Multinationals and the Globalization of Production

Final Exam Review

Penn State // Fall 2017

Administrative things

- Sign in to Arkaive.com (course code: 84ST)
  - If not working, sign in up front
- Problem Set #5
  - Due end of class today
  - Solutions posted this afternoon
- Final exam
  - Monday December 11, 8:00AM–9:50AM
  - Osmond Lab 101
- SRTE open now until December 10
  - Current response rate 35%.
  - Last year's response rate was 38%.

Final exam

- Place/Time
  - Monday 12/11/2017, here (Osmond 101)
  - 8:00AM–9:50AM (get here 5 minutes early)
- Calculator + 2 pages of notes (2 sheets of paper, both sides)
- Office hours
  - By email: (kjr42@psu.edu) Th, Fr, Sat, Sun until 5PM
  - In person: Nikita (nxl48@psu.edu)
    - Friday 12:00PM-2:00PM, 413 Kern

Exam format

1. Regular-length (1:15) exam covering material since last exam

   Update: 3 true/false + 1 long-form + 2 short-form questions

   - Location: Taxes
   - Internalization: Contracting

2. Cumulative mini-exam (0:35) made up of
   - 2 short-answer "high-level" questions
   - 1 long-form "calculation" question

Cumulative questions

- Short-answer "high-level"
  - Short-answer: not more than 4 or 5 sentences
  - High-level: conceptual questions, not calculation questions
  - Still useful to have models to help frame answers

Example: "Give two motives for foreign direct investment. For each one: i) discuss the gains from FDI and the costs; ii) give an example of a firm (or industry) that uses FDI for that reason"

Cumulative questions

- Calculation questions
  - Same as in regular exams: some calculation, some writing
  - Will be a bit shorter than on regular exams
  - Will be either:
    - **Heterogeneous-firm HFDI/export platform** or
    - **VFDI model**
  - Example: plenty in exams I, II, and the practice exams…

Roadmap

- Cumulative: The big picture
  1. OLI
  2. Facts
  3. Horizontal FDI (model/calcs)
  4. Vertical FDI (model/calcs)
  5. Impact of FDI on the host country
  6. Competing for FDI
- Since last exam
  1. Taxes and MNEs (model/calcs)
  2. Incomplete contracts, outsourcing, and holdup (model/calcs)
- This review is not meant to be exhaustive!

OLI

- Ownership advantage ~ firm asset valuable abroad
- Location advantage ~ what is it about foreign country that's valuable?
- Internalization advantage → why own the foreign producer? HFDI, VFDI, Taxes
- Have some examples ready?

vs. "arms-length" suppliers

Six facts

1. Multinationals are concentrated in developed countries
2. Multinationals are concentrated in R&D- and capital-intensive goods
3. Multinational activity falls off in the distance from the parent
4. MNE parents and affiliates, compared to domestic firms, are larger, more productive, more R&D intensive, and more likely to export
5. MNE parents specialize in R&D, affiliates in selling to foreign markets
6. Mergers and acquisitions make up a large part of MNE expansion

- Need to know the facts "broadly"
- Do not need to know specific numbers

Heterogeneous firm model

- Horizontal FDI: export or use a foreign affiliate?
  - Trade costs vs fixed costs of production

How big are sales?

- Firms differ in productivity φ
- More productive firms have lower prices, sell more
- Better firms more likely to be MNEs
- Parameters:
  - wage w;
  - elasticity ϵ;
  - trade cost τ;
  - expenditure E,
  - fixed cost to export f^e;
  - fixed cost to produce in foreign country f^p

Horizontal FDI with heterogeneous firms

- More productive, lower price $0 \leq \tau < 1$

$$p_e = \frac{w_1}{\varphi}\frac{\epsilon_2}{\epsilon_2 - 1}(1+\tau) \qquad p_m = \frac{w_2}{\varphi}\frac{\epsilon_2}{\epsilon_2 - 1}$$

(no trade cost)

