Multinationals and the Globalization of Production

Internalization

Penn State // Fall 2017

Administrative things

- Sign in to Arkaive.com (course code: 84ST)
  - If not working, sign in up front
- PS #5
  - Due end of class December 7
  - Posted on course website
- Final exam
  - Review session Thursday December 7
  - Monday December 11, 8:00AM–9:50AM
  - Osmond Lab 101
- SRTE open now until December 10

Roadmap

- Past: Where do firms locate?
  - FDI for market access (Horizontal/Export platform)
  - FDI for factor cost savings (Vertical)
  - FDI for tax motives
- Present: Why do firms own affiliates?
  - Why not purchase from another firm?
  - Today: hold-up problems and contracts

O L Internalization

OLI framework

- Being a multinational comes with costs
- What are the benefits?
- For a firm we ask what *advantage* comes from
  - ownership? [Patents, brands, good ideas…]
  - location? [HFDI, VDFI, tax FDI]
  - internalization?

What is the benefit from **owning** the foreign producer?

The hold-up problem

- Many reasons a firm may want to own an affiliate
- Today, study contract incompleteness
- Decision makers
  - A final-good firm that needs component parts
  - A potential supplier firm that can produce components cheaper than final good firm
- Components
  - Components are specific to the final-good firm: value to other firms is very low (zero, for simplicity)
  - Hard for an outside party to verify component quality

Contract difficulties

- Suppose final-good firm and supplier write contract that specifies some dimensions of quality, quantity to produce, and the price
- Supplier produces the components
- Both firms now have an incentive to renegotiate the contract
  - Final good firm: the (final-good specific) components are worthless to the supplier; wants a lower the price
  - Supplier: final-good technology worthless without components; wants a higher price
  - These are "hold up" problems
- A good contract keeps them from being able to do this
- Difficulty in verifying quality makes it hard to write a good contract

Fisher Body & GM

- Early 1900s: Fisher Body Corp. supplies auto bodies to GM

Fisher Body & GM

- Early 1900s: Fisher Body Corp. supplies auto bodies to GM
- Fisher is the exclusive dealer of bodies to GM
  - GM promised to buy bodies only from Fisher for 10 years at cost + margin
- In 1920, unforeseen increase in demand for GM cars: value of Fisher body parts more valuable
- Fisher demands higher price as "costs" have increased
  - Hard to verify if costs really increased

Integrated firms

- One way to avoid hold up is to make the product yourself
  - We say the firm is *integrated*
- If an employee/manager attempts to hold up the firm, fire them
  - Better able to incentivize employees
  - Integration may have other costs
- In 1926, GM acquires Fisher Body

A hold-up model

- A final-good firm i owns the final good production function

$$q = A_i m^{\alpha}$$

- Need components m to produce (if $m = 0$, then $q = 0$)
- Sell the final good for price p

Components

Relationship specificity. The components are relationship specific. The components are specially tailored to the final-good firm's application. The components have no value to anyone else but the final-good firm.

Difficult verification. It is difficult to verify the quality of the components. The final-good firm and the supplier can judge the quality of the components, but outside parties — like a court — cannot.

- This will make contracting difficult

Component costs

- A potential *supplier* firm can produce components for cost p_m per unit
- The final-goods firm can produce components
  - Cost of γp_m per unit, $\gamma > 1$
  - Fixed cost of operating the production line f^I
- Buying from a supplier is "cheaper," but not necessarily the best...

Contracting environment

- In everything we have done (and in most of your econ. classes)
  - Contracts are complete and enforceable
  - Can write a contract that anticipates any future outcome
  - Contract is always followed
- A useful abstraction when studying other decisions
- But incomplete (or unenforceable) contracts are a feature of reality
- Today we want to relax this assumption

Contracting in our model

- Assumption: Hard to verify quantity of components m
  - Think of m as a quantity-quality mixture
- Final-good firm and supplier know if components are right, but outside parties, like a judge cannot tell
- This makes it impossible to enforce the contract
  - This is the extreme case; could have partial enforceability
- The firms understand that the contract cannot be enforced, so they do not write the contract in the first place

