The Gains from Trade in Factors

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Abstract

This note provides a simple graphical analysis of the gains from factor movements. The analysis can be extended to general settings which include differentiated products and nontraded goods and many factors and goods.

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In theoretical trade models, the set of factor allocations in which trade equalizes factor prices (FPE) is important since it simplifies the analysis of a wide range of models. For the same reason, the set of points outside the FPE set (NFPE) has received less attention. Nevertheless, if we are interested in the possibility of factor movements, the NFPE is the relevant set of allocations of world factors since there is no need for factor movements within the FPE. The object of this note is to present a diagrammatic analysis of the gains from factor trade which can be easily extended to higher dimensions.

To fix ideas consider a conventional 2x2x2 Heckscher-Ohlin-Samuelson (HOS) model and begin by analysing the FPE set (Helpman and Krugman (1985)). The points in the rectangle in figure 1 represent all the possible divisions of world capital and labor between two countries (starred variables refer to the foreign country). A point such as E represents one possible allocation of world resources into a capital abundant domestic country and a labor abundant foreign country (because E lies above the diagonal). The FPE set in factor space is the rhomboid OQO^*Q^*, where OQ (O^*Q) has the slope of the capital labor ratio in the capital (labor) intensive industry in the *integrated equilibrium*, defined as the equilibrium that obtains when the world is not divided into countries. Similarly, OQ^* (O^*Q^*) has the slope of the labor intensive industry. Within the FPE set, trade replicates the integrated economy and there are no potential gains from factor movements. Consider the line passing through E with a slope equal to the trade wage-rental (w/r) ratio of the integrated economy, which in general depends on technology and preferences. This is the budget line of the home (foreign) country in factor space after trade. Consider point C, the intersection of the home country budget line with the diagonal. The vector OC corresponds to the fraction of the resources of the integrated equilibrium that the home country can buy with trade. Hence, OC/OO^* is the fraction of the integrated equilibrium GNP accruing to the home country. Similarly, $1 - OC/OO^*$ is the fraction accruing to the foreign country. The trading economy replicates the integrated economy and there are no potential gains from factor trade.

Consider a point within the NFPE set, for example E in figure 2. Since the home country is capital abundant, the post-trade wage-rental ratio is higher than in the foreign country and the home country's budget line is steeper. We denote the two trade wage-rental ratios by (w/r) and $(w/r)^*$. These two wage-rental ratios define two budget lines in factor space. The intersections with the diagonal are C and C^*. These intersections are the vector of factors with the integrated equilibrium

proportions that the countries can buy after trade is established. Hence the ratios OC/OO^* and O^*C^*/OO^* represent the fraction of the integrated equilibrium GNP that each country achieves with trade. Adding these fractions does not add up to the GNP of the integrated equilibrium. Hence, there are gains to be made by allowing factor movements (i.e., moving into the FPE set). The gains are measured by CC^* and as a proportion of the integrated equilibrium these are CC^*/OO^*. Thus, these two figures provide a complete graphical representation of the welfare gains from factor movements in the 2x2 HOS model. Moreover, a larger difference in factor prices is associated with a longer distance CC^*, and hence the gains from factor trade are larger. We have shown:

Proposition 1 *The gains from factor trade as a proportion of the welfare under trade are given by the ratio CC^*/OO^*. Moreover, the larger the difference in factor prices under trade, the greater the gains from factor movements.*

Clearly, this analysis can be extended to the case of more goods than factors, since the FPE set in this case is a polygon with more sides and the general principle continues to apply. Moreover, we can use the model to determine the welfare gains from factor movements in the case of other FPE sets investigated by Krugman and Helpman (1985), such as those involving economies of scale, non-traded goods, external effects, differentiated products, etc.

The analysis can be readily extended to more than two factors. Consider the case of n factors. The set of possible allocations is an n-dimensional rectangle in factor space. As in the 2x2 case, the diagonal between the two antipodal vertices O and O^* consists of points with the world integrated equilibrium relative factor abundances. Suppose E is a point outside the FPE set. There exist two different post-trade budget hyperplanes in factor space passing through E that intersect the diagonal at C and C^* respectively. The intersections must be such that the fractions OC/OO^* and O^*C^*/OO^* add up to strictly less than one, or the GNP's of the two countries would be higher than the integrated equilibrium product. Hence, once again, CC^* represents the additional gains from factor mobility and CC^*/OO^* are the welfare gains as a fraction of the integrated equilibrium production.

