Multinationals and the Globalization of Production

Exam 2 Review

Penn State // Fall 2017

Administrative things

- Sign in to Arkaive.com (course code: 84ST)
  - If not working, sign in up front
- Problem set #4
  - Ready for pickup
- Exam II
  - Thursday, 11/9
  - Covers material from 10/10–11/7
  - Same format as exam I

Exam II: Thursday 11/3

- Exam duration is 75 minutes
- We will start on time; arrive early
- Bring
  - Calculator
  - One page of notes (8.5″x11″)
  - No wireless devices or other materials
- Show your work!

Grading

Deliverable	**Contribution**
5 Problem Sets	5%
Exam 1	25%
Exam 2	25%
Final Exam	40%
Participation	5%

- Course score is "curved" at the end of the semester
- Your relative position in class is what matters

Roadmap

- Big picture
  1. Leontief production function/cost function
  2. Vertical FDI model
  3. Host country effects of FDI
  4. Evaluating foreign investments
  5. Competing for FDI
- Practice problems

Leontief production

- Inputs are used in fixed proportions

$$x = \min\left\{\frac{\ell_u}{\theta_u}, \frac{\ell_s}{\theta_s}\right\}$$

- θ_u = unit requirement of ℓ_u (paid wage w_u)
- θ_s = unit requirement of ℓ_s (paid wage w_s)
- Associated cost function

$$c\left(w_u, w_s\right) = \theta_u w_u + \theta_s w_s$$

Vertical FDI model

- Factor price differences encourage VFDI
- Costs of trading goods limits VFDI

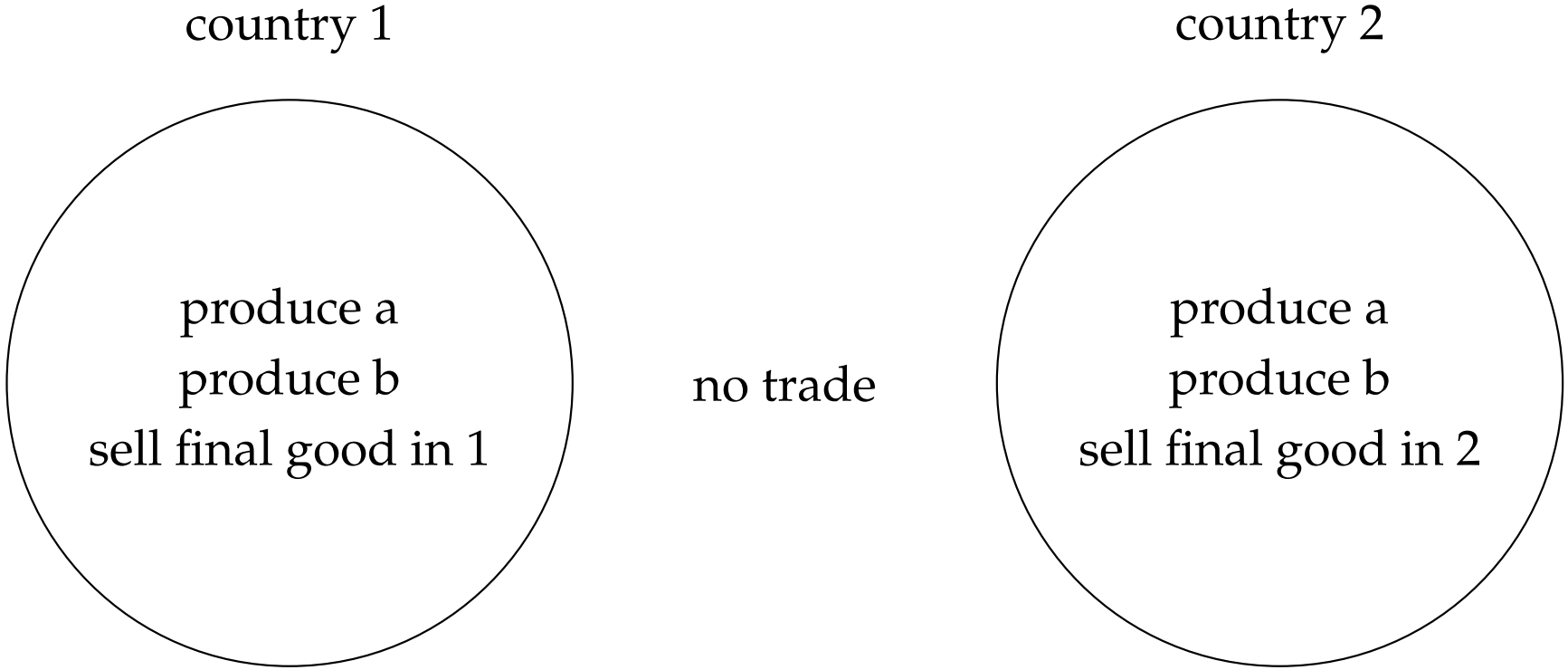
- The final good is made up of two parts
  1. Component parts b (b for circuit *boards*)
  2. Assembly services a
- 1 unit of parts and 1 unit of assembly combine to make the final good
- The unit cost of the final good is

$$c(w_u, w_s) = c_a(w_u, w_s) + c_b(w_u, w_s)$$

Vertical FDI model

- $\theta_{ua} = 5$ and $\theta_{sa} = 1$; $\theta_{ub} = 1$ and $\theta_{sb} = 10$ [b is skill-intensive]
- Two countries that differ by wages
  - Country 1: $w_u^1 = 10$ (\$/h) and $w_s^1 = 20$ (\$/h)
  - Country 2: $w_u^2 = 2$ (\$/h) and $w_s^2 = 30$ (\$/h)
- Two trade costs
  - τ_b = cost of shipping good b
  - τ = cost of shipping final good
- What firm structure delivers the lowest cost final good in each country?