Hold up

- No contract + relationship specificity $\rightarrow$ hold up problem
- After components are produced:
- Final-good firm: "these components are junk, lower your price"
  - Supplier has already incurred cost of producing
  - Parts have no value to other firms
- Supplier: "you need my components to produce, raise the price"
  - $m = 0 \rightarrow q = 0$
- Firms will resort to bargaining

THURSDAY: PS #5, REVIEW

MONDAY 12/11 101 OSMOND

8:00 AM

SRTE

- Incomplete contracts
- Hold-up problem

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
  1. Complete contracts (set a benchmark, not available to the firms)
  2. Outsourcing
  3. Integration

Best-case scenario

- Suppose we could write complete and enforceable contracts
- Such a contract would maximize joint profit
  - Would need a rule for splitting the joint profit
  - We do not need to know the profit split
  - We only want to know the "best" choice of m
- Provides a benchmark to measure the distorted decisions in the no-contracts case

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

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

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

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

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

Numerical example

Efficient Benchmark

- $\alpha = 0.75, A = 2, p_m = 1.1, p = 1.5$
- What is m^*? What are the associated quantity of final goods q^*, revenues $R^* = p^* q^*$, and joint profits $\pi_S^* + \pi_F^*$?

$$m^* = \left(\frac{pA\alpha}{p_m}\right)^{\frac{1}{1-\alpha}} = \left(\frac{1.5 \times 2 \times 0.75}{1.1}\right)^{\frac{1}{1-0.7}} = 17.5$$

$$q^* = A m^{\alpha} = 2 \ (17.5)^{0.75} = 17.1$$

$$R^* = p \cdot q = 1.5 \times 17.1 = 25.7$$

$$\pi^* = p \cdot q - p_m m = 25.7 - 17.5 \times 1.1 = 6.45$$

Option 1: Outsourcing

- What are profits if the final-good firm buys from the supplier?
- Contracts are not possible
  1. The supplier chooses how much m to produce.
  2. The final good firm and supplier bargain over the revenue the components will generate.
  3. The final good is made and sold at price p.
  4. The revenue from selling the final good is split between the two firms according to the deal struck in step 2.
- We are assuming the deal reached in step 2 is enforceable
  - Outsider can observe revenue earned from selling q

Bargaining

- How does bargaining work?
- Potentially very complicated
- Something simple
  - Supplier has bargaining power $\beta \in [0, 1]$
  - Final-good firm has bargaining power $1 - \beta$
- The outcome of a *Nash Bargaining* protocol yields
  - Supplier gets share β of revenue
  - Final-good firm gets share $1 - \beta$ of revenue

Supplier choice problem

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

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

- First-order condition

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

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

Supplier choice problem

- 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

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

Underprovision of m

- The suppliers choice is

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

- Since $\beta < 1$ and $\alpha < 1 \rightarrow \beta^{\frac{1}{1-\alpha}} < 1$

- The supplier does not produce as many components (or enough quality) because it knows it cannot earn its full value in the bargaining stage

12:35

In-class example: Outsourcing

- Take 5 minutes, work with someone next to you
- $\alpha = 0.75, A = 2, p_m = 1.1, p = 1.5, \beta = 0.7$
- What are m^B, q^B, R^B, π_F^B, and π_S^B?
- How do joint profits compare to those in the best-case scenario?

$\pi_F^B + \pi_S^B = 4.17$

$m^B = m^* \beta^{\frac{1}{1-\alpha}} = 17.5 \times 0.24 = 4.2$

$q^B = A m^{\alpha} = 2 \times 4.2^{0.75} = 5.87$

$R^B = 1.5 \times 5.87 = 8.8$

$\pi_F^B = (1-\beta) R^B = 2.64$

$\pi_S^B = \underbrace{\beta R^B}_{6.15} - p_m m = 0.7 \times 8.8 - 1.1 \times 4.2$
$= 1.53$

