Foreign direct investment and multinational firms

- What is a multinational firm / a multinational enterprise?

Richard Caves, Harvard University:

“The multinational enterprise (MNE) is [...] an enterprise that controls and manages production establishments – plants – located in at least two countries. It is simply one subspecies of a multiplant firm.“

→ Two resulting decisions:

1. Location decision
2. Internalization decision
1. **Location decision:**

- Why do some firms operate in more than one country while other firms operate only in one country?

- What determines the countries in which production facilities are located?

- Assumption (in this section): Production always occurs within the boundaries of the firm.

- Two motives for multinational activity: horizontal and vertical
  
  - Horizontal multinational firm:
    - A firm that produces similar products and/or services in multiple plants in various countries
  
  - Vertical multinational firm:
    - A firm that produces different fragments of final products in different locations
Horizontal multinational activity:

→ with homogeneous firms
  Brainard, S.L. (1997), An Empirical Assessment of the Proximity-Concentration Trade-Off between Multinational Sales and Trade, American Economic Review]

→ with heterogeneous firms

  ▪ To sell its (final) product on the foreign market, a firm can either serve the market through exports or build a plant in the foreign country and produce there (horizontal FDI).

→ Introduce the possibility of horizontal FDI in the Melitz (2003) framework!
  Assumption (as in the baseline model): Symmetric countries!

  ▪ Profits for the export market and the cutoff productivity level of exporting firms are given by:

\[
\pi_x(\varphi_x) = \tau^{1-\sigma} \frac{R}{\sigma} \left( P \rho \varphi_x \right)^{\sigma-1} - f_x \iff \pi_x(\varphi_x^*) = 0 \iff \varphi_x^* = \left( \frac{f_x \tau^{\sigma-1} \sigma}{R \left( P \rho \right)^{\sigma-1}} \right)^{1/(\sigma-1)}
\]
Analogously, we can derive the profits and the cutoff productivity level of a firm that serves the foreign market via horizontal FDI:

\[
\pi_h(\varphi_h) = \frac{R}{\sigma}(P \rho \varphi_h)^{\sigma-1} - f_h \quad \Leftrightarrow \quad \pi_h(\varphi_h^*) = \pi_x(\varphi_x^*) \quad \Leftrightarrow \quad \varphi_h^* = \left(\frac{(f_h - f_x) \tau^{\sigma-1} \sigma}{(\tau^{\sigma-1} - 1)R(P \rho)^{\sigma-1}}\right)^{1/\sigma-1}
\]

Comparing the cutoff productivity levels gives:

\[
\frac{\varphi_h^*}{\varphi_x^*} = \left(\frac{(f_h - f_x) \tau^{\sigma-1} \sigma}{(\tau^{\sigma-1} - 1)R(P \rho)^{\sigma-1}}\right)^{1/\sigma-1} = \left(\frac{f_h - f_x}{f_x(\tau^{\sigma-1} - 1)}\right)^{1/\sigma-1} > 1 \text{ if } f_h > f_x \tau^{\sigma-1}
\]

As long as \( f_h > f_x \tau^{\sigma-1} \) holds, firms face a “Proximity-Concentration-Trade-Off”:
Producing in the foreign market implies giving up the concentration of production (higher fixed costs), but since the firm is closer to the market, it can avoid trade costs.

\[\rightarrow\] Firms that choose FDI are more productive than exporters!
Profits from domestic sales, from exports and from horizontal FDI:
2. **Internalization decision**

- Why do firms own foreign facilities rather than simply contract with local producers, i.e. why do some firm only operate within the boundaries of the firm?

- Two organizational forms:
  
  1. **Integration:** produce the input within the boundaries of the firm
  2. **Outsourcing:** buy the input from an unaffiliated supplier

**Examples:**

- Intel Corporation assembles most of its microchips in wholly owned subsidiaries in China, Costa Rica, Malaysia, and the Philippines.

- Nike subcontracts most of its manufacturing to independent producers in Thailand, Indonesia, Cambodia, and Vietnam.

→ **Organizational decision/“make or buy”-decision:** Integration or outsourcing?
The organization of firms: The model of Antràs and Helpman

What is a “firm”?  

Combining different inputs to produce some final output \( y \).