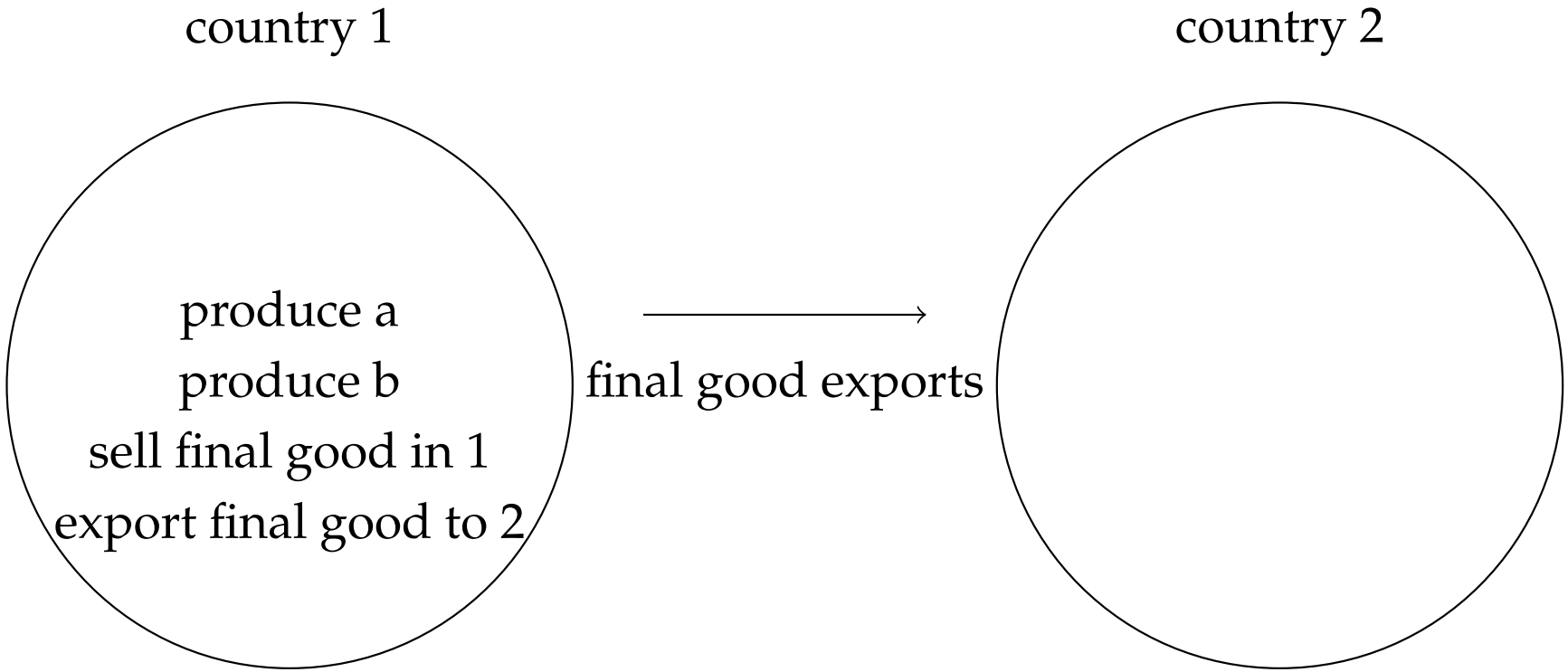
Structure 1 (HFDI)