$m^* = 17.5$

$q^* = 17.1$

$R^* = 25.7$

$\pi_S^* + \pi_F^* = 6.45$

Inefficiency

- Incomplete contracts $\rightarrow$ under production ($q^* = 17.1$, $q^B = 5.9$)
- And lower joint profit ($\pi^* = 6.45$, $\pi^B = 4.17$)
  - Not only about bargaining
  - The size of the profit to bargain over has shrunk
- If the firms could write a contract both could be better off
  - Best production yields ($6.45 - 4.17 =$) 2.28 more profit
  - Can give **both** firms more profits compared to bargaining
- Better contracts lead to more efficient production

Institutional quality

- In our case, can't enforce contract because the component quality is difficult to observe
- Poor contract enforcement can arise from poor legal institutions
- Attempt to measuring institutional quality
  - World Bank's Doing Business

Option 2: Integrate the firm

- Final good firm produces components
- Avoids hold-up bargaining problem, pays higher costs $\gamma > 1$
- 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

$$pA_i \alpha m^{\alpha-1} - \gamma p_m = 0$$

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

m^*

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

$$\max_m \pi_F = pA_i m^\alpha - \gamma p_m m - f^I$$

- First-order condition

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

- Solution

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

Choice of m

- The final-good firm chooses

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

- Again, less m is chosen compared to m^*
- The reason is different, though,
  - Incentives are aligned: marginal revenue = marginal cost
  - Marginal cost is higher $\gamma > 1$

12:50

In-class example: Integration

- Take 5 minutes, work with someone next to you
- $\alpha = 0.75, A = 2, p_m = 1.1, p = 1.5, \beta = 0.7, \gamma = 1.3, f^I = 0.25$
- What are m^I, q^I, R^I, π_F^I?
- Should the final good firm integrate, or purchase from a supplier, despite the ex post bargaining?

Integrate

$m^I = m^* \left(\frac{1}{\gamma}\right)^{\frac{1}{1-\alpha}} = 17.5 \left(\frac{1}{1.3}\right)^{\frac{1}{1-.75}} = 6.1$

$q^I = 2 \times 6.1^{0.75} = 7.8$

$R^I = 1.5 \times 7.8 = 11.7$

$R^I - \gamma p_m m^I - f^I$

$\pi_F^I = 11.7 - 1.3 \times 1.1 \times 6.1 - 0.25$

$= 2.73$

BCS	BARG
17.5	4.2
17.1	5.86
25.7	8.79
$\pi_S + \pi_F$	$\pi_S^B = 1.53$
$= 6.45$	$\pi_F^B = 2.64$
	$\pi_{F+S}^B = 4.17$

