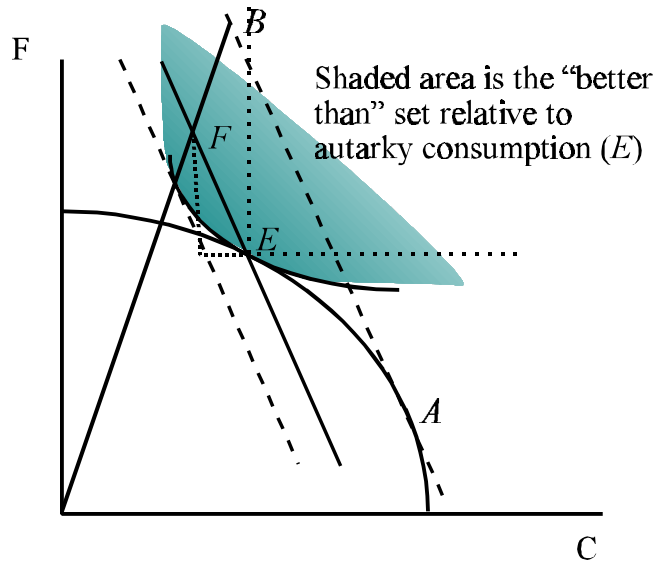


Homework #2: Answers

Text questions:

1. The home country in Figure 3.3 responds to the trading opportunities shown by line 2 by increasing production of clothing for export (from E to A) and actually reducing the quantity of clothing consumed. Show why:



- a. For a country in which production cannot change (e.g. the home country in figure 2.3), trade *must* result in a drop in consumption of the good exported.

With fixed production, any amount of trade must reduce the quantity consumed of one of the goods (of course the quantity of the other must rise). This follows from the condition that expenditure = income (i.e. balanced trade): the exports used to pay for the imports will reduce the quantity of the export good available for consumption.

- b. If production can respond to new world prices, the quantity of clothing consumed at home could rise.

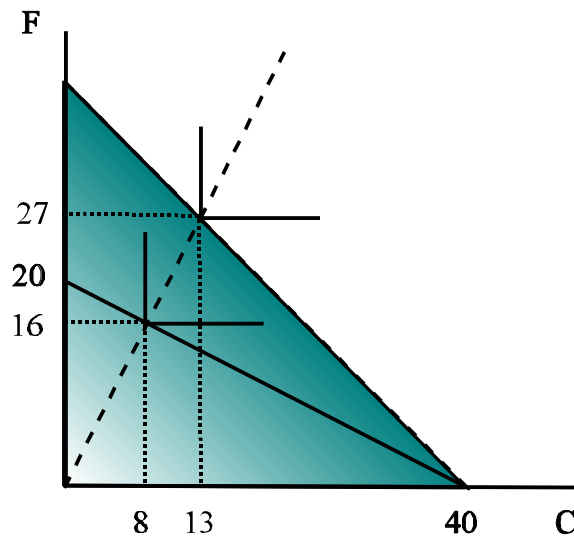
With both goods normal in consumption, as income increases (as it must when production responds to world prices) the consumption of both goods increase. Thus, for a sufficiently large increase in income, the quantity of clothing consumed will rise.

- c. In figure 3.3 reduction in clothing consumption results in an increase in well-being, compared with taking advantage of trade to consume more of both commodities.

Because substitution in consumption is assumed to be possible, when prices change consumers prefer an alternative bundle of goods (i.e. $MRS \neq p$). By trading, they are able

to achieve a more preferred consumption bundle. Even if adjustment of production permits increased consumption of both goods (i.e. in the area defined to the NE of the right angle centered on E), this will only occur if tastes pick out such a point. In the figure above, at F , they do not. Note that, in the diagram, every indifference curve consistent through consumption points in the region defined by the right angle centered on E must be lower than the indifference curve through B (not shown).

2. Some consumers have quite rigid taste patterns. Suppose the indifference curves for a community are strictly right-angled, and the corner of each ever-higher indifference curve lies on a ray from the origin. To be precise, suppose that whatever the prices prevailing in the market, two units of food are demanded for each unit of clothing demanded. Furthermore, suppose the transformation schedule shows considerable flexibility in production, so much so that it is a downward sloping straight line, with a vertical food intercept of 20 units and a horizontal clothing intercept of 40 units.