$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^2, w_u^2)$$

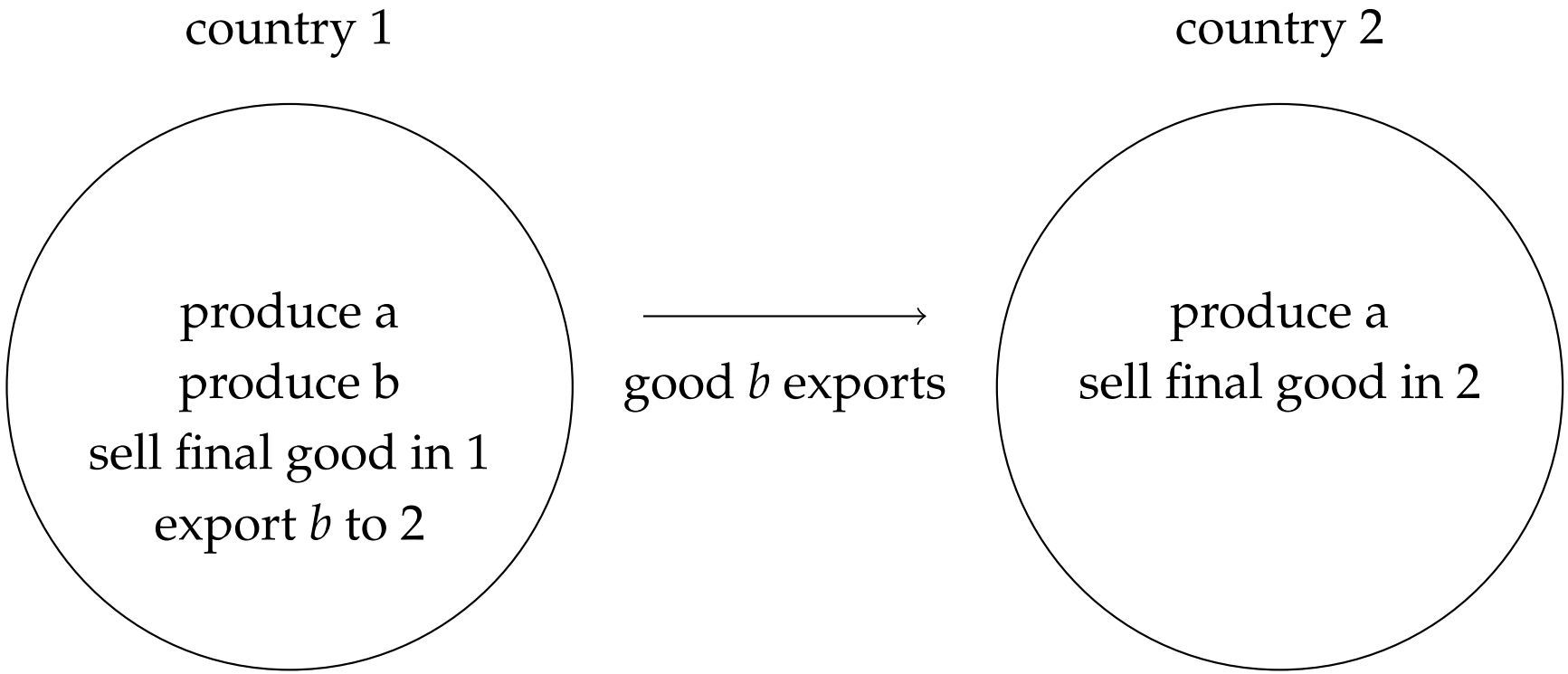
Structure 2 (Export)



$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

$$c^2 = \left[c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)\right](1+\tau)$$

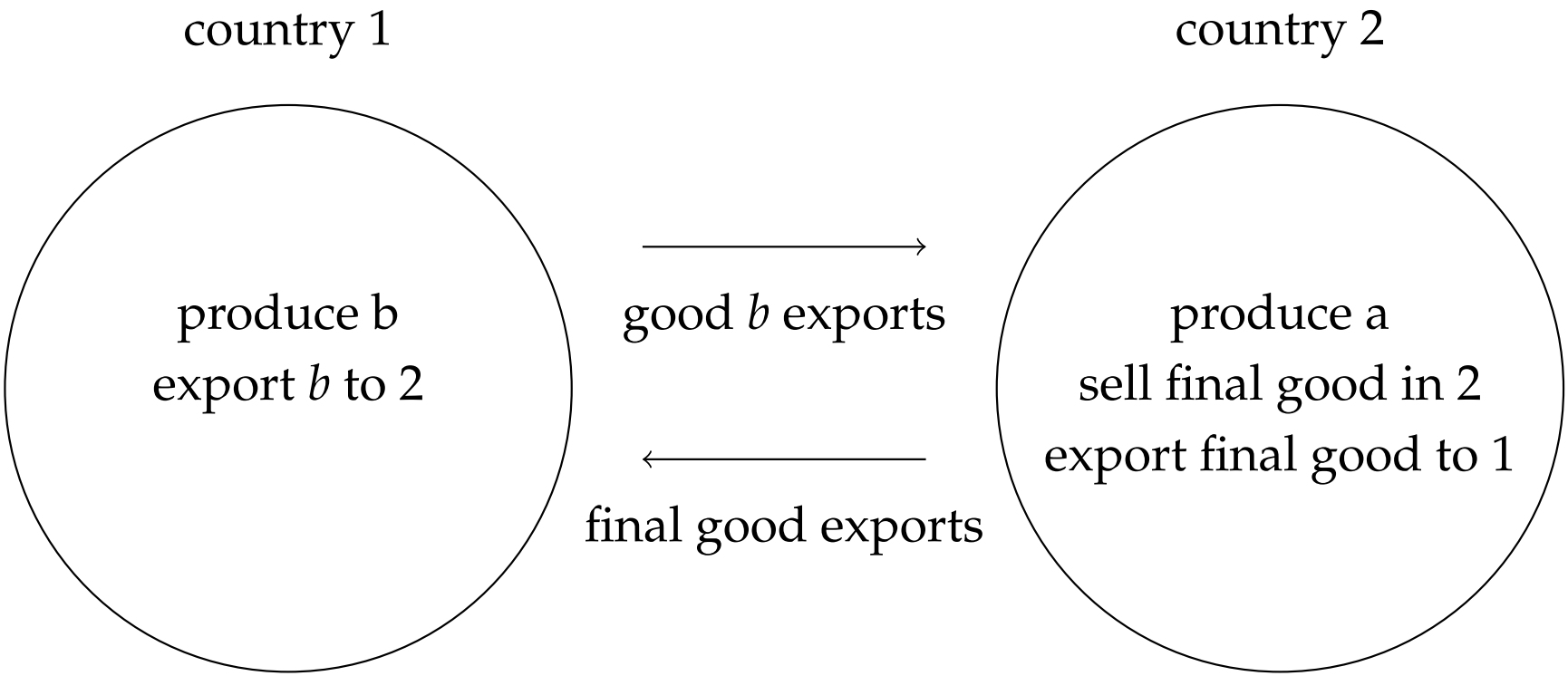
Structure 3 (Partial fragmentation)