Taking stock

- Best-case (but unobtainable) m

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

- When outsourcing, distorted by bargaining

$$m^B = \beta^{\frac{1}{1-\alpha}} m^*$$

- When integrating, face higher costs

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

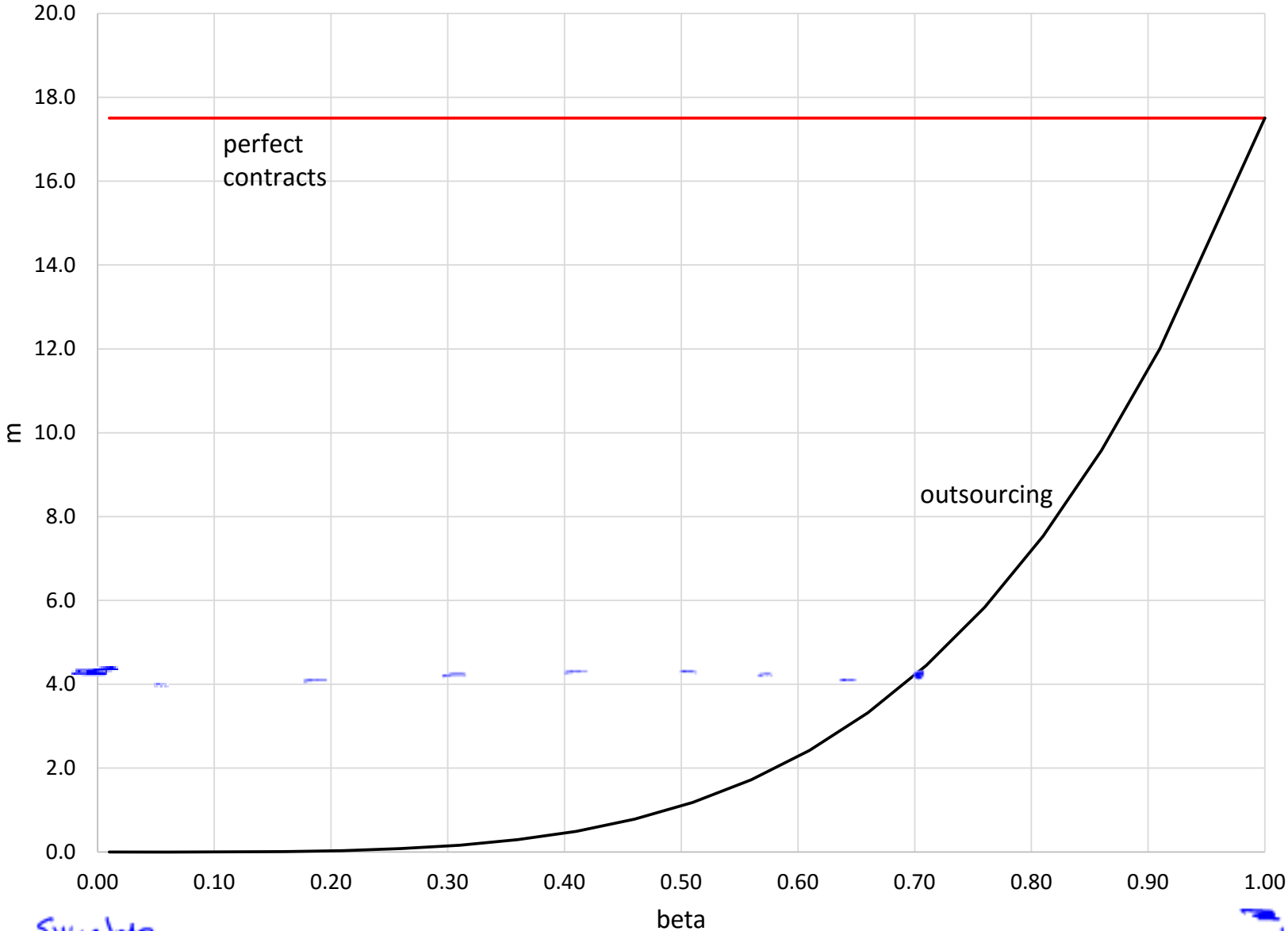
- Both options generate smaller joint profit than the best-case

Bargaining power effects

- β is not a choice in this model
- But we can learn more about the model by changing β

