SECTOR-SPECIFIC CAPITAL (RICARDO-VINER) MODEL

ASSUMPTIONS

Two goods, two countries. Goods can be traded but not factors across countries.
Capital specific to sectors, labor mobile across sectors.
Constant returns to scale in each sector; perfect competition in all 8 markets:
2 worldwide for the two goods, and 3 for factors within each country

NOTATION

Goods, X and Y, prices P_X and P_Y

Capital endowments given (exogenous), specific to sectors, K_X and K_Y

Labor endowment L, given. Quantities in the two sectors L_X and L_Y; $L_X + L_Y = L$

L is exogenous, but L_X and L_Y are endogenous

Production functions $X = F_X(K_X,L_X)$, $Y = F_Y(K_Y,L_Y)$.

Wage W; returns to capital in the two sectors R_X, R_Y

Foreign country variables with asterisk * ; home without.

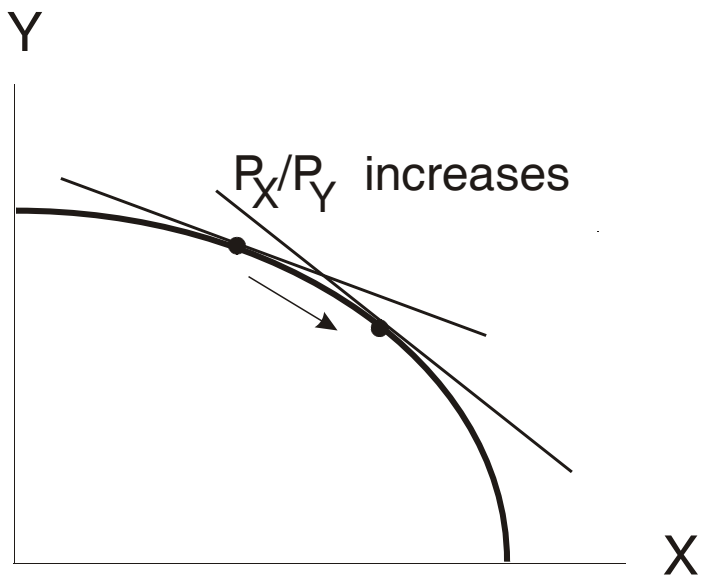
PRODUCTION

Diminishing returns to labor working with a fixed amount of capital in each sector

MPL_X falls as more labor moves into X

MPL_Y rises as more labor moves out of Y

$MRT = MPL_Y / MPL_X$ rises; PPF gets steeper



Example:

$$X = (K_X L_X)^{1/2} \quad , \quad Y = (K_Y L_Y)^{1/2}$$

$$L_X = X^2 / K_X \ , \ L_Y = Y^2 / K_Y$$

$$L = L_X + L_Y = X^2 / K_X + Y^2 / K_Y$$

PPF is an ellipse

Chosen point along it is found by tangency with price ratio P_X/P_Y

As P_X/P_Y increases, supply response is gradual

Optimum output mix
(maxes GDP at given prices)
satisfies tangency condition

$P_X / P_Y = MRT = MPL_Y / MPL_X$

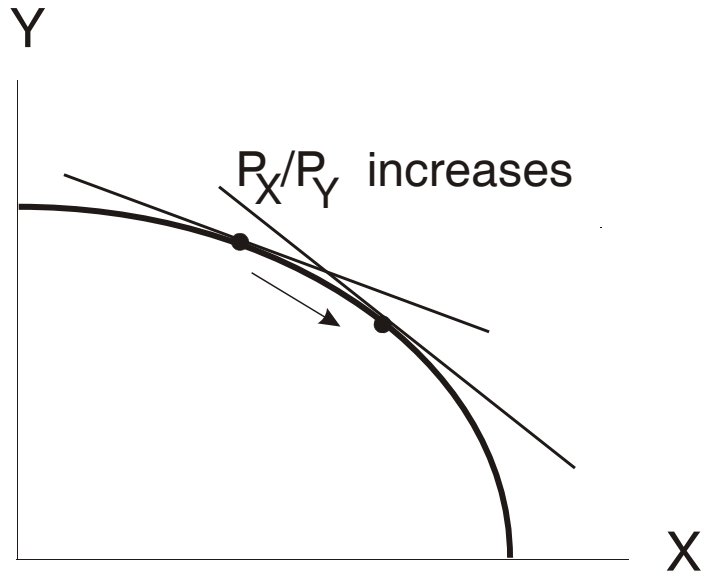
Equivalent to $P_X \ MPL_X = P_Y \ MPL_Y$
efficient labor allocation

Supply response: each of X, Y is

function of relative price P_X / P_Y ,
X increasing, Y decreasing.