$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)$$

Structure 4 (Complete fragmentation)



$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)$$

$$c^1 = \left[c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)\right](1 + \tau)$$

Possible firm structures

1. Do a and b in each country (HFDI)

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$
$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^2, w_u^2)$$

2. Do a and b in country 1, export to country 2

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$
$$c^2 = \left[c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)\right](1+\tau)$$

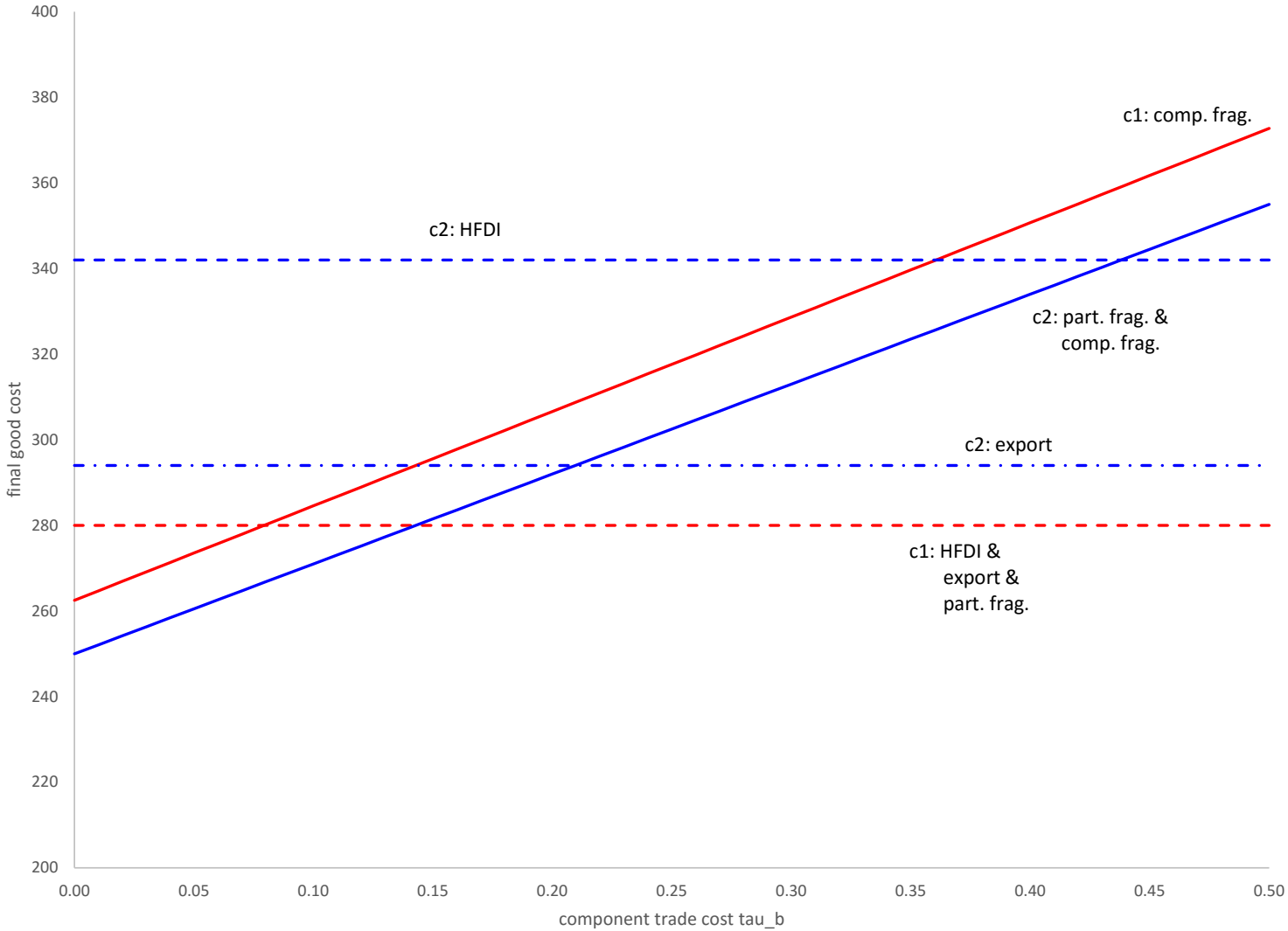
3. Do b in country 1, both countries do a

