Professor Robert Staiger

Economics 165
Problem Set 5

1.   Consider the 2-country 2-good Ricardian Trade Model.

(a) Depict graphically the free-trade equilibrium of the model when one country (country A) is "small" compared to the other country (country B).

(b) Demonstrate that A cannot increase its aggregate national income by imposing a tariff on its import good.

(c) Finally, suppose that A is pursuing a consumption goal, and determine whether an import tariff or a consumption tax would be a better policy for this purpose. What feature of the Ricardian Trade Model accounts for the special nature of your answer here?

2.   Consider the following "special case" of the two-country (countries A and B) two-good (goods x and y) basic trade model. Country A is endowed with capital and labor, and its technologies for producing x and y use capital and labor as inputs and exhibit constant-returns-to-scale. Country B, however, is special: while it also faces constant-returns-to-scale technologies for producing x and y, it is endowed with only labor, and its technologies for producing x and y require only labor as inputs.

In this setting, show that, if country B produces positive amounts of both x and y in the free trade equilibrium between it and country A, then the "optimal tariff" for country A (i.e., the tariff that maximizes A's aggregate social welfare) is zero (i.e., a policy of free trade).

3.   Using the Continuum-of-Goods Ricardian Trade Model, suppose that the home-country unit labor requirement for good $z \in [0,1]$ is given by $l(z)=l+\theta z$, while the foreign-country unit labor requirement for good $z \in [0,1]$ is given by $l^*(z)=l^*+\theta^*z$. Let us interpret θz as the amount of labor required to comply with the pollution standards of the domestic country when producing one unit of good z in the domestic country. Likewise, θ^*z is the amount of labor required to comply with the pollution standards of the foreign country when producing one unit of good z in the foreign country. So for a given pollution standard, we can think of low-z goods as "naturally clean" goods, because it doesn't take much labor to clean up the production process and meet the standard, while high-z goods are "naturally dirty" goods.

Show that, if the domestic country has strict environmental standards while the foreign country has none (i.e., if $\theta>0=\theta^*$), then (i) the domestic country will specialize in a range of naturally clean goods, and (ii) if the domestic country tightens its pollution standards (i.e., if θ is increased), then a range of the dirtiest goods among those originally produced in the domestic

country will stop being produced domestically and will instead be produced in the foreign country.

4.   On Monday, May 1, 2006, hundreds of thousands of immigrants across the United States skipped work to create a "Day Without an Immigrant," hoping to influence the debate in Congress over granting legal status to the estimated 11 million illegal immigrants in the country. The idea, in part, was to provide a graphic illustration of the economic impacts that deportation of large numbers of illegal immigrants would have in this country. The Congressional Budget Office (CBO) has been asked by Congress to assess the likely impacts that the temporary boycott had on economic activity during the day of May 1, and to evaluate whether these short run impacts are likely to be a good guide for the long term impacts if similar numbers of illegal immigrants are permanently deported as part of immigration reform.

You are a summer intern working for CBO, and here is your chance to really impress the boss, by answering questions (A), (B) and (C) below. In answering each of these questions, you may assume that the United States is a *small* open economy.

(A)   Use the Specific Factors Model (in which there is capital that is specific to the food sector, and capital that is specific to the clothing sector, and labor that is perfectly mobile between the two sectors) to make a prediction about the likely impacts that the boycott (i.e., the reduction in U.S. labor endowment) had on economic activity during the day of May 1 (i.e., the short run impact). In particular, what will happen to output in each sector and to real incomes of the non-boycotting workers and owners of each kind of capital when the U.S. labor endowment is reduced?
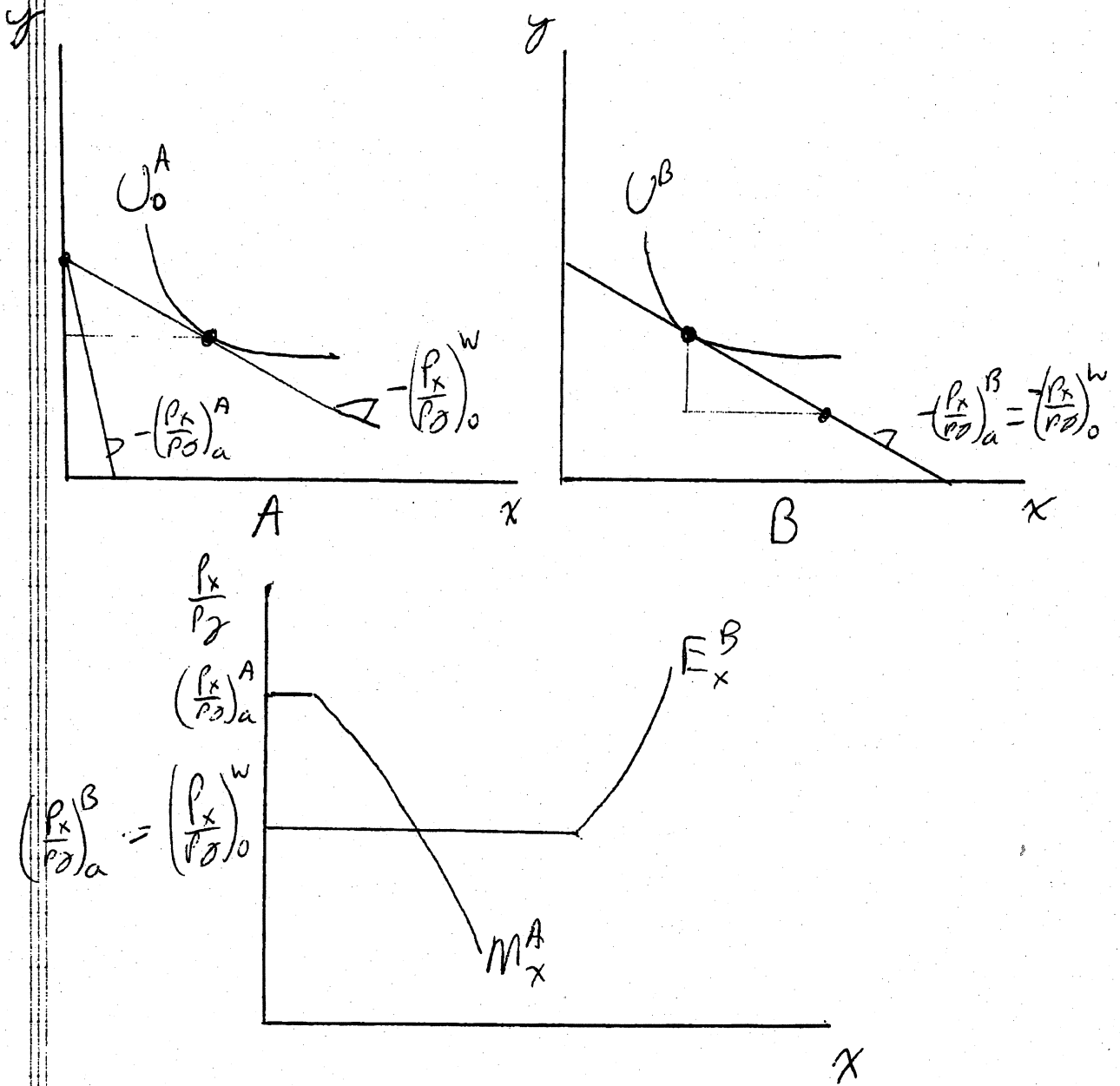
(B)   Use the Heckscher-Ohlin Model (in which there is capital and there is labor, and each is perfectly mobile between the capital-intensive food sector and the labor-intensive clothing sector) to evaluate the long term impacts if similar numbers of illegal immigrants are permanently deported as part of immigration reform (causing a reduction in U.S. labor endowment). In particular, what will happen to output in each sector and to real incomes of the remaining workers and owners of capital if the U.S. labor endowment is reduced? In light of your answer here and in part (A), are the likely impacts of the May 1 boycott a good guide for what we could expect in the long run if similar numbers of illegal immigrants are permanently deported?

