HECKSCHER-OHLIN MODEL

OR... WHY I HATE MY MOTHER-IN-LAW

⇒ Ricardian Model assumed that differences in productivity give rise to comparative advantage (i.e. generated differences in opp. costs)

⇒ H-O Model assumes that differences in resources (factor endowments) give rise to comp adv

- a country that has a relative abundance of Kapital exports goods whose production is relatively intensive in the use of Kapital
- similar to Specific-Factors Model, but H-O model assumes that both factors of production are free to move between industries,
- Specific-Factors Model is a Short Run Mo because a factor of production was held constant in each industry
- H-O Model is a Long Run Model because factors of production can move between industries

→ Wife + I are both economists + we both want to get jobs that pay better than the City University of New York, so we need to publish some Papers

→ Unfortunately, the word "papers" begins with the letter "p" and we'll need "p" to denote "price," so let's use the word "NOTES" instead

→ Wife + I also have to do HOUSEWORK

NOTES are produced using Brains + Time
HOUSEWORK is also produced w/ Brains + Time

NB: Brains + Time can move between sectors

→ Since the H-O model is a Factor-Proportions Theory, we need to focus on two concepts:
relative intensity and relative abundance

→ The production of NOTES is relatively intensive in the use of BRAINS

→ while the production of Housework is relatively intensive in the use of TIME

→ but what does that mean?

→ express the amount of Brains used to produce Notes as a fraction of the total amount of Brains in the economy

$$\lambda_{BN} \equiv \frac{a_{BN} N}{B} = \frac{a_{BN} \frac{\text{units of brains}}{\text{unit of notes}} \cdot N \text{ notes produced}}{B \text{ brains available}}$$

→ since there are only two sectors (NOTES and HOUSEWORK) the amount of brains used in both the NOTE-WRITING and HOUSEWORK sectors must equal the total amount of brains available in the economy

$$\lambda_{BN} + \lambda_{BH} = 1 \quad \| \quad B_N + B_H = B \quad \| \quad \frac{B_N}{B} + \frac{B_H}{B} = 1$$

similarly $\lambda_{TN} + \lambda_{TH} = 1 \quad \| \quad \frac{T_N}{T} + \frac{T_H}{T} = 1$

→ NOTE-WRITING is relatively intensive in the use of BRAINS if

$$\lambda_{BN} > \lambda_{TN} \quad \| \quad \frac{B_N}{B} > \frac{T_N}{T}$$

in words: the share of Brains used in the production of Notes is greater than the share of Time used in the production of NOTES

$\lambda_{BN} > \lambda_{TN} \Rightarrow 1 - \lambda_{BN} < 1 - \lambda_{TN}$

$\lambda_{BH} < \lambda_{TH}$ $\quad \| \quad \frac{B_H}{B} < \frac{T_H}{T}$

→ Note that the assumption that Note-writing is relatively intensive in the use of Brains implies that:

→ Housework is relatively intensive in the use of time

→ But what is relative abundance?

consider two economies

my wife + I (US) and mother-in-law (ML)

$$\frac{B_{US}}{T_{US}} > \frac{B_{ML}}{T_{ML}}$$

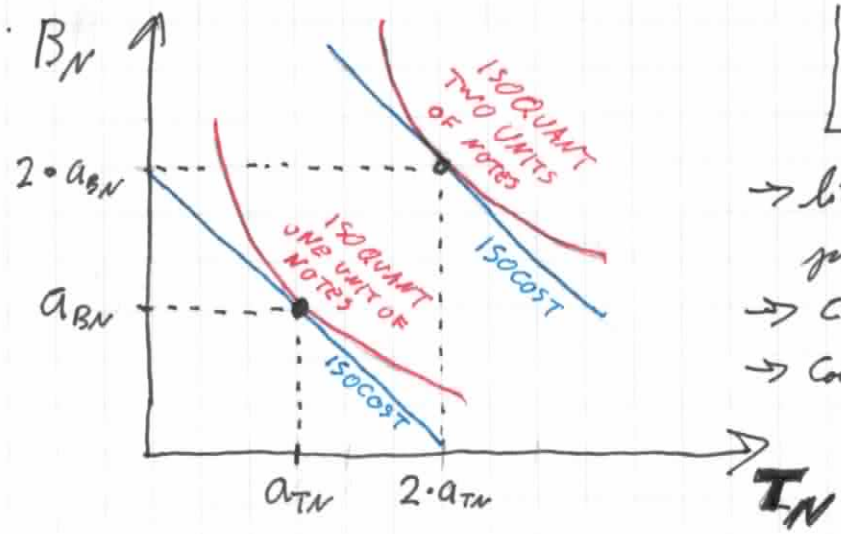
my wife + I have a relative abundance of brains because our ratio of brains to time is greater than mother-in-law's

Conversely, mother-in-law has a relative abundance of time

$$\frac{T_{US}}{B_{US}} < \frac{T_{ML}}{B_{ML}}$$

How much labor + How much brains will be used in the prod of Notes + Housework?

