

Problem Set 4

Due April 25th at 8pm

Problem 1: True, false, or uncertain

Please *evaluate* whether each statement is true, false, or uncertain. Use economic reasoning, graphical analysis, or evidence discussed in class.

1. As in the Specific Factors model, in the Heckscher-Ohlin model, a decrease in the terms of trade has ambiguous effects on workers' welfare.
2. The discovery of new oil reserves can harm workers in the economy.
3. If one country has a greater endowment of all resources than another, both will benefit from trade.
4. If two countries experience population growth simultaneously, one might lose some gains from trade.

Problem 2: Has China de-industrialized other developing countries? (Wood and Mayer, 2009)

For this question, read [this VoxEU column](#) that summarizes the findings from Wood and Mayer (2009). You do not need to read the paper itself to answer the questions.

Wood and Mayer (2009) argue that the rise of China – treated as a massive infusion of basic-educated labor into world markets – has lowered the world relative price of labor-intensive manufactures and pushed land-abundant developing regions (sub-Saharan Africa, parts of Latin America) *away* from manufacturing and *toward* primary commodities. Their Table 4 predicts that China's entry reduces the other developing countries' gross-output ratio of manufactures to primary commodities by about 7–11% (in log points) and the corresponding export ratio by 16–21% – entirely through a world-price channel. This problem builds a minimal 2×2 Heckscher-Ohlin model that reproduces that logic and asks you to compare the model's prediction to their estimates.

Setup. Two economies, “China” (Chn) and “Africa” (Afr, shorthand for the paper's land-abundant developing region), trade two goods – manufactures M and primary commodities P – using two factors, labor L and land T . Factors are mobile across sectors within a country and immobile across countries. Technologies are Cobb–Douglas and identical across countries,

$$Q_M = L_M^{3/4} T_M^{1/4}, \quad Q_P = L_P^{1/4} T_P^{3/4},$$

so the land share is $\alpha_M = 1/4$ in M and $\alpha_P = 3/4$ in P (hence M is labor-intensive, P is land-intensive). Preferences are identical, homothetic, and Cobb–Douglas with equal budget shares on each good, $\beta = 1/2$, so the aggregate relative demand is

$$RD(p) = 1/p, \quad \text{where } p \equiv p_M/p_P.$$

Factor markets are perfectly competitive and there are no factor-intensity reversals. Normalize units so that land is measured in km^2 per hundred workers (the paper's variable $n = T/L$ in Table 1). China's measured n in 2000 was ≈ 1 ; the rest of the developing world averaged $n \approx 4$. Accordingly the initial endowments are:

	L	T	$n = T/L$
China	100	100	1
Africa	100	400	4

1. **Factor abundance and the H–O theorem.** Compute $n = T/L$ for each country. Which country is land-abundant, which is labor-abundant? Using the Heckscher–Ohlin theorem, state which good each country exports under free trade, and briefly explain the intuition (why does factor abundance determine the direction of trade?).
2. **Autarky factor prices and autarky goods prices.** The model (which you do *not* need to derive here) pins down autarky factor and goods prices uniquely from the endowments:

	$\omega = w/r$	$p_A = p_M/p_P$
China	1	1
Africa	4	2

Manufactures are *twice as expensive* relative to primary goods in Africa as in China. Explain in two or three sentences *why* the labor-abundant country has the lower autarky relative price of manufactures.

3. **PPFs and autarky equilibria.** Sketch the two countries' PPFs on a common (Q_M, Q_P) diagram. Mark each country's autarky allocation with a dot and the autarky price line (tangent to the PPF, slope $-p_A$). Explain in one sentence why China's PPF is bowed toward the Q_M -axis while Africa's is bowed toward the Q_P -axis.
4. **World RS–RD and initial free-trade equilibrium.** Under free trade both countries face a common world price p^W . For this calibration $p^W \approx 1.58$. On a diagram with Q_M/Q_P on the horizontal axis and p on the vertical axis, sketch the world relative supply curve RS^W and the demand curve $RD(p) = 1/p$, mark each country's autarky price on the vertical axis, and mark the free-trade equilibrium. Explain in one or two sentences *why* the free-trade price must lie strictly *between* the two autarky prices.
5. **Stolper–Samuelson when Africa opens to trade.** Africa's relative price of manufactures falls from $p_A^{\text{Afr}} = 2$ to $p^W \approx 1.58$ on opening. Using the *Stolper–Samuelson theorem* (the “magnification effect”):
 - 5.a. Which Africa factor price, w or r , *rises* in real terms, and which *falls*? (You should be able to answer this without any calculation – just use factor intensities and the direction of the price change.)
 - 5.b. Who in Africa *gains* in real terms from opening to trade, and who *loses*?
 - 5.c. Is your answer consistent with the general H–O prediction that *trade benefits the abundant factor and hurts the scarce factor*? Explain in one sentence.

6. **Rybczynski at fixed world price: China's labor-force expansion.** Wood and Mayer interpret China's rise as a large expansion in the world's effective labor supply. We capture the shock here as China's labor growing from $L^{\text{Chn}} = 100$ to $L^{\text{Chn}} = 110$ (+10%), with land T^{Chn} , Africa's endowment, and technologies all unchanged. Holding the world price *temporarily fixed* at $p^W = \sqrt{2.5}$:
- Using the *Rybczynski theorem*, which of China's outputs – Q_M^{Chn} or Q_P^{Chn} – *expands*, and which *contracts*?
 - What does this imply about world relative supply at the original price? Does RS^W shift *right* (higher Q_M/Q_P at each p) or *left*?
 - Once world prices adjust to clear markets again, does the new equilibrium price $p^{W,\text{new}}$ lie *above* or *below* the old p^W ? Explain briefly.
7. **World-price channel and the Wood–Mayer estimate.** Now let the world price adjust. The diagram below shows the shift of RS^W : the old curve is solid, the new (post-shock) curve is dashed, the old equilibrium is the filled dot, the new equilibrium is the hollow dot. Wood and Mayer (2009, Table 4) report two empirical quantities driven *entirely through this world-price channel*:
- The world relative price of manufactures fell by approximately 4%;
 - Africa's gross-output ratio of manufactures to primary commodities fell by around 15% (their estimates lies in the range $[-0.21, -0.07]$).
- Matching paper quantities to the diagram.* On the RS–RD diagram, which graphical distance represents the first estimated change? (Be specific: which two points, and along which axis?)
 - Africa's $Q_M^{\text{Afr}}/Q_P^{\text{Afr}}$ is *not* the same as the world ratio on the horizontal axis. Using only your earlier answers about which way Africa's production bundle moves when p^W falls (Parts 3 and 5), state the *sign* of $\widehat{RS}^{\text{Afr}}$ and reflect the effect on Africa's PPF graph.
 - Sign check against the paper.* Are the signs you identified in (i) and (ii) consistent with Wood and Mayer's Table-4 range? What does it mean in plain English for what Africa produces?
 - Welfare in Africa.* Apply Stolper–Samuelson once more (with the sign of $\hat{p}^W$ you read off from the diagram). Who in Africa *gains* and who *loses* from China's rise? Is this the *same* direction as the “Africa opens to trade” experiment in Part 5, or the opposite?
 - Using your general economic knowledge/intuition, give *one* reason why the 2×2 model might over- or under-state the magnitude of Africa's de-industrialization relative to the prediction of the Heckscher–Ohlin model.