References

Helpman, E. and Krugman, P. (1985): "*Market Structure and Foreign Trade*", The MIT Press, Cambridge.

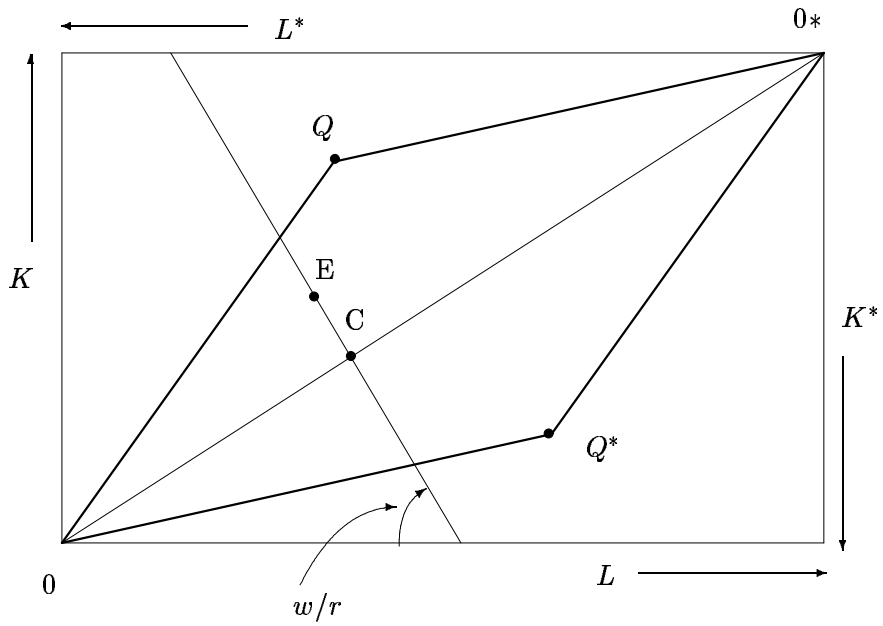

Figure 1: Allocation of the product within the FPE set

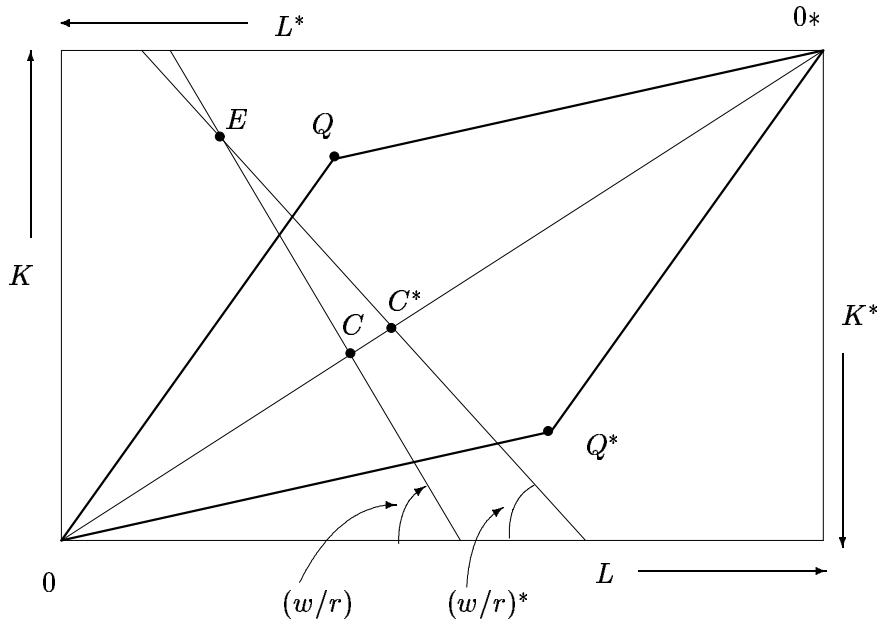

Figure 2: Allocation of the product outside the FPE set