

Solution to Homework 2

Heckscher-Ohlin Model and Specific Factors Model

ECO-13101 Economía Internacional I (International Trade Theory)*

Question 1: Implication of HO Theorem

1. We would expect wheat and software outputs to rise, shirts to fall.
2. Real incomes of land owners and skilled labor would rise, of unskilled labor would fall.
3. Assuming a university education is the ticket to becoming a skilled laborer, the incentives to go to university would rise due to the growing gap between skilled-labor and unskilled-labor living standards. (By the way, it is true that investments in college education pay a very large return in terms of lifetime incomes in the U.S.)
4. If skilled workers and landowners are at the high end of the income distribution and unskilled workers are at the low end, trade would tend to increase income inequality. You should think about how this process would work in a country that has an abundance of unskilled workers.

Question 2: Ricardian versus Heckscher-Ohlin Forces of Trade

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1. Firms of each country in each sector maximize profits. So, in sector X in country $j = \{h, f\}$, firms

$$\begin{aligned} & \max_{\{L_x^j, K_x^j\}} p_x^j X^j - w_j L_x^j - r_j K_x^j \\ & s.t. \quad X^j = Z_x^j (K_x^j)^\alpha (L_x^j)^{1-\alpha} \quad , \end{aligned}$$

which can be rewritten as

$$\max_{\{L_x^j, K_x^j\}} p_x^j Z_x^j (K_x^j)^\alpha (L_x^j)^{1-\alpha} - w_j L_x^j - r_j K_x^j \quad .$$

The first order conditions with respect to labor and capital, respectively, are:

$$p_x^j (1 - \alpha) Z_x^j (K_x^j)^\alpha (L_x^j)^{-\alpha} = w_j \quad , \quad (1)$$

$$p_x^j \alpha Z_x^j (K_x^j)^{\alpha-1} (L_x^j)^{1-\alpha} = r_j \quad . \quad (2)$$

Similarly for sector Y in country $j = \{h, f\}$ the first order conditions with respect to labor and capital are:

$$p_y^j (1 - \beta) Z_y^j (K_y^j)^\beta (L_y^j)^{-\beta} = w_j \quad , \quad (3)$$

$$p_y^j \beta Z_y^j (K_y^j)^{\beta-1} (L_y^j)^{1-\beta} = r_j \quad . \quad (4)$$

2. Divide Eq. (1) by Eq. (2) (and Eq. (3) by Eq. (4)) to get the capital-labor ratio of each sector as a function of the wage-rental ratio.

$$\frac{K_x^j}{L_x^j} = \frac{\alpha}{(1 - \alpha)} \frac{w_j}{r_j} \quad , \quad \frac{K_y^j}{L_y^j} = \frac{\beta}{(1 - \beta)} \frac{w_j}{r_j} \quad . \quad (5)$$

3. Dividing Eq. (1) by Eq. (3) (or Eq. (2) by Eq. (4)) gives us

$$\frac{p_x^j}{p_y^j} = \frac{(1 - \beta)}{(1 - \alpha)} \cdot \frac{Z_y^j}{Z_x^j} \cdot \frac{(K_y^j/L_y^j)^\beta}{(K_x^j/L_x^j)^\alpha} \quad ,$$

which can be re-written by substituting for the capital-labor ratios of the two sectors (from Eq. (5)):

$$\frac{p_x^j}{p_y^j} = \frac{Z_y^j}{Z_x^j} \cdot \frac{\beta^\beta}{\alpha^\alpha} \cdot \frac{(1 - \beta)^{(1-\beta)}}{(1 - \alpha)^{(1-\alpha)}} \cdot \left(\frac{w_j}{r_j} \right)^{(\beta-\alpha)} \quad . \quad (6)$$

