

## Learning Heckscher-Ohlin Model in Five Easy Steps

By Omer GOKCEKUS<sup>a †</sup> & Kevin BENGYAK<sup>b</sup>

**Abstract.** With students in the policy and business schools with no formal economics background in mind, we propose an intuitively appealing and simple step-by-step graphical approach to explain the Heckscher-Ohlin (HO) model. Our approach is simple because it needs only two pieces of information, specifically about factor endowments and factor intensities, and from there it uses straightforward logic to construct the HO model. In easy five steps we show how to build the HO model and derive its three theorems, specifically, pattern of trade, factor price equalization, and income distribution.

**Keywords.** Heckscher-Ohlin theory, teaching economics.

**JEL.** A20, F11

### 1. Introduction

The Heckscher-Ohlin model is one of the most important and influential ideas in international economics. It is regularly used by policymakers and academics, (e.g., [Hakura, 1994](#); [Tahomy & Mixon, 2003](#); [Romalis, 2004](#); [Bernard et al., 2006](#); [Guscina, 2006](#); [Krugman, 2008](#); [Bajona & Kehoe, 2010](#); [Kukenova, 2011](#); [Ricci & Trionfetti, 2011](#)) and has been subject to extensive empirical testing. ([Baldwin 2008](#); [Leamer 1995](#))

Although, and probably because of, its frequent use by the International Financial Institutions and by economists in academia, the Heckscher-Ohlin (HO) model is taught to more than just economist students. This underlies the importance of the model but at this point, most methods for teaching HO rely on students already having a strong background in microeconomics and economic jargon.

In many non-economics graduate programs, learning the HO model is part of the core curriculum, such as graduate level International Relations (IR) programs. However, master's students in IR programs often do not have formal economics backgrounds. For instance, at our institution, the School of Diplomacy and International Relations, for the last four academic years, (2009-2012) an average 3.8% of students entering into the master's program had undergraduate economics majors. Yet, all students are required to take a semester long course in international economics in which they will be taught comparative advantage (which includes the Ricardian Model) and then the HO model. Students at the School of Diplomacy and International Relations are taught international economics as it is crucial for them to understand how economics and economic policy affect the relations between states, the foreign policy choices of governments, development strategies

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of the countries, potential domestic and political implications, and the many international political issues that stem from trade.

The Diplomacy and International Relations School's requirement that master's students learn HO and international economics is in line with other IR programs. Examining the curriculums of other IR programs reveals that students at the Fletcher School, Georgetown School of Foreign Service, American University School of International Service, the Elliot School, and Columbia's School of International and Public Affairs all require their master's students to take at least one course in international economics. It is reasonable to assume that many students at these institutions, much like the ones at the Whitehead School, may not have an undergraduate background in economics. This may also be the case at schools focused on business or public policy.

Despite the fact that many of these students do not have economics backgrounds, textbooks on international economics frequently use heavy economics jargon, concepts such as isoquant, isocost, production possibility curve, and modeling approaches that are overloaded with economics techniques and vocabulary to build on microeconomics theories to explain the HO model. After reviewing how widely used international economics textbooks teach HO, in this study, we propose an intuitively appealing and simple graphical approach to explain the HO model; particularly on how to derive its three theorems about (1) the pattern of trade, (2) factor price equalization, and (3) income distribution.

### 2. Currently available textbooks and teaching techniques

Dominick Salvatore's textbook *International Economics*, explains factor intensity in a flurry of ratios (Salvatore 2007, 125) and then explains the HO model using terms such as production frontier, indifference maps, and tangency of indifference curve. (Salvatore 2007, 134) Paul Krugman and Maurice Obstfeld's *International Economics: Theory & Policy* also uses production possibility frontiers in addition to jargon such as isovalue line (Krugman & Obstfeld 2007, 134) in explaining the HO model through a heavy modeling approach. Henry Thompson's textbook on international economics also uses terms such as isoquant and marginal rate of technical substitution, and production possibility frontiers to explain HO model in again a heavy modeling approach. (Thompson 2001, 195-96, 204) This way of explaining and teaching HO will not come intuitively to students without economics backgrounds. Simply, this is because of their unfamiliarity with these terms and approaches to teaching economics concepts and theories. This way of teaching is more suited to economics majors, who are, incidentally, usually the target of authors who write on teaching economics.

