

Prof. Tybout

INTERNATIONAL TRADE (ECONOMICS 507A)
Midterm Exam and Answers

February 21, 2002

Please write your student ID number at the top of each page you turn in and number all pages (For example, if you use 6 pages, label them 1 of 6, 2 of 6., and so on.) Do not write your name anywhere on the exam.

You must answer all three questions on this exam. Each will receive equal weight. However, please note that you may choose any 3 of the 4 parts in questions in 2 and 3. Gook luck!

1. **(25 minutes)** The world consists of two trading regions: Europe and the rest of the world. Both regions are able to produce and consume two goods, beef and clothes, using two factors, land and labor. Compared to the rest of the world, Europe is relatively well endowed with labor. Production of beef is relatively intensive in the use of land, compared to production of clothes. All markets are perfectly competitive and there are no distortions. Trade between the countries is free and frictionless. All consumers demand strictly positive amounts of both goods at all finite prices. Answer the following questions:

- a) What can you say for sure about the pattern of trade and the pattern of production, based on this information alone? That is, who produces, exports, and imports what?

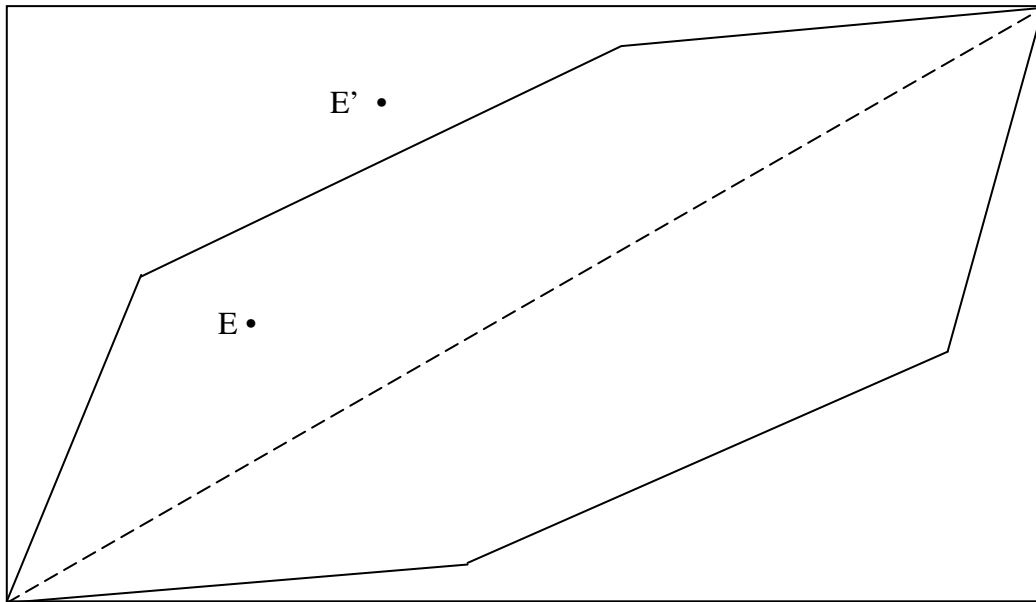
You can't say much without more assumptions on the production technology (identical CRS in both regions) and tastes (identical, homothetic in both regions). With these extra assumptions, the HOS model predicts that Europe will produce more clothes than it consumes and export the difference in exchange for beef.

- b) Explain, using the integrated world economy, how you would determine whether or not factor price equalization (FPE) occurs in this equilibrium.

Again, we need more assumptions about the production technology to proceed—assume CRS technologies that don't vary across regions. Next, find the product and factor prices that would prevail if the world were a single, integrated, friction-free economy. Associated with these prices are vectors of factor usage, $\bar{V}(i)$ for each product, i . If the allocation of global factor stocks across countries (indexed by j) can be written as a convex combination of these vectors for each region, and if the weights applied to a given vector $\bar{V}(i)$ sum to unity across countries, the trading equilibria will be characterized by FPE. Algebraically, the requirement is:

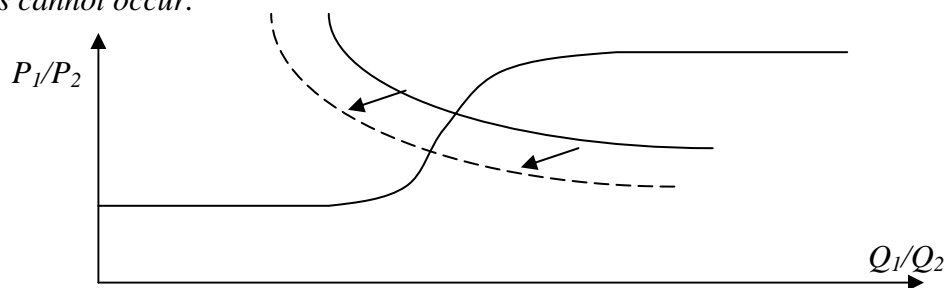
$$\left\{ (V^1, V^2, \dots, V^J) \mid \exists \lambda_{ij} \geq 0, \sum_{j \in J} \lambda_{ij} = 1, \exists V^j = \sum_{i \in I} \lambda_{ij} \bar{V}(i), \forall i \in I, j \in J \right\}.$$

When there are two factors and two countries, the conditions for FPE can be represented graphically. The endowment point must in the region enclosed by the $\bar{V}(i)$ vectors. For example, in the diagram below, point E is consistent with FPE while point E' is not:



- c) Suppose that European consumers suddenly become afraid to eat beef. Explain why this will reduce the relative price of beef in Europe and elsewhere if there initially was FPE. If there initially was *not* FPE, could the effects on relative prices be any different?

A reduction in global demand for beef will drive down the relative price of beef unless the global relative supply schedule is horizontal. But the horizontal ranges of the global supply schedule correspond to zero production of one good or the other. We have ruled out equilibria in these ranges by assuming that consumers always demand positive quantities of both goods, so this cannot occur.



Whether or not there is factor price equalization is irrelevant. The global supply schedule is upward sloping so long as at least one country is producing each good, so one or both of the countries could be specialized. (Notice this is a question about output prices, not factor prices.)

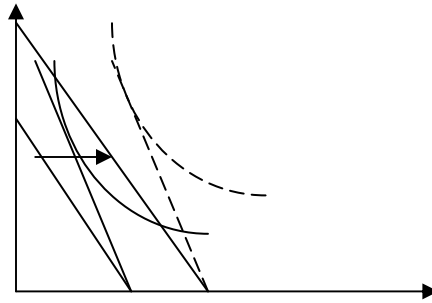
2. (25 minutes) Suppose that a country discovers a costless way to make all of its people 10 percent more productive than they were before. (Perhaps it involves a new vitamin or mass hypnosis.) That is, in any production relationship, any given output can be produced with 10 percent less labor than was needed before. **For any three of the four models described below**, describe the implications of this change for the country's:

- production,
- trade, and
- real factor prices

Note: For this question, you need not take the time to provide detailed defenses for your answers. Grades will be based on the changes that you predict.

- a) A Ricardian 2-good model of a small open economy, completely specialized under free and frictionless trade.

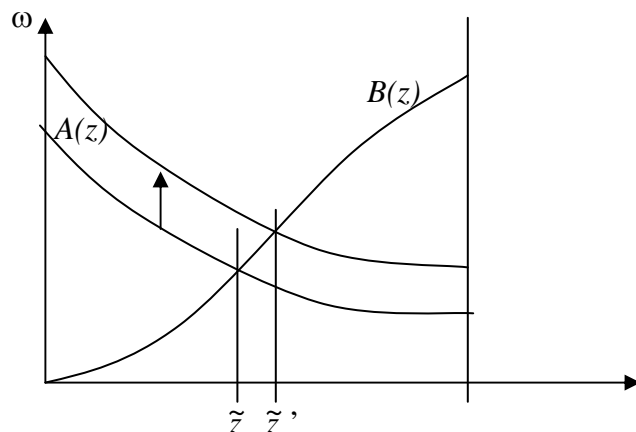
A 10 percent increase in labor productivity shifts the ppf out proportionately. Since the country is small, this doesn't affect world prices, and the country continues to specialize in the same good and import the other. It produces more and earns higher wages. (The real wage in terms of the exported good is the global price divided by labor requirements per unit output, which have fallen. Since the price of the import good hasn't changed relative to the price of the imported good, real wages improve in terms of importables too.) So long as both goods are normal it exports more and imports more:



- b) The Dornbusch-Fischer-Samuelson continuum of goods model with free trade.