- **Inputs:**

  - headquarter services \( (h) \):
    - provided by the firm owner/producer \( (H) \)
  
  - manufacturing component \( (m) \):
    - specifically tailored to output \( y \), supplier \( (M) \) may be an external contractor (outsourcing), or an integrated affiliate
Setup

- (Inverse) demand function: \( p = \left( \frac{y}{A} \right)^{\alpha - 1}, \quad 0 < \alpha < 1, \quad A > 0 \)

- Production of good \( y \) requires the development of two specialized inputs \( h \) and \( m \):

\[
y = \varphi \cdot \left( \frac{h}{\eta} \right)^{\eta} \cdot \left( \frac{m}{1-\eta} \right)^{1-\eta}, \quad 0 < \eta < 1
\]

\( \eta \) headquarter-intensity of final good production (component-intensity 1–\( \eta \))

\( \varphi \) firm-specific productivity

- Revenue is thus given by:

\[
R = p \cdot y = A^{1-\alpha} \cdot \left[ \varphi \cdot \left( \frac{h}{\eta} \right)^{\eta} \cdot \left( \frac{m}{1-\eta} \right)^{1-\eta} \right]^\alpha
\]
Further assumptions:

- The (essential) inputs $h$ and $m$ are specific for the final product.
  
  $\rightarrow$ $h$ and $m$ have no value outside the relationship.

- The input investments of the firm owner and the supplier are irreversible.
  
  $\rightarrow$ Production costs are sunk.

$\rightarrow$ Ex ante relationship-specific investments subject to sunk costs

Two scenarios

1. **Complete contracts**: Stipulate quantity and quality of the inputs, ex post payments

2. **Incomplete contracts**: Hold-up problem! Ex-post bargaining, underinvestment
Scenario 1: Complete contracts

Structure of the game

1st stage: The producer offers a contract to the supplier. This contract stipulates the supplier’s input provision of the manufacturing component $m$ and the payment to $M$. The supplier (who has an outside option equal to $w_M$) decides whether to accept the contract or not.

2nd stage: The producer and the supplier produce the headquarter services $h$ and the manufacturing component $m$, respectively.

3rd stage: Output is produced and revenue is realized. The producer and the supplier receive the payment stipulated in the contract.

→ Supplier provides the input (stage 2) & receives the payment (stage 3) as stipulated in the contract (stage 1)!

Note: No organizational decision with complete contracts!
3\textsuperscript{rd} stage: Final good production and division of surplus

- Final output is produced and sold. The supplier receives the payment $s_M$ as stipulated in the contract.
- The producer keeps the residual $R - s_M$.

2\textsuperscript{nd} stage: Input provisions

- The supplier provides $m$ units of the manufacturing component as stipulated in the contract.
- The producer provides the level $h$ of headquarter services.
- Input production takes place simultaneously in stage 2. Yet, the producer’s decision on the optimal provision level of $h$ is determined already in the contract design stage 1 (see below).
1st stage: Terms of contract and participation of the supplier

- For the supplier to accept the contract, his expected payoff $\pi_M$ must be larger than the outside option $w_M$:

$$\pi_M = s_M - c_M \cdot m \geq w_M$$

- The producer has no reason to leave rents to the supplier. Hence, the producer offers contract packages $\{s_M, m\}$ such that:

$$s_M = c_M \cdot m + w_M$$

→ “participation constraint”

- To simplify notation, we assume that the supplier’s outside option is equal to zero, i.e.:

$$s_M = c_M \cdot m$$
The firm controls the input $h$ directly and the input $m$ indirectly via the contract. She chooses $h$ and $m$ so as to maximize her own payoff:

$$
\pi_H = R - c_H \cdot h - s_M
$$

$$
= A^{1-\alpha} \cdot \left[ \phi \cdot \left( \frac{h}{\eta} \right) \eta \cdot \left( \frac{m}{1-\eta} \right)^{1-\eta} \right]^\alpha - c_H \cdot h - s_M
$$

Taking into account the supplier’s participation constraint, problem is equivalent to:

$$
\pi = A^{1-\alpha} \cdot \left[ \phi \cdot \left( \frac{h}{\eta} \right) \eta \cdot \left( \frac{m}{1-\eta} \right)^{1-\eta} \right]^\alpha - c_H \cdot h - c_M \cdot m
$$