As is reported in Becker and Watts (2001), economists in academia are spending more time on coming up with different pedagogical techniques to teach economics, e.g., using different class games as summarized by Becker and Watts, (1996) or even utilizing the internet (Katz and Becker 1999). The *International Review of Economics Education* frequently publishes these articles of this nature, e.g., Kauper, 2012; Marsden & Sibly, 2011; Moore, 2011; Lawson & Lawson, 2010; and Colander, 2004. Yet, these articles have focused more on teaching intermediate microeconomics and not the HO model. *The Journal of Economic Education*, also publishes articles on teaching economics and as expected there are many different teaching techniques to explain the HO model better, e.g., Gilbert, 2011; Gilbert & Oladi, 2008; and Haight, 1994. Yet, these methods are almost exclusively designed with economics students in mind.

Gilbert is an example of a better way to teach HO but his method may not be accessible to students with no economics training. Heckscher-Ohlin is explained in

more technical heavy jargon, such as isoquant diagram, production possibility frontier, and indifference curves. (Gilbert 2004, 350) His teaching method then involves having students put multiple equations into Excel to make graphs from these equations to explain HO. (Gilbert 2004, 347-351) This heavy use of equations is more geared to economics students rather than non-majors. This line of teaching follows what Tohamy and Mixon Jr. proposed in their 2003 paper for teaching the specific factor model. They laid out steps to teach this model to students by having them go through several Excel worksheets where they could tweak data and equations to generate output and graphs. While they got some positive feedback from their students (Tohamy & Mixon Jr. 2003, 145) this process was again geared towards economics majors. Gilbert and Tower (2013) is another excellent example of using numerical simulation methods of analyzing trade issues; yet, the book is only accessible to graduate students with a background in microeconomics and trade theory.

Gilbert and Oladi also laid out an effective way to teach HO. However, they had economics majors in mind, and when referring to the importance of factor proportions and the HO model they wrote “Therefore, it is important that economics majors develop a thorough understanding of the models and their relationship to one another.” (Gilbert & Oladi 2008, 145-6) While they show that HO can be taught using a geometric approach, the graphs they use become cluttered and may not appear to be simple or straightforward to non-majors. (Gilbert & Oladi 2008, 150)

Haight set forth a way to teach HO using vertical slice graphs instead of horizontal graphs. While these graphs effectively predicted changes under HO, they were made with economics students in mind, who could then actively learn them. (Haight 1994, 258) While requiring economics students to memorize a theorem and then create their own vertical slice proof from it will be helpful to them as they advance in their studies, (Haight 1994, 251) for a non-economics major a better method would be to have them develop an understanding of the core concepts behind the HO model.

### 3. Learning Heckscher-Ohlin Model in Five Easy Steps

#### 3.1 Set Up

There are two countries, Home and Foreign. Each country possesses the same technology with constant returns to scale. There are two goods, W and C, and two factors of production, capital and labor. Both goods are being produced in both countries and, independent of their income, consumers in both countries have identical demand preferences and want the same ratios of goods. All markets are perfectly competitive and there is full employment. At this point, students should have already learned the Ricardian model; therefore, the setup is clear and they have an idea what perfect competition, constant returns to scale and full employment imply.

In addition, the following two conditions hold:

Home is capital abundant and Foreign is labor abundant:  $(K/L)_H > (K/L)_F$

Good W is capital intensive and good C is labor intensive:  $\left(\frac{k}{l}\right)^W > \left(\frac{k}{l}\right)^C$