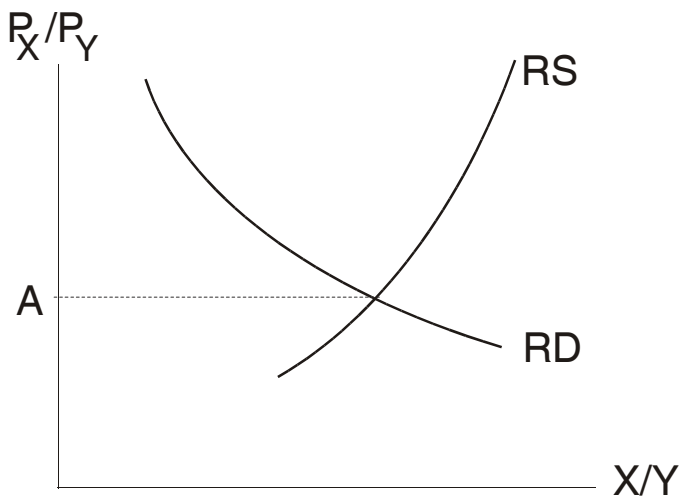
So relative supply X / Y is an

increasing function of P_X / P_Y



AUTARKY EQUILIBRIUM

Intersection of RD and RS;
similarly foreign.



TRADE EQUILIBRIUM

Relative supply curves RS, RS*

World's RS^W is weighted average

Assume identical homothetic preferences

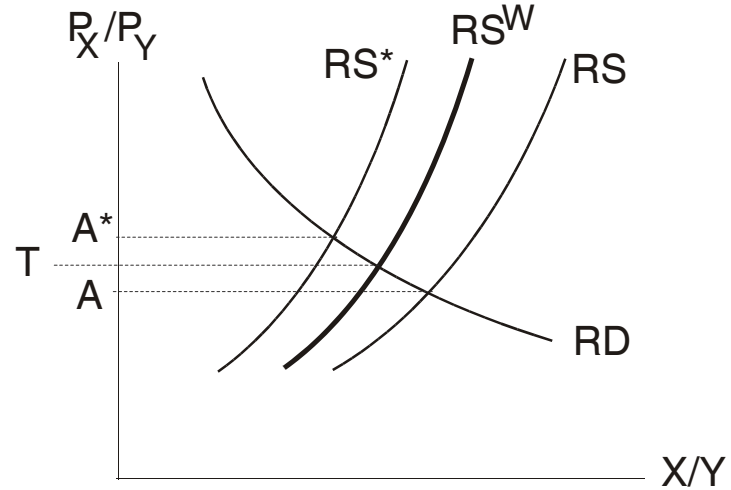
relative demand RD = RD* = RD^W

Autarkic equilibrium relative prices

at levels shown as A, A*

Trading equilibrium at level T,

between the autarkic ones as usual.



As shown here, Home's RS is to the right of Foreign's RS*

Home's autarkic $(P_X/P_Y)^A$ is less than foreign's autarkic $(P_X/P_Y)^{A*}$

That is, Home has comparative advantage in X.

