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(1) [15 points (3 points each)] All answers are taken from slides shown in class and posted on the Web.

(1.a) False. The share of agricultural products has been steadily declining from around 37% in the 1950s to 9% in this decade.

(1.b) False. Export of transport services grew about 2.4% since the 1980s. whereas exports of computer and information services grew 22.9%.

(1.c) False. Agriculture constitutes 5% of U.S. exports, whereas manufactured goods constitute 61% and services about 30%.

(1.d) False. Exports rose faster than real GNP (about 2% higher).

(1.e) True. In 2005, the value of imports of computers and electronics was $\$271$ billion. The value of exports of computers and electronics was $\$170$ billion.

(2a) [5 points] The PPF is not drawn here. The equation for the U.S. PPF is: $W_p^U = 50 - M_p^U/2$. Hence, the slop of the PPF (assuming M is on the horizontal axis) is $-1/2$. Therefore the equilibrium price ratio under autarky is

$$\left(\frac{p_M}{p_W}\right)^U = \frac{1}{2}.$$

That is, $p_W = 2p_M$.

The consumption/production levels occur at the "tangency" condition

$$MRS_{W,M} = \frac{MU_M}{MU_W} = \frac{W}{M} = \frac{1}{2} \quad \text{hence} \quad M = 2W.$$

Substituting into the U.S. PPF yields $M_p^U = M_c^U = 50$ and $W_p^U = W_c^U = 25$.

(2b) [5 points] The PPF is not drawn here. The equation for the Canadian PPF is: $W_p^C = 30 - M_p^C$. Hence, the slop of the PPF (assuming M is on the horizontal axis) is -1. Therefore the equilibrium price ratio under autarky is

$$\left(\frac{p_M}{p_W}\right)^C = 1.$$

That is $p_M = p_W$.

The consumption/production levels occur at the "tangency" condition

$$MRS_{W,M} = \frac{MU_M}{MU_W} = \frac{W}{M} = 1 \quad \text{hence} \quad M = W.$$

Substituting into the U.S. PPF yields $M_p^U = M_c^U = W_p^U = W_c^U = 15$.

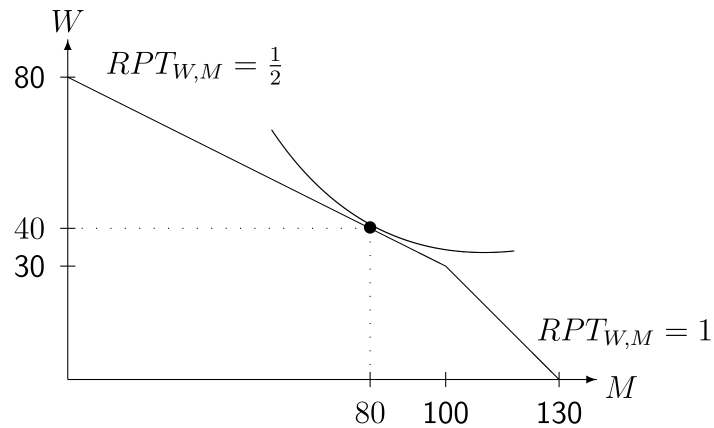

Figure 1: Solution to 2c: World PPF.

(2c) [5 points] Figure 1 illustrates the world PPF. The tangency between the indifference curves and the world PPF occurs at the segment where the slope of the world PPF is $-1/2$. To find this point solve

$$MRS_{W,M} = \frac{MU_M}{MU_W} = \frac{W}{M} = \frac{1}{2} \quad \text{and} \quad W = 80 - \frac{1}{2}M$$

yielding world aggregate consumption/production levels of $W = 40$ and $M = 80$.

