Multinationals and the Globalization of Production

Vertical FDI 2

Penn State // Fall 2016

Administrative things

- Arkaive.com course code: 3D0Y
  - Please sign in
- Problem set #3
  - Due end of class, Thursday 10/13
  - Discuss Q1a today

Roadmap

- Building a model of vertical FDI
  - Break up production across countries
  - FDI to save on factor costs (factors = inputs)
  - Need a model with multi-stage production

- Today: how does firm structure depend on transport costs?

Model summary

- Two stages to final good: components b; assembly a
  - b is skilled-labor intensive ($\theta_{ub} = 1$, $\theta_{sb} = 10$)
  - a is unskilled-labor intensive ($\theta_{ua} = 5$, $\theta_{sa} = 1$)
- Final good cost

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

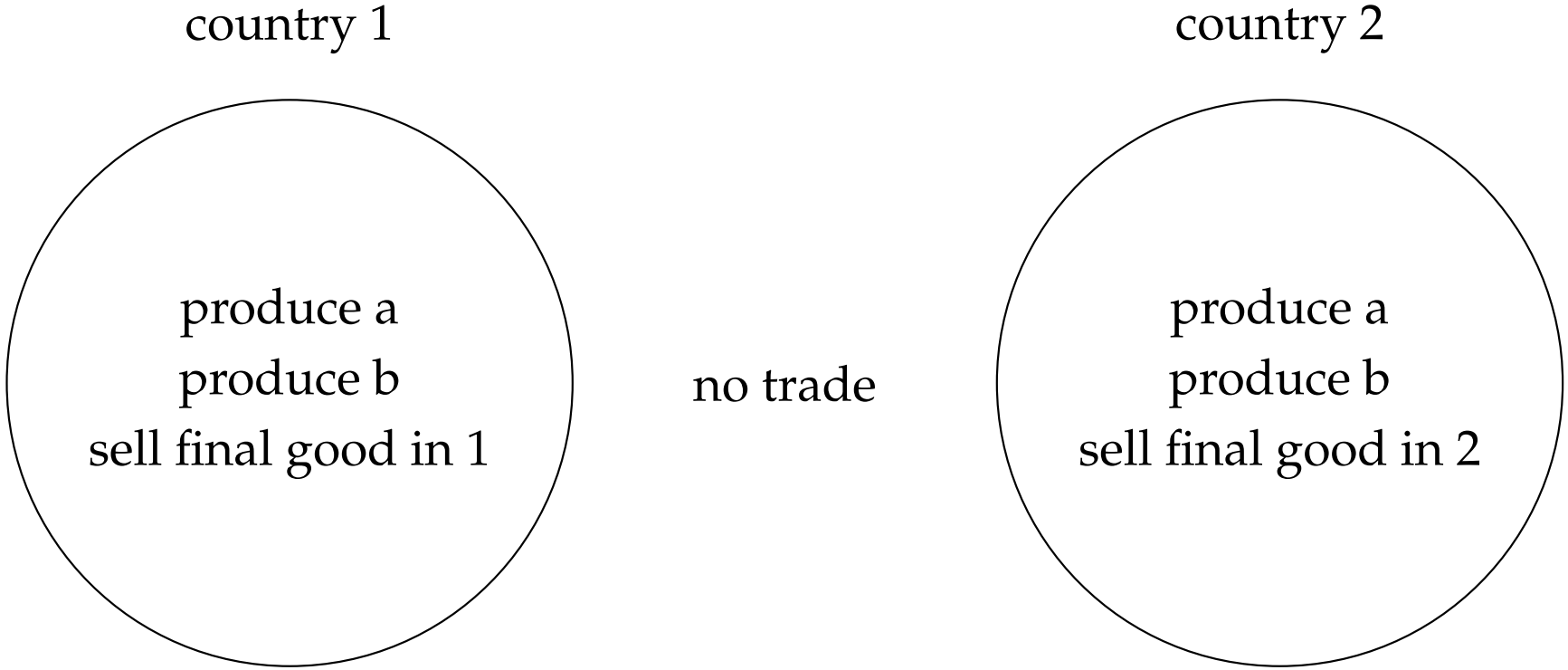
- Two countries, $i = 1, 2$
  - Country 1: $w_u = 10$ (\$/h) and $w_s = 20$ (\$/h)
  - Country 2: $w_u = 2$ (\$/h) and $w_s = 30$ (\$/h)
- Two symmetric trade costs
  - τ_b = cost of shipping good b
  - τ = cost of shipping final good

