Problem Set 3 - *Answers*
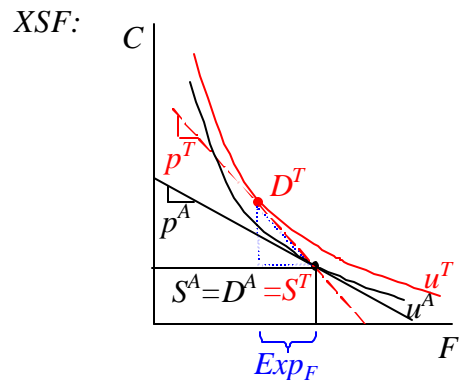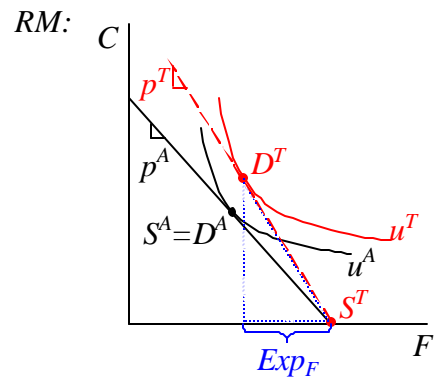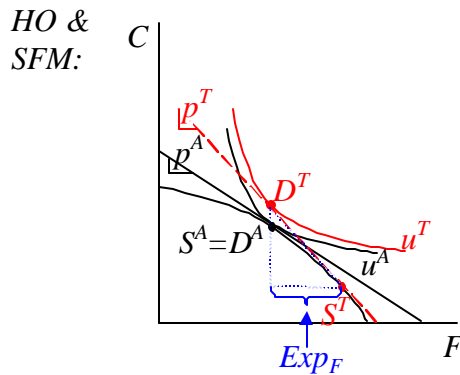
Specific Factors Model

1. By now you have seen four 2-good models in this course: The Ricardian Model (RM), Heckscher-Ohlin Model (HO), the Extreme Specific Factors Model (XSF), and the (Standard) Specific Factors Model (SFM). Determine the validity of each of the statements below for each of these models. Since answers may depend on whether a country is specialized or diversified, you should assume in all models except RM that in any trading equilibrium the country or countries are diversified (producing two goods) and that any changes are small enough that the pattern of specialization does not change. In RM, assume that countries are producing only one good with trade. Assume also that relative prices with trade are always strictly different from relative prices in autarky.

    Autarky vs. Trade:
    a. A country will export the good for which its autarky relative price was lower than the world price, and it will gain by doing so.

    True in all models, as illustrated here. (For this purpose there is no important difference between the PPFs for HO and SFM, so a single diagram is enough.) For each model is shown the case of the world relative price of food, p^T being above the autarky price, p^A.

b.   In the move from autarky to free trade, a country increases its production of the good it exports.

This is true in every model except XSF, where outputs of both goods are fixed at the levels that can be produced by the available specific factors. All of this can be seen above in the figures in part (a).

c.   The real return to some factor of production must rise in the move from autarky to free trade.

This is true in all four models. One way of seeing it is simply from the gains from trade. Since the country gains from trade (moves to a higher indifference curve) in all four cases, and since all income in these models goes to factors of production, it must be true that factors in the aggregate are better off. So at least one of the factors, whatever and wherever they are, must earn a higher real return. Of course, we also know enough about the models to say more about which factor or factors these are. In the cases shown in part (a), of a country for which p_F/p_C rises with trade:

RM: There is only one factor, labor, and its wage remains the same in terms of Food but rises in terms of Cloth: $w/p_F = 1/a_{LF}$ is unchanged; $w/p_C = (w/p_F)(p_F/p_C)$ rises.