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$
$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)$$

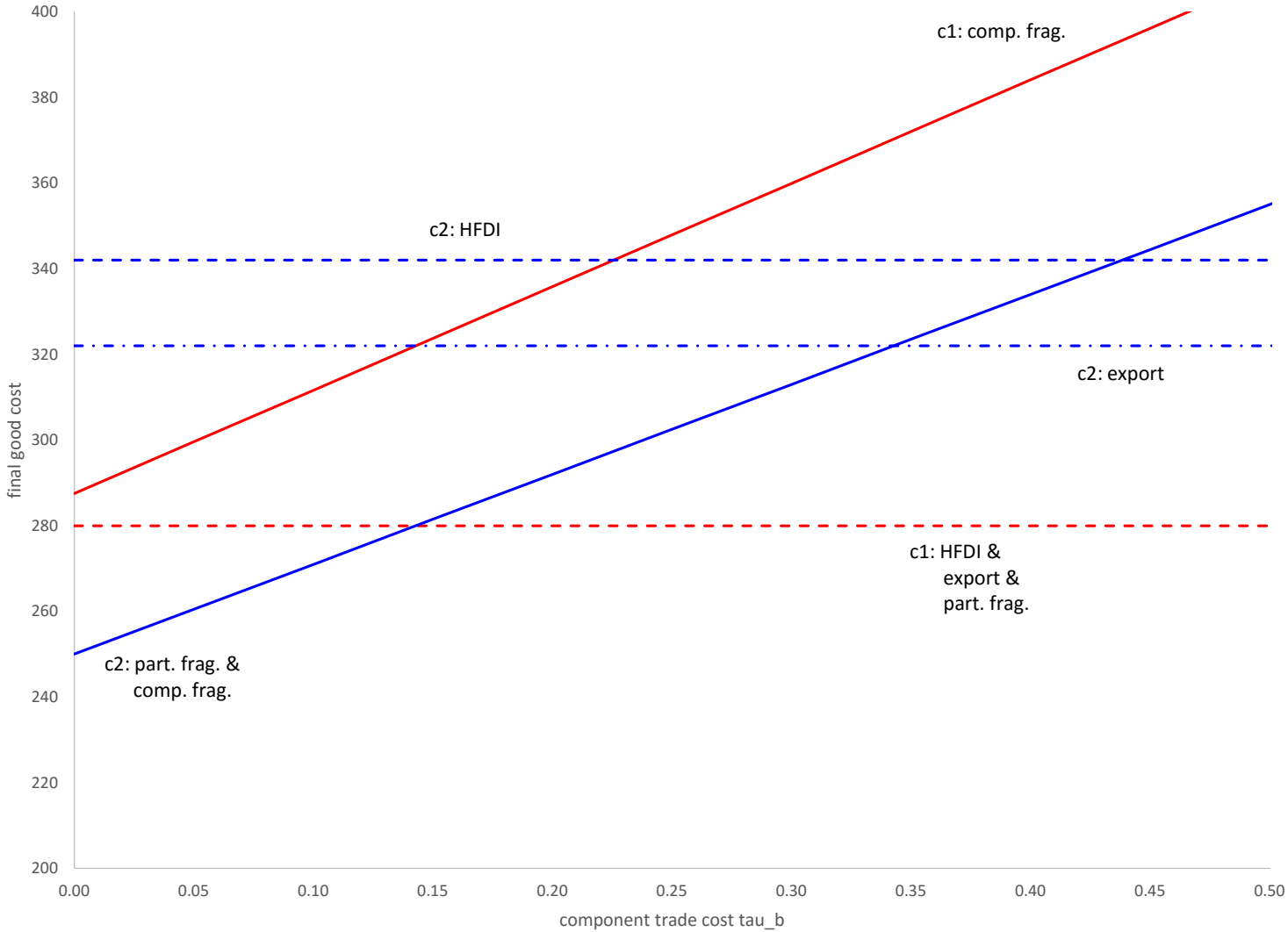
4. Do b in country 1, do a in country 2 and ship final good to 1

$$c^1 = \left[c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)\right](1+\tau)$$
$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)$$