$\rightarrow$ Firm maximizes the overall payoff of the relationship!
• First-order conditions (FOCs):

\[
\frac{\partial \pi}{\partial h} = \alpha \cdot A^{1-\alpha} \cdot \left[ \varphi \left( \frac{h}{\eta} \right) \eta \left( \frac{m}{1-\eta} \right)^{1-\eta} \right]^\alpha \cdot \left( \frac{h}{\eta} \right)^{-1} - c_H = \alpha \cdot R \cdot \frac{\eta}{h} - c_H = 0
\]

\[
\frac{\partial \pi}{\partial m} = \alpha \cdot A^{1-\alpha} \cdot \left[ \varphi \left( \frac{h}{\eta} \right) \eta \left( \frac{m}{1-\eta} \right)^{1-\eta} \right]^\alpha \cdot \left( \frac{m}{1-\eta} \right)^{-1} - c_M = \alpha \cdot R \cdot \frac{1-\eta}{m} - c_M = 0
\]

• Component input relative to headquarter input:

\[
\frac{m}{h} = \frac{1-\eta}{\eta} \cdot \frac{c_H}{c_M}
\]

• Higher in more component-intensive (less headquarter-intensive) industries.

• Decreasing in the supplier’s (relative) unit costs.
Combining the FOCs, we obtain the following input provision levels (verify for yourself!):

\[
h^* = A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{1/(1-\alpha)} \cdot \frac{\eta}{c_H} \cdot \left(\frac{1}{c_H^{\eta} \cdot c_M^{1-\eta}}\right)^{\alpha/(1-\alpha)}
\]

\[
m^* = A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{1/(1-\alpha)} \cdot \frac{1-\eta}{c_M} \cdot \left(\frac{1}{c_H^{\eta} \cdot c_M^{1-\eta}}\right)^{\alpha/(1-\alpha)}
\]

Total revenue is then:

\[
R^* = A^{1-\alpha} \cdot \left[ \varphi \left(\frac{h^*}{\eta}\right)^\eta \cdot \left(\frac{m^*}{1-\eta}\right)^{1-\eta} \right]^\alpha = A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{\alpha/(1-\alpha)} \cdot \left(\frac{1}{c_H^{\eta} \cdot c_M^{1-\eta}}\right)^{\alpha/(1-\alpha)}
\]

Hence:

\[
h^* = \frac{\alpha \cdot \eta}{c_H} \cdot R^* \quad \text{and} \quad m^* = \frac{\alpha \cdot (1-\eta)}{c_M} \cdot R^*
\]

- Optimal investments \(h^*\) and \(m^*\) increasing in productivity \(\varphi\) and demand \(A\).
- Everything else equal, \(h^*\) increasing in input intensity \(\eta\), decreasing in unit costs \(c_H\). Analogous for \(m^*\).
Given the optimal input provisions, total payoff of the relationship is given by:

\[
\pi^* = R^* - c_H \cdot h^* - c_M \cdot m^* \\
= R^* - c_H \cdot \alpha \cdot \eta/c_H \cdot R^* - c_M \cdot \alpha \cdot (1-\eta)/c_M \cdot R^* \\
= R^* [1-\alpha \cdot \eta - \alpha \cdot (1-\eta)] = R^* \cdot [1-\alpha]
\]

Using \( R^* \) this may be rewritten as:

\[
\pi^* = A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{\alpha/(1-\alpha)} \cdot \psi^*
\]

with \( \psi^* = [1-\alpha] \cdot \left( \frac{1}{c_H^\eta \cdot c_M^{1-\eta}} \right)^{\alpha/(1-\alpha)} \)

Total payoff increasing in productivity \( \varphi \) and demand \( A \), decreasing in both unit costs \( (c_H \text{ and } c_M) \).
Scenario 2: Incomplete contracts

Structure of the game

1st stage: The producer decides on the organization of the firm, i.e. if the component supplier is vertically integrated or outsourced.

2nd stage: The producer $H$ and the supplier $M$ independently decide on their non-contractible investment levels for the headquarter services $h$ and the component $m$, respectively.

3rd stage: Output is produced, revenue is realized. Producer and supplier bargain over the surplus value.