Possible firm structures

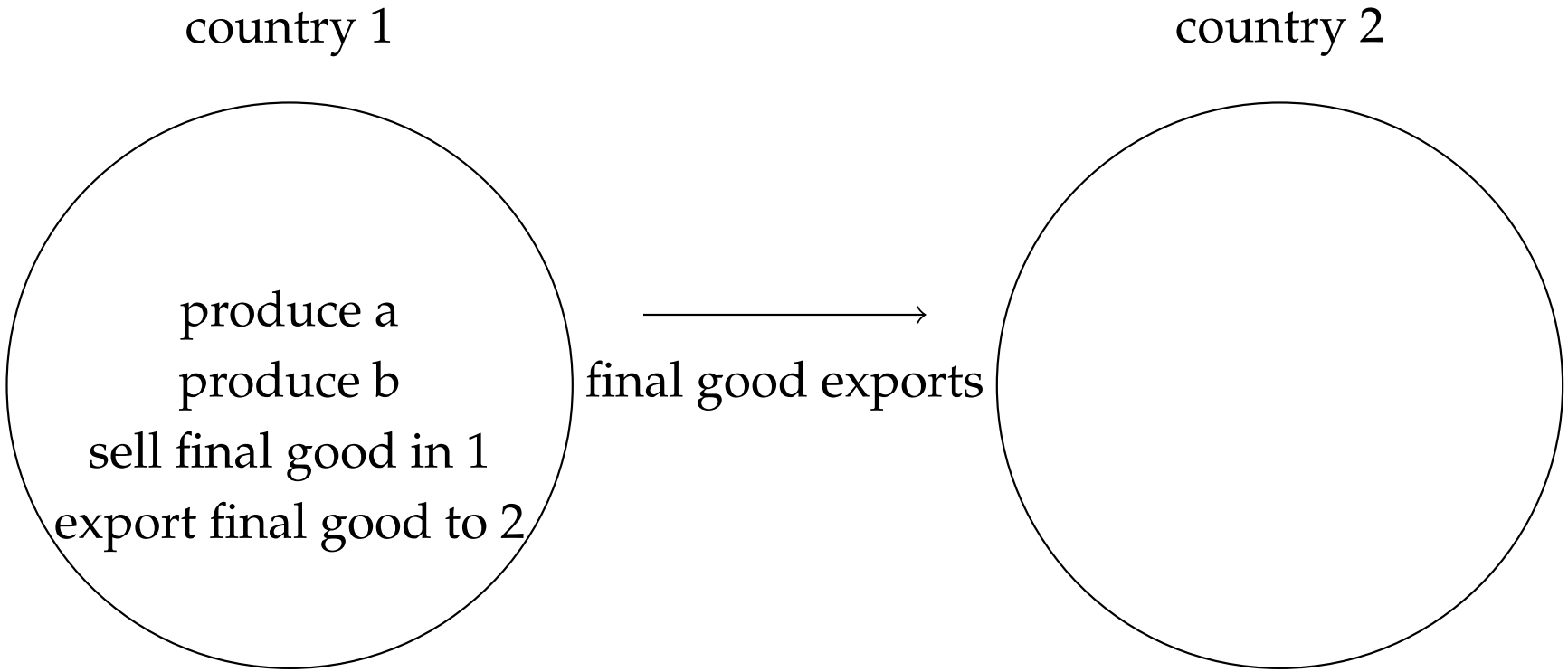
- A firm in country 1 wants to sell final good in both countries
- Firm wants lowest final good price in each country

1. **Horizontal FDI.** Produce a and b in each country.
2. **Export.** Produce a and b in country 1, export final good to country 2.
3. **Partial fragmentation.** Produce b in country 1, ship some of good b to country 2. Both countries produce a.
4. **Complete fragmentation.** Produce b in country 1, ship all of good b to country 2. Produce a in country 2 and ship some of the final good to country 1.