4. The price ratio is a function of (i) relative productivity (TFP) $\frac{Z_y^j}{Z_x^j}$, and (ii) the wage-rental ratio $\frac{w_j}{r_j}$. As compared to the foreign country, a higher productivity in sector X relative to sector Y in the home country will imply a lower price of good X relative to good Y in home country. This is the Ricardian force leading to comparative advantage differences across countries. On the other hand, if home country is abundant in labor relative to capital as compared to the foreign country, it will result in lower wage-rental ratio in home and hence a lower price ratio (since $\beta > \alpha \Rightarrow \beta - \alpha > 0$). This is the Heckscher-Ohlin force leading to differences in comparative advantage. Thus, in this model, relative prices in autarky, or comparative advantage, is determined by productivity differences as well as by relative factor endowment differences across the two countries.
5. When the two countries trade firms will face world prices instead of autarky prices. Therefore, now we have that

$$\begin{aligned}
p^* &= \frac{p_x^*}{p_y^*} = \frac{Z_y^j}{Z_x^j} \cdot \frac{\beta^\beta}{\alpha^\alpha} \cdot \frac{(1-\beta)^{(1-\beta)}}{(1-\alpha)^{(1-\alpha)}} \cdot \left(\frac{w_j}{r_j}\right)^{(\beta-\alpha)}, \\
\Rightarrow \frac{Z_y^h}{Z_x^h} \cdot \frac{\beta^\beta}{\alpha^\alpha} \cdot \frac{(1-\beta)^{(1-\beta)}}{(1-\alpha)^{(1-\alpha)}} \cdot \left(\frac{w_h}{r_h}\right)^{(\beta-\alpha)} &= \frac{Z_y^f}{Z_x^f} \cdot \frac{\beta^\beta}{\alpha^\alpha} \cdot \frac{(1-\beta)^{(1-\beta)}}{(1-\alpha)^{(1-\alpha)}} \cdot \left(\frac{w_f}{r_f}\right)^{(\beta-\alpha)}, \\
\Rightarrow \frac{Z_y^h}{Z_x^h} \cdot \left(\frac{w_h}{r_h}\right)^{(\beta-\alpha)} &= \frac{Z_y^f}{Z_x^f} \cdot \left(\frac{w_f}{r_f}\right)^{(\beta-\alpha)}, \\
\Rightarrow \frac{w_h}{r_h} &= \left[\frac{Z_y^f/Z_x^f}{Z_y^h/Z_x^h} \right]^{\frac{1}{(\beta-\alpha)}} \frac{w_f}{r_f}. \tag{7}
\end{aligned}$$

This equation implies that the wage-rental ratio in country H is not equal to that in country F . This is because of the presence of the TFP terms. The presence of technological differences across sectors and across countries leads to the violation of FPE.

Question 3: Specific-Factors Model

As a result of trade there is an increase in the relative price of a good X , which results in an increase in the real return to the specific factor used in X , a decrease in the real return to the specific factor used in Y and has an ambiguous effect on the mobile factor, labor.

In the long run, when capital is mobile, the higher real return to capital in sector X will attract capital into sector X out of sector Y . Thus, at with the same allocation of labor, and unchanged goods prices, the marginal product of labor will be higher in X and lower in Y . This implies that VMP_{LX} curve would shift up and VMP_{LY} would shift down. This process will continue till the return to capital, r , in addition to the wage, w , is also equalized across the sectors.

The changes in K/L ratios will change labor allocation as well. If, in the long-run, good X is the labor intensive good and good Y is the capital intensive good, then sector Y will release capital in a greater proportion relative to labor than needed by sector X . This will cause K/L ratio to increase in both sectors, resulting an increase the real return to labor in both sectors and a decline the real return to capital in both sectors. Thus, in the long-run the Stolper-Samuelson result will hold. The output of good X will increase and that of good Y will decline.

Question 4: Assumptions of HO Model

1. U.S. by allowing countries with relative abundance of low priced labor to produce low-skill intensive goods would specialize in goods in which it has comparative advantage - high-skill intensive goods. Specialization according to comparative advantage, would result in lower prices and more output of both low-skill intensive goods and high-skill intensive goods. This will improve the welfare of consumers.
2. “The theory rests on the assumption that a low-skilled U.S. job shifted offshore would have remained low-skilled had it stayed home.” This statement from the article essentially means that the crucial assumption is that there is no factor-intensity reversal, i.e. a low-skill intensive good remains low-skill intensive in both countries.
3. In the article this assumption is violated because New Balance’s production in U.S. is skill-intensive whereas in China it is low-skill intensive.
4. If this assumption is violated it is not clear that gains from trade are guaranteed.