HO: With labor-intensive food, the increase in p_F/p_C raises the real return to labor, according to the Stolper-Samuelson Theorem. Proof is shown at the right, using a fall in p_C in the Lerner Diagram. Since this causes w to rise, while p_F is constant and p_C falls, this is a rise in both w/p_F and w/p_C.
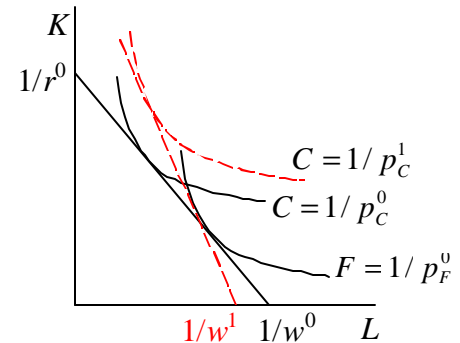
XSF: Here, since marginal products do not change, all factor prices remain constant in units of what they produce. But both specific factors in the Food industry are paid more in terms of cloth: $w/p_C = (w/p_F)(p_F/p_C)$ rises and $r/p_C = (r/p_F)(p_F/p_C)$ rises.

SFM: The rise in the Food price causes labor in the Food sector to expand as shown at the right. This increases MPK_F and therefore also r_F/p_F. Since $r_F/p_C = (r_F/p_F)(p_F/p_C)$ therefore also rises, capital employed in Food is better off.
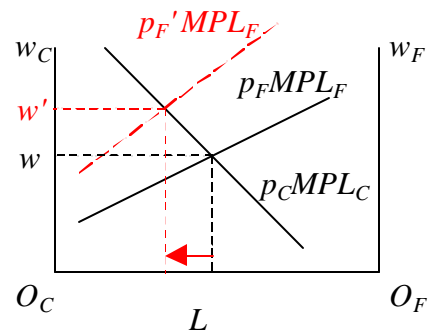
Small Open Economy:

   d. If a country's endowments of all factors of production rise by 10%, none of its factor prices will change.

   True in all models. Since goods prices are unchanged in a small open economy, we only need to look at nominal factor prices:

   RM: $w=p_F/a_{LF}$ is unchanged

   HO: The proportional expansion in all factor endowments (see diagram at the right) leaves the country in the same diversification cone, and therefore with the same factor prices, w^0 and r^0.

   XSF: Since all factors endowments are expanding in the same proportion, including all specific factors, the ratios of factors employed in each sector are unchanged. It follows that the marginal products of factors are unchanged and also the factor prices.
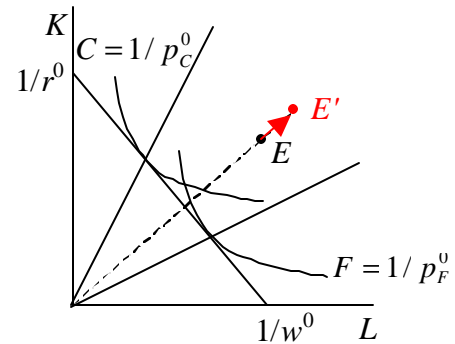
   SFM: This would be somewhat tricky to draw, since it involves shifting both the labor demand curves (i.e., the $p_J MPL_J$ curves), due to the changes in specific capital endowments, and at the same time expanding the box due to the increased labor endowment. However, without doing all of that, one might guess that this proportional expansion would leave all relative amounts unchanged, and then just check that this is indeed an equilibrium. That is, suppose that both industries expand their employment of both labor and capital by 10%. This will keep the factors fully employed, and since marginal products depend only on the ratios of factors, these will not change. That means that the initial factor prices also need not change, and that this is an equilibrium.

e.   If a country's endowment of labor (including labor in each industry in XSF) rises by 10%, the real wage of labor will fall and the output of any good that was already being produced will increase.

Only in the two variants of the Specific Factors Model is all of this true. In the other models, at least one of these effects does not occur:

RM: Here, with initial specialization in Food, the output of food increases. But the wage does not fall, since it continues to equal p_F/a_{LF}.