- a. If the country cannot engage in trade, how much of each commodity does it consume and produce?

We can answer this problem by solving the system of equations consisting of the income-expansion line and the PPF for the point where $y_F = x_F$ and $y_C = x_C$:

$$y_F = 20 - \frac{1}{2} y_C$$

$$x_F = 2 x_C.$$

This will yield, $y_F = x_F = 16$ and $y_C = x_C = 8$.

b. In the no-trade (autarky) state, what is the relative price of food?

The autarky relative price will be given by the slope of the PPF: $\frac{P_C}{P_F} = \frac{2}{4} = \frac{1}{2}$. That is,

1 unit of food buys 2 units of clothing. The relative price of food is just the inverse, i.e. 2. That is 2 units of clothing buy one unit of food.

c. Suppose that world trade is now opened up and the relative price of clothing is double what it was in autarky. Describe what happens to consumption and production.

With the linear PPF, a small country facing any price different than the (constant) slope of the PPF must specialize. In the diagram we have $p > MRT$ over the entire PPF, so the country specializes in clothing. This specialization leads to a consumption possibility set that lies outside the PPF at every point except on the C boundary. Consumption moves to a point on the national income line determined by specializing in clothing production. To solve for the equilibrium values, we need to solve the following two equations (again, we need to find the point where $y_F = x_F$ and $y_C = x_C$):

$$\begin{aligned}y_F &= 40 - y_C \\x_F &= 2x_C.\end{aligned}$$

The solution values here are $y_F = x_F = 80/3 = 26.67$ and $y_C = x_C = 40/3 = 13.33$.

d. Is the country better-off with trade?

It is easy to see from the diagram above that, with trade, the country's consumption point lies on a higher indifference curve. Thus, there are gains from trade. An alternative demonstration proceeds by noting that the post trade consumption possibility set (shaded in the diagram) contains the autarky consumption possibility set (i.e. the production possibility set). Since this must permit increased consumption, there must be gains from trade. It is useful to note that, since there are no substitution effects, the gains come entirely from more efficient allocation of resources in production at world prices.

3. Suppose that in autarky the decomposition of food and clothing aggregates reveals that ten varieties of each are produced, with each variety requiring 200 units of resources for setup costs, regardless of scale of output. In addition, each unit of food of any variety produced requires one unit of resources, and each unit of clothing requires two units of resources. The autarky output levels are 400 units of each variety of clothing and 200 units of each variety of food. With trade, competition from the world market narrows the number of varieties produced in each industry (food, clothing) to four.

a. If resources are allocated to food and clothing industries exactly as in autarky, by

how much has trade allowed each industry aggregate to expand?

In autarky, 4,000 units of resources are used in the production of food and 10,000 units in the production of clothing. After trade, since there are only 4 varieties of each produced, there will be 800 units of each variety of food produced and 1150 units of each of the 4 varieties of clothing produced.

- b. Why did the number of varieties produced not get cut back to four in each industry before trade?

Trade allows the economy to produce a limited variety of each good. Since there are fixed costs in the production of a variety, trade thus allows for a smaller fraction of resources to be used in setup costs. In autarky, production cannot be cut back to 4 varieties per good as demand dictated that 10 varieties per good are produced. With trade, the varieties not produced domestically are imported.

4. (Answer problem after reading appendix A). In showing why the production possibilities curve in Figure 3.1 bows out, we assumed that techniques used at F to produce food differed from those used at A to produce food. Similarly we assumed techniques differed in clothing production between F and A . Now suppose this is not so. Suppose that one all-purpose input is required to produce either food or clothing, and that two units of this input are required per unit of food regardless of the scale of output, and that four units are required to produce a unit of clothing.

- a. If the community possesses 400 units of this all purpose input, draw its production possibilities schedule.

We can write the equation of the PPF as:

$$400 = 2 y_F + 4 y_C, \text{ or}$$
$$y_F = \frac{400}{2} - \frac{4}{2} y_C.$$

Note that the first equality is a full-employment condition for the all-purpose input: the first term on the RHS is employment of the input in food production (i.e. units per output times total output) and the second is employment in clothing production; with only two goods, this is full employment (or 400 units). In slope-intercept form, we can see that this is a straight line with a slope of -2 and an F -intercept of 200.