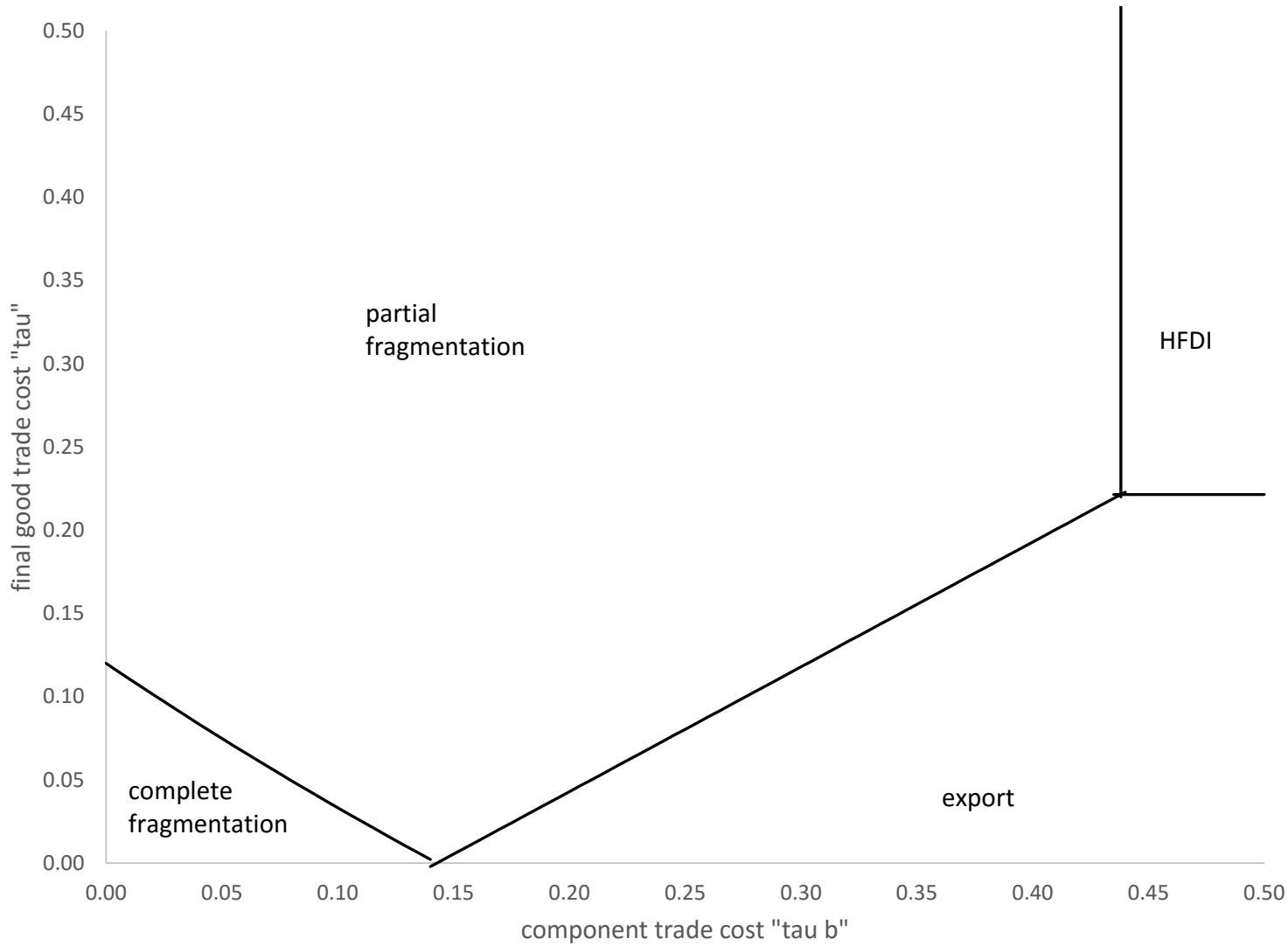
Determining firm structure ($\tau = 0.05$)



Determining firm structure ($\tau = 0.15$)



How trade costs shape firm structure

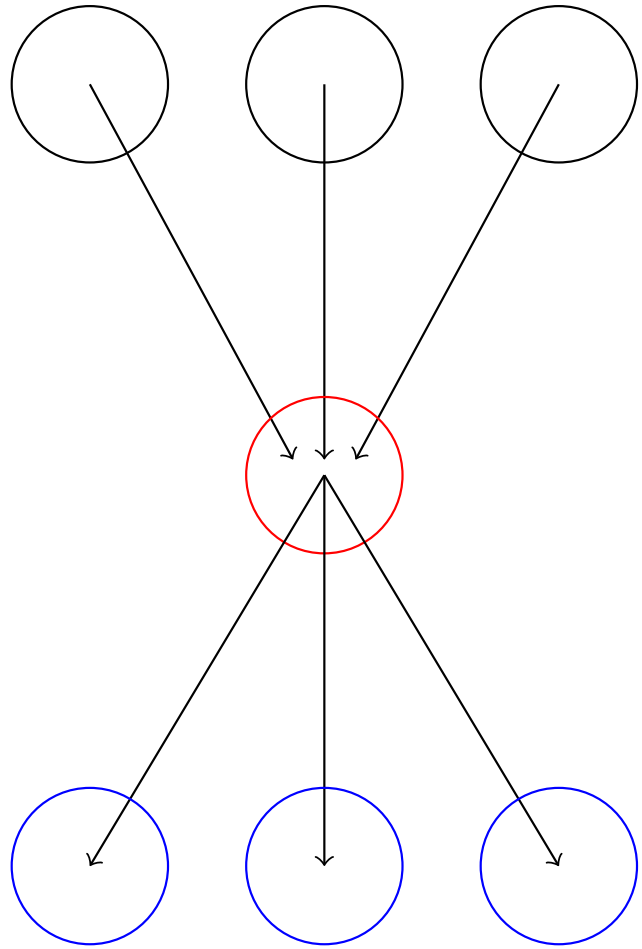


Host country effects of FDI

- Host country productivity effects of MNEs
- Factor market effects
- Competition effects