5. Congress might offer tax credits or other incentives to companies that invest in training or technology for low-skilled production and upgrade to high-skill intensive.
6. If the U.S. workers were no more efficient than those in China, New Balance's labor costs in the U.S., where it pays \$14 an hour in wages and benefits, would be an untenable \$44 per pair of shoes. But the company has whittled the cost down to \$4 a pair vs. \$1.30 in China, where labor costs are about 40 cents an hour. The remaining \$2.70 labor cost differential is a manageable 4% of a typical \$70 shoe. And it's offset by the advantages of producing in the U.S., where stores can fill orders faster than rivals and whip out style changes more quickly. This also allows New Balance to forgo extensive advertising, so it can afford the \$15 million or so in annual capital investments required by its high-tech approach. Profits come in at midrange in the industry.
7. Technology allows the same good to be produced as skill-intensive in the U.S. and low-skill intensive in China.

Question 5: What does Mexico Import and Export

1. Table 1 below lists the top 10 commodities in terms of their share in total exports of 1993. The table also gives the rank of each commodity in 2007 based on its share in total exports of 2007.

Most of the top 10 commodities of 1993 are still within the top 10 commodities of 2007. However, some of the major downward moves in the rank include Electric current, Electrical distribution equipment, and Valves/transistors/etc. Some of the major upward moves in the rank are Tea and mate.

2. Table 2 lists the top 10 commodities in terms of their share in total exports of 2007. The table also gives the rank of each commodity in 1993 based on its share in total exports of 1993.

Most of the top 10 commodities of 2007 are still within the top 10 commodities of 1993. However, the commodities that saw major improvement in their ranks from

Table 1: Rank based on share in total exports, sorted by 1993 Rank

Product Description	Rank 1993	Rank 2007
Perfume/toilet/cosmetics	1	1
Paper/paperboard	2	3
Electric current	3	8
Monofilament rods/sticks	4	5
Electrical distrib equip	5	9
Tea and mate	6	2
Taps/cocks/valves	7	4
Indust heat/cool equipmt	8	11
Elect power transm equip	9	10
Valves/transistors/etc	10	16

Table 2: Rank based on share in total exports, sorted by 2007 Rank

Product Description	Rank 1993	Rank 2007
Perfume/toilet/cosmetics	1	1
Tea and mate	6	2
Paper/paperboard	2	3
Taps/cocks/valves	7	4
Monofilament rods/sticks	4	5
Gold non-monetary ex ore	17	6
Coke/semi-coke/retort c	13	7
Electric current	3	8
Electrical distrib equip	5	9
Elect power transm equip	9	10

Table 3: Rank based on share in total imports, sorted by 1993 Rank

Product Description	Rank 1993	Rank 2007
Valves/transistors/etc	1	6
Electric circuit equipmt	2	4
Electrical equipment nes	3	11
Telecomms equipment nes	4	1
Articles nes of plastics	5	9
Base metal manufac nes	6	10
Electrical distrib equip	7	14
Computer equipment	8	7
Heavy petrol/bitum oils	9	2
Special indust machn nes	10	16

1993 to 2007 include Tea and mate, Taps/cocks/valves, Gold non-monetary ex ore, and Coke/semi-coke/retort.

The two tables reveal that even though some of the major exporting industries of 1993 are also the major exporting industries of 2007, there are some new entrants in the top 10 ranks of 2007. These industries were not in the top 10 industries of 1993. Similarly, there are a few industries that were among the top 10 industries in 1993 that are no longer in the top 10 industries of 2007. These shifts represent the changes due to NAFTA.

- Table 3 shows the top 10 commodities in terms of their share in total imports of 1993. The table also gives the rank of each commodity in 2007 based on its share in total imports of 2007.

7 of the top 10 commodities of 1993 are still within the top 10 commodities of 2007, but this time there are bigger changes in the ranks, and most of these changes are downward (decrease in rank). Some of the major downward moves in the rank include Valves/transistors/etc, Electrical equipment nes, Articles nes of plastics, Base metal manufac nes, and Special indust machn nes. Some of the major upward moves in the rank are Telecomms equipment nes, and Heavy petrol/bitum oils.