ISOQUANT + ISOCOST



$$-\frac{w}{r} = \frac{da_{BN}}{da_{TN}}$$

→ linearly homogeneous production fn
→ Constant returns to scale
→ Cobb-Douglas or CES

We assume that there is zero-profit

→ the price of ~~producing~~ one unit of notes is equal to the cost of producing one unit of notes

$$p_N = a_{TN} w + a_{BN} r$$

→ "firms" minimize the cost of producing output (for given price, w and r)

$$0 = w \cdot da_{TN} + r \cdot da_{BN}$$

ISOCOST's slope is the relative wage

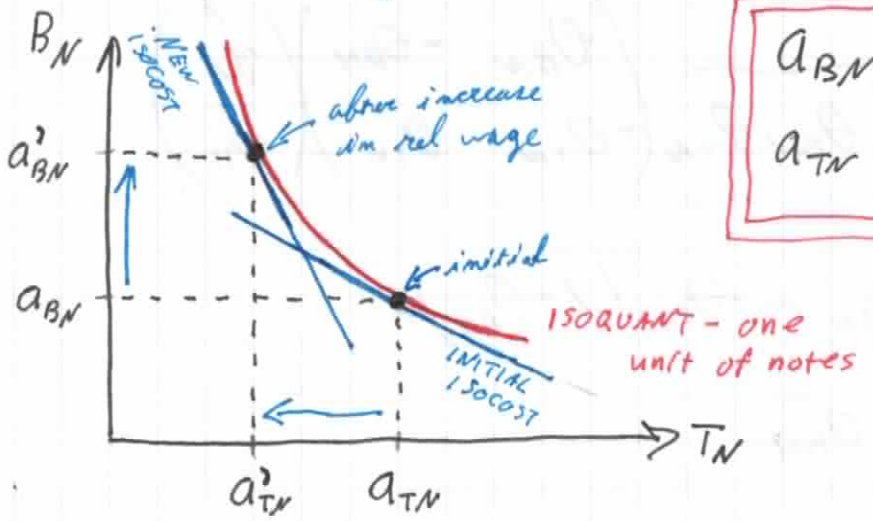
$$-\frac{w}{r} = \frac{da_{BN}}{da_{TN}}$$

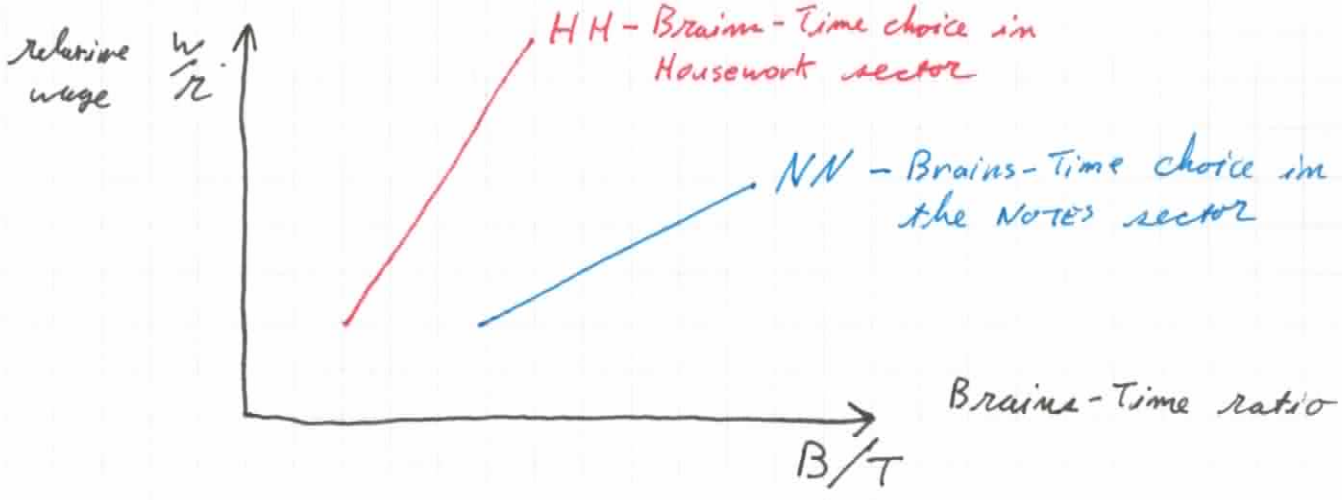
ISOQUANT's slope is Marg Rate of Tech Subs Here we minimize the cost of producing ~~one~~ Notes

