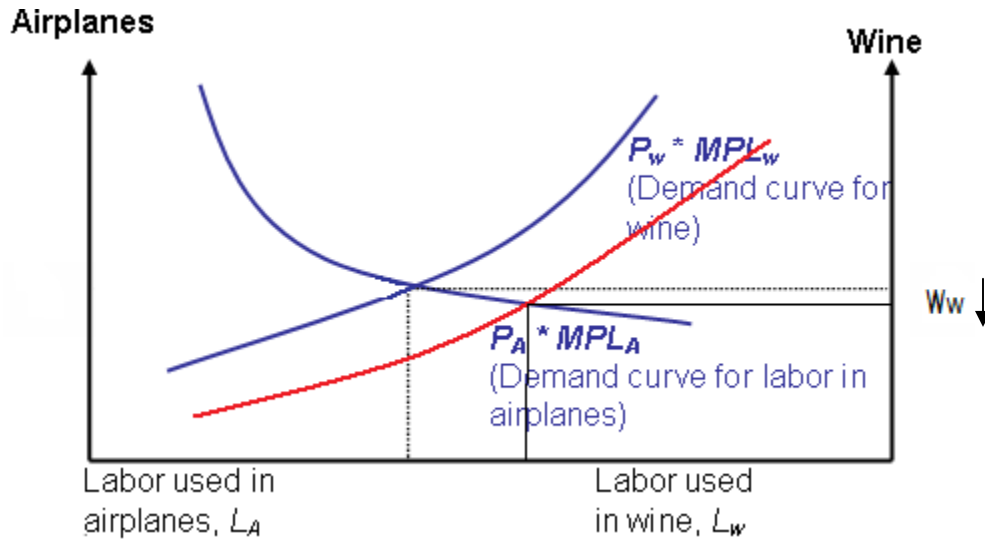
- a. What is the equation describing the demand for labor in each sector?

The wage for each sector must be equal to the value marginal product of labor (MPL is in units of output; value MPL converts units of output into dollars by multiplying by the price the good sells for). For the airline sector  $W_A = P_A * MPL_A$ , for the wine sector  $W_W = P_W * MPL_W$ . Firms in each sector will demand labor up to the point where wage is equal to value marginal product of labor.

- b. What conditions must be met for the labor allocation to be a stable equilibrium?

Firms in both sectors must be on their demand curves (meaning they are paying a wage equal to their marginal benefit of hiring labor). The labor allocation will be stable when both sectors have the same wage. This implies  $P_A * MPL_A = P_W * MPL_W$ .

2. Redraw the bucket diagram, and let the price of wine fall.



The red line in the diagram is the new demand curve for wine.

a. What happens to the labor demand curve in the airplane sector?

**No Change.**

b. What happens to the labor demand curve in the wine sector?

**Shifts down to reflect the falling benefit of hiring workers because the value of their production is dropping.**

c. What happens to the allocation of labor and why?

**As  $P_w$  falls, the marginal benefit of hiring labor in the wine industry ( $P_w * MPL_w$ ) falls. Firms will offer a lower wage rate in wine sector, and labor will move out of the wine sector and into the airplane sector.**

d. What happens to the real and the nominal labor wage?

**Nominal wage in both sectors decrease. (Note that even though nothing changed the demand curve for labor in the airplane sector, the fall in demand for wine labor pushes wages down everywhere.)**

**Real wage is nominal wage divided by the price of the product. Since price of wine has also fallen the effect on real wage is ambiguous.**

e. What happens to the returns to K and V?

**The return to a specific factor can be calculated just like the labor wage by setting the marginal cost of hiring that factor equal to its marginal benefit.**

$$R_V = p_w MPV \quad \text{and} \quad R_K = p_A MPK$$

The first equation is the return on vineyards (V) as a function of the price of wine and the marginal product of vineyards. The second equation is the return on airplane capital.

MPV and MPK depend on how many workers are in each sector: capital is more productive at the margin when there are more workers using it.