- Export profit

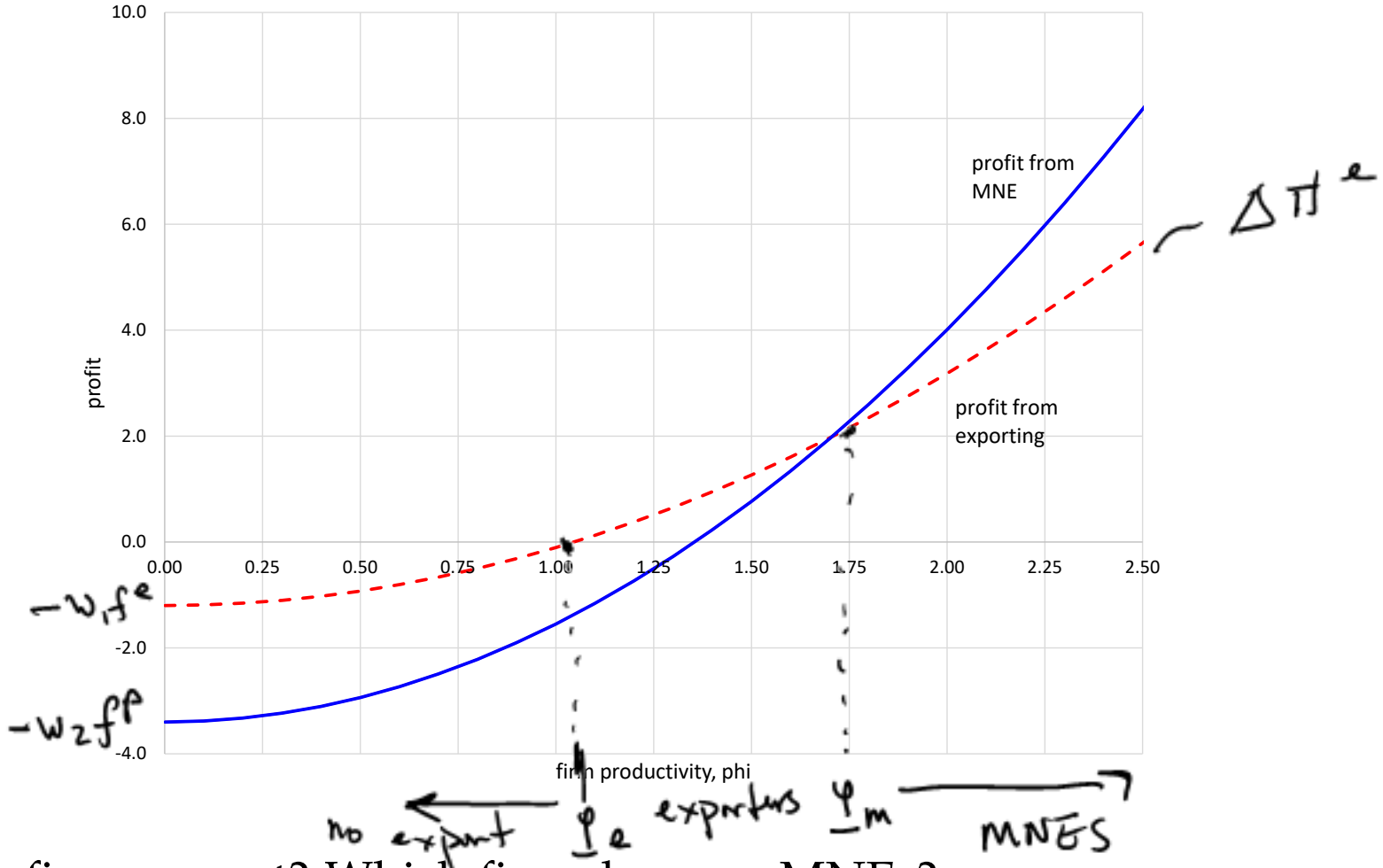
$$\Delta\pi_1^e(\varphi) = \left(\frac{\epsilon_2}{\epsilon_2 - 1}\frac{1}{\varphi}w_1(1+\tau)\right)^{1-\epsilon_2}\frac{E_2}{\epsilon_2} - w_1 f^e$$

- Multinational profit

$$\Delta\pi_1^m(\varphi) = \left(\frac{\epsilon_2}{\epsilon_2 - 1}\frac{1}{\varphi}w_2\right)^{1-\epsilon_2}\frac{E_2}{\epsilon_2} - w_2 f^p$$

+ Export Platform

Profits and productivity



- Which firms export? Which firms become MNEs?