Horizontal FDI



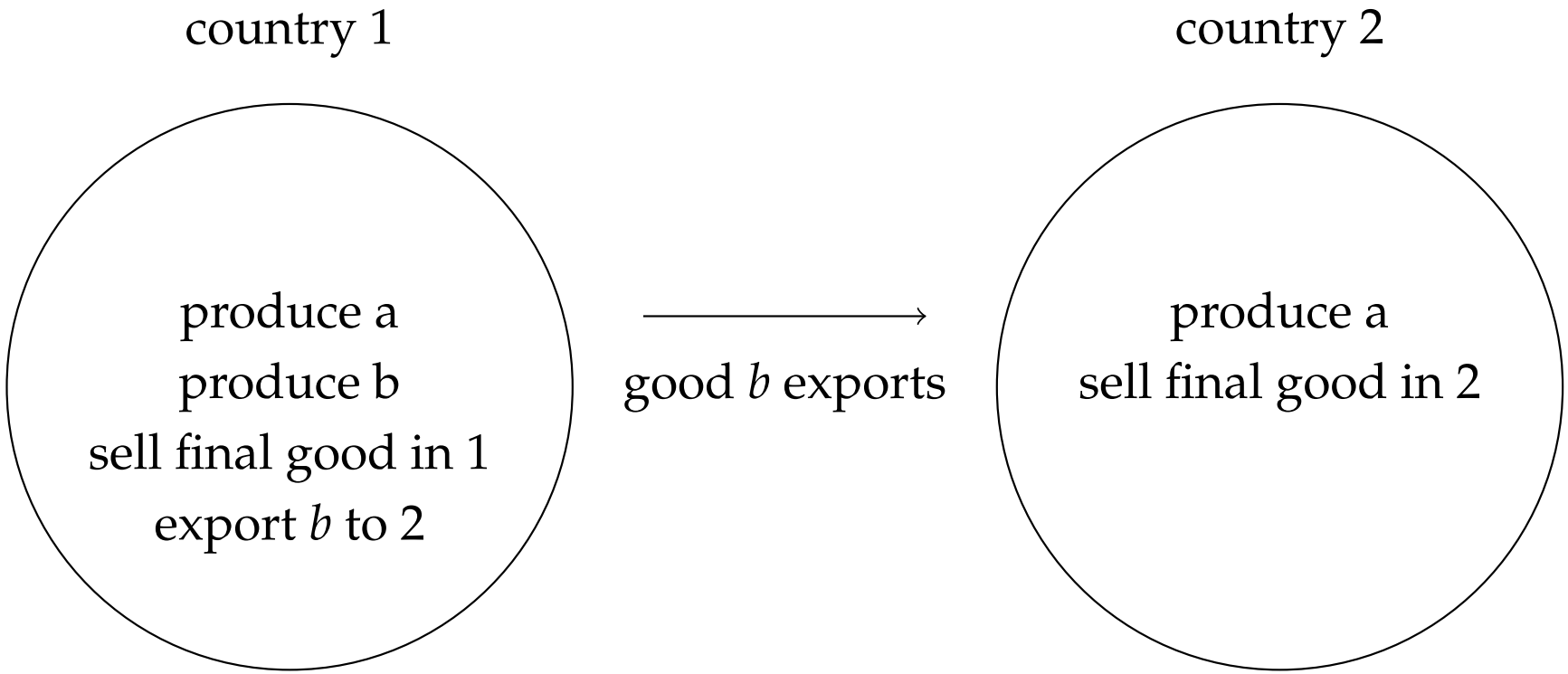
Export



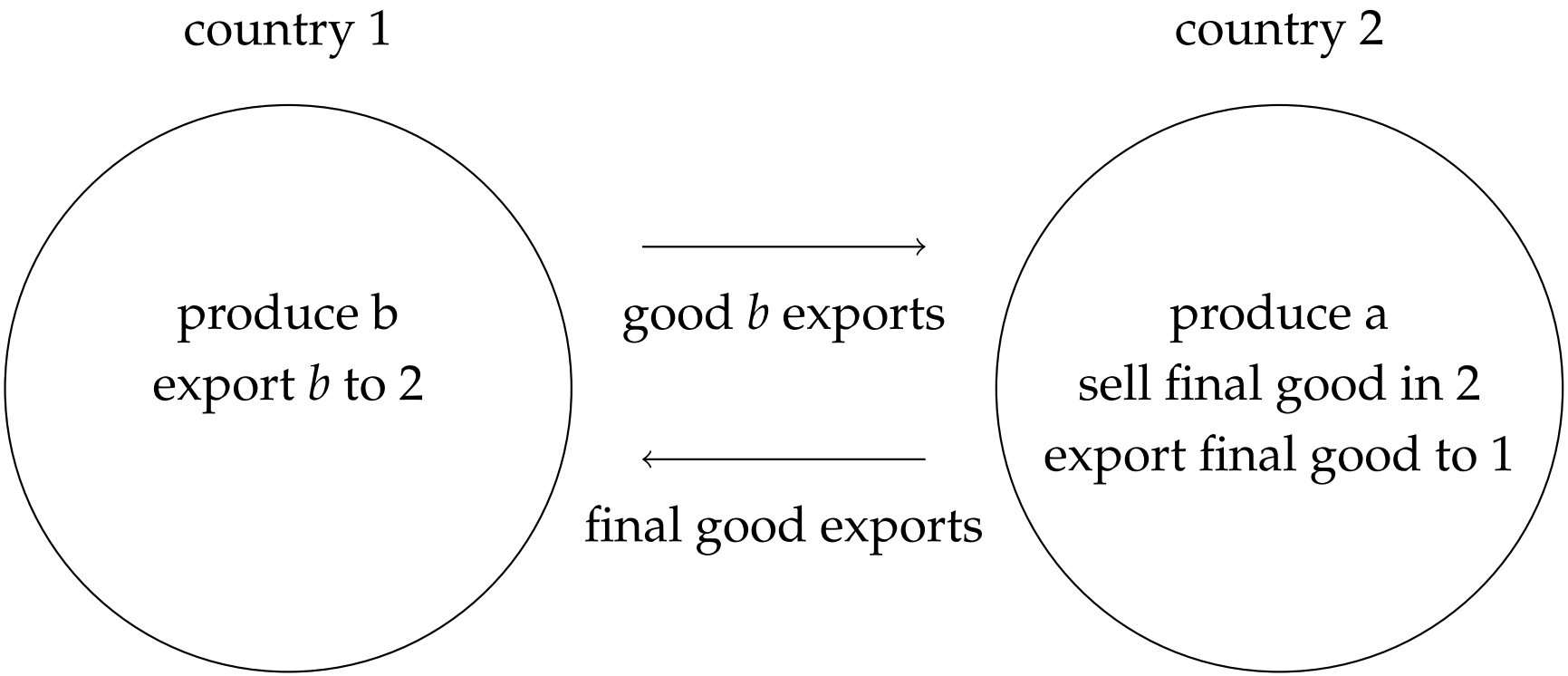
$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$

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

Partial fragmentation



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. **HFDI.** Do a and b in each country
   $c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$
   $c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^2, w_u^2)$
2. **Export.** 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. **Partial fragmentation.** 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. **Complete fragmentation.** Do b in country 1, do a in country 2 and ship final good to 1
   $c^1 = \left[c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)\right](1+\tau)$
   $c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)$

Which firm structure?

- Which production structure would a firm choose?
- Depends on w_s^1, w_u^1, w_s^2, w_u^2, τ_b, and τ
- Hold fixed wages, focus on trading costs

In class problem: Where to produce?

- $\theta_{ua} = 5$ and $\theta_{sa} = 1$; $\theta_{ub} = 1$ and $\theta_{sb} = 10$
- $w_u^1 = 10$, $w_s^1 = 20$, $w_u^2 = 2$, $w_s^2 = 30$, $\tau_b = 0.05$, $\tau = 0.05$

- How should the firm structure itself?

