Econ 165 Stanford University
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Notes on HO — part 2

the four main results of the HO model — an overview:

	global	local
prices:	FPE	Stolper–Samuelson
quantities:	Heckscher–Ohlin	Rybczynski

the Stolper–Samuelson result:

This result concerns the relationship between the relative price of final goods on the world market and the domestic relative factor price: *If the price of an output good rises relative to the other output good then the factor that is used intensively in the production of the former increases in price relative to the other factor.* We derived this result in the Mussa diagram (see last handout). The diagram also showed us that the factor price changes more than proportionally. This was the so-called magnification effect in prices:

$$\hat{w_S} > \hat{p_H} > \hat{p_L} > \hat{w_U}$$

or — depending on which way the relative output price change goes

$$\hat{w_S} < \hat{p_H} < \hat{p_L} < \hat{w_U}$$

where hats stand for percentage changes. These inequalities tell us something interesting about the distributional implications of trade (opening up to trade changes the relative output price): the owners of the losing factor must be worse off no matter what combination of output goods they consume because the price of their factor falls by more than the price of either output good. The opposite is true for the lucky factor: its owners are unambiguously better off. This result has been very influential and still forms the basis for the public discussion of the distributional effects of trade. It seems to explain the increase in inequality in developed countries (lowtech goods have become relatively cheaper, therefore the wage for unskilled labor has declined in relative terms). But it implies the opposite for the country we trade with. Yet, there is hardly any evidence of decreasing inequality in developing countries.

Factor Price Equalization:

The factor price equalization result tells us that *free trade equalizes factor prices in both countries.* The argument goes as follows: with free trade the law of one price implies equal output prices in both countries. Then the Stolper–Samuelson result establishes a link between relative output and relative factor price (see left part of diagram below). Its derivation

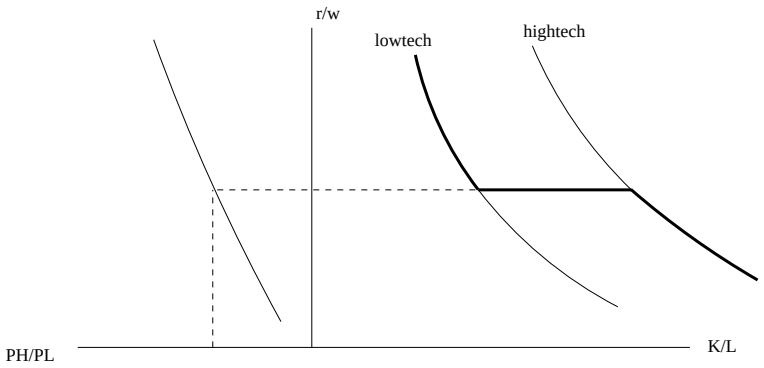
depended only on technology and since technologies are assumed to be the same in both countries the link must be the same. So the relative factor price is also equal. But with equal output prices and equal relative factor price absolute factor prices have to be equalized because otherwise sectors could not make zero profits everywhere.

This results depends crucially on the rather unrealistic assumption of equal technologies in both countries. So it is not surprising that there is little evidence for FPE in the real world. But even if we take the theoretical result at face value it breaks down as soon as one country becomes completely specialized. Look at the right half of the diagram below. If a country's relative factor endowment lies between the intersections of the relative factor price line with the sectoral factor intensities then the country produces a combination of both commodities. But if the relative factor lies too far left or too far right then it completely specializes and FPE breaks down. It stops producing one commodity and, referring back to the Mussa diagram (which established the link between output and factor prices), we no longer need to be on that sector's zero profit line, in other words the relative factor price must no longer be the intersection. In the diagram below the relative factor price follows the lowtech factor intensity line up for very labor abundant countries and falls with hightech's factor intensity for very capital abundant countries.

the Heckscher–Ohlin result:

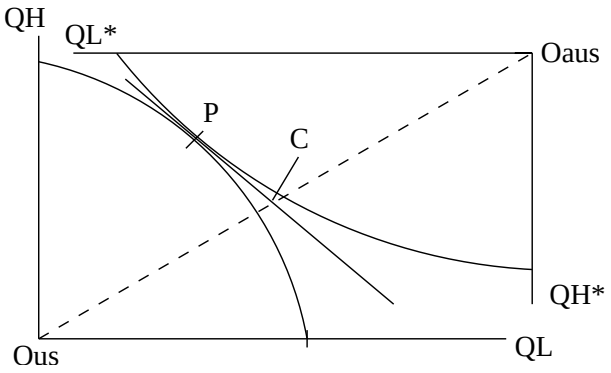
This is the main result of the Heckscher–Ohlin model. It explains the pattern of trade, i.e. which country exports which commodity: *a country exports that commodity which is produced using that factor intensively with which the country is relatively well endowed.* There are (at least) three ways to illustrate this result:

Consider the right hand side of the diagram below. If two countries have different relative factor endowments but equal consumption patterns as the Heckscher–Ohlin model presupposes then the factor intensity of that consumption pattern (equal for both countries) must lie between the capital labor ratios of both countries. This implies that one country produces a more capital intensive output combination than it consumes. But this can only be the case if it exports the capital intensive good and vice versa for the other country establishing the pattern predicted by the HO theorem.