HO: Here both parts are false. Due to Factor Price Equalization, any change in endowments that leaves the country in the diversification cone leaves factor prices unchanged. As for output, the Rybczynski Theorem tells us that output of the labor intensive good will rise, but output of the other good will fall.

XSF: With more labor in each sector, both outputs will rise. And due to the Law of Diminishing Returns, having more labor without an increase in specific capital will cause the marginal product of labor to fall, so that both forms of specific labor will earn lower wages.

SFM: Here the expansion of the labor force must be allocated by the market across the two sectors. In the diagram below, this appears as a widening of the diagram, moving the O_F origin to the right and shifting the p_FMPL_F curve along with it. The result, as shown, is a fall in the equilibrium nominal wage, which is also a fall in the real wage since both prices are constant.
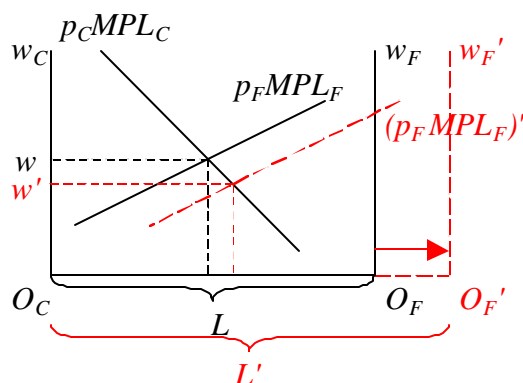
f.   If productivity increases (more output for any given inputs) in one sector only, only the
output of that sector will change.

True in RM and XSF, not in the others:

*RM: The country is specialized in Food. If a_{LF} falls, then it will continue to produce food
since its comparative advantage in Food is increased, and it will be able to produce
more. (Of course, if the productivity increase is in the other sector, Cloth, where there is
no production, then the change will either leave its output unchanged at zero, or – if the
improvement is large enough to reverse comparative advantage – cause it to produce
there and cease producing Food. In that case, the statement would be false. But you
were told to assume that patterns of specialization do not
change.)*

*HO: Here there will necessarily be a change in output in
the other sector, as shown by the Lerner Diagram at the
right. The productivity increase shifts the unit-value
isoquant for Food in towards the origin, steepening the
common tangent and also rotating the diversification cone
counter-clockwise. Inputs to the Food sector move from v_F
to $v_F{}'$, expanding food output, and inputs in the Cloth
sector move from v_C to $v_C{}'$, causing the output of Cloth to fall.*
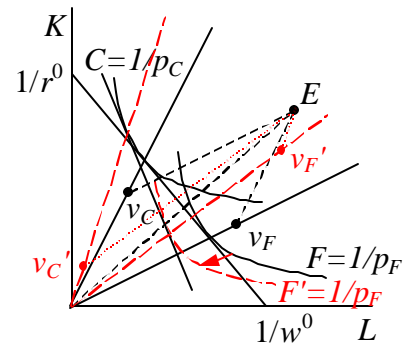
*XSF: Here the inputs to the other sector are unchanged, as is their productivity, so
output does not change.*

*SFM: The rise in productivity in, say, Food, shifts the
marginal product of labor there upward as shown at the
right. Labor is drawn into the Food sector and out of the
Cloth sector, reducing output of Cloth.*
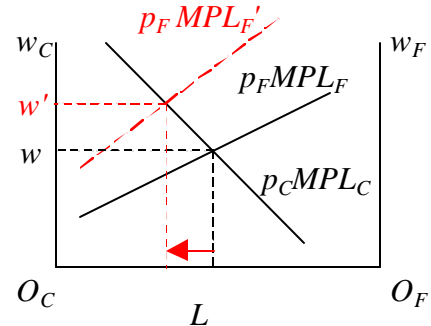
g. If the world relative price of food rises, the country will increase its relative supply of food.