Productivity gains at home shift the $A(z) = a^(z) / a(z)$ schedule upward because the denominator falls. The $B(z)$ schedule, which ensures balanced trade, is not affected so the new equilibrium is at a higher wage for the home country, and a larger range of goods is produced at home. In terms of economics, the productivity gain makes a larger range of goods cheaper at home than abroad, this shifts demand toward home goods, creating a trade surplus for the home country that is eliminated by an increase in the relative wage for home workers. Since the home wage doesn't rise as much as unit labor requirements fall, home goods become cheaper for foreigners too.*

(See diagram below.)



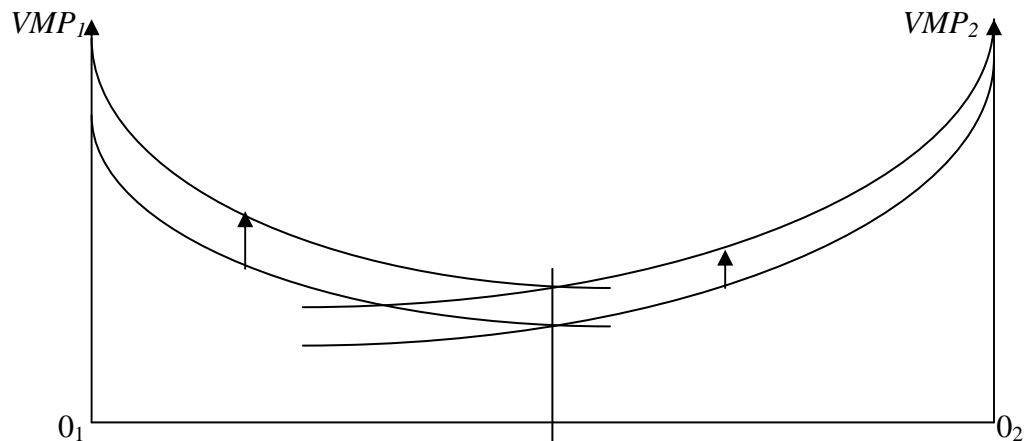
Although trade flows increase in terms of number of goods traded, the effect of productivity gains on the value of trade is ambiguous. To see this, note that home imports are $M = [1 - B(\tilde{z})]wL$, so the rising wages encourage imports but the increasing share of the product range produced at home discourages imports. The latter effect is dominant when w is large. To show this formally, note that the change in imports is $dM = [1 - B(\tilde{z})]dw \cdot L - B'(\tilde{z})d\tilde{z} \cdot wL$ and imports grow if $[1 - B(\tilde{z})] > B'(\tilde{z}) \left(\frac{d\tilde{z}}{dw} \right) w$. Let the foreign wage be the numeraire, so $\omega = w$. Since the B schedule doesn't shift, we know $\left(\frac{d\tilde{z}}{dw} \right) = B'(\tilde{z})^{-1}$ and imports increase when $[1 - B(\tilde{z})] > w$. This happens at small \tilde{z} but not large \tilde{z} . (Discussion of the value of imports was not necessary to get a good score on this question, but it was necessary for a perfect score.)

- c) The Heckscher-Ohlin 2-good model of a small open economy that produces both goods but exports the labor-intensive good, under free and frictionless trade.

IN the HOS model, a 10 percent increase in the efficiency of labor has the same effect on equilibrium as a 10 percent increase in the labor force. Hence the Rybczynski theorem tells us most of what we need to know. (The standard diagrams could be provided here, but were not necessary if the discussion was clear.) Production will increase for the labor intensive good, which will be exported in greater volume in exchange for more of the imported good. Factor prices won't change if we measure labor in efficiency units, but each worker will now be supplying more labor services, so each worker will be earning more income.

- d) The Specific Factors model with labor mobile between sectors and other factors *permanently* dedicated to their current sectors.

One way to interpret this question is to assume that a 10 percent increase in labor productivity means output per worker increases by 10 percent. This will increase the marginal product of labor by 10 percent at each possible level of employment, so the VMP curves for both sectors will shift up by the same amount, as diagrammed below:



With these shifts, the value of output rises 10 percent and the product mix is unaffected. Clearly, with both VMP schedules shifting up 10 percent, the wage rate must rise 10 percent. Payments to capital rise 10 percent too because factor payments would otherwise not exhaust revenues. With this outward shift in the production possibilities frontier the volume and value of trade will expand with homothetic tastes.