**V:**

$$p_w \downarrow \text{ and } MPV \downarrow \Rightarrow R_V \downarrow$$

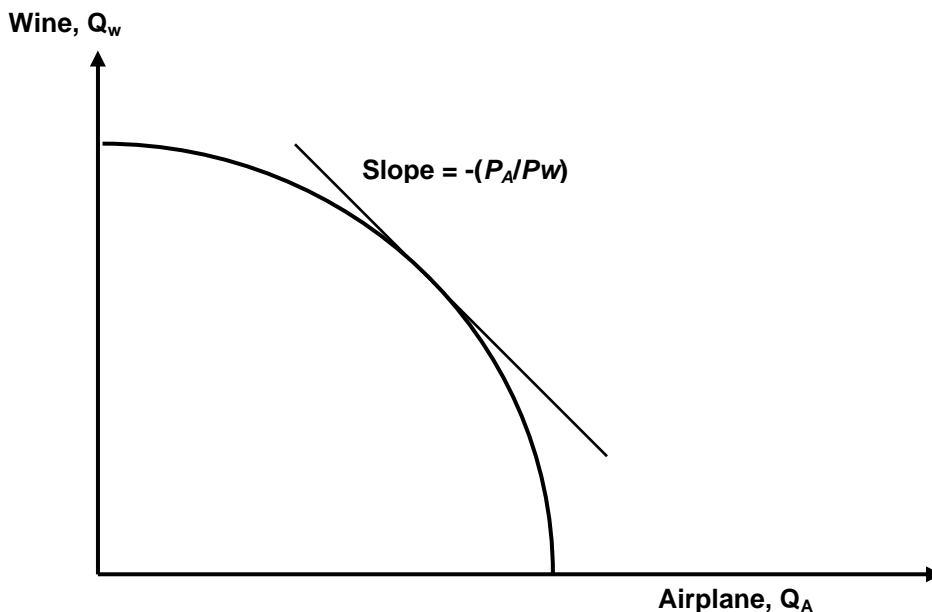
**The obvious effect is that wine prices drop which lower the return to owning a vineyard. In addition since labor moved out from wine sector returns to V will fall because less labor is available to work with same amount of V.**

**K:**

$$p_A \text{ no change, but } MPK \uparrow \Rightarrow R_K \uparrow$$

**As labor moves into airplane sector returns to K increase because more labor is available to work with same amount of capital.**

3. Draw a PPF for France. Put the output of wine on the vertical axis and the output of airplanes on the horizontal axis.



- a. Explain why the PPF looks different from the one we drew for the Ricardian model.  
**The difference between the PPF in specific factor model and Ricardian model is that in the Ricardian model the PPF is a straight line whereas in the SF model the PPF is curved. This is because in the SF model as we produce more of a good the opportunity cost of the good increases whereas in the Ricardina model the opportunity cost is constant.**

b. Pick an output ratio (wine/airplanes) = 1. What is the slope of the French PPF at this output ratio equal to and why? (I want an equation here, not a number.)

**The slope of PPF is equal to the ratio of MPL's. And the ratio of the MPL's is equal to the relative prices. This relation is coming from the labor demand equations**

$$W_a = P_a \cdot MPL_a$$

$$W_w = P_w \cdot MPL_w$$

**Wages are equal across sectors. Therefore we can write  $P_a \cdot MPL_a = P_w \cdot MPL_w$ .**

**This implies  $\frac{P_a}{P_w} = \frac{MPL_w}{MPL_a}$**

c. Decrease the output ratio (wine/airplanes) to 1/2. How has the slope of the French PPF changed and why?

**To decrease the output ratio to 1/2 we need to move labor out of the wine sector and into the airplane sector. As a result  $MPL_A$  falls and  $MPL_w$  increases. The ratio  $\frac{MPL_w}{MPL_a}$  rises, the slope of the French PPF increases (becomes steeper.)**

4. Use what you have learned from questions 2 and 3 to draw a relative supply (RS) curve showing how the relative output of wine/airplanes changes as the relative price of wine/airplanes changes.