In class problem: Where to produce?

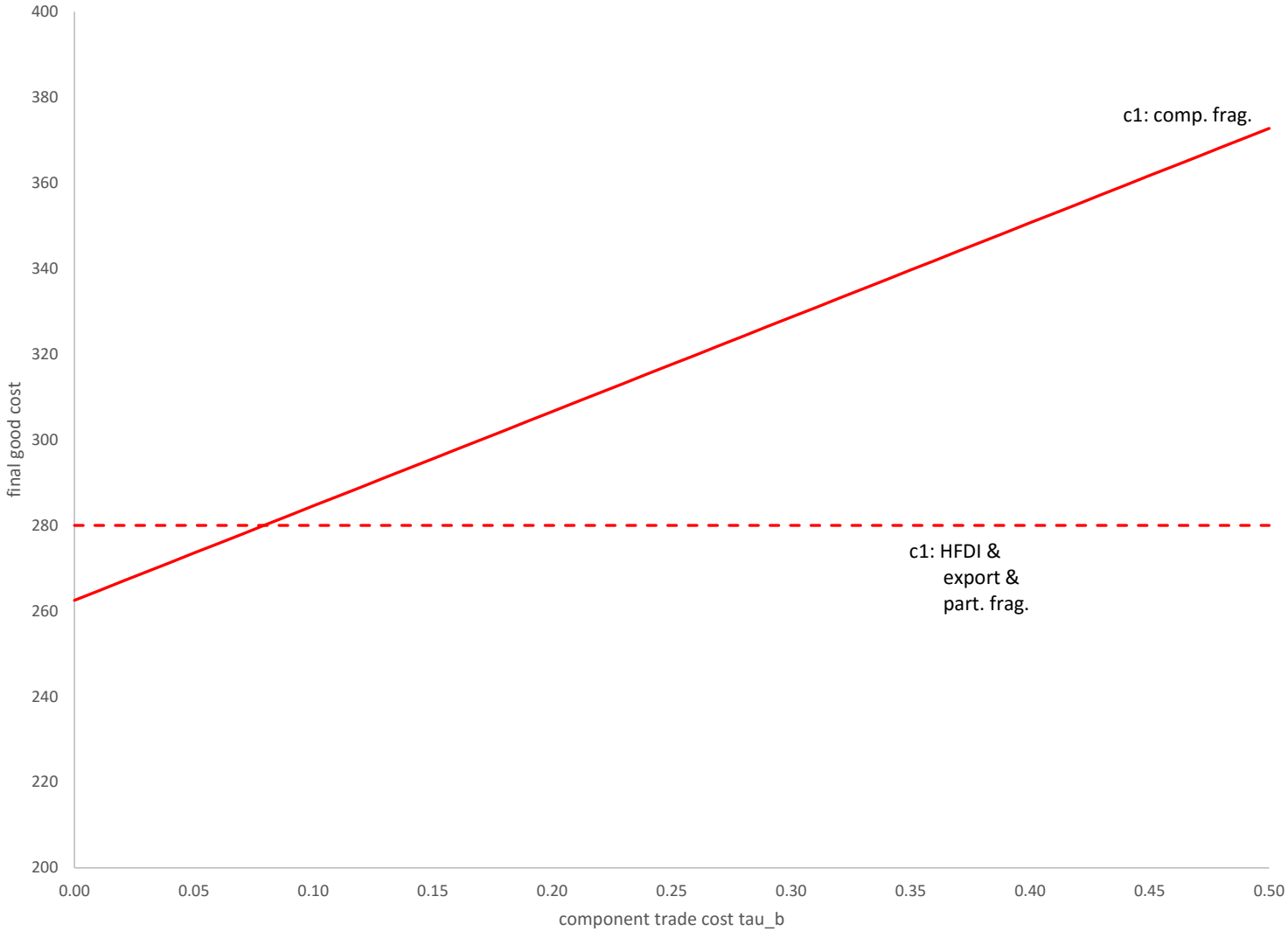
1. **HFDI.** Do a and b in each country
   $c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1) = 280$
   $c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^2, w_u^2) = 342$
2. **Export.** Do a and b in country 1, export to country 2
   $c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1) = 280$
   $c^2 = \left[c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)\right](1+\tau) = 294$
3. **Partial fragmentation.** Do b in country 1, both countries do a
   $c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1) = 280$
   $c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b) = 260.5$
4. **Complete fragmentation.** Do b in country 1, do a in country 2 and ship final good to 1
   $c^1 = \left[c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)\right](1+\tau) = 273.5$
   $c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b) = 260.5$

In class problem: Where to produce?