#### 3.2 Autarky

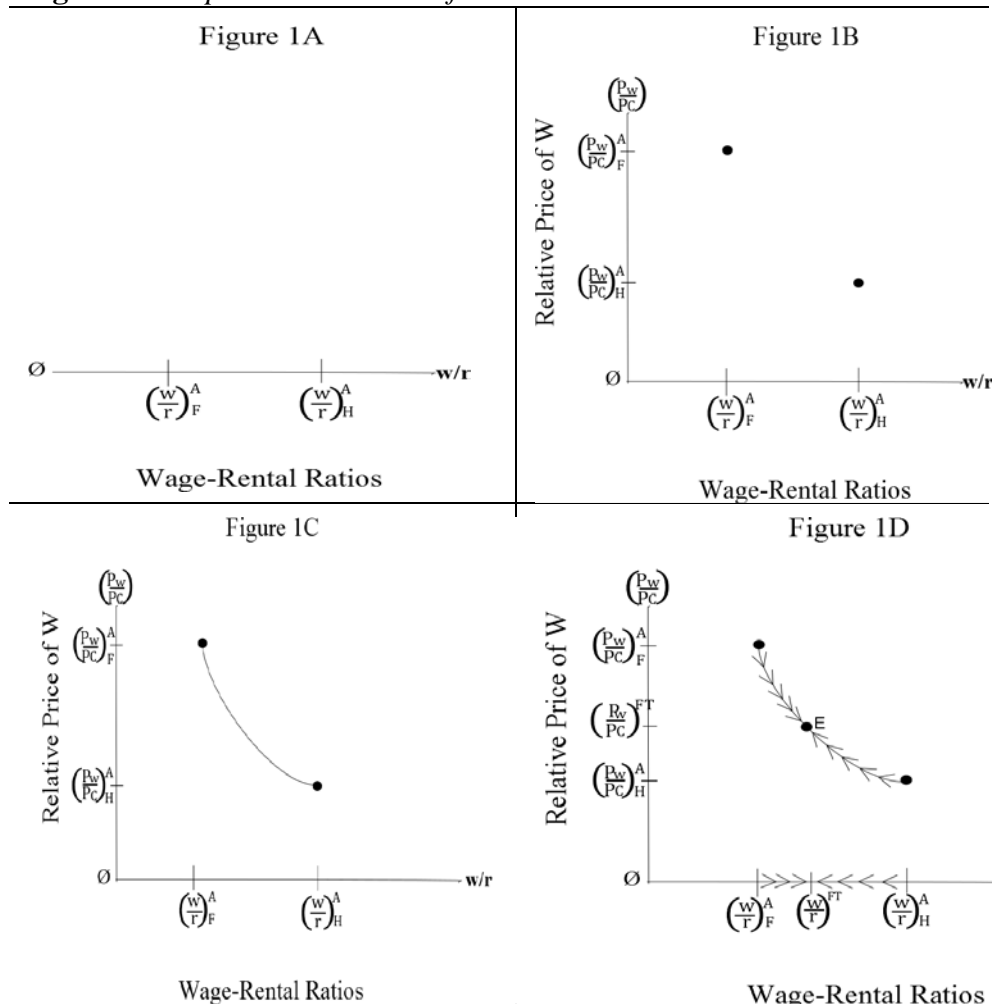
In two consecutive steps, we will determine the relative positions of each country under autarky. The first step will utilize information regarding factor abundances in both Home and Foreign to determine relative factor prices, namely wage rental ratios ( $w/r$ ). Given the  $w/r$  in each country, the second step will utilize information regarding labor and capital intensity in each sector to determine

relative output prices. In other words, at the end of these two steps, we will be able to position each country on the relative input price-relative output price axes.

**Step 1: Wage Rental Ratios in Each Country**

Let's recall what we said about capital-labor ratios in each country, from equation 1. Home is capital abundant and Foreign is labor abundant. That is to say, Home has more capital per unit of labor, and vice versa at Foreign. Abundant factors tend to have lower prices; therefore it is reasonable to expect a lower relative rent—capital price—in Home; and by the same token a lower relative wage—labor price—in Foreign. We can show this graphically (Figure 1A), if for Home the  $w/r$  is at  $(\frac{w}{r})_H^A$ , then for Foreign the  $w/r$   $(\frac{w}{r})_F^A$  has to be on the left hand side of Home's. Students can make this placement on their own by asking them to assume the labor price in Foreign is one and for Home, since its more expensive, two. For capital students can be asked to assume these numbers are switched. Now, having determined the  $w/r$  in both countries based on the information regarding factor abundance; let us move to determining the output prices.

**Figure 1. Graphical derivation of the HO model and its theorems**



**Step 2: Relative Prices in Each Country**

If the autarky relative price of good W (in terms of good C),  $(\frac{P^W}{P^C})$  at Home is  $(\frac{P^W}{P^C})_H^A$  (as seen in Figure 1B), then where should it be in the Foreign; higher,

lower, or the same? To answer this question, recall what we said about capital-labor ratios in each industry, from equation 2: Good W is capital intensive; and good C is labor intensive. That is to say, in order to produce a unit of good W we would use more capital per unit of labor than to produce a unit of good C. (To keep it simple, let's assume that there is no factor intensity reversal, i.e., at any given wage-rental ratio this relationship holds.) Can we conclude then that the relative price of good W in Foreign,  $\left(\frac{p^W}{p^C}\right)_F^A$ , is at a point northwest of the Home's? In other words, is the autarky relative price of good W higher in Foreign? Yes. After all, Foreign has plenty of labor and good C is labor intensive; therefore good C costs less in Foreign and good W costs more. Conversely, students can see this relationship because Home has more capital than Foreign, which will make good W cheaper in Home under autarky.