Table 4: Rank based on share in total imports, sorted by 2007 Rank

Product Description	Rank 1993	Rank 2007
Telecomms equipment nes	4	1
Heavy petrol/bitum oils	9	2
Motor veh parts/access	12	3
Electric circuit equipmt	2	4
Passenger cars etc	37	5
Valves/transistors/etc	1	6
Computer equipment	8	7
Optical instruments nes	208	8
Articles nes of plastics	5	9
Base metal manufac nes	6	10

Table 4 shows the top 10 commodities in terms of their share in total imports of 2007. The table also gives the rank of each commodity in 1993 based on its share in total imports of 1993.

Some of the big improvements in rank from 1993 to 2007 are Telecomms equipment nes, Heavy petrol/bitum oils, Motor veh parts/access, Passenger cars etc, Optical instruments nes. On the other hand, some of the big downward changes in ranks from 1993 to 2007 are Articles nes of plastics, Valves/transistors/etc, and Base metal manufac nes.

In case of imports we can see big shifts. For example, emergence of Passenger cars and optical instruments nes as top 10 imports of 2007. These are examples of the big effects of NAFTA.

4. Table 5 list the top 10 commodities based on growth in exports between 1993 and 2007.

Table 6 list the top 10 commodities based on growth in imports between 1993 and 2007.

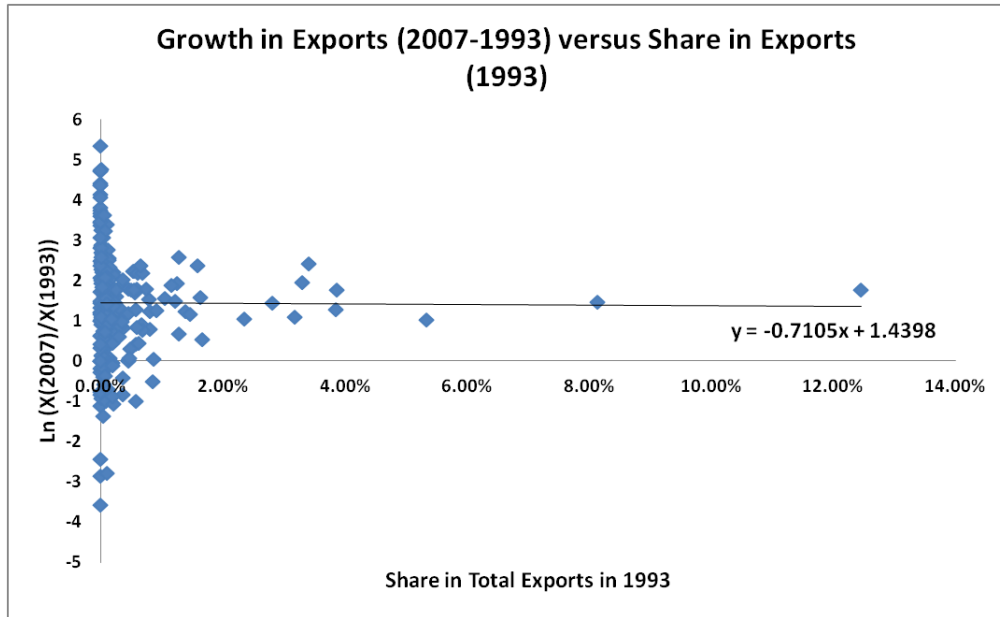
5. Both exports and imports exhibit a negative correlation between growth during 1993-2007 period and the share in 1993, i.e. commodities with high share in import/export

Table 5: Top 10 fastest growing commodities, Exports

ProductDescription	Growth Rate $((X_{07} - X_{93})/X_{93})$
Cheese and curd	210
Rice	118
Synthetic spinning fibre	114
Internal combust engines	112
Floor coverings etc.	83
Passenger cars etc	80
Residual petrol. prods	79.5
Butter and cheese	62
Precious metal ore/conc.	58
Meat/offal preserved	45

Table 6: Top 10 fastest growing commodities, Imports

ProductDescription	Growth Rate $((M_{07} - M_{93})/M_{93})$
Precious metal ore/conc.	215156
Optical instruments nes	309
Iron ore/concentrates	307
Tobacco, manufactured	86
Coal non-agglomerated	81
Silk	71
Coin nongold non current	40
Natural gas	29
Nf base metal waste nes	27.5
Knit/crochet fabrics	22.5



in 1993 exhibit slower growth between 1993-2007, while commodities that had a small share in import/export in 1993 exhibit a higher growth rate. The graphs are given below.