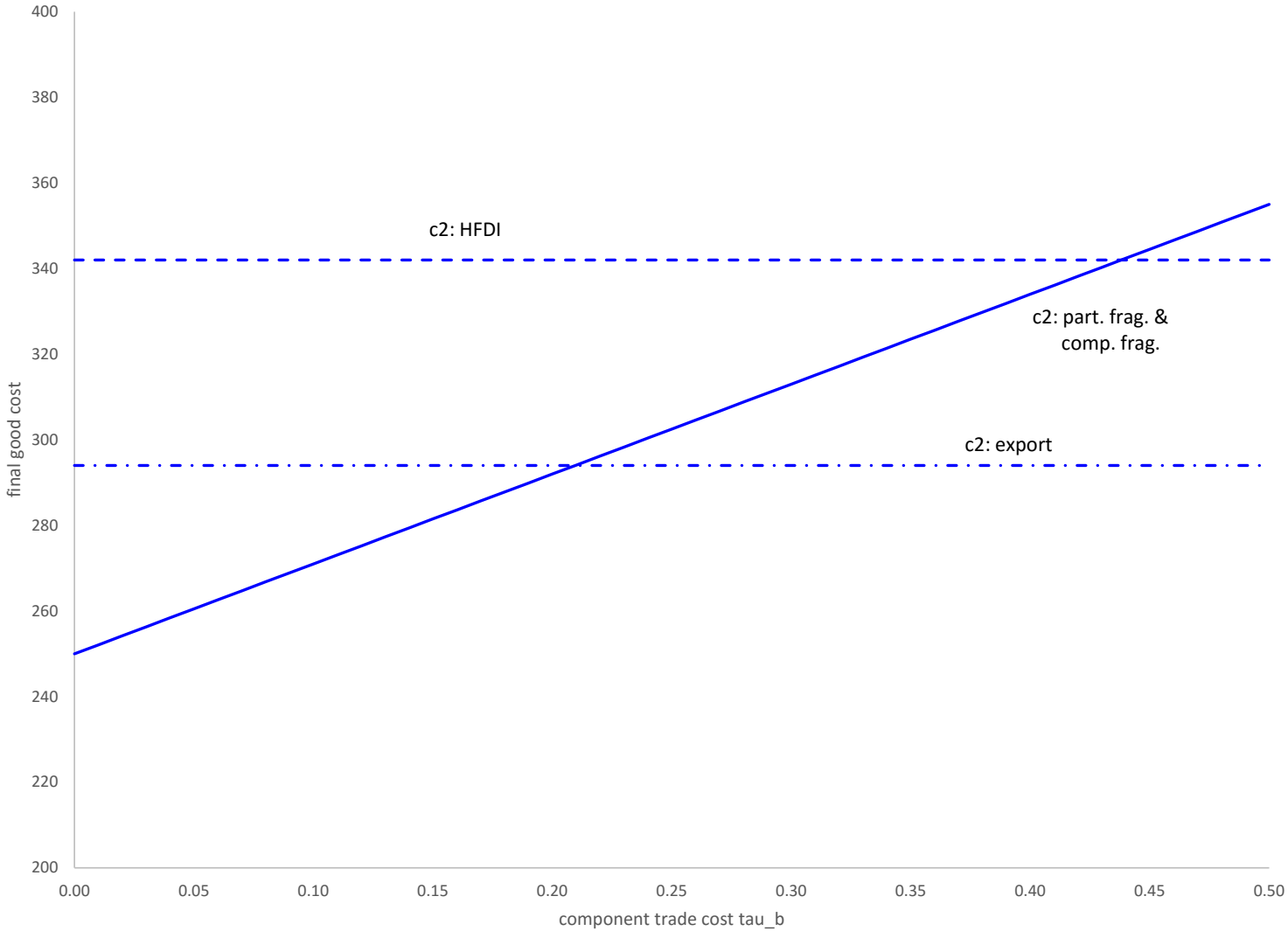
- Now increase τ_b
- $\theta_{ua} = 5$ and $\theta_{sa} = 1$; $\theta_{ub} = 1$ and $\theta_{sb} = 10$
- $w_u^1 = 10$, $w_s^1 = 20$, $w_u^2 = 2$, $w_s^2 = 30$, $\tau_b = 0.15$, $\tau = 0.05$

- How should the firm structure itself?