β = share of revenue goes to supplier

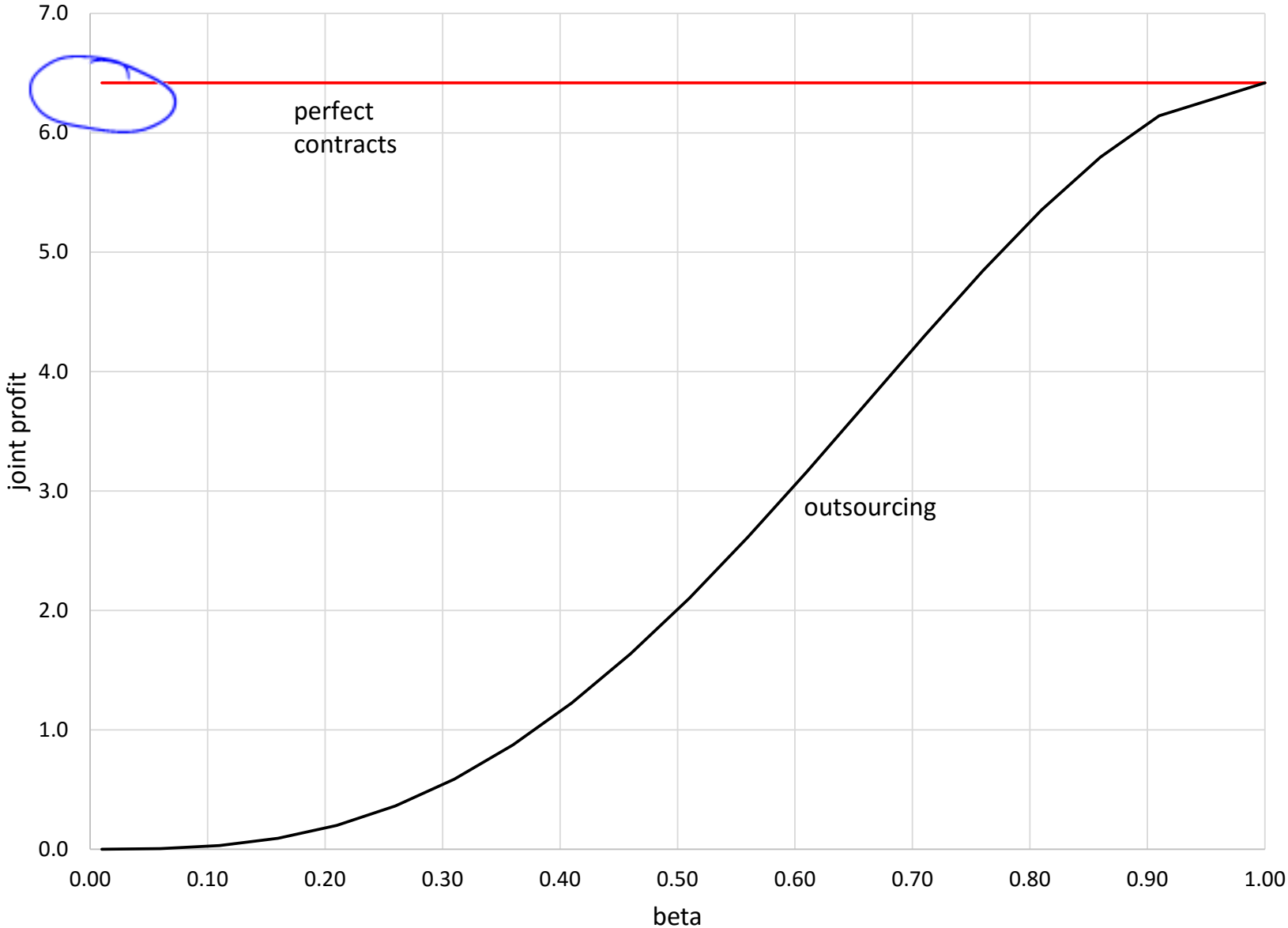
Input choice and β



Bargaining power effects

- β is not a choice in this model
- But we can learn more about the model by changing β
- As we increase β
  - Supplier delivers more inputs ($\beta = 1 \rightarrow m = m^*$)