(C)   There is some debate about whether the United States is better described as a Heckscher-Ohlin economy or a Ricardian economy. So just to be on the safe side, use the 2-good Ricardian Model (in which labor is the only factor of production, and is perfectly mobile between the food sector and the clothing sector) to evaluate the long term impacts if similar numbers of illegal immigrants are permanently deported as part of immigration reform (causing a reduction in U.S. labor endowment). In particular, what will happen to output in each sector (you may assume that the United States is initially specialized in the production of food) and to real incomes of the remaining workers if the U.S. labor endowment is reduced? In light of your answer here and in part (B), does it matter whether the United States is a Heckscher-Ohlin economy or a Ricardian economy for predicting the long run impacts of deporting illegal immigrant workers?
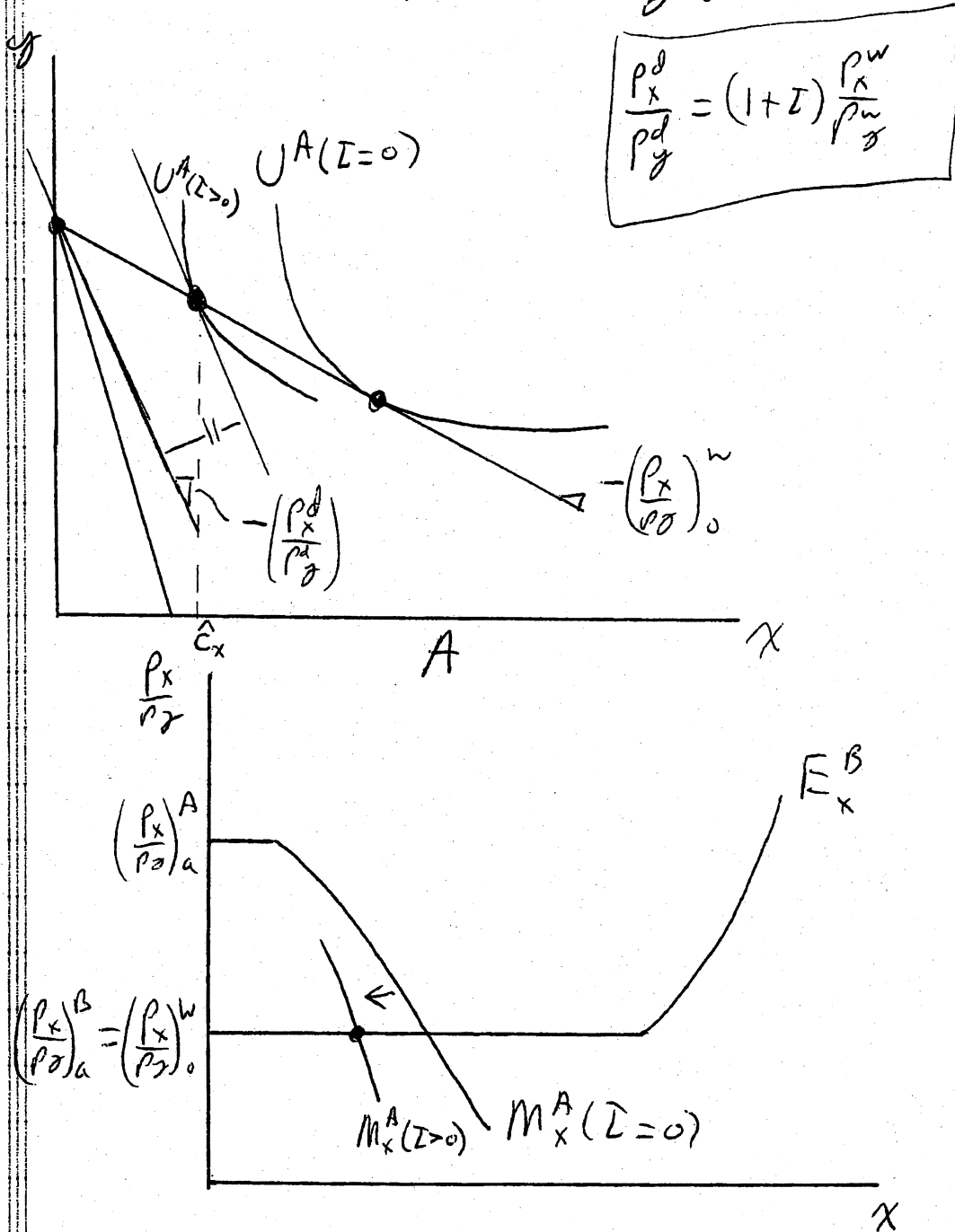
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Problem Set 5
Sketch of Answers
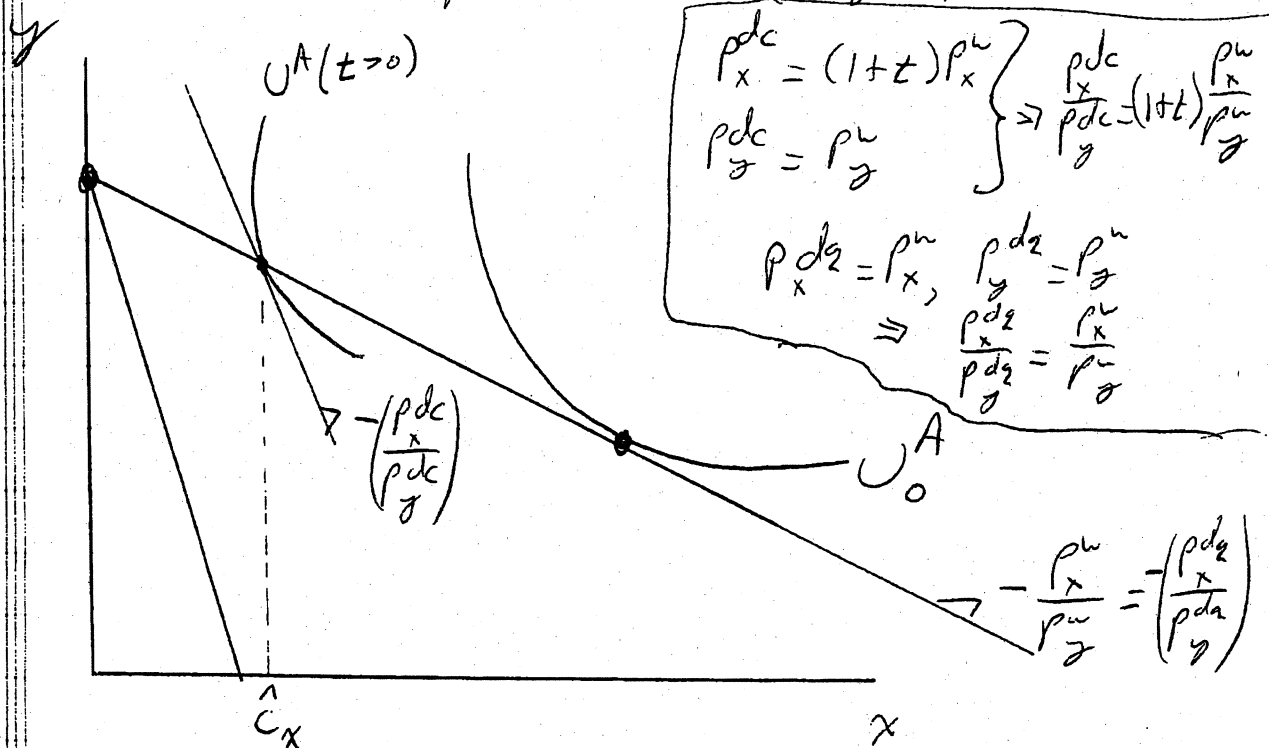
1. (a) The free trade equilibrium when A is small:

Left graph (A):
U_0^A

$-\left(\frac{P_x}{P_y}\right)_a^A$

$-\left(\frac{P_x}{P_y}\right)_0^W$

Right graph (B):
U^B

$-\left(\frac{P_x}{P_y}\right)_a^B = -\left(\frac{P_x}{P_y}\right)_0^W$

Bottom graph:
$\frac{P_x}{P_y}$

$\left(\frac{P_x}{P_y}\right)_a^A$

$\left(\frac{P_x}{P_y}\right)_a^B = \left(\frac{P_x}{P_y}\right)_0^W$

E_x^B

M_x^A

(b) A cannot increase its welfare with a tariff, owing to the fact that it is a "small" country:

$$\frac{P_X^d}{P_y^d} = (1+I)\frac{P_X^w}{P_y^w}$$

$$U^A(I>0) < U^A(I=0).$$

(c) An import tariff (I) and a consumption tax (t) are <u>equally good</u> instruments for pursuing a consumption goal, say, $C_x = \hat{C}_x$. Below is the consumption tax achieving $C_x = \hat{C}_x$:

$$
\left.\begin{array}{l} P_x^{dc} = (1+t)P_x^w \\ P_y^{dc} = P_y^w \end{array}\right\} \Rightarrow \frac{P_x^{dc}}{P_y^{dc}} = (1+t)\frac{P_x^w}{P_y^w}
$$

$$
P_x^{d_2} = P_x^w, \quad P_y^{d_2} = P_y^w
$$

$$
\Rightarrow \frac{P_x^{d_2}}{P_y^{d_2}} = \frac{P_x^w}{P_y^w}
$$

The utility level $U^A(t>0)$ pictured above is identical to the utility level $U^A(I>0)$ pictured in (b), because the tariff I only distorts consumer decisions in the Ricardian model, and leaves producer decisions undistorted, just as a consumption tax t does. The <u>special</u> nature of this answer reflects the production specialization exhibited by the Ricardian model.