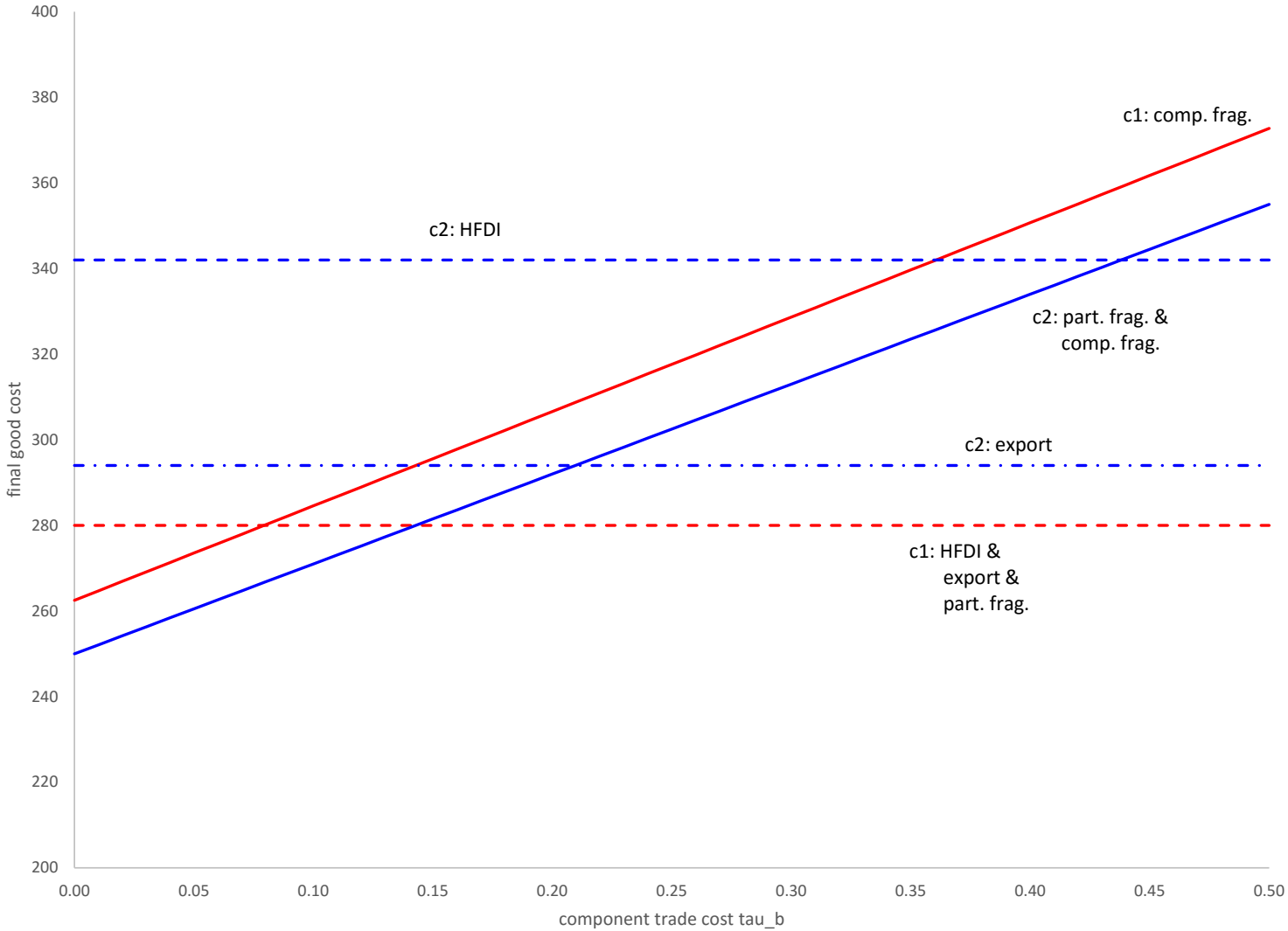
Final good cost in country 1



Final good cost in country 2



Determining firm structure ($\tau = 0.05$)



τ_b and firm structure

- When $\tau_b \in [0, 0.07]$
  - Complete fragmentation
  - Costs of trading b and the final good are low
- When $\tau_b \in (0.07, 0.21]$
  - Partial fragmentation
  - Trading b too expensive for roundtrip from country 1
  - Still worth sending b for the country-2 market
- When $\tau_b > 0.21$
  - Export from country 1
  - Gain from $w_u^1 > w_u^2$ no longer overcomes cost of trading b