MNE interactions with other firms

local suppliers



multinational

local competitors

local distributors

Two kinds of productivity effects

1. Composition effects (changes in f)

- MNEs more productive than local firms
- Increase competition
- Change in types of firms in production
- Aggregate productivity increases

2. Spillover effects (changes in φ)

- MNEs make local firms more productive
- Backward linkages with local input suppliers [Walmex]
- Forward linkages with local distributors

Factor market effects and FDI

- How will MNEs affect factor market prices?
- Factor markets: labor markets, capital markets, natural resource markets, utilities
- Key issue: factor demand by MNEs vs. factor supply in the country
  - If MNEs need inelastic factors $\rightarrow$ likely negative effects
  - If MNEs need elastic factors $\rightarrow$ likely small effects

Competition effects of FDI

- If local firms have market power
  - MNE provides competition
  - Decreases markups, lowers prices
  - Good for consumers, downstream firms

- Can it go too far?
  - If MNE drives local firms out of business
  - Potentially less competition in the market
  - Higher markups and prices
  - Bad for consumers, downstream firms

Evaluating potential FDI

- Policy makers faced with potential FDI projects
- Who are the winners and the losers?
- A framework of questions
  1. Is the investment likely to raise production costs for local firms?
  2. Are there local firms that compete directly with the MNE?
  3. Are there local firms that will likely benefit from the MNE?

- Often this a local (region/state/city) analysis
- Depends on how "big" markets are

Competing for FDI

- Countries $i = 1, \ldots, N$
- Multinational has project with profit $\pi_i = v_i - f_i^p$
- If project is located in i, country benefit is b_i
- Not privately profitable: $\pi_i = v_i - f_i^p < 0$
- Jointly beneficial: $\pi + b_i = v_i - f_i^p + b_i > 0$
- Country can offer a take-it-or-leave-it subsidy, s_i

The equilibrium with one country

- The optimal subsidy is $s_i = f_i^p - v_i + \eta$
- η is a very small positive number — just enough to make the project profitable for the multinational

- The multinational's profit is $\pi_i + s_i = v_i - f_i^p + f_i^p - v_i + \eta = \eta$
- The country's after-subsidy benefit is $\beta_i = b_i - f_i^p + v_i - \eta = b_i + \pi_i - \eta$