2.

According to the description in the problem, Country B has the features of a Ricardian Model economy, while County A looks like a standard Basic Trade Model economy.

So if county B produces positive amounts of both x and y in the free trade equilibrium between it and County A, then we must have a situation such as:
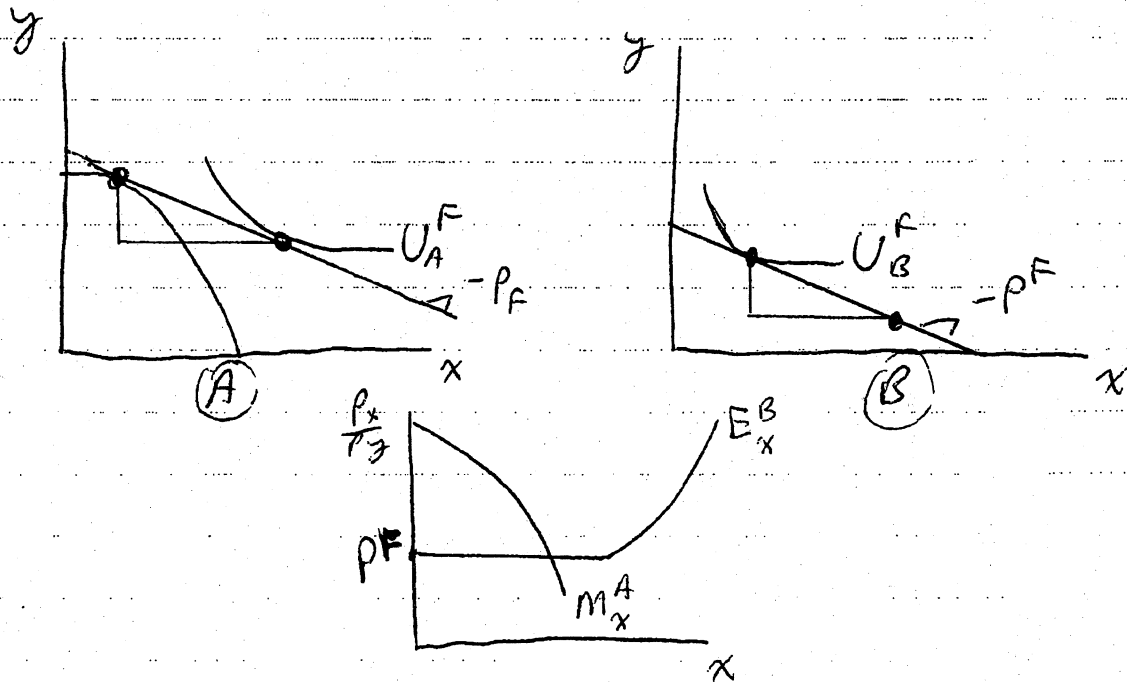
Now if country A considers any positive (and non-prohibitive) tariff, we have:
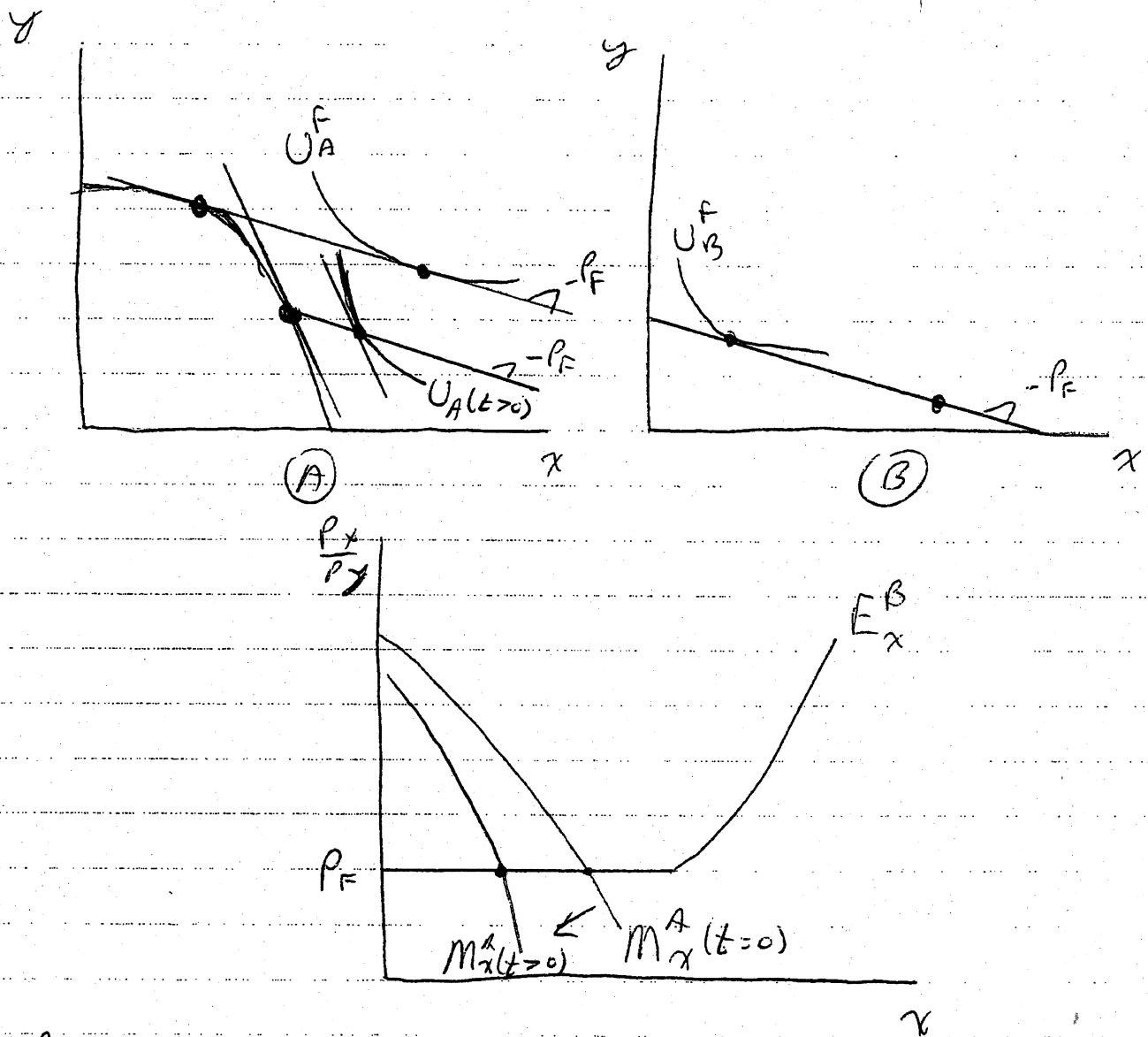
And so the "optimal tariff" for county A in this situation is zero. This is because A cannot alter its terms of trade from P_F with any positive tariff.
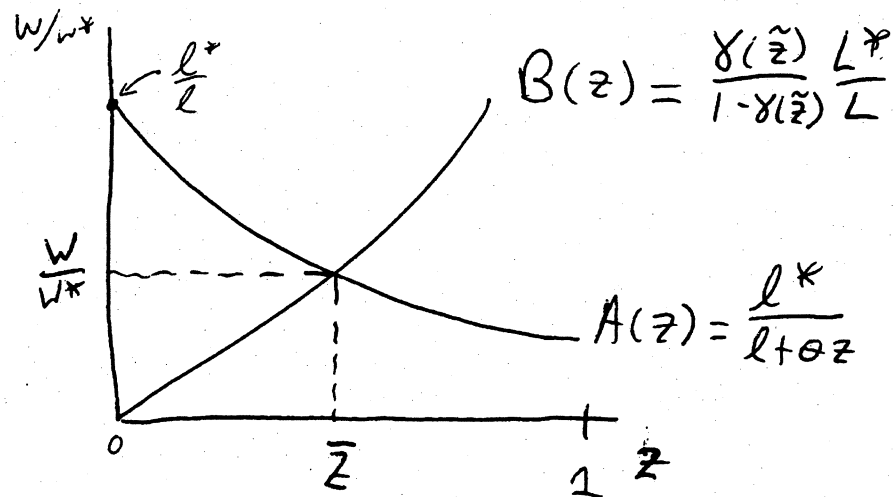
3.