Heterogeneous firm model, low productivity

- $w_1 = w_2 = 2, E_2 = 50, \epsilon_2 = 3, f^p = 1.5, f^e = 0.6, \tau = 0.3$ ←
- Let $\varphi = 1.5$. Compute p_e, p_m. Should the firm export to serve the foreign market or use a foreign affiliate?

$$p_e = \frac{w_1}{\varphi}\frac{\epsilon}{\epsilon-1}(1+\tau) = \frac{2}{1.5}\frac{3}{2}(1.3) = 2.4$$

$$p_m = \frac{w_2}{\varphi}\frac{\epsilon}{\epsilon-1} = \frac{2}{1.5}\frac{3}{2} = 2.0$$

0.148

$$\pi_1^e(\varphi) = (p_e)^{1-\epsilon}\frac{E_2}{\epsilon_2} - w_1 f^e = (2.6)^{-2}\frac{50}{3} - 2\times 0.6 = 1.265$$

$$\pi_1^m(\varphi) = (p_m)^{1-\epsilon}\frac{E_2}{\epsilon_2} - w_2 f^p = (2.0)^{-2}\frac{50}{3} - 2\times 1.5 = 1.167$$

0.25

Exporter

Heterogeneous firm model, high productivity

- $w_1 = w_2 = 2, E_2 = 50, \epsilon_2 = 3, f^p = 1.5, f^e = 0.6, \tau = 0.3$
- Let $\varphi = 2.0$. Compute p_e, p_m. Should the firm export to serve the foreign market or use a foreign affiliate?

MNE

$$p_e \geq \frac{w_1}{\varphi}\frac{\epsilon}{\epsilon-1}(1+\tau) = \frac{2}{2}\frac{3}{2}(1.3) = 1.95$$

$$p_m = \frac{w_2}{\varphi}\frac{\epsilon}{\epsilon-1} = \frac{2}{2}\frac{3}{2} = 1.5$$

$$\Delta\pi_1^e(\varphi=2) = (p_e)^{1-\epsilon}\frac{E_2}{\epsilon_2} - w_1 f^e = 1.95^{-2}\frac{50}{3} - 2\times 0.6 = 3.183$$

$$\Delta\pi_1^m(\varphi=2) = (p_m)^{1-\epsilon}\frac{E_2}{\epsilon_2} - w_2 f^e = 1.5^{-2}\frac{50}{3} - 2\times 1.5 = 4.111$$

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

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

Leontief production: $y = \min\left\{\frac{l_u}{\theta_u}, \frac{l_s}{\theta_s}\right\}$

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?