Note: “Property rights approach of the firm”

- $H$ and $M$ make relationship-specific investments. Investment costs are sunk.
  Inputs are not contractible $\rightarrow$ if there were a contract $\{s_M, m\}$, it would not be enforceable $\rightarrow$ HOLD-UP PROBLEM!
- Hold-up problem also arises within the firm (for vertical integration)!
- Bargaining power of $H$ and $M$ differs across organizational forms (integration or outsourcing).
3\textsuperscript{rd} stage: Final good production and bargaining over surplus

- The surplus value over which the agents bargain is the total revenue \( R(h, m) \).
- The “size of the pie” is bigger, the more \( H \) and \( M \) have invested in stage 2.
- Asymmetric Nash-Bargaining: The bargaining power of the producer is denoted by \( \beta \) and the bargaining power of the supplier is \( (1 - \beta) \) (with \( 0 < \beta < 1 \)).
- Agents receive revenue shares \( (s \text{ and } 1 - s) \), that are reflective of their respective bargaining power:

\[
\arg \max_s \Omega = \left[ s R \right]^{\beta} \left[ (1 - s) R \right]^{1 - \beta}
\]

\[
\frac{\partial \Omega}{\partial s} = \beta R \left[ s R \right]^{\beta-1} \left[ (1 - s) R \right]^{1 - \beta} - (1 - \beta) R \left[ s R \right]^{\beta} \left[ (1 - s) R \right]^{-\beta} = 0
\]

\[
\Leftrightarrow \left( \frac{1}{s} \right) (\beta - s) R \left[ s R \right]^{\beta} \left[ (1 - s) R \right]^{-\beta} = 0 \Rightarrow s = \beta
\]

- Below we discuss what influences this bargaining power. For the moment, consider \( \beta \) as being given.
2\textsuperscript{nd} stage: Input provisions

- Given the revenue shares $\beta$, the final good producer’s and the supplier’s maximization problems are:

$$\max_h \pi_h = \beta \cdot R(h) - c_h \cdot h \quad \text{and} \quad \max_m \pi_m = (1 - \beta) \cdot R(m) - c_m \cdot m$$

where revenue is given by:

$$R = p \cdot y = \left(\frac{y}{A}\right)^{-1+\alpha} \cdot y = A^{1-\alpha} \varphi^\alpha \cdot \left[ \left(\frac{h}{\eta}\right)^\eta \cdot \left(\frac{m}{1-\eta}\right)^{1-\eta} \right]^\alpha$$

- FOCs:

$$\frac{\partial \pi_H}{\partial h} = \beta \cdot \alpha \cdot \left(\frac{\eta}{h}\right) \cdot R - c_h = 0$$

$$\frac{\partial \pi_M}{\partial m} = (1 - \beta) \cdot \alpha \cdot \left(\frac{1-\eta}{m}\right) \cdot R - c_m = 0$$

$$\Rightarrow \quad m = \left(\frac{1 - \beta}{\beta} \cdot \frac{1 - \eta}{\eta} \cdot \frac{c_h}{c_m}\right) \cdot h$$
Solving the FOCs, we obtain (verify for yourself!)

\[
\tilde{h} = A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{1/(1-\alpha)} \cdot \left( \frac{\beta \cdot \eta}{c_H} \right) \cdot \left( \frac{\beta}{c_H} \right)^\eta \left( \frac{1-\beta}{c_M} \right)^{1-\eta} \alpha^{/(1-\alpha)}
\]

\[
\tilde{m} = A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{1/(1-\alpha)} \cdot \left( \frac{(1-\beta) \cdot (1-\eta)}{c_M} \right) \cdot \left( \frac{\beta}{c_H} \right)^\eta \left( \frac{1-\beta}{c_M} \right)^{1-\eta} \alpha^{/(1-\alpha)}
\]

with:

\[
\tilde{R} = A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{\alpha/(1-\alpha)} \left[ \left( \frac{\beta}{c_H} \right)^\eta \left( \frac{1-\beta}{c_M} \right)^{1-\eta} \alpha^{/(1-\alpha)} \right]
\]

Hence:

\[
\tilde{h} = \frac{\alpha \cdot \beta \cdot \eta}{c_H} \cdot \tilde{R} \quad \text{and} \quad \tilde{m} = \frac{\alpha \cdot (1-\beta) \cdot (1-\eta)}{c_M} \cdot \tilde{R}
\]

- Everything else equal, the supplier increases his investment level \( \tilde{m} \) if his revenue share \( (1 - \beta) \) increases, if the component-intensity \( (1 - \eta) \) increases, or if unit costs \( c_M \) decrease.
- Analogous insights for the producer!
1st stage: Organizational decision

- The producer chooses the organization of the firm so as to maximize the total payoff:

\[ \tilde{\pi} = \tilde{R} - c_H \cdot \tilde{h} - c_M \cdot \tilde{m} \]