$$-\frac{w}{r} = \frac{d\,a_{BN}}{d\,a_{TN}}$$

Note that if the relative wage rises, each unit of NOTES + Housework will be produced using less TIME + more BRAINS

a_{BN} rises
a_{TN} falls





$$\begin{pmatrix} a_{TN} & a_{BN} \\ a_{TH} & a_{BH} \end{pmatrix} \begin{pmatrix} w \\ r \end{pmatrix} = \begin{pmatrix} p_N \\ p_H \end{pmatrix} \qquad \boxed{A^T w = p}$$

totally differentiate:

$$a_{TN}\, w + a_{BN}\, r = p_N$$

$$(w \cdot da_{TN} + r \cdot da_{BN}) + (a_{TN}\, dw + a_{BN}\, dr) = dp_N$$

zero by cost min

$$\frac{a_{TN}\, w}{p_N} \cdot \frac{dw}{w} + \frac{a_{BN}\, r}{p_N} \cdot \frac{dr}{r} = \frac{dp_N}{p_N}$$

$$\theta_{TN}\, \hat{w} + \theta_{BN}\, \hat{r} = \hat{p}_N$$

~~θ [illegible] represents the [illegible] of time~~

~~are the cost of proding [illegible] notes~~

θ_{TN} the percentage of the cost of ~~[illegible]~~ producing notes accounted for by time

$$\theta_{TN} + \theta_{BN} = 1$$

also $\theta_{TH} + \theta_{BH} = 1$

~~$$\begin{pmatrix} \theta_{TN} & \theta_{BN} \\ \theta_{TH} & \theta_{BH} \end{pmatrix} \begin{pmatrix} \hat{w} \\ \hat{r} \end{pmatrix} = \begin{pmatrix} \hat{p}_N \\ \hat{p}_H \end{pmatrix} \quad \Big\| \quad \begin{pmatrix} \theta_{TH} & \theta_{BH} \\ \theta_{TN} & \theta_{BN} \end{pmatrix} \begin{pmatrix} \hat{r} \\ \hat{w} \end{pmatrix} = \begin{pmatrix} \hat{p}_H \\ \hat{p}_N \end{pmatrix}$$~~

$$\begin{pmatrix} \theta_{TN} & \theta_{BN} \\ \theta_{TH} & \theta_{BH} \end{pmatrix} \begin{pmatrix} \hat{w} \\ \hat{r} \end{pmatrix} = \begin{pmatrix} \hat{p}_N \\ \hat{p}_H \end{pmatrix}$$

$$\begin{pmatrix} \hat{w} \\ \hat{r} \end{pmatrix} = \frac{1}{\theta_{TN}\theta_{BH} - \theta_{BN}\theta_{TH}} \begin{pmatrix} \theta_{BH} & -\theta_{BN} \\ -\theta_{TH} & \theta_{TN} \end{pmatrix} \begin{pmatrix} \hat{p}_N \\ \hat{p}_H \end{pmatrix}$$

but becs: $\theta_{BH} = 1 - \theta_{TH}$ and $\theta_{BN} = 1 - \theta_{TN}$ $\Rightarrow$ $\theta_{TN} = 1 - \theta_{BN}$, $\theta_{TH} = 1 - \theta_{BH}$

$$\theta_{TN}\theta_{BH} - \theta_{BN}\theta_{TH} = \theta_{BN} - \theta_{BH} =$$

$$= \boxed{\theta_{TN} - \theta_{TH} = \theta_{BH} - \theta_{BN}} < 0$$

becs NOTE-WRITING is relatively INTENSIVE in the use of BRAINS

HOUSEWORK is relatively INTENSIVE in the use of TIME

$\theta_{BN} > \theta_{BH}$
$1 - \theta_{TN} > 1 - \theta_{TH}$
$\theta_{TN} < \theta_{TH}$
$\theta_{TH} > \theta_{TN}$

$$\theta_{BN} > \theta_{BH} \Longrightarrow \theta_{TH} > \theta_{TN}$$

% of cost of NOTES accounted for by BRAINS $>$ % of cost of HOUSEWORK accounted for by BRAINS

% of cost of HOUSEWORK accounted for by TIME $>$ % of cost of NOTES accounted for by TIME