This is true only where outputs can in fact vary, which is in HO and SFM:

RM: If the country is already completely specialized in Food, then its relative food output is infinite and cannot become any greater with a rise in price of Food. (Only if it was specialized in Cloth might a food price increase cause it to cease producing Cloth, start producing Food, and thus increase its relative supply of food from zero to infinity. But, again, you were told to assume that patterns of specialization do not change.)

HO: Here we have the standard effect of a price increase in the Lerner Diagram at the right. From the changes in factors employed it is clear that output of Food rises and output of Cloth falls.

XSF: Outputs cannot change here, since the factor inputs are fixed.

SFM: The rise in price of Food increases the Food sector's demand for labor, causing employment there to rise and employment in Cloth to fall, as in the figure at the right. This raises food output and lowers Cloth output.
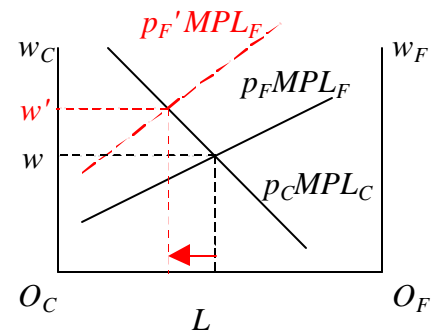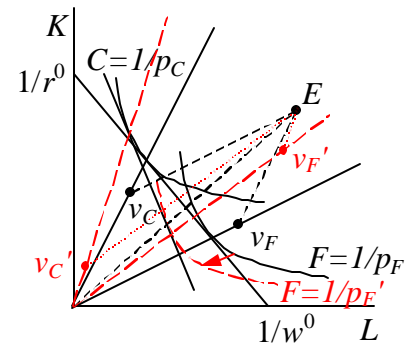
Two-Country World

h. If productivity increases (as in part (f)) in the import-competing sector of the Home country, the country will be better off.

RM: Here the country does not produce the import-competing good at all, and the productivity increase is assumed not to be large enough to change that. So the country is not affected at all and the statement is false.