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 Expating

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

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

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

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

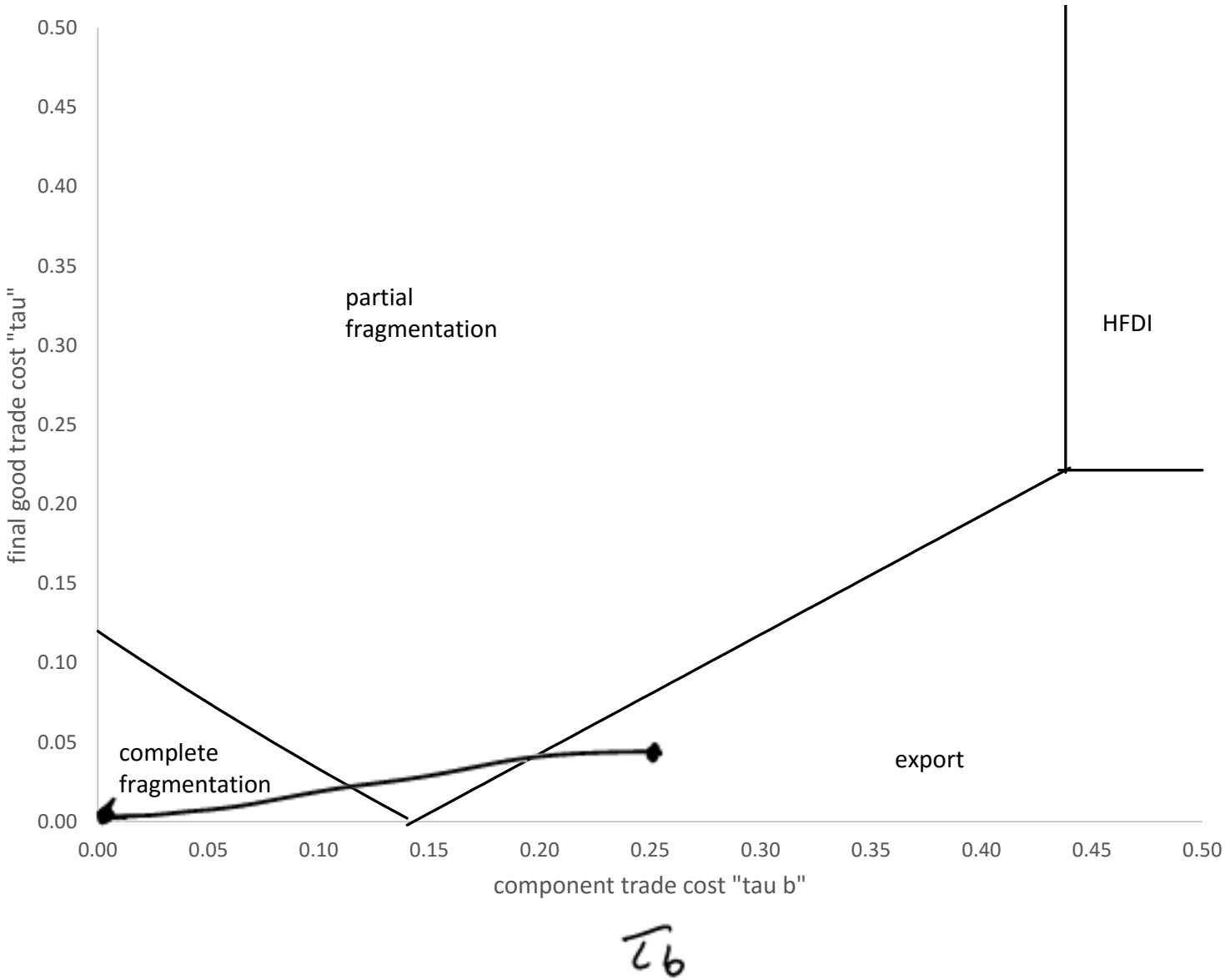
$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)$$

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

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

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

How trade costs shape firm structure



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?

$c_a^1 = 4 \times 5 + 1 \times 20 = 40$

$c_b^1 = 1 \times 5 + 6 \times 20 = 125$

$c_a^2 = 4 \times 2 + 1 \times 30 = 38$

$c_b^2 = 1 \times 2 + 6 \times 30 = 182$

Possible firm structures

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

$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$ = 40 + 125 = 165

$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^2, w_u^2)$ = 39 + 182 = 220

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

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

$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)$ = 39 + 125 × 1.15 = 181.75

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

$c^1 = \left[c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1+\tau_b)\right](1+\tau)$ = 181.75 × 1.1 = 199.9

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

Complete Fragmentation.