$$\ell(z) = \ell + \theta z \quad, \quad \ell^*(z) = \ell^* + \theta^* z,$$

so $A(z) \equiv \dfrac{\ell^*(z)}{\ell(z)} = \dfrac{\ell^* + \theta^* z}{\ell + \theta z}$.

If $\theta > 0 = \theta^*$, then

$$A(z) = \frac{\ell^*}{\ell + \theta z}.$$ So we have

$$B(z) = \frac{\gamma(\tilde{z})}{1 - \gamma(\tilde{z})} \frac{L^*}{L}$$

$$A(z) = \frac{\ell^*}{\ell + \theta z}$$
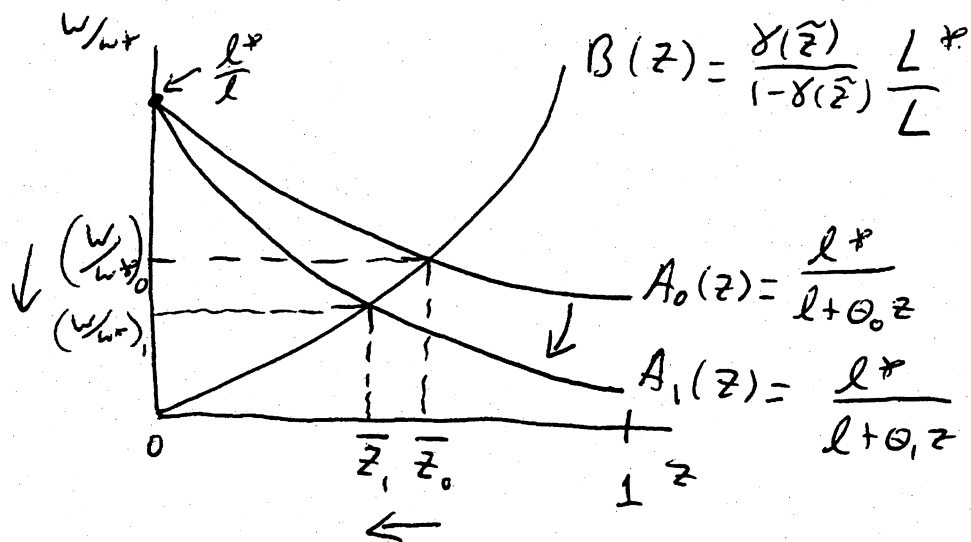
So (i) Domestic country specializes in $z \in [0, \bar{z}]$, and these are "naturally clean" goods as compared to $z \in [\bar{z}, 1]$.