Think of this two ways:

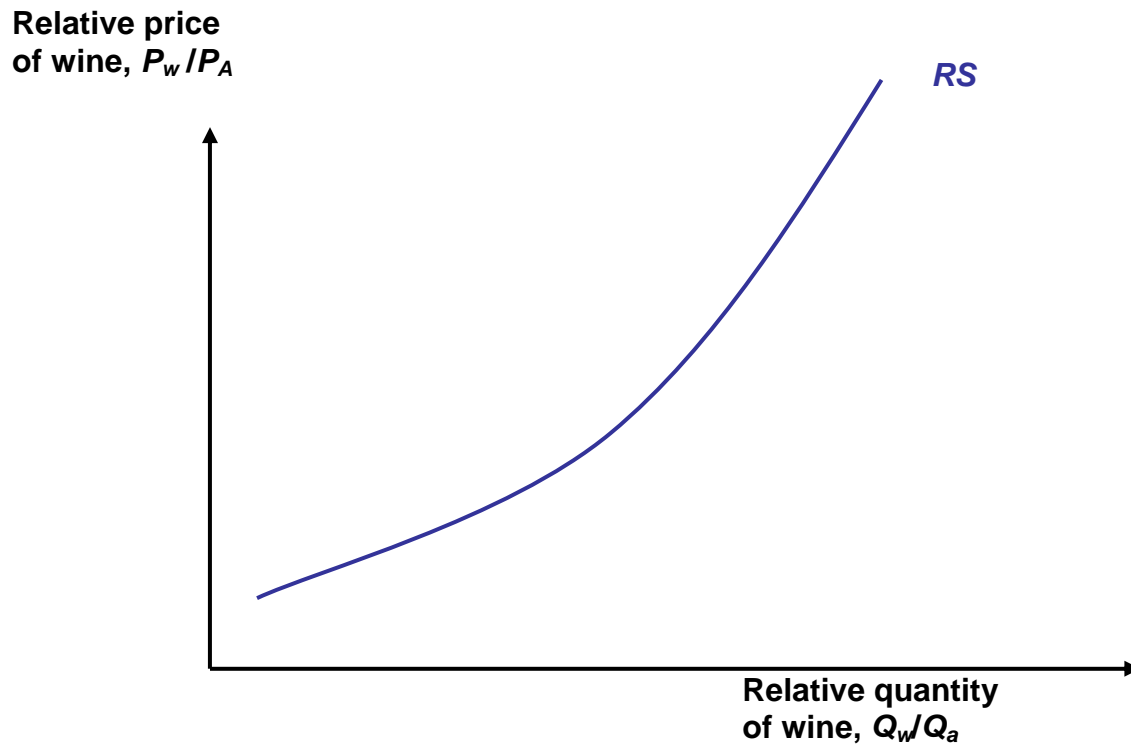
1. How will output adjust as prices change?
2. How will prices change as output adjusts?

To do the first, let  $\frac{P_w}{P_a}$  rise. **This shifts the labor demand curves in the bucket diagram so that labor moves out of airplanes and into wine, the output of wine rises and the output of airplanes falls. The ratio  $\frac{Q_w}{Q_a}$  rises.**

To do the second, ask how a change in the output ratio would change the cost of production. Let  $\frac{Q_w}{Q_a}$  rise. **To make this happen you need to move labor into wine production and out of airplanes. This means that, at the margin, labor is becoming less productive in the wine sector and more productive in the airplane sector, or**

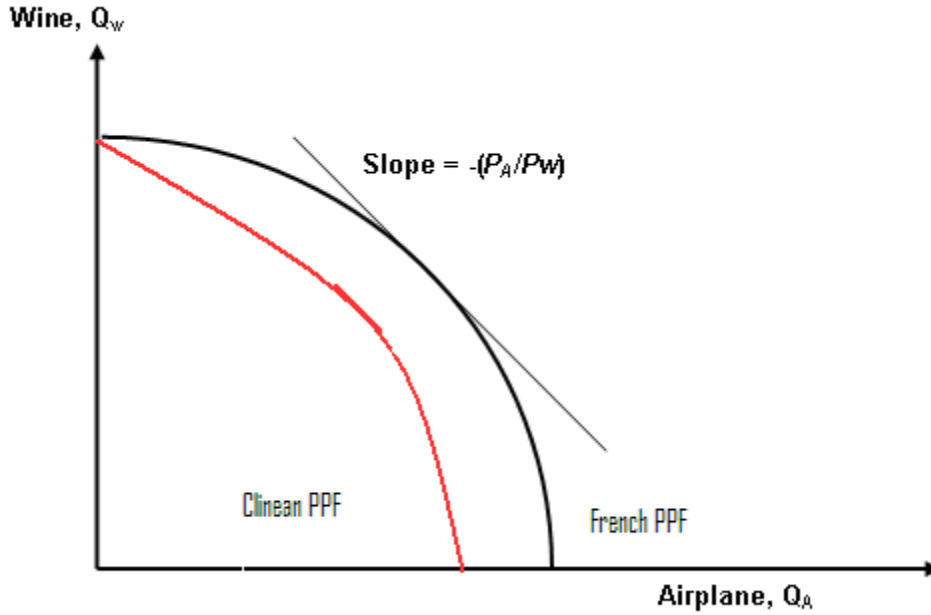
$\frac{MPL_a}{MPL_w}$  is rising. What does that do to prices?  $\frac{P_w}{P_A} = \frac{MPL_A}{MPL_W}$ , so the price of wine relative to airplanes has to rise as a result.