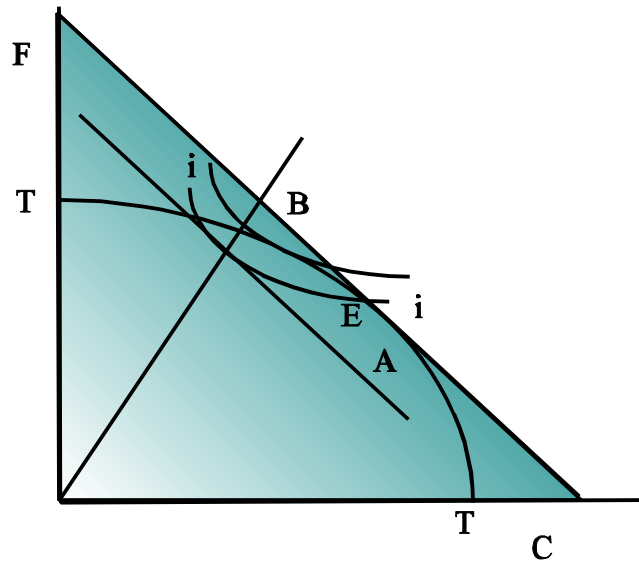
- b. How sensitive are prices to shifts in demand if this country cannot trade?

Note that, since the PPF is a straight line, that (except at the corners) price is constant, at $p \equiv P_C/P_F = 2$. Thus, unless preferences shift to a corner, change in demand has no effect on relative price.

Workbook questions

1. In workbook

2. Feasible set with production and trade: In the following diagram, point E indicates Robinson Crusoe's endowment of clothing and food, and TT the production possibilities frontier corresponding to a technology for converting clothing into food and vice versa.



a. What is Robinson Crusoe's feasible set in autarky?

The feasible set is the area below and including TT. This is the set of outputs that can be generated by Robinson given the resources he possesses and his technology.

b. In which sense can Robinson can by trading with Nature?

If we treat E as an endowment and TT as a technology for transforming food into clothing and vice versa, that technology can be seen as given by nature. Thus, the MRT reflects the terms of Robinson's trade with nature.

c. The locus labeled ii is an indifference curve. Assuming that Robinson Crusoe's preferences are homothetic, indicate in the diagram the solution to Robinson's problem as a consumer in autarky.

The problem of maximizing welfare, subject to TT, is found where the highest indifference curve is just tangent to the PPF. [I'm not sure that homotheticity helps here.]

d. What is the interpretation of the tangent line at the best autarky consumption point?

The slope of the tangent at the autarky consumption point gives Robinson's terms-of-trade with nature, when he is optimized.

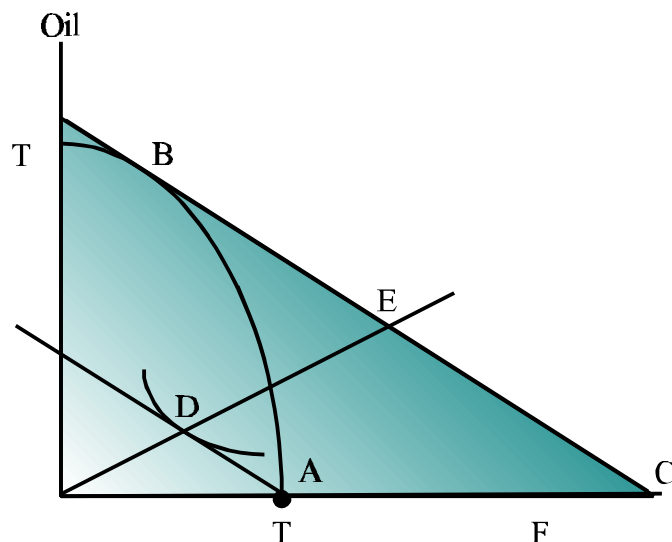
- e. What is Robinson's feasible set if he can trade internationally at the terms of trade indicated by the slope of the price line 1-1'?