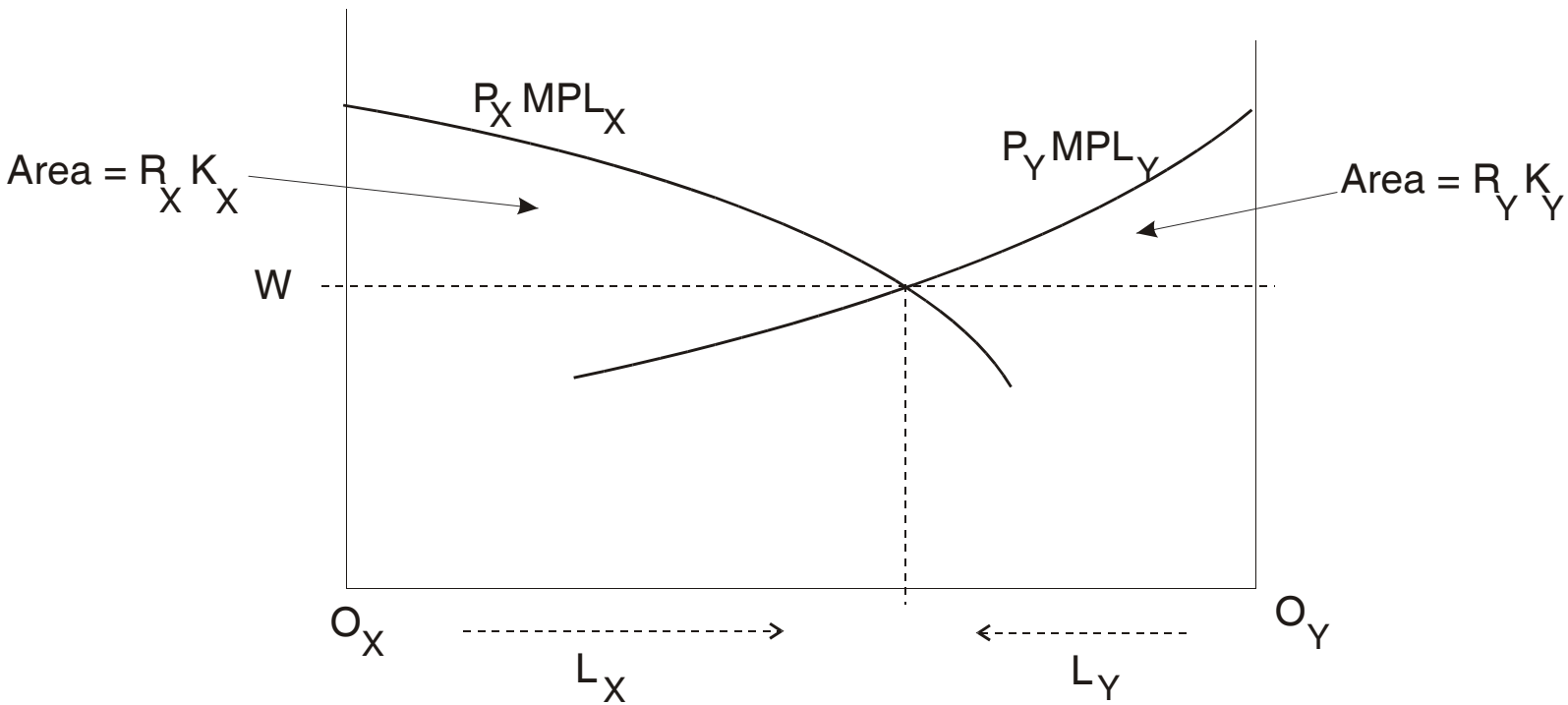
What is the underlying cause of this? Differences in factor endowments.

Intuitively, a higher K_X and/or lower K_Y will shift RS to the right.

Effects of L are ambiguous. Will study example in precept.

ANOTHER PERSPECTIVE ON PRODUCTION

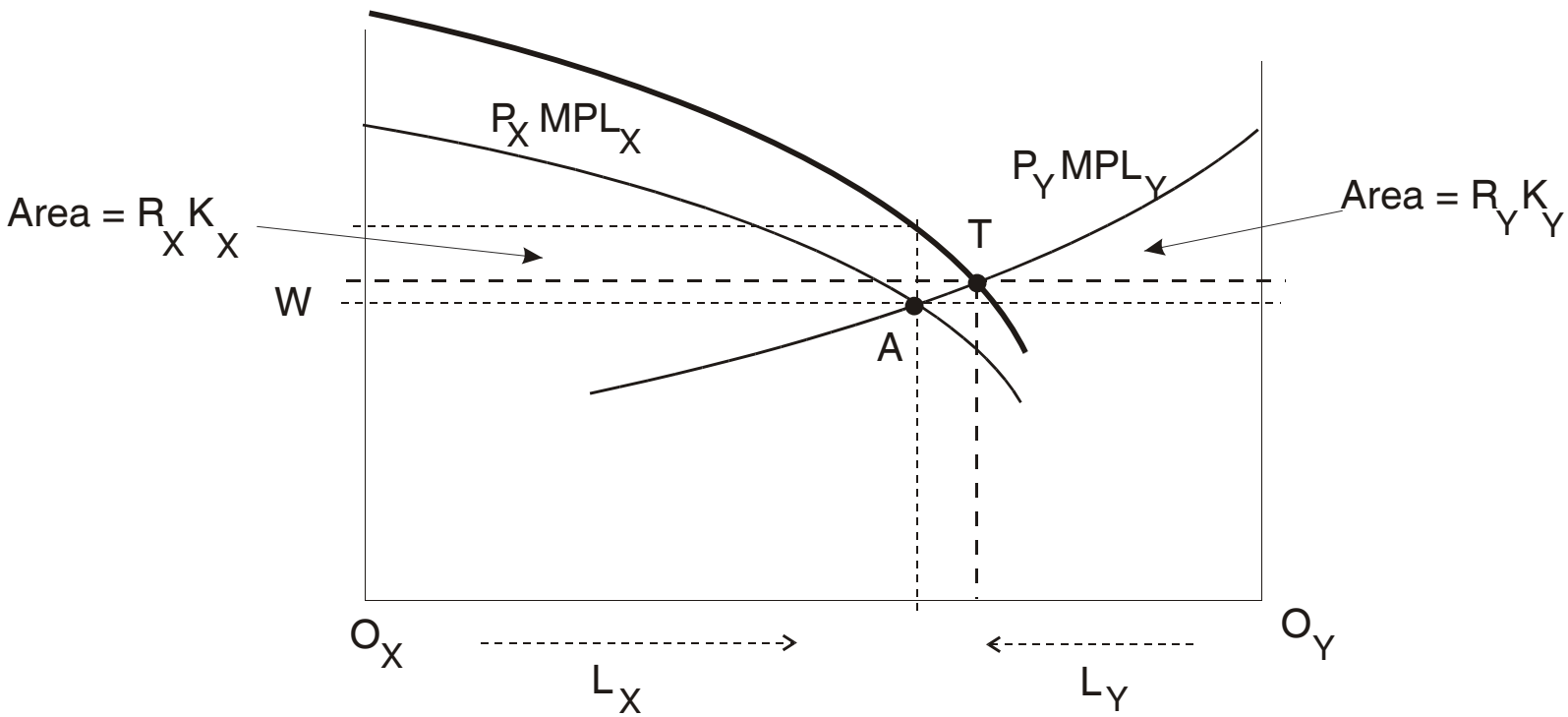
Along a line of total length L, show L_X and L_Y from opposite origins O_X and O_Y
On vertical axis show the values of marginal products of labor
Efficient allocation is where the two curves intersect.
Values of total products of X, Y are areas under the two marginals curves
Wage is the common height; total returns to capitals are the "surplus" triangles.