The international price ratio is $(p_M/p_W)^W = 1/2$. Figure 1 shows that under free trade Canada completely specializes in the production of wood. Thus, the equilibrium production levels in each country are given by

$$M_p^C = 0, \quad W_p^C = 30, \quad M_p^U = 80, \quad \text{and} \quad W_p^U = 40 - 30 = 10.$$

(2d) [5 points] Given that $W_p^C = 30$ and the world price ratio $p_M/p_W = 1/2$, Canada's trade line is $W = 30 - M/2$. Solving

$$MRS_{W,M} = \frac{MU_M}{MU_W} = \frac{W}{M} = \frac{1}{2} \quad \text{and} \quad W = 30 - \frac{1}{2}M$$

yields the Canadian equilibrium consumption levels $W_c^C = 15$ and $M_c^C = 30$. Therefore, the U.S. equilibrium consumption levels are $W_c^U = 40 - 15 = 25$ and $M_c^U = 80 - 30 = 50$ (same as under autarky).

(2e) [5 points] In each country, competitive firms hire workers until the value of their marginal products equals to the ongoing wage rate. Canada produces 30 units of wood and the U.S. produces machines. Therefore, the ratio of Canada's wage rate to the U.S. wage rate is computed by

$$w^C = p_W \frac{1}{\ell_W^C} = p_W \quad \text{and} \quad w^U = p_M \frac{1}{\ell_M^U} = \frac{p_M}{3}, \quad \text{hence} \quad \frac{w^C}{w^U} = \frac{p_W}{p_M/3} = 3 \cdot 2 = 6,$$

implying that $w^C = 6w^U$, meaning that the Canadian wage is 6 times the U.S. wage. This happens here (not in the real life) since Canada has a "strong" comparative advantage in the production of wood which is highly demanded by the consumers modeled in this example.

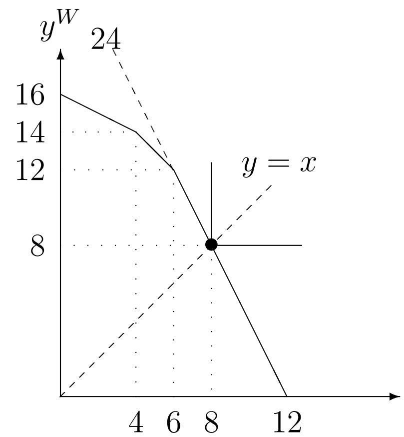

Figure 2: Solution to 3a: World PPF.

(3a) [10 points] Figure 2 illustrates the world PPF. The tangency occurs at the slope -2, hence, $p_X/p_Y = 2$. To find the aggregate world production/consumption levels solve $y = x$ and $y = 24 - 2x$, yielding $x^W = y^W = 8$.

From Figure 2 we can conclude the following production patterns: Countries A and C completely specialize in the production of good X, so that $x_p^A = 2$ and $x_p^C = 4$. Country B produces $x_p^B = 8 - 2 - 4 = 2$ and the entire world supply of good Y, $y_p^B = 8$.

(3b) [10 points] Before we compute import/export levels, we must compute the consumption level in each country. Country A produces $x_p^A = 2$ only. Therefore its trade line is $y = 4 - 2x$. Intersecting with $y = x$ yields $x_c^A = 4/3$.

Next, country B's trade line coincides with its PPF, hence, intersect $y = x$ with $y = 12 - 2x$, yielding $x_c^B = 4$. Therefore, country C consumes $x_c^C = 8 - 4 - 4/3 = 8/3$ units of X.

Country A exports $x_p^A - x_c^A = 2 - 4/3 = 2/3$ units of X. Country B imports $x_c^B - x_p^B = 4 - 2 = 2$ units of X. Finally Country C exports $x_p^C - x_c^C = 4 - 8/3 = 4/3$ units of X. Notice that the sum of all imports and exports of X is zero.

(4a) [10 points] Figure 3 illustrates Brazil's PPF, where $(p_C/p_F)^B$ denotes Brazil's autarkic price ratio.

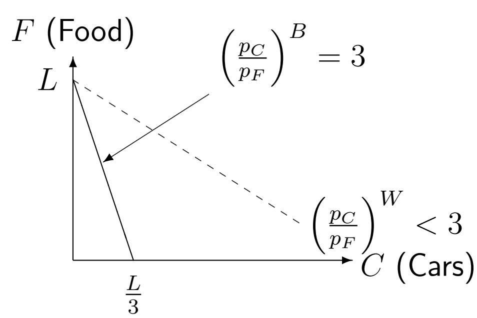

Figure 3: Solution to 4a: Brazil's PPF.