- Using \( \tilde{h} \) and \( \tilde{m} \) from above:

\[
\tilde{\pi} = \tilde{R} - c_M \cdot (1 - \beta) \cdot (1 - \eta) \cdot \alpha \cdot \tilde{R} / c_M - c_H \cdot \beta \cdot \eta \cdot \alpha \cdot \tilde{R} / c_H \\
= \tilde{R} \cdot [1 - \alpha \cdot (1 - \beta) \cdot (1 - \eta) - \alpha \cdot \beta \cdot \eta]
\]

→ Total payoff is given by:

\[ \tilde{\pi} = \hat{A} \cdot \varphi^{\alpha/(1 - \alpha)} \cdot \alpha^{\alpha/(1 - \alpha)} \cdot \tilde{\psi}, \text{ with} \]

\[ \tilde{\psi} = [1 - \alpha \cdot (1 - \beta) \cdot (1 - \eta) - \alpha \cdot \beta \cdot \eta] \cdot \left[ \left( \frac{\beta}{c_H} \right)^\eta \left( \frac{1 - \beta}{c_M} \right)^{1 - \eta} \right]^{\alpha/(1 - \alpha)} \]
Comparison: Complete contracts vs. incomplete contracts

- Recall: $0 < \alpha < 1, 0 < \beta < 1$ and $0 < \eta < 1$

- Investment of the producer $H$:

$$
\frac{\tilde{h}}{h^*} = \frac{A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{1/(1-\alpha)} \cdot \left( \frac{\beta \cdot \eta}{c_H} \right) \cdot \left[ \left( \frac{\beta}{c_H} \right)^\eta \left( \frac{1 - \beta}{c_M} \right)^{1-\eta} \right]^{(1-\alpha)/\alpha}}{A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{1/(1-\alpha)} \cdot \frac{\eta}{c_H} \cdot \left( \frac{1}{c_H \cdot c_M^{1-\eta}} \right)^{(1-\alpha)/\alpha}} = \frac{1}{\beta} \cdot \left[ \beta^\eta (1 - \beta)^{1-\eta} \right]^{(1-\alpha)/\alpha} < 1
$$

- Investment of the supplier $M$:

$$
\frac{\tilde{m}}{m^*} = \frac{A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{1/(1-\alpha)} \cdot \left( \frac{1 - \beta \cdot (1 - \eta)}{c_M} \right) \cdot \left[ \left( \frac{\beta}{c_H} \right)^\eta \left( \frac{1 - \beta}{c_M} \right)^{1-\eta} \right]^{(1-\alpha)/\alpha}}{A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{1/(1-\alpha)} \cdot \frac{1 - \eta}{c_M} \cdot \left( \frac{1}{c_H \cdot c_M^{1-\eta}} \right)^{(1-\alpha)/\alpha}} = \left( 1 - \beta \right) \cdot \left[ \beta^\eta (1 - \beta)^{1-\eta} \right]^{(1-\alpha)/\alpha} < 1
$$

→ Hold-up problem leads to a two-sided underinvestment problem!
Revenue and total payoff also lower under incomplete contracts:

\[
\frac{\tilde{R}_{ic}}{R^*_{cc}} = \frac{A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{\alpha/(1-\alpha)} \left[ (\beta/c_H)^\eta \left( [1 - \beta]/c_M \right)^{1-\eta} \right]^{\alpha/(1-\alpha)}}{A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{\alpha/(1-\alpha)} \cdot \left[ 1/(c_H^\eta \cdot c_M^{1-\eta}) \right]^{\alpha/(1-\alpha)}} = \left[ \beta^\eta \left( 1 - \beta \right)^{1-\eta} \right]^{\alpha/(1-\alpha)} < 1
\]

\[
\frac{\tilde{\pi}_{ic}}{\pi^*_{cc}} = \frac{R^*_{ic} \cdot \left[ 1 - \alpha \cdot \beta \cdot \eta - \alpha \cdot (1 - \beta) \cdot (1 - \eta) \right]}{R^*_{cc} \cdot \left[ 1 - \alpha \cdot \eta - \alpha \cdot (1 - \eta) \right]}
\]

\[
= \left[ \beta^\eta \left( 1 - \beta \right)^{1-\eta} \right]^{\alpha/(1-\alpha)} \cdot \frac{\left[ 1 - \alpha \cdot \beta \cdot \eta - \alpha \cdot (1 - \beta) \cdot (1 - \eta) \right]}{\left[ 1 - \alpha \cdot \eta - \alpha \cdot (1 - \eta) \right]} < 1
\]

→ **Intuition:** Under IC, both the producer and the supplier do not internalize the full marginal benefits of their investments, but bear the full marginal costs. Anticipating the bargaining, both parties underinvest!