FDI and productivity in the host country

1. Composition effects (changes in f)

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

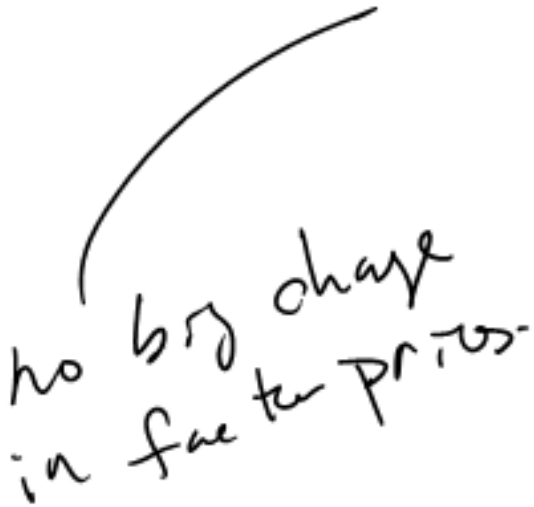
more high φ firms
less low φ firms

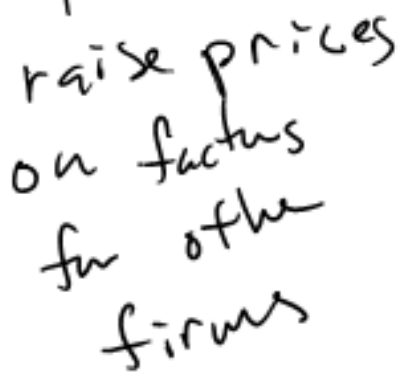
2. Spillover effects (changes in φ)

- 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 → likely negative effects
  - If MNEs need elastic factors → likely small effects





Competing for FDI

- Do not need to know the models
- Do need to know the big idea
- When countries compete for FDI projects...
  MNEs tend to extract more of the joint surplus than the case when countries do not compete

— good to agree not to compete
— limit competition.

Comprehension.

Tax principles

Residence principle Taxpayer's residence is the basis for taxation. For firms, this is typically the country in which the firm is incorporated. Walmart's residence in the United States.

Source principle Where the income is earned is the basis for taxation. Walmart earns income in the United States and Mexico.

- US taxes its firms on residency basis and foreign firms on source basis
  - Walmart pays US tax on its total income — wherever it is earned.
  - Toyota only pays US tax on the income it earns in the US.
- Foreign profit is taxed when it is repatriated

Foreign tax credits

home country firm

- If $\tau^H \geq \tau^F$, then $C = \tau^F \pi^F$

$$T = \tau^H \left(\pi^H + \pi^F\right) - \tau^F \pi^F + \tau^F \pi^F = \tau^H \left(\pi^H + \pi^F\right)$$

- If $\tau^H < \tau^F$, then $C = \tau^H \pi^F$

$$T = \tau^H \left(\pi^H + \pi^F\right) - \tau^H \pi^F + \tau^F \pi^F = \tau^H \pi^H + \tau^F \pi^F$$

τ = tax rate $0 \leq \tau \leq 1$

T = amount of tax paid ($)

- Why two different rules?

Practice question

- $\pi^H = 75, \pi^F = 25, \tau^H = 0.35, \tau^F = 0.45$ $\tau^H < \tau^F$
- What is the value of C? $= \tau^H \pi F = 0.35 \times 25 = 8.75$
- What is the firm's total tax rate, $\tau = T/(\pi^H + \pi^F)$?
- What are the tax revenues for F and H? $= T^F, T^H$

$T^H = 0.35 * (75 + 25) - 8.75 = 26.25$

$T^F = 0.45 \times 25 = 11.25$

$T = 37.5$

$\tau = \frac{37.5}{100} = 0.375$

Tax strategy

- Focus on US tax system

1. Earn profit in low-tax countries: *profit shifting*
   - Transfer pricing
   - Intrafirm financing
   - Inversions
   - Intangible asset location
2. Do not repatriate foreign profit
   - Wait for repatriation tax holiday
   - Use funds to invest outside of United States

manipulate price intra firm trade

transfer profits for low

flip to become foreign firm

park assets in low tax cty. pay royalties.