NB: $\theta_{BN} > \theta_{BH} \Rightarrow \theta_{TH} > \theta_{TN}$

because $1 - \theta_{BN} < 1 - \theta_{BH}$

$\theta_{TN} < \theta_{TH}$

$$\hat{w} = \hat{p}_H + \frac{\theta_{BM}}{\underbrace{\theta_{BN} - \theta_{BH}}_{\text{positive}}} \left(\hat{p}_H - \hat{p}_N\right)$$

$$\hat{r} = \hat{p}_N - \frac{\theta_{TN}}{\underbrace{\theta_{TH} - \theta_{TN}}_{\text{positive}}} \left(\hat{p}_H - \hat{p}_N\right)$$

$\theta_{BN} > \theta_{BH}$

% cost notes accted for by Brains > % cost housework accted for by Brains

$\theta_{TH} > \theta_{TN}$

% cost housework accted for by Time > % cost notes accted for by Time

Recall that: $(p_H/p_N)\hat{} = \hat{p}_H - \hat{p}_N$

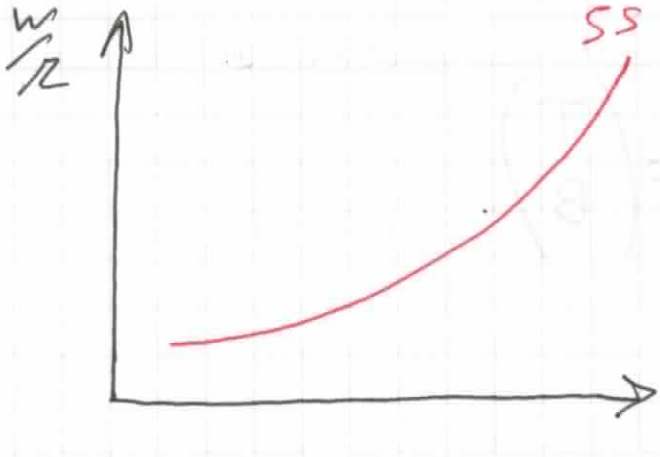
therefore if $p_H/p_N \uparrow$ perhaps by $\hat{p}_H > 0$ & $\hat{p}_N = 0$

then $\hat{r} < \underbrace{\hat{p}_N}_{\text{zero}} < \hat{p}_H < \hat{w}$ STOLPER-SAMUELSON

Intuitively: if $\frac{p_H}{p_N} \uparrow$ then $\frac{w}{r} \uparrow$ because

% of cost of housework accounted for by time is "large", but % of cost of notes accounted for by time is "small" $\theta_{TH} > \theta_{TN}$

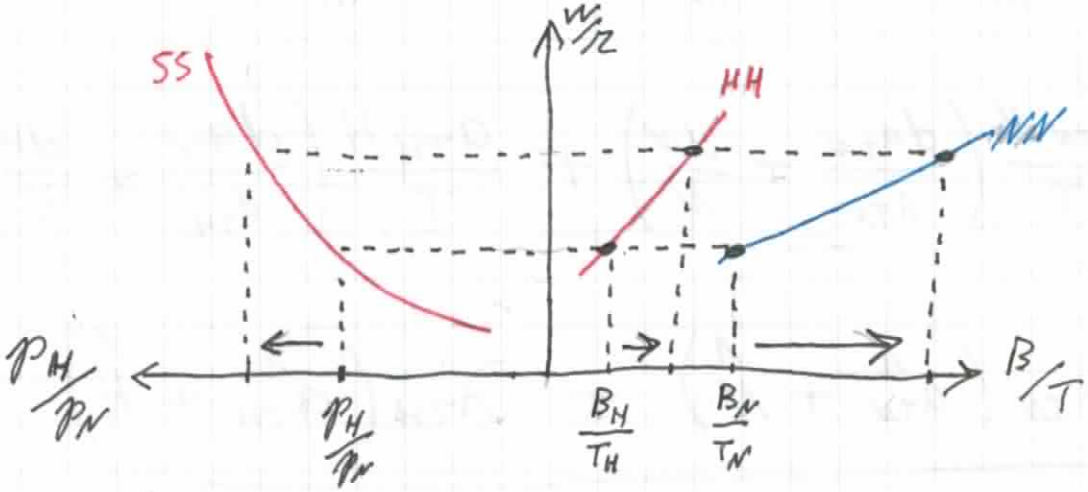
so increase in p_H will have a "large" effect on wage



$\hat{r} < \hat{p}_N < \hat{p}_H < \hat{w}$

Stolper - Samuelson

flip that diagram around + merge it w/ other



So an increase in rel price of housework will increase the rel. wage and increase the cost-minimizing ratio of Brains to Time in prod of Housework + Notes

Now at beginning of lecture I said

wife + I US rel abundant in Brains

mother in law ML rel abundant in Time

How can we ~~~~ use rel abundance to determine who has comp adv in Notes + who has comp adv in Housework?