### 3.3 Free Trade

Having clearly located both Home and Foreign's autarky positions, we are ready to determine the pattern of trade. Obviously, the story above holds for all of the  $w/r$  less than  $\left(\frac{w}{r}\right)_H^A$  and greater than  $\left(\frac{w}{r}\right)_F^A$ , therefore we can draw a line to connect all these points as seen in Figure 1C. When the countries decide to move from autarky to free trade, essentially, they are looking at Figure 1C. (This assumes that the information available is perfect and not asymmetric.)

#### Step 3: Pattern of Trade

Home consumers and Foreign consumers are both excited because they realize that under free trade they can buy goods at lower prices. Specifically, Home consumers can now purchase good C at a lower price from Foreign producers and Foreign consumers can now purchase good W at a lower price from Home producers. Thus, Home will import good C and Foreign good W. That is to say, Home will export good W and Foreign good C. The logic here is straightforward. Once again, it is important to recall two things; Good W is capital intensive and Home is capital abundant, therefore Home will export good W. A capital abundant country has a comparative advantage in a capital intensive good, and by the same token a labor abundant country has a comparative advantage in a labor intensive good.

#### Step 4: Factor Price Equalization

Once trade starts, Home needs to produce more of good W and less of good C. This increases the demand for capital (the factor of production used more intensively in good W production), which in turn puts an upward pressure on rent or a downward pressure on wages. The same mechanism, but in the exact opposite direction, starts working in the Foreign. These processes will continue as long as relative output prices differ between Home and Foreign. Graphically speaking, until the two countries' free trade relative output prices becomes equal to each other, i.e., no more incentives left for reallocation, this process will continue until they both reach point E in Figure 1D. At Point E, or the free trade equilibrium, the relative price of good W is the same in both countries  $\left(\frac{p^W}{p^C}\right)^{FT}$ . If we look at the horizontal  $w/r$ -axis, we will notice that under free trade, as is expected, that the  $w/r$  is also the same in both countries. This is known as the factor-price equalization theorem. This makes intuitive sense. Every time Home exports a unit of good W, it effectively ships some of its capital to Foreign, and every time Foreign exports good C, it sends some of its labor to Home. Free trade in a sense equalizes the capital-labor ratios in both countries, and consequently their relative prices, or the  $w/r$  ratio.

#### Step 5: Income Distribution

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Finally, let us derive the implication of free trade on income distribution in the Heckscher-Ohlin Model, which is also known as the Stolper-Samuelson theorem.

For simplicity, let's depict the rise in the relative price of W,  $\left(\frac{P^W}{P^C}\right)$  at Home under free trade as an increase in price of W, with no change in the price of C. Since the markets are perfectly competitive, when the price of W rises, either wages or rents will increase. First of all, from factor price equalization, recall that the  $w/r$  is down at Home. Second, if  $r$  is up, in order for the price of C to stay the same, wages should go down. Accordingly, we could observe an increase in the price of W and no change in the price of C, if, and only if, the percentage increase in rent is higher than the percentage increase in the price of W, and the percentage change in wage is negative. (This is the so-called magnification effect.)

Both under autarky and free trade, the same amount of labor and capital are fully employed. Yet, under free trade, in relative terms, capital owners in the capital abundant country (Home) are now collecting a higher rent while wages are down. Consequently, under free trade capital owners are getting a bigger share in Home of the national economy. In other words, at the expense of workers, capital owners are becoming better off in Home. Meanwhile, the exact opposite is happening in Foreign; laborers are becoming better off at the expense of capital owners. Therefore, free trade creates a conflict of interest between laborers and capital owners. This can also be explained to students by asking them what affect the increased demand for capital and lower demand for labor in Home will have on capital owners and workers. From this approach, it should be clear to them the effects of free trade on capital owners and laborers in both Home and Foreign.

### 4. Concluding remarks

We have proposed an intuitively appealing and simple graphical approach to explain the HO model, particularly on how to derive its three theorems about the pattern of trade, factor price equalization, and income distribution. This approach is simple because it needs only two pieces of information, factor endowments and factor intensities, to do a step-by-step construction of the model and to derive its theorems. The intuitive appeal stems from its straightforward logic that is sufficient for students without economics backgrounds to understand, as there is no need for "rich" terminology or use of tools such as production possibility frontier, isoquant, isocost, etc.

Although this graphical approach has been developed to better introduce these issues to students with no formal economics background in master's degree programs at international relations schools, it should also appeal to undergraduate and other graduate students who are not majoring in economics. Even for students majoring in economics, this approach could be utilized to give the intuition behind this theorem before delving into a more formal treatment of these issues.

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