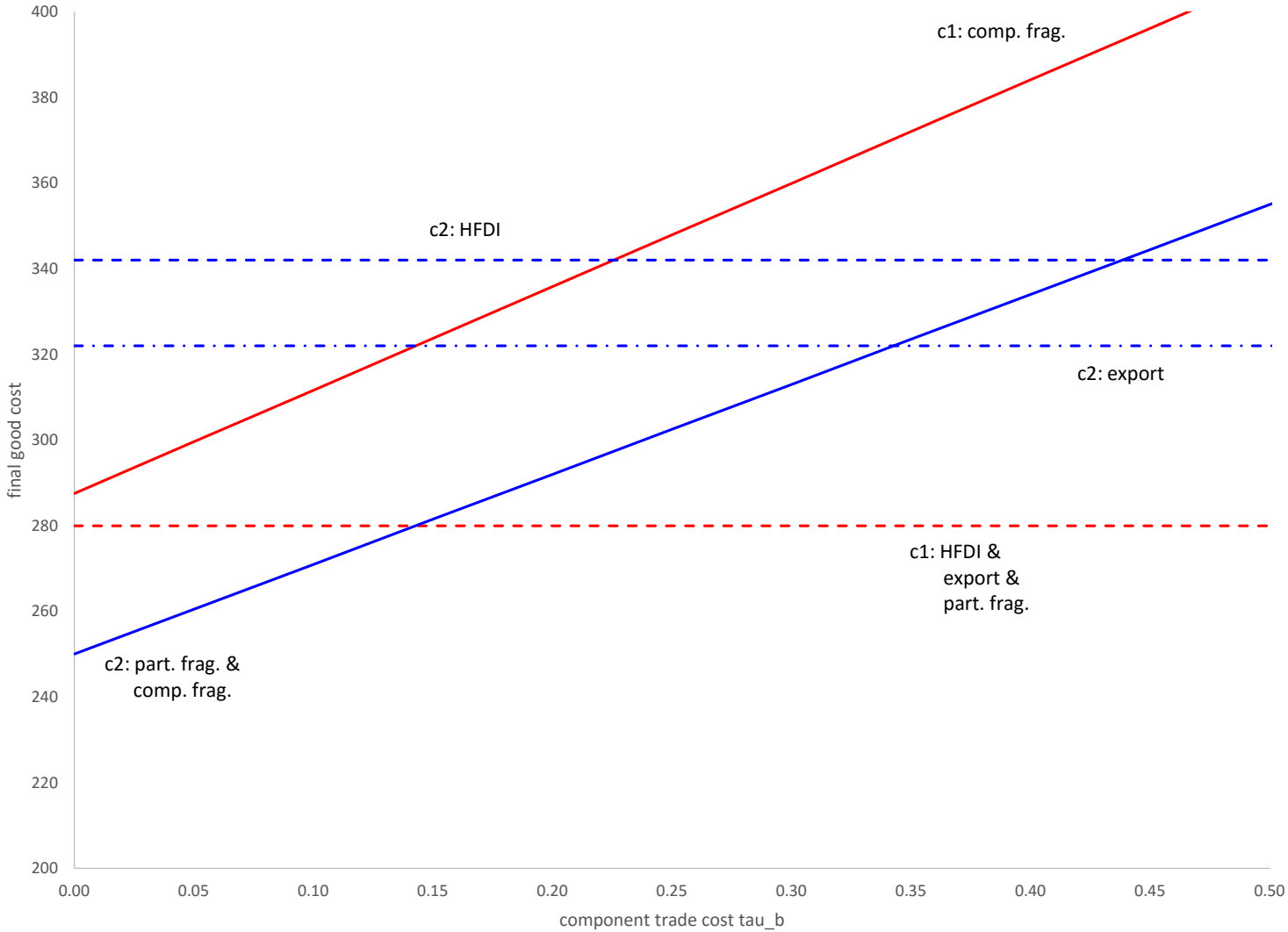
Final good trading costs

- Our analysis held τ fixed
- What happens to firm structure for different τ?

τ_b cutoff values

	Complete frag.	Partial frag.	Export	HFDI
$\tau = 0.05$	[0,0.07]	(0.07,0.21]	$>$0.21	—
$\tau = 0.15$				
$\tau = 0.25$				

Determining firm structure ($\tau = 0.15$)



Final good trading costs

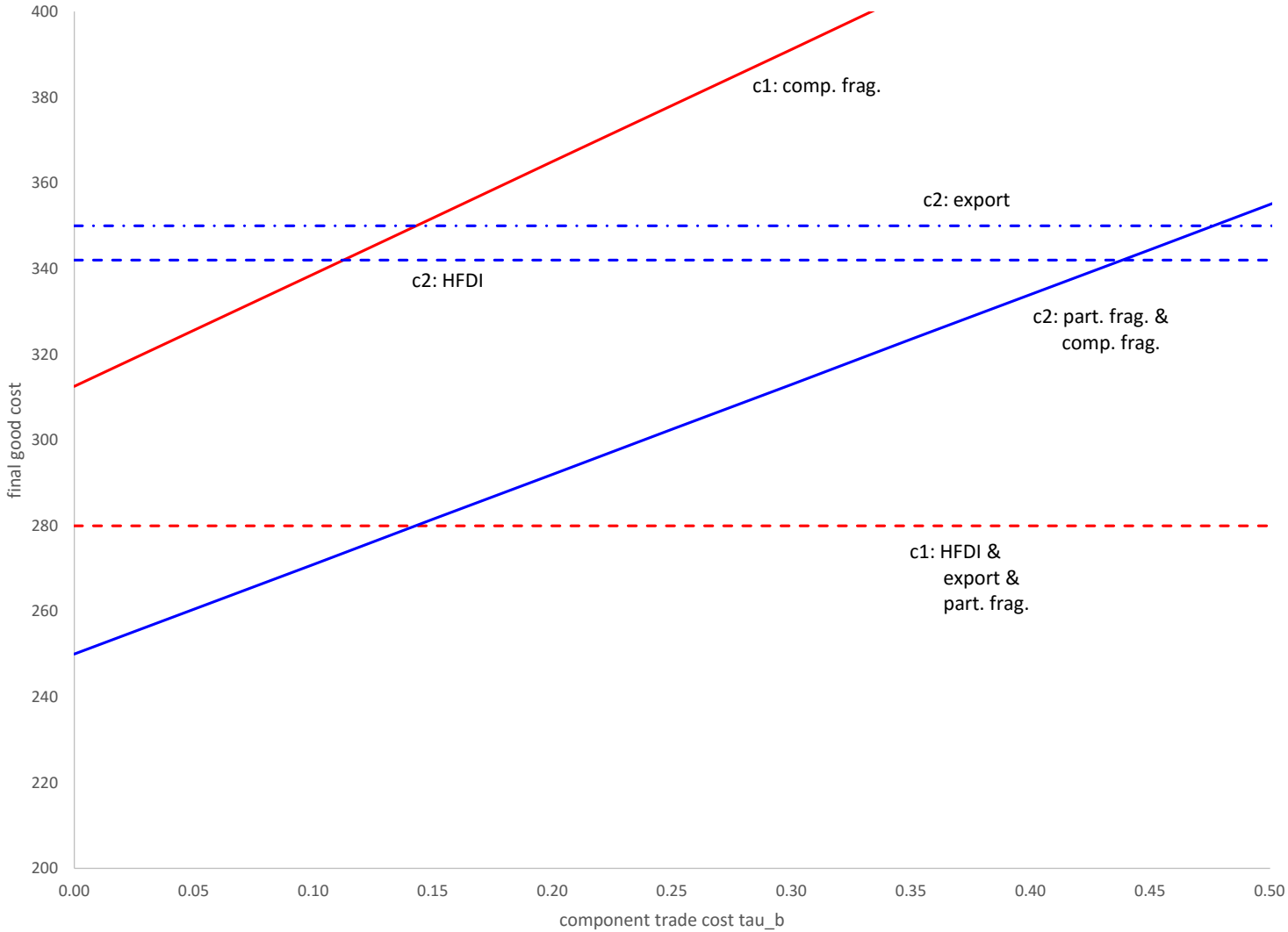
- Our analysis held τ fixed
- What happens to firm structure for different τ?

