

Heckscher-Ohlin: Offshoring and Task Trade

Grossman and Rossi Hansberg (2008)

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- 2 countries (Home & Foreign), 2 sectors (X and Y), and at least 2 factors (unskilled labor, skilled labor, and possibly other factors).
- Technologies:
 - Goods X and Y are produced by a continuum of L -tasks (of measure 1) and a continuum of H -tasks (of measure 1).
 - Within each industry $j \in (X, Y)$, all L -tasks require the same amount of unskilled domestic labor, a_{Lj} , and all H -tasks also require the same amount of unskilled domestic labor, a_{Hj} . (If substitution between L -tasks and H -tasks, then a_{Lj} and a_{Hj} are the outcome of optimization.)
 - Good X is relatively skill intensive: $a_{Hx}/a_{Lx} > a_{Hy}/a_{Ly}$.
- Preferences: homothetic and identical across countries.

- No offshoring of H -tasks.
- L -tasks, indexed by i , are ordered in increasing cost of offshoring.
- A firm producing good j requires a_{Lj} of home labor if it produces L -task i at home, and $a_{Lj}\beta t_j(i)$ of foreign labor if it produces that same task abroad.
- β is a shift parameter (lower β makes offshoring easier across the board); $t_x(i) = t_y(i) = t(i)$ and $t'(i) > 0$.

- w is home wage of unskilled, w^* is foreign wage of unskilled, where $w > \beta t(0)w^*$, so home offshores at least some tasks.
- The marginal task performed at home, I , satisfies the condition

$$w = \beta t(I)w^*$$

- Price of good j :

$$p_j = wa_{Lj}(\cdot)(1 - l) + w^* a_{Lj}(\cdot) \int_0^l \beta t(i) di + sa_{Hj}$$

where s is wage of skilled workers.

- Replace w^* by $w/(\beta t(l))$, we can re-write

$$p_j = wa_{Lj}(\cdot)\Omega(l) + sa_{Hj} \quad (1)$$

where

$$\Omega(l) = 1 - l + \frac{\int_0^l t(i) di}{t(l)}$$

- Note 1: $w\Omega(l)$ is the average cost of an L -task, whereas s is the average cost of an H -task. These two average costs are the arguments that determine a_{Lj} and a_{Hj} .
- Note 2: Since $t'(i) > 1$, $\Omega(l) < 1$, so that offshoring *lowers* the cost of L -tasks.

- Unskilled labor.

$(1 - I)a_{Lx}(\cdot)x + (1 - I)a_{Ly}(\cdot)y = L$, so that

$$a_{Lx}(\cdot)x + a_{Ly}(\cdot)y = \frac{L}{1 - I} \quad (2)$$

- Skilled labor.

$$a_{Hx}(\cdot)x + a_{Hy}(\cdot)y = H \quad (3)$$

Decomposing the wage effect of offshoring

By totally differentiating the zero-profit condition (1) for both sectors, and the market clearing conditions (2) and (3), we can write

$$\hat{w} = -\hat{\Omega} + \mu_1 \hat{p} - \mu_2 \frac{dI}{1-I} \quad (4)$$

where

- First term is *productivity effect*: an improvement in offshoring ($d\beta < 0$) lowers the cost of performing the set of L -tasks ($\hat{\Omega}, 0$), much the same way as an increase in productivity would. This benefits unskilled workers.
- Second term is *relative price effect*: an improvement in offshoring leads to a decrease in the relative price of the unskilled-intensive good, Y , and thus hurt unskilled workers (Stolper-Samuelson)
- Third term is *labor supply effect*: an improvement in offshoring leads to an increase in I , which from (2) can be interpreted as an increase in the supply of unskilled labor. This tends to depress the unskilled wage. (Note: this is not always the case, think of FPE!)

- Take relative price p and foreign price w^* as given (small economy).
- Zero profit conditions (1):

$$1 = \Omega w a_{Lx}(\Omega w / s) + s a_{Hx}(\Omega w / s) \quad (5)$$

$$p = \Omega w a_{Ly}(\Omega w / s) + s a_{Hy}(\Omega w / s) \quad (6)$$

These are two equations in two unknowns, (Ωw and s). These two unknowns do not depend on β . If offshoring improves, and β drops, Ωw and s do not change. Therefore, $\hat{w} = -\hat{\Omega}$ and $\hat{s} = 0$.