Outsourcing and incomplete contracts

- Final good firm $q = Am^{\alpha}$
- Needs components m
- Potential supplier produces m at cost p_m
- Final good firm produces m at cost γp_m per unit, fixed cost f^I

- No contract + relationship specificity $\rightarrow$ hold up problem
- After components are produced, both firms want to renegotiate
- No contract enforceable, so bargain after production

Final-good firm choices

- Given this setup, firm can choose to
  1. **Integrate**. Both stages of production are done within the final good firm.
  2. **Outsource**. Contract with an arm's-length firm (the supplier) to produce the components and produce the final good in-house.
- Firm will choose whichever structure maximizes profit
- We will study 3 choice problems
  0. Complete contracts (set a benchmark, not available to the firms)
  1. Outsourcing
  2. Integration

Complete contracts: Best-case scenario

- Choose m to maximize joint profit

$$\max_{m} \quad \pi_F + \pi_S = pA_i m^{\alpha} - p_m m.$$

- First-order condition

$$\alpha p A_i m^{\alpha-1} - p_m = 0$$

- Solution is the amount of m that delivers the most joint profit

$$m^* = \left(\frac{\alpha p A_i}{p_m} \right)^{\frac{1}{1-\alpha}}$$

Option 1: Outsourcing

- Supplier understand it gets β of future revenues
- Choose m to maximize its profits (not joint profits!)

$$\max_{m} \quad \pi_S = \beta p A_i m^{\alpha} - p_m m$$

- First-order condition

$$\alpha \beta p A_i m^{\alpha-1} - p_m = 0$$

- Solution

$$m^B = \left(\frac{\alpha \beta p A_i}{p_m} \right)^{\frac{1}{1-\alpha}} = m^* \left(\beta \right)^{\frac{1}{1-\alpha}}$$

Option 2: Integrate the firm

- Final good firm produces components
- Avoids hold-up bargaining problem, pays higher costs
- Final-good firm chooses m to solve

$$\max_{m} \quad \pi_F = pA_i m^{\alpha} - \gamma p_m m - f^I$$

- First-order condition

$$\alpha p A_i m^{\alpha} - \gamma p_m = 0$$

- Solution

$$m^I = \left(\frac{\alpha p A_i}{\gamma p_m}\right)^{\frac{1}{1-\alpha}} = m^* \left(\frac{1}{\gamma}\right)^{\frac{1}{1-\alpha}}$$

Practice question

- $\alpha = 0.75, A = 2, p_m = 1.1, p = 1.5, \beta = 0.7, \gamma = 1.3, f^I = 0.25$
- Complete contracts solution

$$m^* = \left(\frac{0.75 \times 2 \times 1.5}{1.1}\right)^{\frac{1}{1-0.75}} = 17.5 \qquad q^* = 2 \times (17.5)^{0.75} = 17.11$$

$$\pi_F^* + \pi_S^* = 1.5 \times 17.11 - 1.1 \times 17.5 = 6.4$$

- Outsource and bargain solution

$$m^B = m^* \beta^{\frac{1}{1-\alpha}} = 17.5 \times (0.7)^4 = 4.20 \qquad q^* = 2 \times 4.2^{0.75} = 5.87$$

$$\pi_F^B = (1-\beta) \times p \times q = 0.3 \times 1.5 \times 5.87 = 2.64$$

$$\pi_S^B = \beta \times p \times q - p_m m = 0.7 \times 1.5 \times 5.87 - 1.1 \times 4.2 = 1.54$$