→ Suppose US + ML both have: Rybczyński

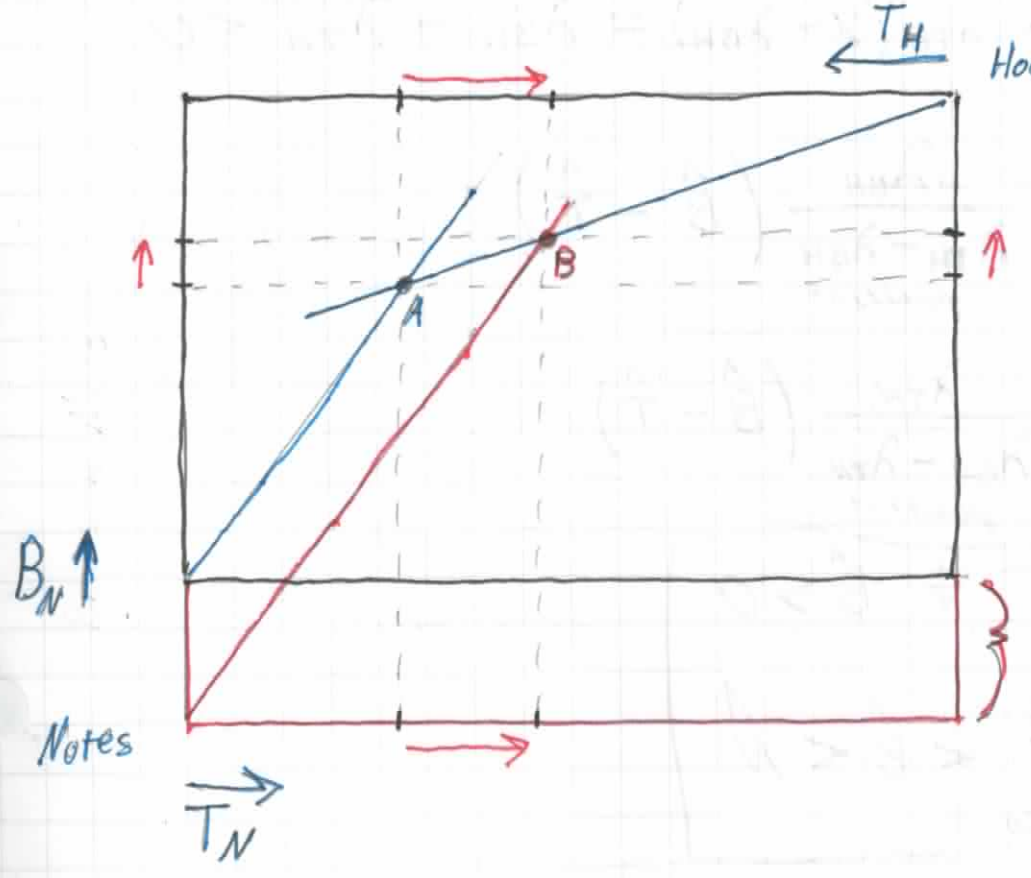
→ same technology

→ same amt of Time

$\hat{H} < \hat{T}_{\text{zero}} < \hat{B} < \hat{N}$

So difference is that US has more Brains

→ equivalent to US + ML starting off w/ same amt of Brains, but ~~~~ endowment of Brains increases in US $B_{US} = B_{ML} + \Delta B$



Slopes are:

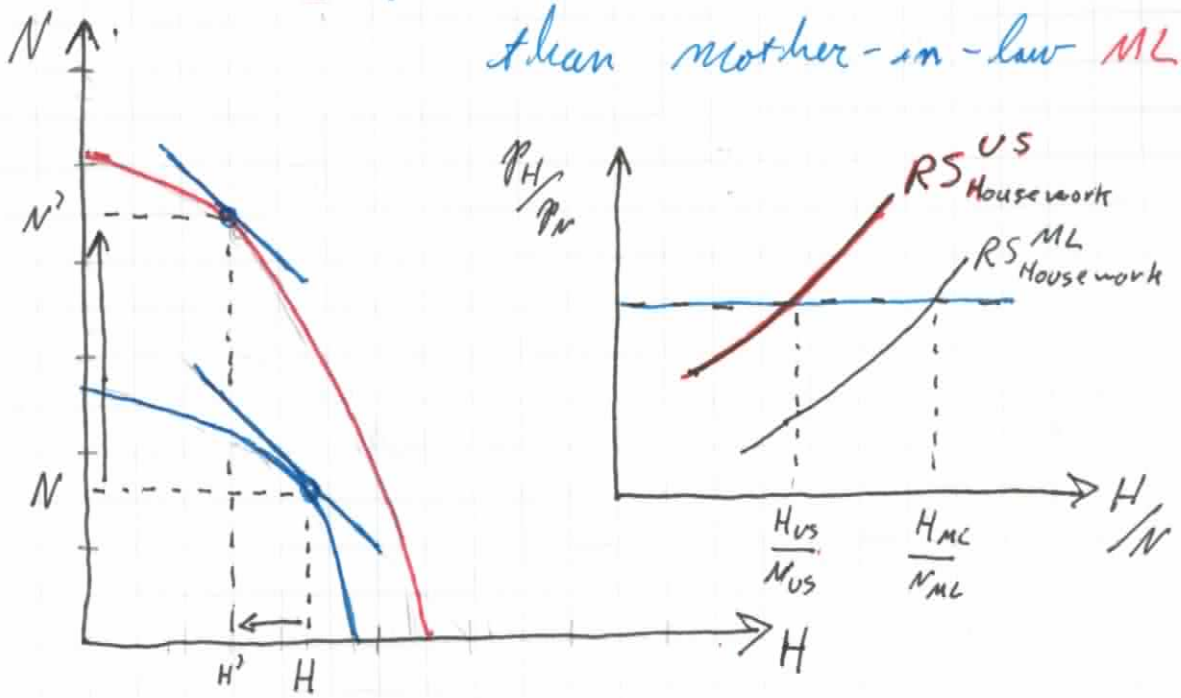
$\frac{B_N}{T_N}$ ratio

+ $\frac{B_H}{T_H}$ ratio

Note assume that factor prices (w+r) are constant because p_H + p_N constant

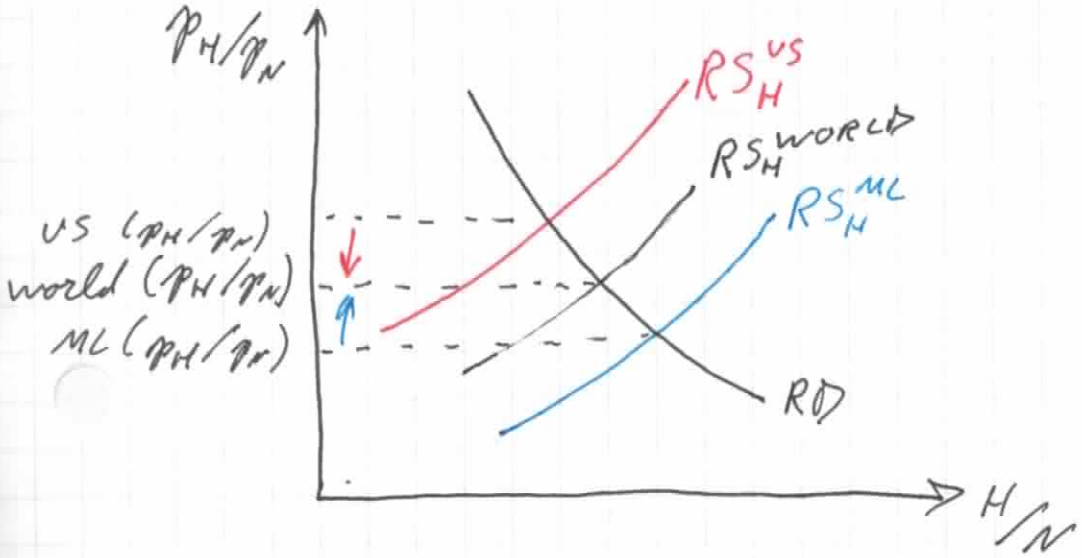
→ Since both Brains + Time must be fully employed + if we hold the prices P_N + P_H constant (so that w and r are constant + optimal ratios of B_N/T_N and B_H/T_H are constant) an increase in the supply of Brains increases an economy's output of NOTES and decreases the economy's output of HOUSEWORK

→ Therefore wife + I US will have a lower rel supply of Housework at every rel price of Housework than mother-in-law ML



→ If US + ML have same rel demand for Housework & Notes

- autarky rel price of housework will be higher in US
- autarky rel price of housework will be lower in ML



→ opening to trade will cause:

p_H/p_N falls in US

p_H/p_N rises in ML

→ by Stolper-Samuelson:

when p_H/p_N falls $\quad p_H^{\downarrow} - p_N^{\uparrow} < 0$

$w^{\downarrow} < p_H^{\downarrow} < p_N^{\uparrow} < r^{\uparrow}$

→ Now suppose that prior to arrival of mother-in-law:

NB: I'm rel abundant in time • I was doing the Housework

Wife rel abundant in brains • Wife was writing the Notes

→ when mother-in-law arrives • the relative price of housework falls

$$\left(\hat{p_H}/\hat{p_N}\right) = \hat{p_H} - \hat{p_N} < 0$$

→ by Stolper-Samuelson:

$$\hat{w} < \hat{p_H} < \hat{p_N} < \hat{r}$$

→ Notice that the rel price of the good that I was producing (housework) falls • after mother-in-law arrives

→ so my income falls

→ Rel price of good wife was producing (notes) rises after mother-in-law arrives

→ so her income rises

→ So what happens? wife and I get into a big fight

→ I want to send mother-in-law home, wife wants her to stay

→ I want protection from trade wife wants free trade

IMPLICATION: in SR, I'm stuck in the import-competing sector, so my short-term interest is to "send her home" (restrict trade)

in LR, I can move into the production of NOTES & gain from trade

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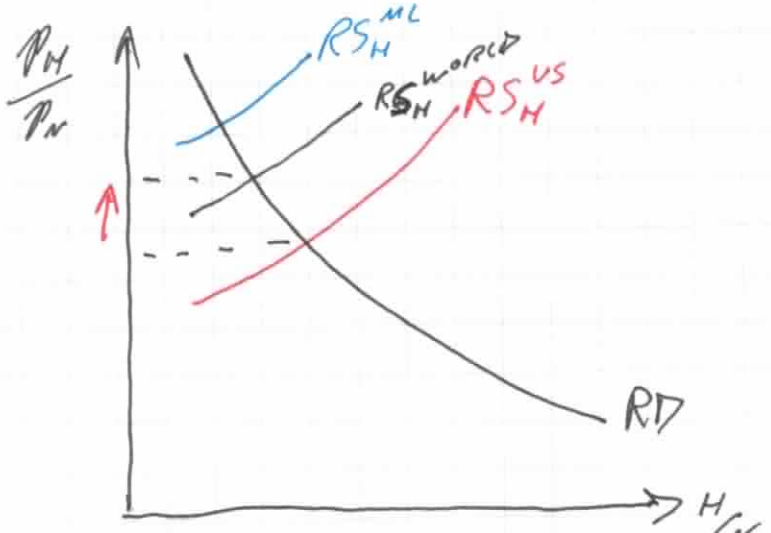
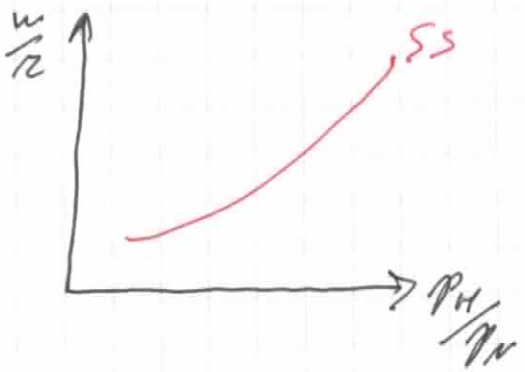
WHAT REALLY HAPPENED? Mother-in-law came & decided to produce NOTES, so rel value of housework soared & my wife and I both wanted to send her home



Factor Price Equalization

with trade, rel prices of goods converge causing complete equalisation of factor prices



WHY? when US + ML trade we're not simply exchanging goods

we're actually trading in factors of production

US sells Brains to ML — Brains as embodied in the Notes that US exports to ML

ML sells Time to US — Time as embodied in the Housework that ML exports to US

the Notes (that US exports) embody more Brains than the Housework that US receives in return

Consequently, US is exporting Brains + importing Time from ML

so trade effectively equalises the supplies of Brains + Time in US + ML

Factor Price Equalization has not occurred in practice why? assumptions necessary for FPE violated

ASSUMPTIONS → both countries produce both goods

→ same technologies

→ trade equalizes the prices of goods in the two countries

Is it occurring as Newly Industrializing Economies (NIEs) export basic manuf to "Advanced Economies?" No. Growing income inequality ~~caused by tech~~ in the US caused by techno change which has devalued less-skilled labor

K-O argues (in 1997 edition) that HO model has not stood up well in empirical tests

I think K-O overstate the case against the HO model

Leontief Paradox

→ Leontief (1953) compared K and L embodied in US exports & imports in the year 1947 & found that K/L ratio in US imports higher than K/L ratio in US exports