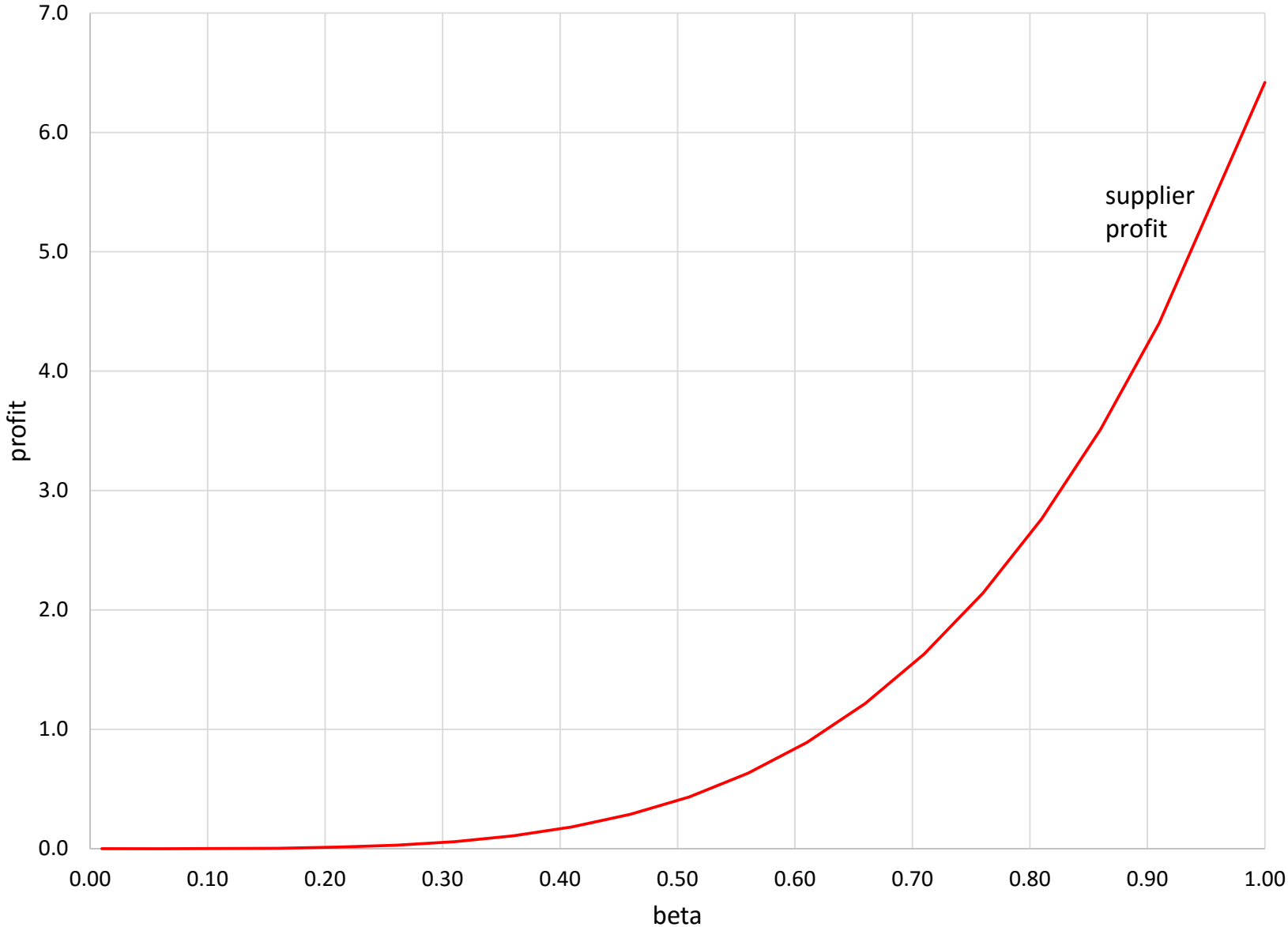
Joint profit and β



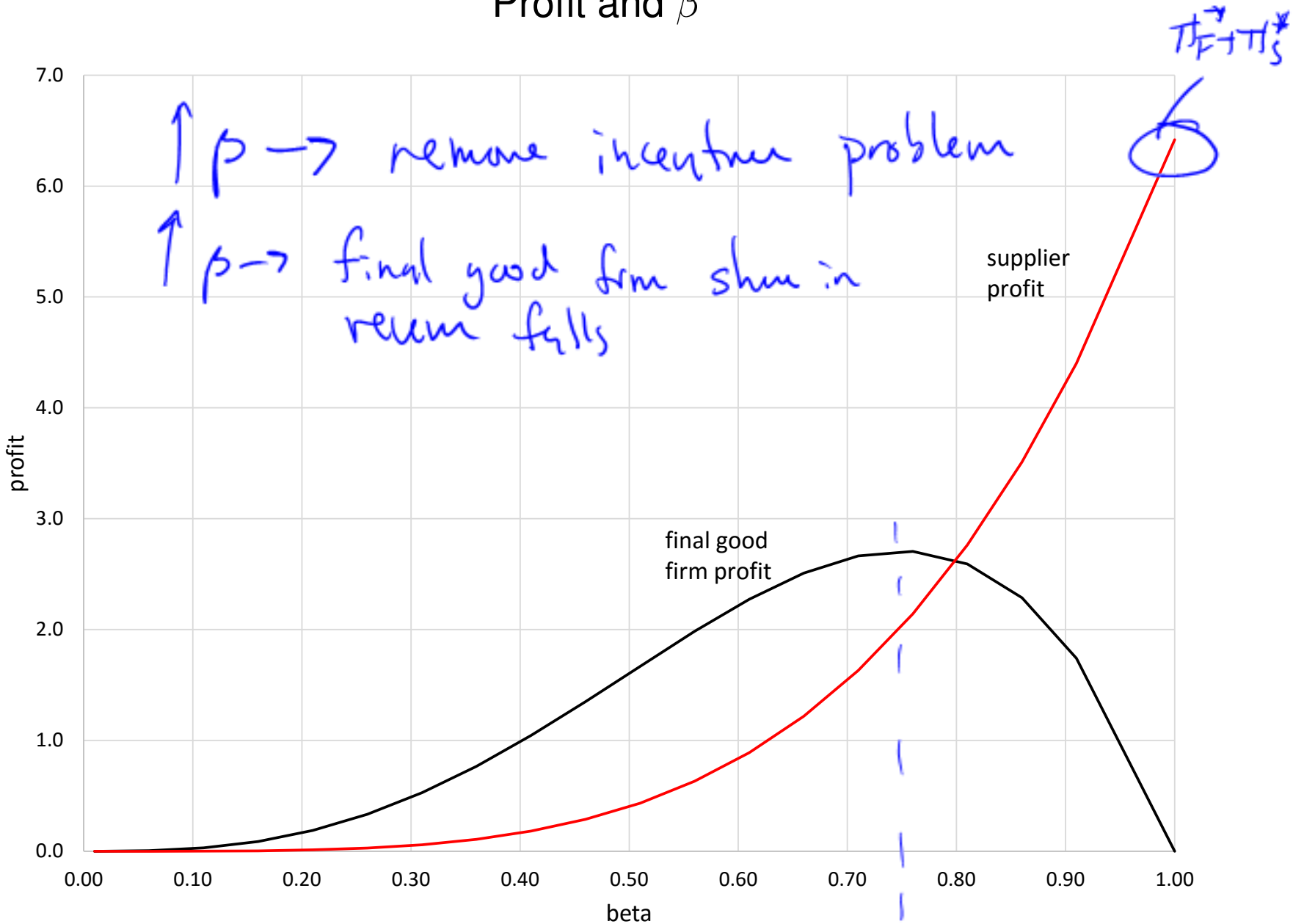
Bargaining power effects

- β is not a choice in this model
- But we can learn more about the model by changing β
- As we increase β
  - Supplier delivers more inputs ($\beta = 1 \rightarrow m = m^*$)
  - Joint profit increases ($\beta = 1 \rightarrow \pi_F^B + \pi_S^B = \pi_F^* + \pi_S^*$)

Profit and β



Profit and β



Bargaining power effects

- β is not a choice in this model
- But we can learn more about the model by changing β
- As we increase β
  - Supplier delivers more inputs ($\beta = 1 \rightarrow m = m^*$)
  - Joint profit increases ($\beta = 1 \rightarrow \pi_F^B + \pi_S^B = \pi_F^* + \pi_S^*$)
  - Supplier profit increases
  - Final-good firm profit increases, then decreases