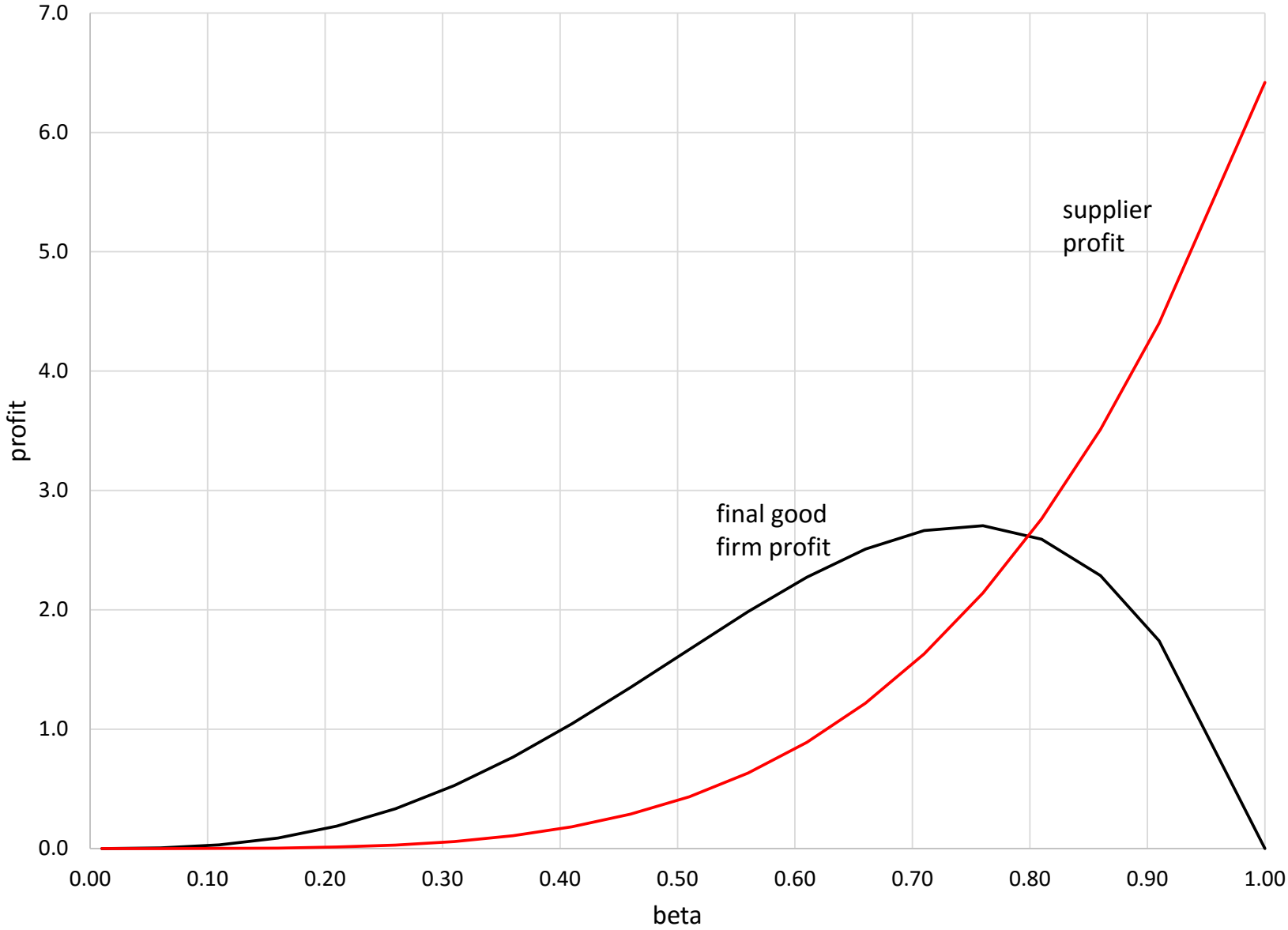
- Integrated firm solution

$$m^I = m^* \left(\frac{1}{\gamma}\right)^{\frac{1}{1-\alpha}} = 17.5 \times \left(\frac{1}{1.3}\right)^4 = 6.127 \qquad q = 2 \times 6.13^{0.75} = 7.79$$

$$\pi_F^I = 1.5 \times 7.79 - 1.3 \times 1.1 \times 6.127 - 0.25 = 2.67$$

$$\pi_S^I = 0$$

Profit and β



Final-good firm profit and productivity