EFFECTS OF TRADE ON LABOR ALLOCATION AND FACTOR REWARDS

Consider Home country with comparative advantage in X

Trade raises its P_X / P_Y . Measure everything in units of Y so keep P_Y =1, raise P_X



P_X MPL_X curve rises vertically in the same proportion as the rise in P

to the thicker position. Intersection with P_Y MPL_Y shifts from point A to T

Labor shifts from the Y sector to the X sector. What happens to factor returns?

W rises but less than in proportion to the rise in P_X

So the purchasing power of the wage (W/CPI) can go either way,
depending on the relative weights of X and Y in workers' CPI

The capital return "triangle" in the Y-sector gets smaller

That area equals $R_Y K_Y$, but K_Y is unchanged, so R_Y falls (in units of Y)

So R_Y / P_X also falls; Y-sector capital is unambiguously worse off.

The capital return "triangle" in the X-sector would rise in the same proportion as the rise in P_X even without the labor reallocation; with that, it increases by even more.

So R_X / P_X increases; then R_X in units of Y also increases
X-sector capital is unambiguously better off

Algebraically: Labor reallocation implies L_X / K_X increases, L_Y / K_Y decreases

So $MPL_X = W / P_X$ decreases; $MPL_Y = W / P_Y$ increases

$MPK_X = R_X / P_X$ increases; $R_X / P_Y = (R_X / P_X)*(P_X / P_Y)$ increases

$MPK_Y = R_Y / P_Y$ decreases; $R_Y / P_X = (R_Y / P_Y)*(P_Y / P_X)$ decreases

Further points re effects of trade

[1] The same analysis also applies to any increase in terms of trade P_X / P_Y
for any reason, not just move from autarky to trade.

[2] Exercise: Use same method of analysis
(shifts of MPL curves, changes in K/L ratios in the two sectors, etc.)

to find the effects on factor returns W, R_X, R_Y

of changes in factor endowments L, K_X and K_Y and
of technical progress (shifts of production functions)

DIFFERENCE BETWEEN PURE EXCHANGE AND SECTOR-SPECIFIC CAPITAL MODEL

In pure exchange model, distributive conflict was purely across sectors
In sector-specific capital model, conflict remains between the two specific capitals,
but labor in the "losing" sector can mitigate its loss by reallocating.
What happens when in a longer run where capital can also reallocate?
That is the subject of the next model: Heckscher-Ohlin.
There the conflict will be along more conventional "class" lines.

DIFFERENCES BETWEEN RICARDO AND SECTOR-SPECIFIC CAPITAL MODELS

[1] In Ricardo's model, if the two countries had identical technologies,
there would be no difference in autarkic relative prices,
so no comparative advantage and no reason to trade.
In sector-specific capital (Ricardo-Viner) model, even if the two countries
have identical technologies (same production functions $F_X(.,.)$, $F_Y(.,.)$),
their factor endowment differences can create comparative advantage.

[2] In Ricardo, trade can lead to complete specialization: import-competing sector
disappears completely. That cannot happen in Ricardo-Viner.
If all labor were to leave the Y sector, the marginal product of labor there,
working with the given fixed K_Y , would be very high.
So it would be profitable / efficient to bring back some labor into Y
Efficiency / equilibrium condition is equality of values of *marginal* products.

[3] In Ricardo there was no distributional conflict.
In Ricardo-Viner there is very sharp distributional conflict between
owners of the specific capital in the two sectors.
Workers may side with either; depends on their consumption pattern.