Either way, you get an upward sloping RS curve.



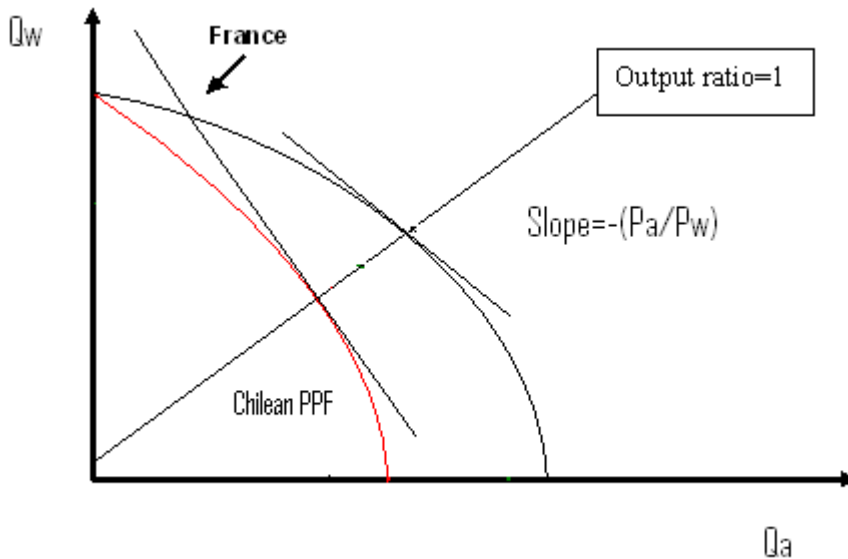
Consider a second country, Chile. Chile has the same size labor force (L), the same number of vineyards (V), the same demand for and the same technology for producing airplanes and wine as France. However, France has more airplane capital,  $K^F > K^C$ .

5. Recopy the French PPF from question 3.
  - a. On the same graph, draw the Chilean PPF.



Since they have the same amount of labor and V, when all labor is making wine they can produce the same amount of wine. But France has more airplane capital, meaning that a shift of labor toward airplanes generates more airplane output in France than in Chile.

- a. Pick an output ratio (wine/airplanes) = 1. Compare the slopes of the French and Chilean PPF's at this output ratio.



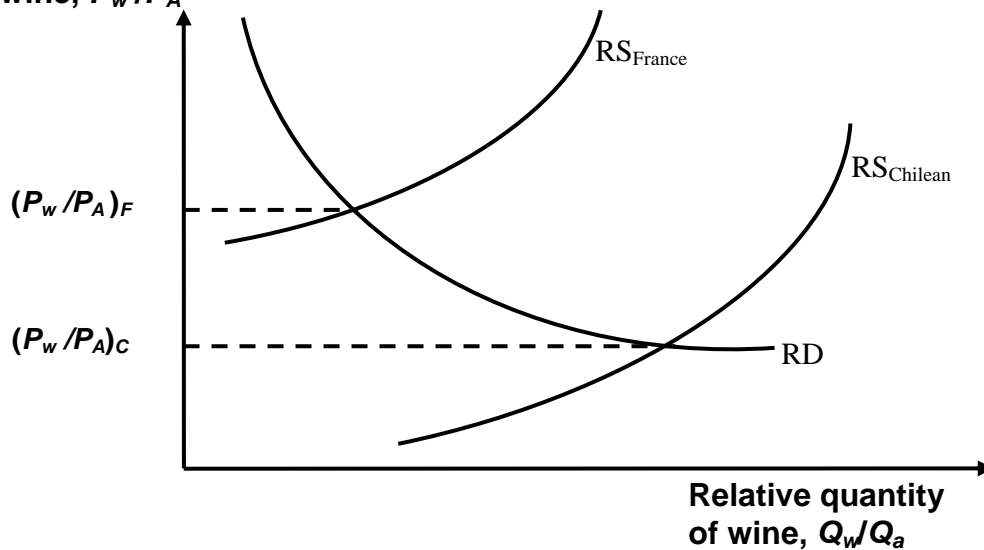
To pick a constant output ratio, draw a straight line running through the origin. At all points on this line the output ratio is a constant.