(ii) If $\theta_1 > \theta_0$, then

$$B(z) = \frac{\gamma(\tilde{z})}{1-\gamma(\tilde{z})} \frac{L^*}{L}$$

$$A_0(z) = \frac{\ell^*}{\ell + \theta_0 z}$$

$$A_1(z) = \frac{\ell^*}{\ell + \theta_1 z}$$

So as the domestic country tightens its pollution standard $(\theta_1 > \theta_0)$, a range of the dirtiest goods originally produced in the domestic country cease being produced domestically and are instead produced abroad (i.e., $z \in [\bar{z}_1, \bar{z}_0]$).
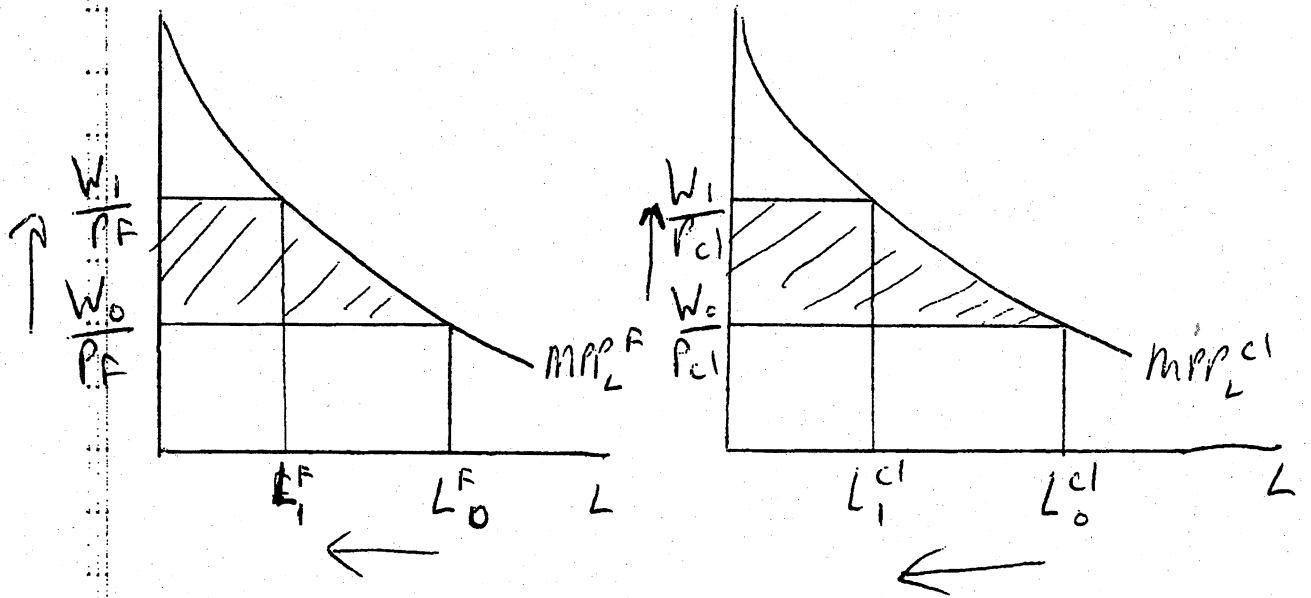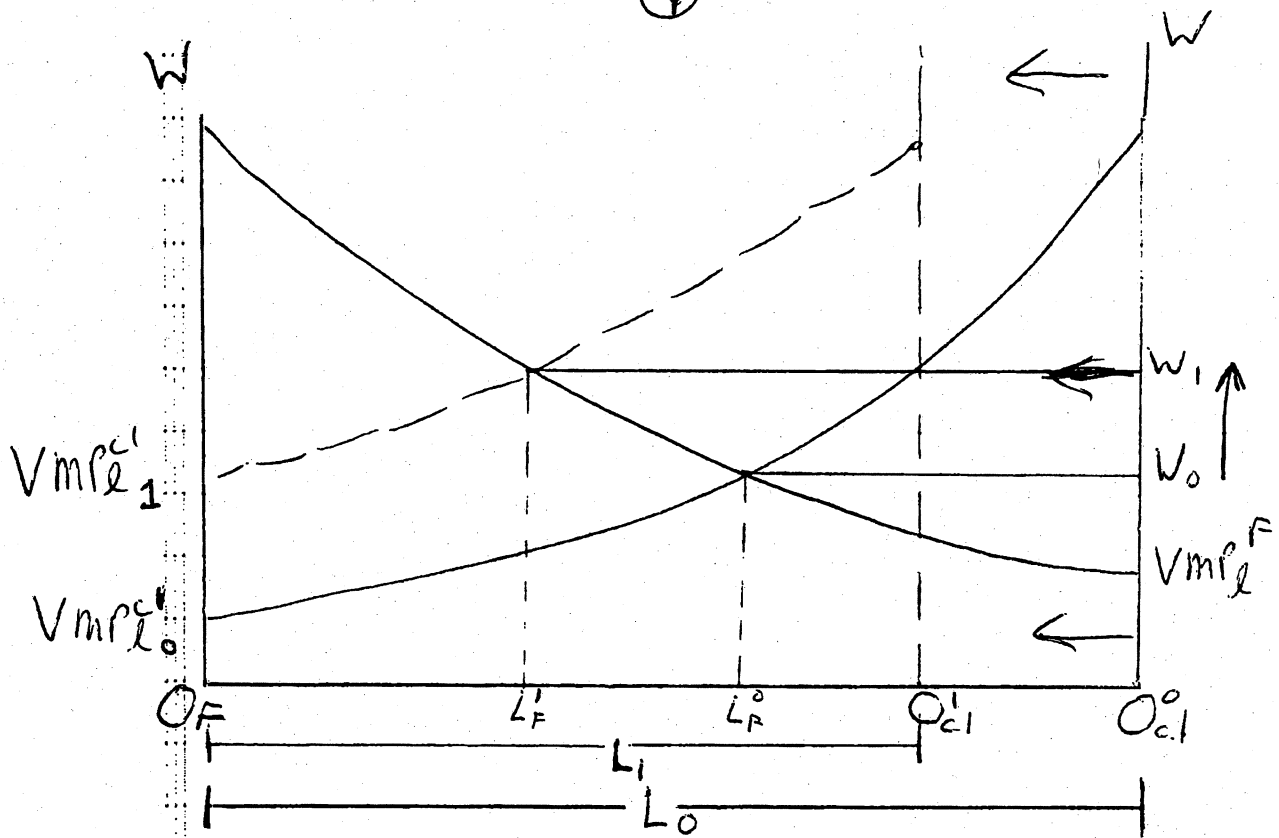
4.