- Combining $\hat{w} = \hat{\Omega}$, $\hat{w} = \hat{\beta} + \hat{t}(l)$ and $\frac{d\Omega}{dl} = -\frac{\int_0^l t(i)di}{t(l)}\hat{t}(l)$ gives

$$\hat{w} = -\hat{\Omega} = -\frac{\int_0^1 t(i)di}{(1-l)t(l)}\hat{\beta}$$

Therefore, if β goes down, then $\hat{w} > 0$ as long as $l > 0$, i.e., the productivity effect is positive if there is already some offshoring.

- Firms save costs on the inframarginal tasks, i.e., on the ones that were already offshored. It also saves by shifting the marginal task offshore, but that effect is second-order. Taken together, the effect is zero when no tasks have been offshored yet.

Relative price effect

- To get relative price effect, no longer small country assumption.
- To get reason for offshoring, wages should be lower in foreign country. Therefore, assume that productivity in indigenous firms in foreign country is lower. In particular, the productivity of foreign indigenous firms is $1/A^*$, compared to domestic firms or compared to foreign firms that work in offshoring.
- Zero profit conditions:

$$1 = A^* w^* a_{Lx}(w^*/s^*) + A^* s^* a_{Hx}(w^*/s^*) \quad (7)$$

$$p = A^* w^* a_{Ly}(w^*/s^*) + A^* s^* a_{Hy}(w^*/s^*) \quad (8)$$

These equations, together with (5) and (6), imply that $w\Omega = w^*A^*$ and $s = s^*A^*$.

- Foreign factor market clearing conditions:

$$A^* a_{Lx} x^* + A^* a_{Ly} y^* + \beta \int_0^I t(i) di (a_{Lx} x + a_{Ly} y) = L^* \quad (9)$$

$$A^* a_{Hx} x^* + A^* a_{Hy} y^* = H^* \quad (10)$$

- Foreign factor market clearing, together with Home factor market clearing, implies

$$x + x^* = \frac{a_{Ly}(H + H^*/A^*) - a_{Hy}(L^*/A^* + L/\Omega)}{\Delta_a} \quad (11)$$

$$y + y^* = \frac{a_{Hx}(L^*/A^* + L/\Omega) - a_{Lx}(H + H^*/A^*)}{\Delta_a} \quad (12)$$

where $\Delta_a = a_{Hx} a_{Ly} - a_{Lx} a_{Hy} > 0$.

- Equations $w\Omega = w^*A^*$ and $w = \beta t(l)w^*$ imply that

$$A^* = \beta t(l)\Omega(l) = \beta[(1-l)t(l) + \int_0^1 t(i)di]$$

- Therefore, when the cost of offshoring falls, and β drops, $(1-l)t(l) + \int_0^1 t(i)di$ must increase.
- This implies that l must increase, i.e., the range of tasks that are offshored goes up.
- Higher l means lower Ω .
- From (11) and (12), the relative supply of unskilled intensive goods, $(y + y^*)/(x + x^*)$, increases.
- Relative price of unskilled-intensive goods, p , decreases.

- The drop in p hurts unskilled workers for the usual Stolper-Samuelson effect.
- Of course, the productivity effect is still present.
- If the productivity effect is strong enough, an increase in offshoring may be Pareto improving for the home country.

- Will be present if change in labor supply affects relative wages.
Example: in an economy with more factors than goods.
- To illustrate this, focus on small open economy with two factors, specialized in the production of X .
- Factor market clearing:

$$a_{LX}(w\Omega/s)_X = \frac{L}{1 - I} \quad (13)$$

$$a_{HX}(w\Omega/s)_X = H \quad (14)$$

- Differentiating zero profit condition (5) gives

$$\theta_{Lx}(\hat{w} + \hat{\Omega}) + (1 - \theta_{Lx})\hat{s} \quad (15)$$

where θ_{Lx} is share of unskilled labor in total cost.

- Differentiating the ratio of (13) and (14) gives

$$\sigma_x(\hat{s} - \hat{w} - \hat{\Omega}) = \frac{dl}{1 - l} \quad (16)$$

where σ_x is the elasticity of substitution between the set of L -tasks and the set of H -tasks.

- Combining (15) and (16) gives

$$\hat{w} = -\hat{\Omega} - \frac{1 - \theta_{Lx}}{\sigma_x} \frac{dl}{1 - l} \quad (17)$$

Therefore, if β goes down, and l increases, the labor supply effect (the second term in (17)) hurts the unskilled workers.