An alternative approach would be to treat the productivity gain as a 10 percent increase in the flow of labor services. Then the base of the diagram above should be stretched 10 percent. The ratio of good 1 production to good 2 production will generally not remain the same, although both goods will expand because both will be at a lower point on their VMP curve (now interpreted as the value of the marginal product of an efficiency unit of labor). Trade will expand, as in the first scenario, unless the expansion in production is very biased and/or one of the goods is inferior (in the economic sense). The wage per unit of labor services falls, but unless the economy-wide demand for labor is inelastic, wage per worker will rise. Since more labor services will be combined with the same amount of capital in each sector, the return to capital will rise in both sectors.

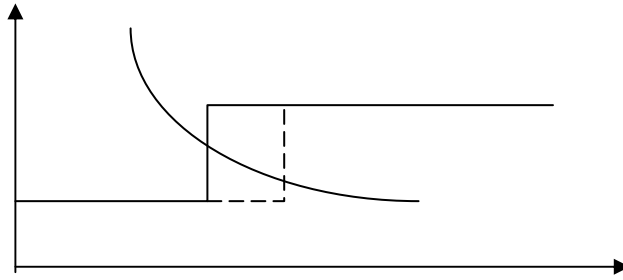
3. (25 minutes) For *any three of the following four statements*, indicate whether it is true, false, or uncertain and defend your answer. Grades will be based mainly on your defenses.

- a) To demonstrate the gains from trade, it is necessary to assume that (1) there are no tariffs or transport costs, (2) no trade subsidies, and (3) all consumers supply factor inputs in the same proportions.

False. In the course of proving the law of comparative advantage, Deardorff shows that utility in the natural trading equilibrium is higher than utility in autarky, even in the presence of tariffs or transport costs. The basic argument is that the autarky production/consumption point is feasible under trading prices, but the trading production/consumption combination is preferred. He rules out trade subsidies, and he does not deal with heterogeneous consumers, however. When consumers supply factor inputs in differing proportions, opening to trade generally creates some losers. But as Dixit and Norman show, (i) the winners could compensate the losers with lump-sum transfers and still have something left over, and (ii) the government could use commodity and factor taxes to ensure that everyone is at least as well off after a country opens to trade.

- b) In Ricardian models (e.g., Dornbusch/Fischer/Samuelson and Eaton/Kortum), a country's welfare depends positively upon productivity levels in every other country, but most heavily upon its own productivity.

True/Uncertain. Whenever productivity gains (say, at home) reduce the relative price of a country's exports, they help the rest of the world too. The home country generally benefits the most, however, because their income is directly enhanced by the productivity gains. For example, in the DFS model, productivity gains at home improve foreign welfare because the price of any product z that foreigners import, $p(z)$, falls in real terms. Algebraically, this is because $p(z) = wa(z)$, and home wages (w) don't rise by the full amount of the productivity gain (i.e., the fall in $a(z)$). Home wages rise relative to foreign wages, however, because home workers become more productive. So the largest real income gains take place at home. In the simple Ricardian model, the home country shares its productivity gains with other countries, only if each country is specialized in its exported good. Then productivity gains at home drive down the global price of the home country's exports, transmitting the benefits abroad—see figure below, where the dotted line shows the effect of labor productivity gains in the country producing good 1. (Otherwise, the home country is the only beneficiary of home country productivity gains.)



In the EK model, welfare is positive function of $\Phi_n = \sum_{i=1}^N T_i (c_i d_{ni})^{-\theta}$, where T_i indexes country i 's level of technological sophistication and d_{ni} is the distance between the home country and country i . Thus, productivity gains at home tend to get a larger weight (because d is at its smallest) than productivity gains abroad, although the latter help too. This reflects the fact that low transport costs make home goods a relatively large share of domestic consumption.

- c) Relative to autarky, the gains from trade are commonly estimated to amount to 50 percent of GDP or more.

False, Irwin calculates 8% gains, while Eaton and Kortum calculate gains ranging from 1 to 10%. The latter do, however, calculate that if all frictions to trade could be removed (transport costs, tariffs and other impediments), the gains might approach 25%.

- d) If everyone has identical tastes, the extent to which an individual gains from trade liberalization depends only upon the factor mix that the individual supplies.

False. In the HOS model this assertion is true because everyone faces the same set of output prices, and each individual's income depends exclusively upon the price of the factor he or she supplies. However, when one's factors are not all perfectly mobile across sectors, the effects of trade liberalization depend upon the sector in which one supplies one's factors. Similarly, in a model with search unemployment, the effect of trade liberalization on an individual's welfare also depends upon his or her employment status, and if employed, it depends upon the sector to which the individual is connected.