The French PPF is shifted toward the x axis, i.e. airplane production. At any relative output ratio (wine/airplanes) the slope of France's PPF is flatter.  $\frac{P_a^F}{P_w^F} < \frac{P_a^C}{P_w^C}$  implies the opportunity costs of producing wine is higher for France than for Italy.

6. Recopy the French relative supply curve wine/airplanes from question 4.

a. On the same graph, draw the Chilean RS curve.

Relative price  
of wine,  $P_w/P_A$



At any output ratio (wine/airplanes) France has a higher opportunity cost of producing wine. At any  $\frac{P_w}{P_a}$  France can produce less  $\frac{Q_w}{Q_a}$ .

b. Combine this with a relative demand curve to show how relative prices of the two goods differ across the two countries in autarky.

**The relative price of wine is higher in France.**

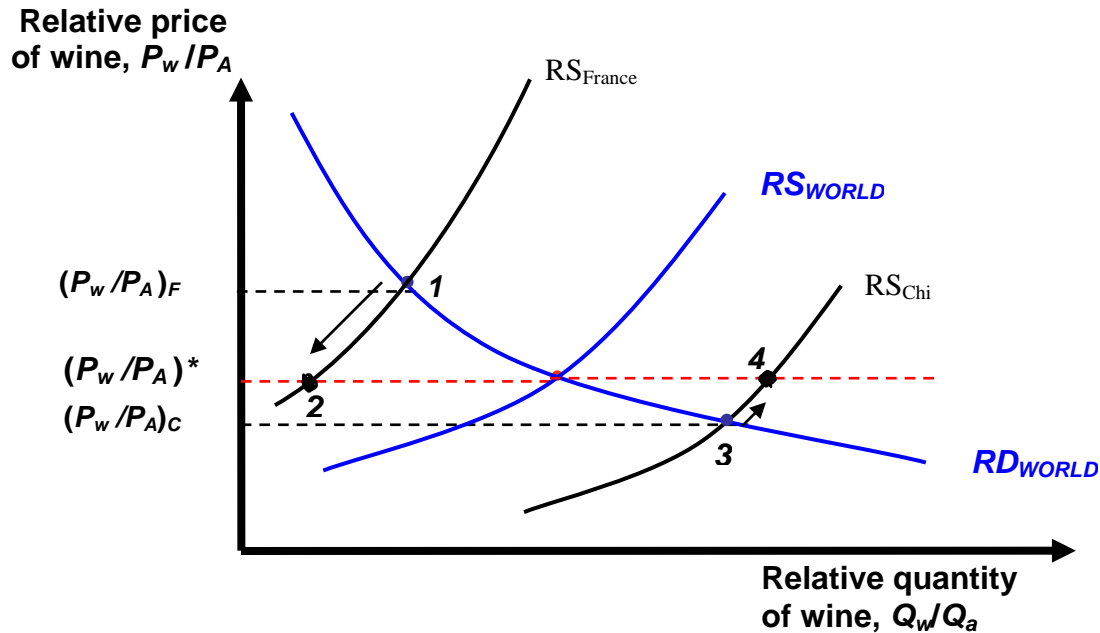
7. Now that you know autarky prices (comparative advantage), we can analyze trade and its effects on each economy.

a. Describe the pattern of trade and changes in the pattern of output in each country.