Because he can trade to any point along the national income line, Robinson's feasible set is everything on and below the national income line (i.e. the shaded area in the diagram). Note that the feasible set without trade (see question 2a) lies below the feasible set with trade everywhere except at the autarky point).

6. Free trade is best, Some trade is better than no trade: A newly formed Pacific island nation has just discovered a rich oil reserve. The only other industry in the nation is subsistence farming. The country's engineers agree that if all resources are put into oil production, the country can produce a great deal of oil, but if resources are concentrated in agriculture, then only a small amount of food can be produced.

The nation's president has called on you for advice. You notice immediately that the country's relative price of food is high relative to the world market relative price of food.

- a. The President believes that the country should not have to import its food supply. Draw a diagram and provide an explanation that might convince the president that the country's welfare is higher under trade than in autarky.



The discovery of oil permits production of food or oil in efficient combinations given by the transformation curve TT. Prior to the production of any oil, the economy is producing and consuming on the food axis (A). The slope of the transformation curve at that point

can be seen to be quite steep relative to the world relative price of food. By allowing resources to move from food production to oil production, to point B (where $MRT = p$), the national income of the economy at world prices will increase. More to the point, the consumption set facing the economy has increased from the area under the PPF to the entire shaded area. Thus, even if the economy wants to consume no oil, it can consume more food (at point C). The only point at which gains are not available is where, at world prices, supply = demand in both markets (i.e. at point B).

b. The president agrees to open up for trade, but is not willing to reduce domestic production of food.

i. Is the country better off than in autarky?

The country cannot be made worse off by trade, even holding output of oil to zero (which is the implication of unchanged domestic production of food). However, it is only strictly better off if the country's people want to consume some positive amount of oil. In this case, they will trade food for oil at world prices. Consuming at a point like D.

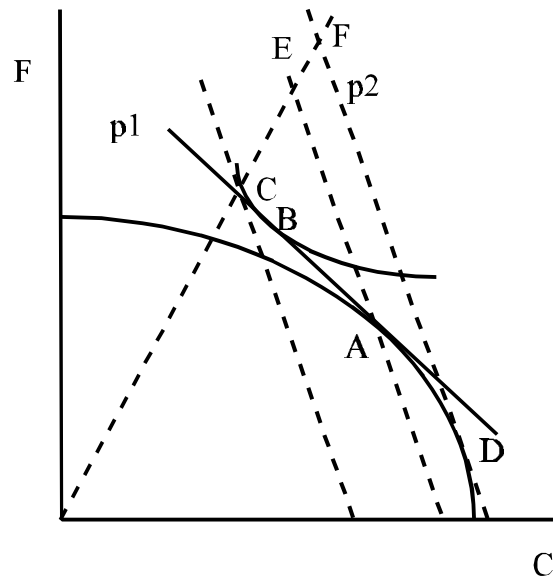
ii. Is it better off than in free trade?

No. If citizens of the country are permitted to trade at world prices, they can achieve a higher level of welfare, by consuming at a point like E, on the national income line generated by efficient production.

iii. Can you think of reasons not included in your model that might support the president's position?

If the country lives close to the subsistence margin, and prices are highly variable, trade could prove very risky. This would be especially true if production of oil required high startup costs (that would have to be taken from food consumption).

8. The geometry of a terms-of-trade improvement. Consider the following diagram for a small country that exports clothing in order to import food. At the terms of trade p^1 the production point is A and the consumption point is B.



- a. Suppose now that the terms of trade improve. Draw a new budget line and label it p^2 .

As above.

- b. Assuming that preferences are homothetic, show how producers and consumers respond to the price change by indicating the substitution and income effect in production and consumption.

By shifting output from A to D, national income is increased, permitting consumption along line p^2 —this is the production effect. The shift from B to C is the substitution effect in consumption, while the shift from E to F is the income effect.

- c. In your diagram, has the volume of imports increased from the price change?

Since production of the importable falls, and consumption of the importable rises, it must be the case that imports (i.e. excess demand) rises.

- d. Has the volume of exports increased from the price change?

The volume of exports could go either way. In my picture it looks like exports rise.