τ_b cutoff values

	Complete frag.	Partial frag.	Export	HFDI
$\tau = 0.05$	[0, 0.07]	(0.07, 0.21]	$>$0.21	—
$\tau = 0.15$				
$\tau = 0.25$				

- As τ increases, complete fragmentation disappears

Determining firm structure ($\tau = 0.25$)



Final good trading costs

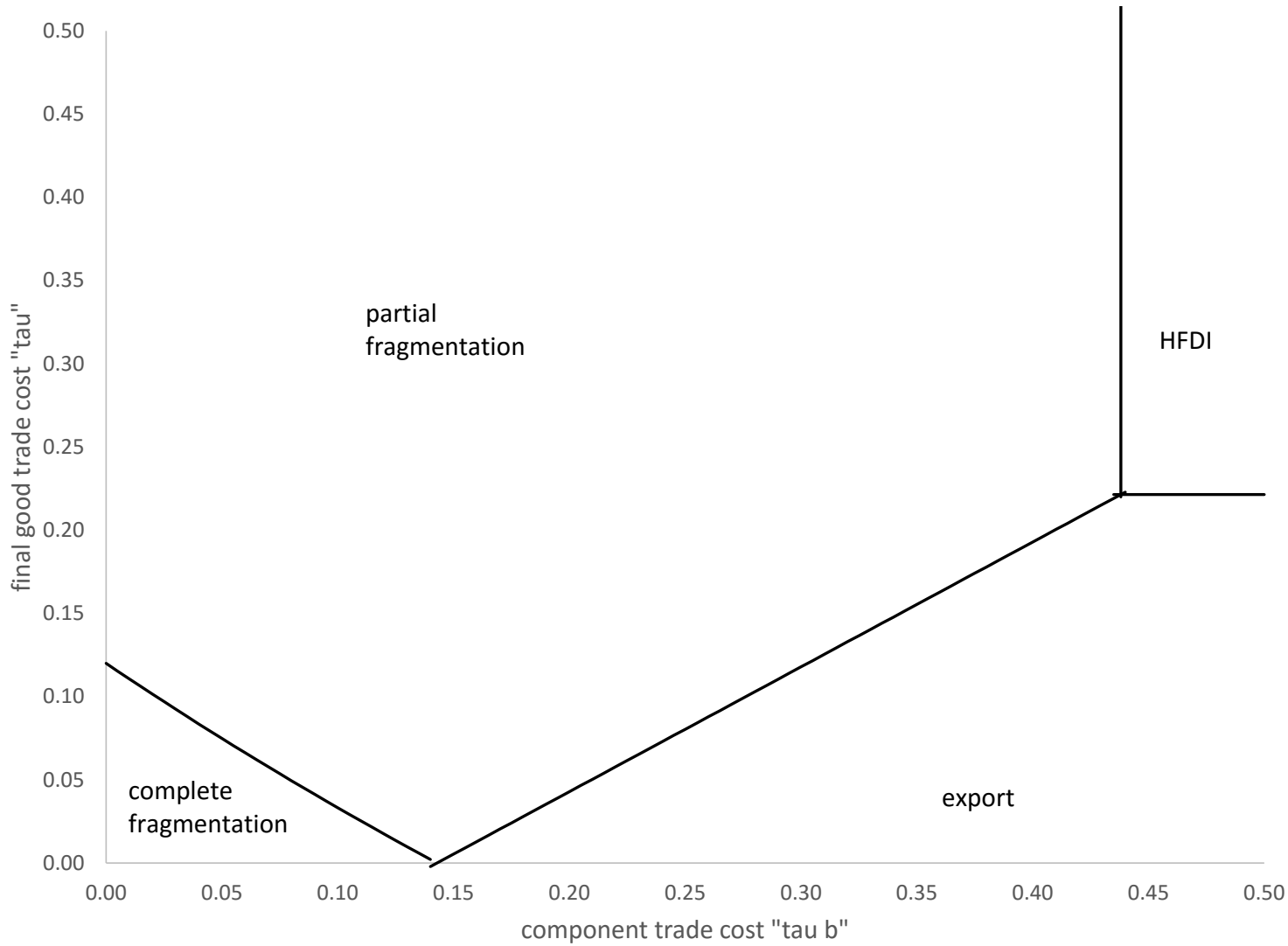
- Our analysis held τ fixed
- What happens to firm structure for different τ?

τ_b cutoff values

	Complete frag.	Partial frag.	Export	HFDI
$\tau = 0.05$	[0, 0.07]	(0.07, 0.21]	>0.21	—
$\tau = 0.15$				
$\tau = 0.25$				

- As τ increases, complete fragmentation disappears
- As τ increases, exporting disappears

How trade costs shape firm structure



Takeaways

- Model admits 4 firm structures:
  1. horizontal FDI
  2. exporting
  3. partial fragmentation
  4. complete fragmentation
- When both τ and τ_b are low $\Rightarrow$ complete fragmentation
- When τ is low and τ_b is high $\Rightarrow$ export
- When τ is high and τ_b is low $\Rightarrow$ partial fragmentation
- When both τ and τ_b are high $\Rightarrow$ horizontal FDI