- The country extracts all but η of the joint surplus

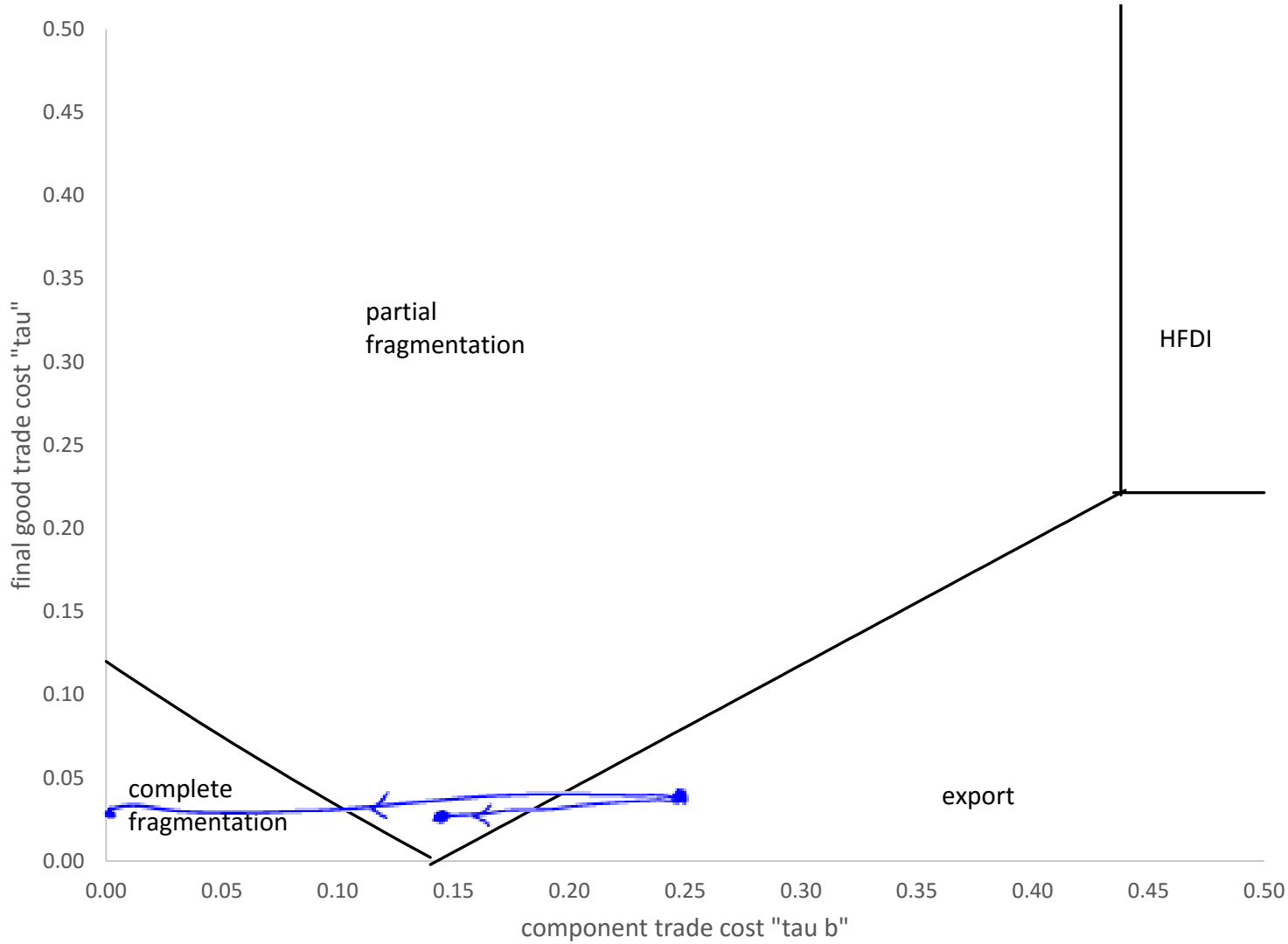
Two identical countries compete

		Country 2	
		subsidize	do not subsidize
Country 1	subsidize	$(0, 0)$	$(\beta_1, 0)$
	do not subsidize	$(0, \beta_2)$	$(0, 0)$

- Why does subsidize, subsidize yield $(0, 0)$?
- What is the Nash equilibrium?

Practice problems

How trade costs shape firm structure



Trade liberalization

- Suppose (in our previous model) $\tau_b = 0.25$ and $\tau = 0.05$
- If a trade agreement lowers $\tau_b = 0.15$, what happens to
  - FDI in country 2? ↑ new assembly plant
  - Exports from country 1? {final goods ↓ still export parts
  - Exports from country 2? → no change

Change to partial fragmentation

- If a trade agreement lowers $\tau_b = 0.0$, what happens to
  - FDI in country 2? ↑ new assembly plant
  - Exports from country 1? { final goods ↓ still export parts
  - Exports from country 2? → ↑ export final goods

Where to produce?

- $\theta_{ua} = 4$ and $\theta_{sa} = 1$; $\theta_{ub} = 1$ and $\theta_{sb} = 6$
- $w_u^1 = 5$, $w_s^1 = 20$, $w_u^2 = 2$, $w_s^2 = 30$, $\tau_b = 0.15$, $\tau = 0.10$

- How should the firm structure itself?

Possible firm structures

1. Do a and b in each country (HFDI)

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1) = [4*5 + 1*20] + [1*5 + 6*20] = 165$$
(40, 125)

$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^2, w_u^2) = [4*2 + 1*30] + [1*2 + 6*30] = 220$$
(38, 182)

2. Do a and b in country 1, export to country 2

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1) = 165$$

$$c^2 = \left[c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)\right](1+\tau) = 165 * 1.1 = 181.5$$

3. Do b in country 1, both countries do a

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1) = 165$$

$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b) = 38 + 125 * 1.15 = 181.75$$

4. Do b in country 1, do a in country 2 and ship final good to 1

$$c^1 = \left[c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)\right](1+\tau) = [38 + 125 * 1.15] * 1.1 = 199.93$$

$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b) = 181.75$$

Where to produce?

- $\theta_{ua} = 4$ and $\theta_{sa} = 1$; $\theta_{ub} = 1$ and $\theta_{sb} = 6$
- $w_u^1 = 5$, $w_s^1 = 20$, $w_u^2 = 2$, $w_s^2 = 30$
- Suppose $\tau_b = 0.0$, $\tau = 0.0$

- How should the firm structure itself? [Don't compute anything!]

No trade costs => complete fragmentation.

Asymmetric countries

- The payoff to the firm is identical in each country, but the benefit to each country is different: $b_1 = 20$, $b_2 = 15$, $v = 65$, $f^p = 70$, $\eta = 0.01$

1. Now both countries compete. Write out the payoff matrix.
2. Where is the project located?
3. In equilibrium, what are $s_1, s_2, \beta_1, \beta_2$, and π?

Only cty 1 subs: $s_1 = 5.01$ $p_1 = 20 - 5.01 = 14.99$

Only cty 2 subs: $s_2 = 5.01$ $p_2 = 15 - 5.01 = 10.99$

Both subs: $s_2 = 15.01, s_1 = 15$, $\beta_2 = 0$ $\beta_1 = 4.99$ $\pi = -5 + 15.01 = 10.01$

1 \ 2	sub	no sub
sub	(4.99, 0)	(14.99, 0)
no sub	(0, 16.99)	(0, 0)