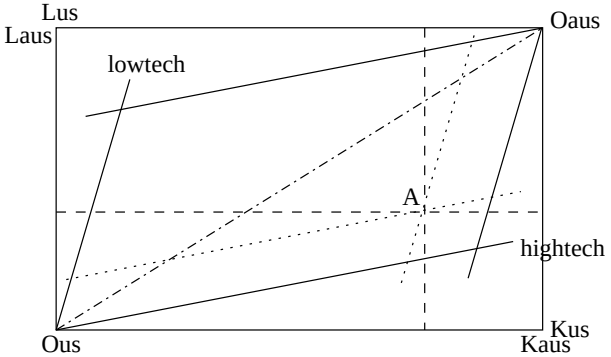


The second way of illustrating the HO result relies on the PPFs we derived. Recall that the capital abundant home country can produce relatively more hightech while foreign's PPF

stretches out horizontally (refer to third diagram on last handout). Now suppose foreign is Australia and turn their PPF upside down. They both trade at one world market equilibrium relative price and their respective production points are the tangency points of that price line with their respective PPFs. The diagram below moves these two production points on top of each other — point P. Now remember that both have the same consumption pattern implying that consumption lies on the diagonal connecting the two origins (to see this consider any point off the diagonal and note that home and foreign then consume different ratios of high-tech relative to lowtech). Again we see that home must export hightech and foreign lowtech in line with the HO result because home produces more hightech than it consumes and vice versa down under.



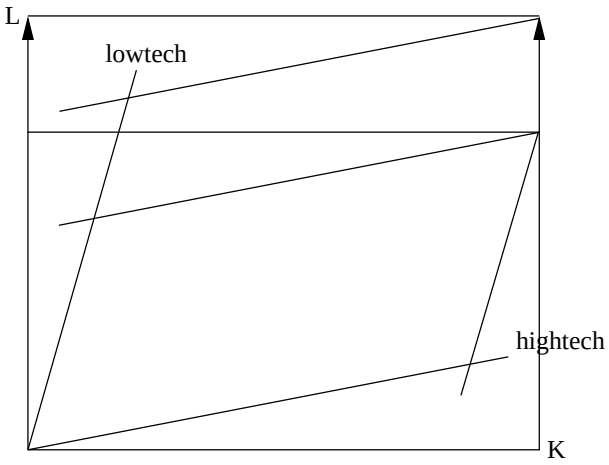
The third way uses a factor quantities Edgeworth box for the whole world. We start with a world market free trade equilibrium. This equilibrium involves a certain relative output price and via FPE one relative factor price. This relative factor price implies particular factor intensities in each of the two sectors (cf. first diagram). These intensities are represented by the rays in the diagram below. Now suppose the world is divided as implied by point A. The rectangle to the southwest of A is the home country's factor endowments box and the rectangle northeast of A is foreign's. A should better lie off the diagonal because the HO model assumes different relative factor endowments. But again equal consumption patterns imply that the consumption point lies on the diagonal. More precisely it lies on the diagonal somewhere in between the two national rectangles because otherwise one country would be handing out presents in the form of factor endowments. Again we see that home's production contains more capital relative to labor than its consumption so it must be exporting the capital intensive commodity.



The HO model used to be THE model of international trade and its predictions for trade patterns have been tested extensively. The results were disappointing at first (Leontief's result is known as the Leontief test). They have improved somewhat over the years as researchers adapted the original model to better fit the data. It does a decent job at explaining north-south trade but performs much worse when it comes to the far larger trade flows between developed countries.

Rybczynski:

This result is the mirror image of Stolper–Samuelson: instead of establishing a link between relative output price and relative factor price it seeks to establish such a link between factor quantities (ie endowments) and output quantities. Take the diagram above and cut out one national rectangle. Now suppose the country's endowment with labor increases, ie the box increases in height, and assume this does not change the relative factor price and the factor intensities it implies. Then we see that the output of the labor intensive lowtech sector increases and the output of hightech decreases. Looking closer, we can see that the increase in output of lowtech is overproportional.



So we obtain a magnification effect in quantities:

$$\hat{Q_L} > \hat{L} > \hat{K} > \hat{Q_H}$$

or — depending on which way the factor quantity change goes

$$\hat{Q_L} < \hat{L} < \hat{K} < \hat{Q_H}$$