Since Chile has a lower  $\frac{P_w}{P_a}$  in autarky, it exports wine. France has a lower  $\frac{P_a}{P_w}$  it exports

airplanes. French airplane production rises while wine production falls. Chilean wine production rises while airplane production falls.

b. Copy the RS curves from question 6 and show how each country moves along their RS curve as a result of trade. Show the point at which these countries stop specializing (hint: check the arbitrage conditions).



$(P_w/P_A)^*$  is the free trade price.

**Specialization;**

**France:**  $Q_A \uparrow, Q_w \downarrow \Rightarrow$  move along  $RS_{\text{France}}$  from 1 to 2

**Chile:**  $Q_w \uparrow, Q_A \downarrow, \Rightarrow$  move along  $RS_{\text{Chi}}$  from 3 to 4

**Note:** These moves cause prices to converge at red line.

c. For each country separately, compare autarky relative prices (wine/airplanes) to free trade prices in each country. (Hint: do they move up? down? stay the same?)

**France:** Compare to autarky price relative price of wine falls.

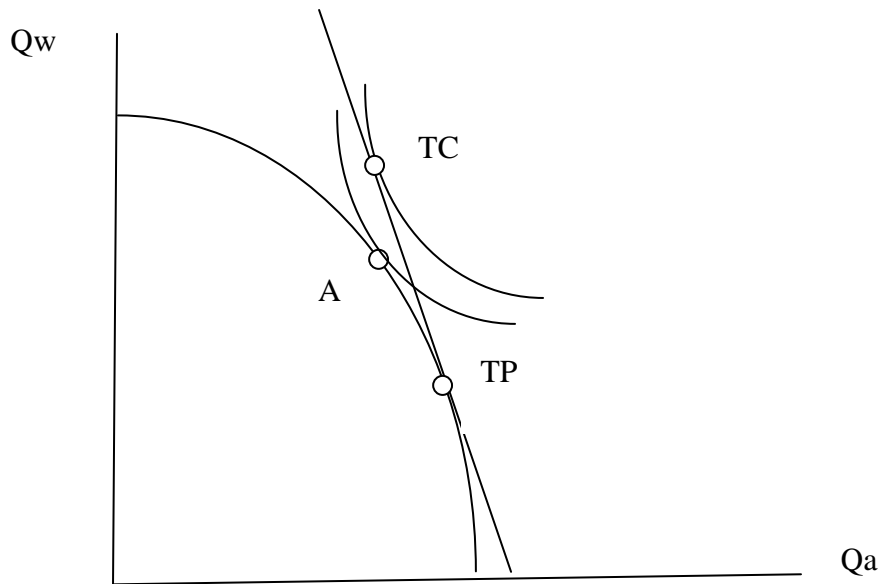
**Chile:** Compare to autarky price relative price of wine rises.

d. How do these goods price changes affect the return to K and V in France? In Chile?

**In France:** Returns to K increases and return to V falls. **In Chile:** Returns to V increases and return to K falls. See answer to problem 2 for details.

8. Welfare gains.

a. Redraw the French PPF and show movement along the PPF as a result of the move from autarky to free trade.



Point A is the autarky point (production and consumption)

As a result of free trade, France moves to point TP ("trade production"). Note also that the slope of the PPF ( $P_a/P_w$ ) at TP is steeper than the slope of the PPF at A. WHY? Because trade causes the price of France export good to rise relative to its import good ( $P_a/P_w$  increases).

The new consumption frontier is that straight line touching the PPF at the point TP, and with slope =  $MPL_w/MPL_a = P_a/P_w$ .

Finally, there are two curved lines, representing the indifference curves for consumers in France. At the free trade consumption point (TC) they can achieve a higher level of utility than they can at the autarky point.

b. Show the new consumption frontier.

**See the above figure.**

c. Look at the French economy in the aggregate. Has it gained or lost from trade? Has Chile?

**As a result of trade, French economy moves to a higher CPF and gains from trade. Same thing is true for the Chilean economy. Both countries gain from trade.**

d. Is there anyone in France who might, on pure economic grounds, oppose the move to freer trade? In Chile?

**In the aggregate both countries gain from trade but the owners of vineyards may oppose the freer trade because in France the returns to owning a Vineyard will fall. Similarly in Chile owners of capital machinery might oppose the freer trade because the return to capital machinery will decrease as a result of free trade.**