HO, XSF, SFM: Assume as usual that the Home country exports Cloth and imports Food, so that this is a productivity increase in Food in Home. From the analysis in part (f) we know that Home's output of Food rises in all three cases, and its output of Cloth falls in HO and SFM. So in all cases, the world relative supply of Food shifts to the right, although the picture is different in XSF where the fixed inputs yield a vertical relative supply curve:
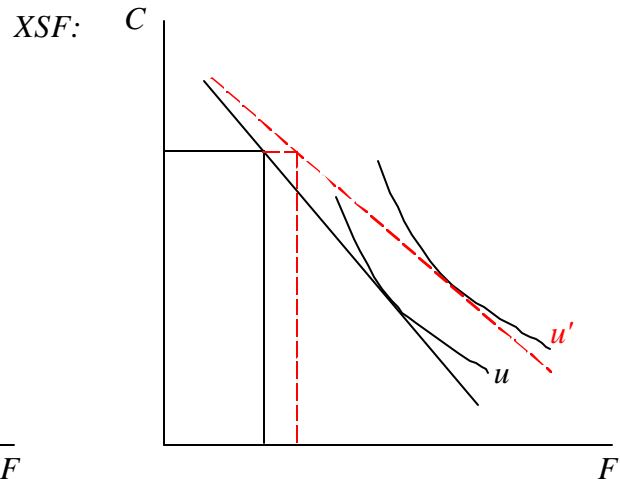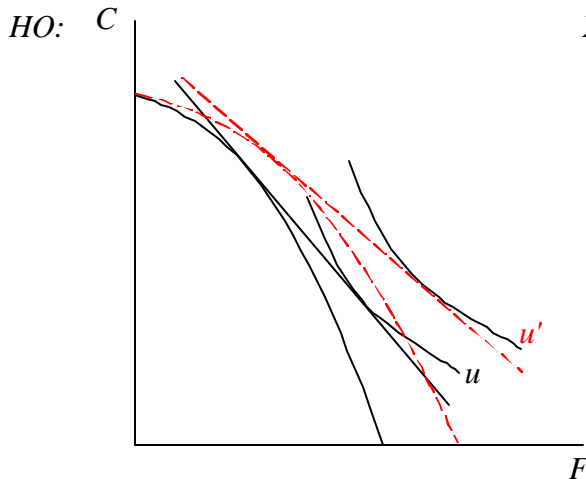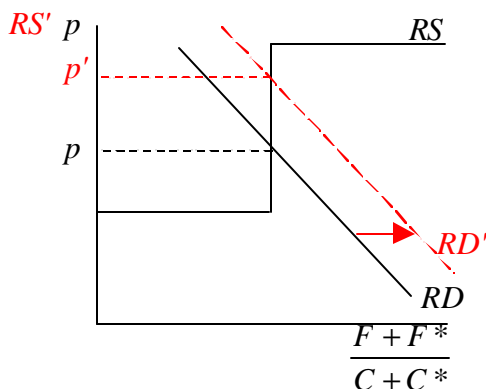
HO:
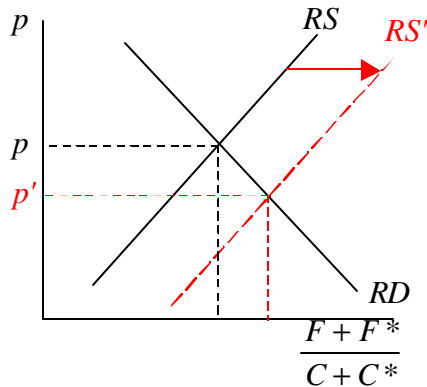
XSF:
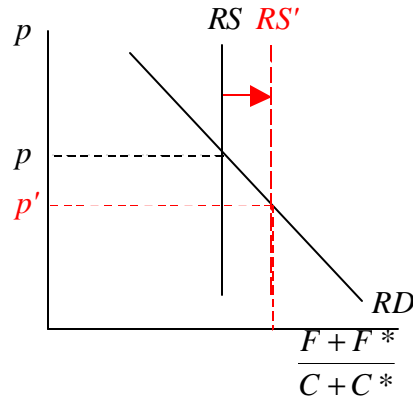
In all cases, the relative price of Food falls. Since the home country imports Food, this is an improvement in its terms of trade and the Home country as a whole benefits. Since it also benefited, at constant prices, from the increased income permitted by the productivity improvement, the country must be better off:
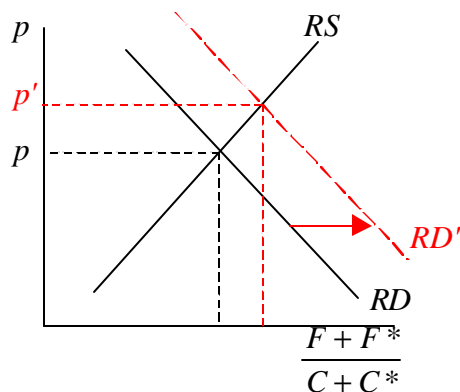
HO:

XSF:

i.   If global warming causes a worldwide change in preferences away from cloth and
toward food, the relative price of food will rise and relative output of food will increase.

*The shift in preferences toward Food will shift the world Relative Demand curve to the
right, since consumers everywhere will demand more Food and less Cloth at any given
prices. What this does to price and output depends on the relative supply curve, which is
upward sloping in HO and SFM, but is vertical in XSF (see above) and a step function in
RM. However, you are told to assume in RM that both countries are specialized and
remain so, which means that the equilibrium is in the vertical portion of it. Therefore the
cases are as follows, in all of which the relative price of food rises. But only in HO and
SFM does the relative output of food increase:*

RM:

HO: *XSF:*