Figure 3 implies that Brazil completely specializes in the production of food (and therefore import cars) when the world price ratio is in the range

$$\left(\frac{p_C}{p_F}\right)^W < \left(\frac{p_C}{p_F}\right)^B = 3.$$

Similarly, Brazil completely specializes in the production of cars (and therefore imports food) when the world price ratio is in the range

$$\left(\frac{p_C}{p_F}\right)^W > \left(\frac{p_C}{p_F}\right)^B = 3.$$

(4b) [10 points] By the same argument, Brazil completely specializes in the production of food (and therefore import cars) when the world price ratio is in the range

$$\frac{1.5p_C^W}{p_F^W} < \left(\frac{p_C}{p_F}\right)^B = 3 \Longrightarrow \left(\frac{p_C}{p_F}\right)^W < \frac{3}{1.5} = 2.$$

Similarly, Brazil completely specializes in the production of cars (and therefore imports food) when the world price ratio is in the range

$$\frac{p_C^W}{1.5p_F^W} > \left(\frac{p_C}{p_F}\right)^B = 3 \Longrightarrow \left(\frac{p_C}{p_F}\right)^W > 3 \cdot 1.5 = 4.5.$$

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(5) [10 points] We first compute the production level under free trade. Profits are maximized when the world price line is tangent to the PPF. Therefore,

$$-\frac{dy}{dx} = x = \left(\frac{p_X}{p_Y}\right)^w = \frac{8}{2} = 4 \quad \text{hence } x_p = 4 \quad \text{and } y_p = 12 - \frac{4^2}{2} = 4.$$

To find the trade line's intercept, a, solve

$$y = a - \left(\frac{p_X}{p_Y}\right)^w x \Longrightarrow \quad 4 = a - 4 \cdot 4 \Longrightarrow a = 20.$$

To compute the island's consumption levels solve

$$y = 20 - 4x \quad \text{and} \quad MRS_{y,x} = \frac{y}{x} = 4 = \frac{p_X}{p_Y},$$

which yields the consumption levels $x_c = 2.5$ and $y_c = 10$.

Finally, the import level of Y is found by subtracting the consumption level from the production level. Thus, $I_Y = y_c - y_p = 10 - 4 = 6$ units.

(6a) [5 points] The capital/labor ratio in the computer industry (as a function of the wage/rent ratio) is:

$$RPT^C = \frac{MP_L^C}{MP_K^C} = \frac{\frac{2}{3}L_C^{-1/3}K_C^{1/3}}{\frac{1}{3}K_C^{-2/3}L_C^{2/3}} = 2\frac{K_C}{L_C} = \frac{W}{R} \quad \text{hence} \quad \frac{K_C}{L_C} = \frac{1}{2}\frac{W}{R}.$$

The capital/labor ratio in the food industry (as a function of the wage/rent ratio) is:

$$RPT^C = \frac{MP_L^F}{MP_K^F} = \frac{\frac{1}{1}L_F^{-1/1}K_F^{1/1}}{\frac{1}{1}K_F^{-1/2}L_F^{1/2}} = 2\frac{K_F}{L_F} = \frac{W}{R} \quad \text{hence} \quad \frac{K_F}{L_F} = \frac{W}{R}.$$

Therefore, the food industry is capital intensive relative to the computer industry because

$$\frac{K_F}{L_F} = \frac{W}{R} > \frac{1}{2}\frac{W}{R} = \frac{K_C}{L_C}.$$

Hence, the computer industry is labor intensive.

(6b) [5 points] The data provided in this question implies that

$$\frac{L^A}{K^A} = \frac{10}{5} = 2 > 1 = \frac{8}{8} = \frac{L^B}{K^B}.$$

Therefore, country A is labor abundant relative to capital compared with country B. Hence, country B is capital abundant relative to labor compared with country A.

Therefore, by the H-O Theorem country A has a comparative advantage in the labor-intensive good, which is computers. Country B has a comparative advantage in the capital-intensive good which is food. Altogether, under free trade country A exports computers to country B, and country B exports food to country A.

THE END