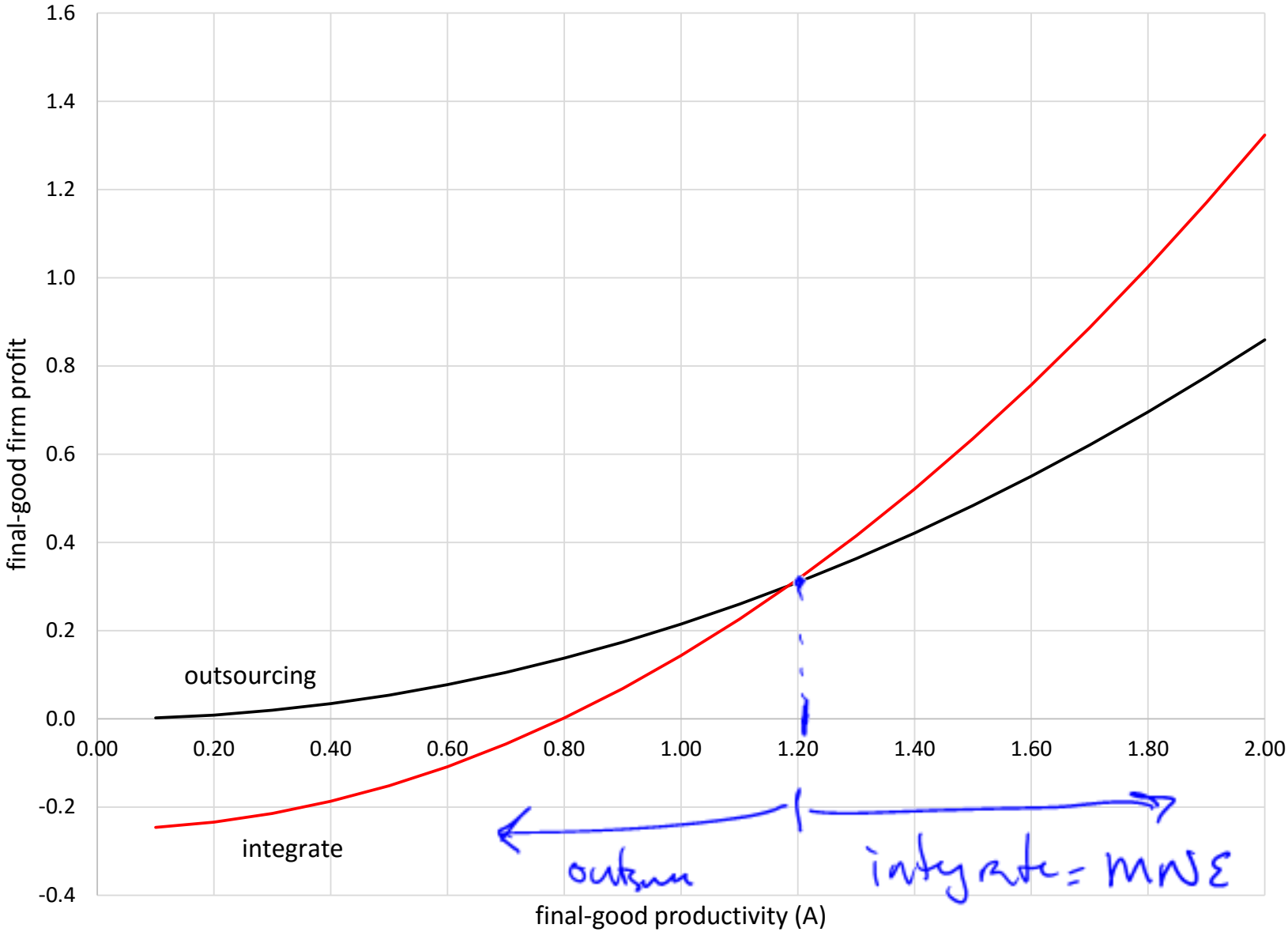
Bargaining power

- Tension between two forces
  1. Increase $\beta \rightarrow$ improve supplier incentives
  2. Increase $\beta \rightarrow$ give up share of revenues
- When β is low, 1. dominates
- When β is high, 2. dominates

Final-good firm productivity

- Final-good firms differ by productivity, A_i
- Increasing A increases profit level, π_F
- Fixed cost of component production
- Leads to "cutoff" productivity for make/buy decision

Final-good firm profit and productivity



Apple

- Apple Inc., does not own Foxconn
- iStuff manufacturing requires very specialized equipment
  - A relationship-specific investment
  - Subject to under-investment by Foxconn
- Apple invests in equipment instead of Foxconn
  - Buys/builds equipment, places it in Foxconn
  - Could lead Foxconn to hold up Apple
- Apple "CapEx" $\approx$ 10 bil. USD per year ($\approx$ GM CapEX)
- Bonus: Use tax-deferred foreign profits to make investments!
- Not Apple's only reason to own equipment...

Summary

- When contracts are difficult to enforce…
  - Poor enforcement from government
  - Hard to verify contract parameters
- …and investment is relationship specific
- Hold-up problems tend to lead to under-investment
- Ex post bargaining distorts firm incentives
- Inefficient production shrinks joint profit
- Solutions
  - Integrate all production into the firm
  - Firm with more bargaining power makes bigger investment
  - Next up: License the technology