(A) A small open economy, so no prices change. The labor endowment, L, drops:

We want to know what happens to output in ~~each~~ each sector, and what happens to real incomes. Since prices don't change, the change in the nominal wage w gives the change in the real wage, while the real incomes for each kind of capital owner can be read off the graphs in the usual way.

(9)

W

W

$Vmpl^{cl}_1$

$Vmpl^{cl}_0$

W_1

W_0

$Vmpl^F_l$

O_F L'_F L^0_P O'_{cl} O^0_{cl}

L_1

L_0

$\frac{W_1}{P_F}$

$\frac{W_0}{P_F}$

mpl^F_L

L^F_1 L^F_0 L

$\frac{W_1}{P_{cl}}$

$\frac{W_0}{P_{cl}}$

mpl^{cl}_L

L^{cl}_1 L^{cl}_0 L

As depicted, the drop in labor endowment from L_0 to L_1, leads to a rise in W, and therefore a higher real wage given that prices don't change. This is shown in the top figure, where the right-hand axis is shifted left-ward to indicate the drop in labor endowment, and the $VMPL^{cl}$ schedule is shifted with it. It can be seen directly from the top figure that food output falls, since L_F falls. But it can also be confirmed from the top figure that labor employed in clothing also falls, so clothing output falls too. Finally, the bottom 2 figures illustrate the real income loss to owners of capital in each sector (the shaded area).

Hence, using the Specific Factors Model, we predict that the impact of the May 1 boycott will be a higher real wage, a lower real return to capital (in both sectors), and lower output in both sectors.

(13) Again a small open economy, so
no price changes. Now we look
at the impact of a drop in
labor endowment in a Heckscher-Ohlin
economy.
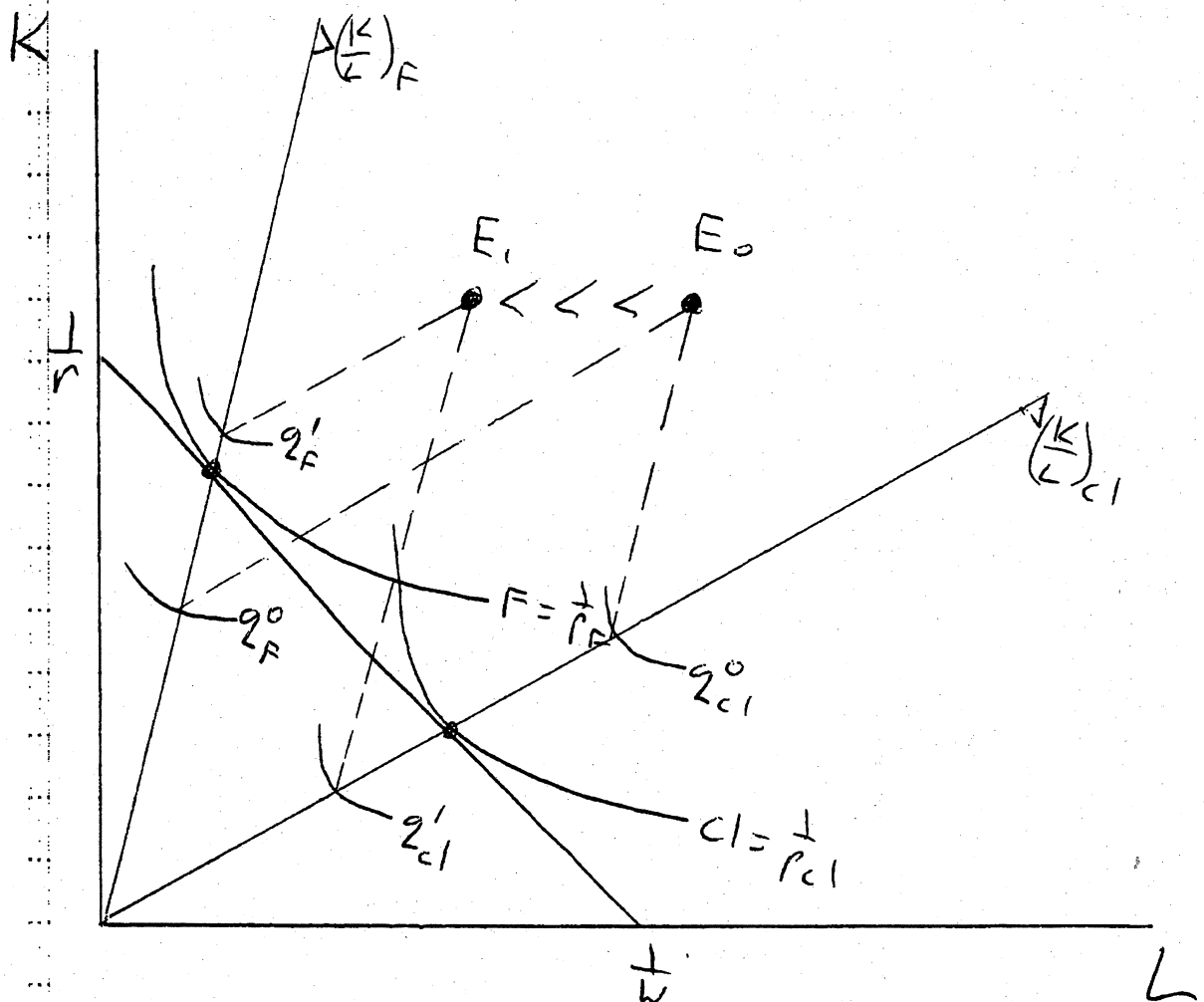
As illustrated, in the Heckscher-Ohlin economy,
w and r do not change with the drop in
labor endowment (as long as the country
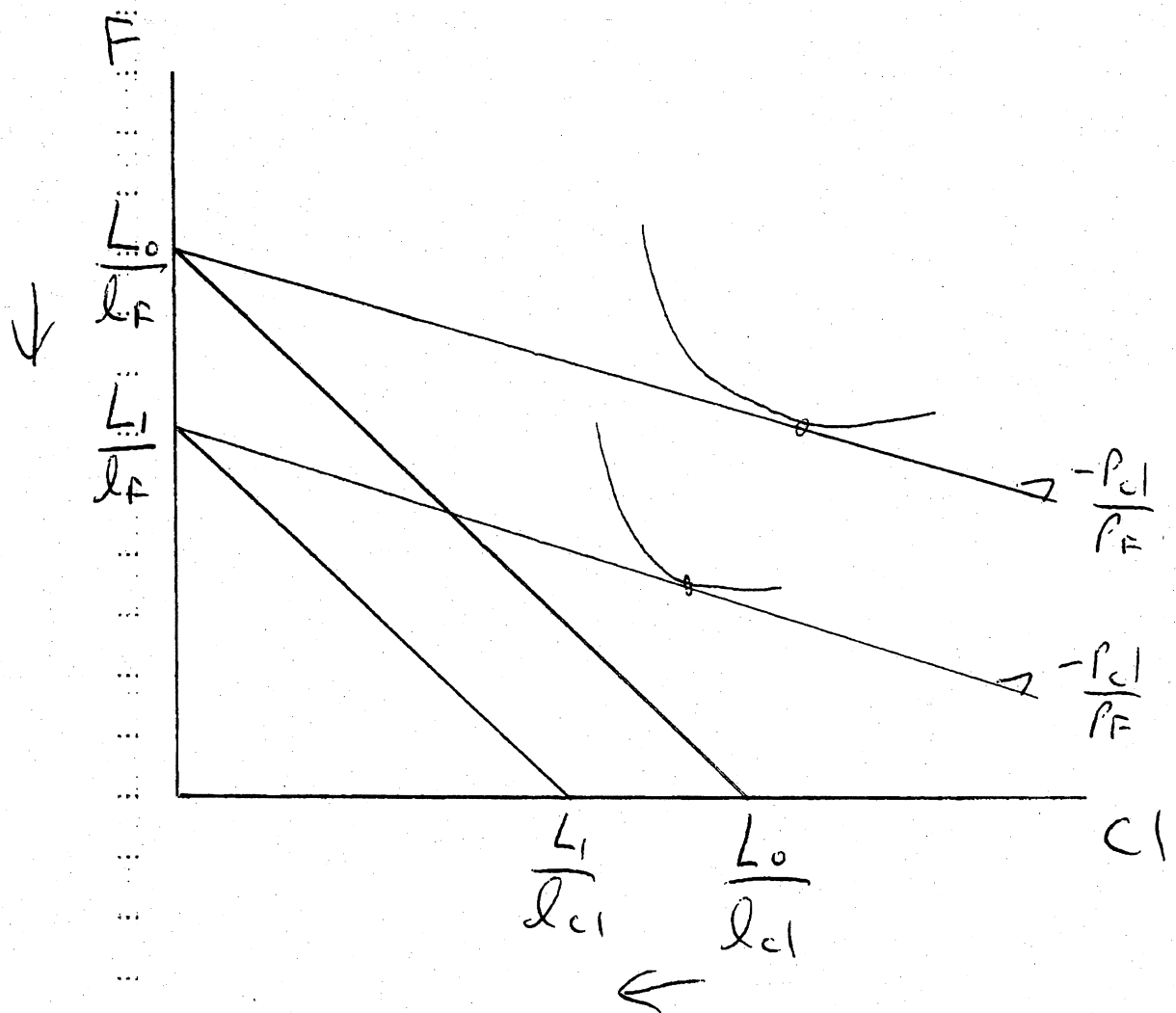remains non-specialized), and so with prices