→ Leamer (1980) responded that Leontief's test not robust to unbalanced trade (in 1947, US was running trade surplus & exporting both capital & labor services), so he compared the K/L ratio in US production to K/L ratio in US consumption & found that K/L ratio in US production was higher

same Learner

→ Bowen, Learner & Sveikauskas (1987)

sign & rank tests: 27 countries
12 factors

SIGN: $\text{sign}\left(F_k^i\right) = \text{sign}\left(V_k^i - s^i V_k^w\right)$

country i's net exports of factor k — same sign as — country i's endowment of factor k minus country i's share of world GDP × world endowment of factor k

positive $\Rightarrow$ country i is rel abundant in factor k

sign test satisfied 61% of the time (pretty poor)

RANK:

if $F_k^i > F_l^i$ then $V_k^i - s^i V_k^w > V_l^i - s^i V_l^w$

if country i's net exports of k greater than net exports of l
then country i should have higher rel abundance of k than l

rank test satisfied 99% of the time

→ Bowen, Learner & Stern Leamer & Sveikauskas and especially Trefler (1993 + 1995) find that productivity differences (i.e. differences in technologies) cause H-O model to perform poorly

Grad Students

→ What I really want you to focus on is developing an understanding of the assumptions & theorems that form the basis of int'l trade theory

→ For example, a std assumption is that there are no factor intensity reversals

I guess it's important to understand what happens if the no FIR assumption is violated, but quite frankly we're not going to explore such cases

→ To that end, you can skip the discussion of no FIRs on p. 24 & 25. If you ever need it, you know where to find it.

→ Similarly, you only need to read the first six pages of the Jones (1965) article & you can skip the mathematical appendix in the Jones/Scheinkman (1977) article

→ You can also skip p. 57-61 of chapter 2 ("other tests of trade")

Key Concepts

Heckscher-Ohlin Thm each country will export the good that uses its abundant factor intensively

→ saw this in today's discussion of the specific factors model

→ Home + Foreign had same supplies of land + labor, but Home had more capital

→ ∴ Home's opp cost manuf was lower than foreign's (bec manuf uses capital) so home exported manuf to Foreign

Factor Price Insensitivity so long as both goods are produced + no FIRs each price vector corresponds to unique factor prices (p_1, p_2) correspond to (w, r)

→ consider a one-sector economy

$y = f(L, K)$

→ if L increases, wage falls ~~[illegible]~~ so countries w/ higher K/L endowments will have higher wages

But factor price insensitivity lemma states that in a 2×2 economy w/ fixed factor prices labor force or capital stock can grow w/out affecting their factor prices

Factor Price Equalisatn Thm if two countries are engaged in free trade
- → having identical technology
- → but different factor endowments
- → and if both goods produced
- → and if no FIRs

then factor prices are equalised across countries bcs each country has the opportunity to disproportionately produce more of one good than the other & export the amounts not consumed at home in exchange for imports of ~~products~~ goods for which there is more demand at home than production

→ bcs trade in goods can equalise factor prices trade in goods is a perfect substitute for trade in factors

Stolper – Samuelson Thm

$\hat{w} > \hat{p}_M > \hat{p}_F > \hat{r}$

an increase in the relative price of a good (e.g. thru tariff policy) will increase the real return to the factor used intensively in that good & reduce the real return to the other factor in 2×2 case

Be sure to understand ~~how~~ Jones & Scheinkman show that in the $n \times n$ case every factor has at least one natural enemy, but does not necessarily have at least one natural friend

→ natural enemy — if the price of good j rises (and if no other good's price changes), then the price of factor i must fall

→ natural friend

but no general proof along these lines can be constructed

- if factor i has a low share in national income, $w_i V_i / Y$ is low compared w/ good k's share in national income $p_k x_k / Y$ is high
- then good k is natural friend of good i

$\hat{M} > \hat{L} > \hat{T} > \hat{K}$

Rybczynski Thm An increase in a factor endowment will increase the output of the industry using it intensively & decrease the output of the other industry

Be sure to understand how Jones & Scheinkman show that the Stolper-Samuelson and Rybczynski Thms depend crucially on the lack of joint production

~~[illegible]~~

joint production occurs when a "small" number of inputs are combined to produce a "large" number of outputs

ex. Ricardian Model - one factor produces two outputs ✗

Heckscher-Ohlin - same number of inputs as outputs

Specific Factors - more factors/inputs than outputs

Finally, be sure to know the three general properties of production models

1. absences of money illusion p. 921

2. return to factor i equals change in value of aggregate output (at initial prices) that would accompany a unit increase in the endowment of factor i p. 922

3. Samuelson's Famous Reciprocity Condition p. 923-929