unchanged as well under the small open economy assumption, the real incomes of workers and capitalists are unaffected by the drop in labor endowment. The impact on output is now uneven across sectors, with the capital-intensive food sector now expanding its output, while the labor-intensive clothing sector contracts its output as a result of the drop in labor endowment.

Hence, using the Heckscher-Ohlin Model to understand the consequences of permanent deportation, we would predict that permanent deportation of illegal immigrants will have no long run impact on real incomes of (the remaining) workers or capitalists, and it would cause the capital-intensive food sector to expand while the labor-intensive clothing sector contracts.

In light of our answer to Ⓐ, we would have to conclude that the likely impacts of the May 1 boycott are not a good guide for anticipating the (LR) effects of a permanent deportation of illegal immigrants.

(C) Again a small open economy, so
no price changes. Now we look
at the impact of a drop in
labor endowment in a Ricardian
economy. We assume that it is
initially specialized in food production.

F

$\downarrow$

$\frac{L_0}{l_F}$

$\frac{L_1}{l_F}$

$-\frac{P_{cl}}{P_F}$

$-\frac{P_{cl}}{P_F}$

$\frac{L_1}{l_{cl}}$ $\frac{L_0}{l_{cl}}$ Cl

$\leftarrow$

As illustrated, in the Ricardian economy,
where the economy was initially specialized
in food production, food production drops,

but per-capita income -- and hence
the real wage -- is unchanged by
the reduction in the labor endowment.
This can be confirmed by noting from
the figure that national income
has fallen by the same percentage as
the fall in the labor force, so
income per capita is unchanged.

So whether the economy is a Heckscher-
Ohlin economy or a Ricardian economy,
the drop in labor endowment has
no impact on real incomes.
On the other hand, the production
effects in the Heckscher-Ohlin economy
move in opposite directions across
the two sectors, whereas in the
Ricardian economy production falls
in the only sector in operation.