→ The severity of the underinvestment problem for \(H\) and \(M\) depends on \(\beta\). In particular, \(\tilde{R}_{ic}/h^*_{cc}\) and \(\tilde{m}_{ic}/m^*_{cc}\) are hump-shaped in \(\beta\). See problem set 5!
Organizational decision: Integration or outsourcing?

1. **Benchmark scenario:** complete contracts ("first best" allocation)
   - With complete contracts, the supplier receives \( s^*_M = c_M \cdot m^*_C \).
   - The producer receives the residual:
     \[
     R^*_C - s^*_M = R^*_C - c_M \cdot \frac{\alpha(1-\eta)}{c_M} = R^*_C \cdot [1 - \alpha (1 - \eta)]
     \]
   - With complete contracts, the producer receives the share \([1 - \alpha (1 - \eta)]\) of the overall surplus.
   - This share is increasing in the headquarter-intensity \( \eta \). Hence, if headquarter-services are more intensively used in production, then a larger share of the overall surplus “should” remain with the producer and a smaller share “should” go to the supplier.
Ex post distribution of surplus with **complete** contracts

\[ 1 - \alpha (1 - \eta) \]
2. Incomplete contracts

- **Recall:** Agents cannot commit on stipulated input contributions and ex post payments! In the bargaining, each player receives a revenue share that reflects his bargaining power: \( \beta \leftrightarrow , \quad (1 - \beta) \leftrightarrow M. \)

- **Key insight:** Size of \( \beta \) governs the investment incentives of both parties! Even if the producer could freely decide on \( \beta \), she would not choose \( \beta = 1 \) since the supplier would not invest at all in that case.

- Choice of \( \beta \) is a trade-off between revenue share and revenue level!
  See problem set 5 where you’ll compute \( \beta^* (\eta) \) that the producer would choose if he could set \( \beta \) freely…

**Ownership form and bargaining power – the simplest possible approach:**

- Bargaining power (revenue share) is just exogenously given, with \( \beta^V > \beta^O \).
  \( (V \text{ - vertical integration, O – outsourcing of the supplier}) \)

- By choosing the organizational structure, the producer thus assigns a bargaining power/revenue share to the supplier, and thereby also pins down her own bargaining power/revenue share from menu \( \{\beta^V, \beta^O\} \).

- Property rights of the supplier are higher as an external supplier than as an integrated affiliate. Hence, the producer’s revenue share is higher with vertical integration than with outsourcing.
Central question: Which ownership structure is chosen in which type of sector?

Profit maximization problem of the producer in the 1st stage:

$$\max_{\beta^V, \beta^O} \pi \left( \text{equivalent to } \max_{\beta^V, \beta^O} \psi \right)$$

Equivalent (intuitive) approach:

From the menu $\{\beta^V, \beta^O\}$ the producer chooses the ownership form that brings her realized revenue share as close as possible to the optimal revenue share $\beta^*$.  

Key parameter for this decision: Headquarter-intensity $\eta$.

“High” $\eta$: headquarter-intensive production, e.g. services, IT

“Low” $\eta$: component-intensive production, e.g. automotive industry

(Imperfect) empirical proxies for $\eta$: Capital intensity, R&D intensity, marketing intensity, ....
Ex-post distribution of surplus with **incomplete** contracts

Profits increase with a **lower** producer’s revenue share.

Producer chooses outsourcing.

Profits increase with a **higher** producer’s revenue share.

Producer chooses integration.

component-intensive sector

headquarter-intensive sector
**MAIN RESULT**

In component-intensive sectors the supplier is outsourced, and in headquarter-intensive sectors the supplier is integrated within the firm. Formally:

- **Component-intensive sector:** If $\eta < \eta_1$ it follows that $\beta^O > 1 - \alpha(1 - \eta)$.
  Profits increase with a lower revenue share.
  Hence, outsourcing dominates integration due to $\beta^V > \beta^O$.

- **Headquarter-intensive sector:** If $\eta > \eta_2$ it follows that $\beta^V < 1 - \alpha(1 - \eta)$.
  Profits increase with a higher revenue share.
  Hence, integration dominates outsourcing due to $\beta^V > \beta^O$.

**Intuition:**

In an incomplete contracts framework, property rights should be assigned to the party undertaking the relatively important investment. This stimulates input contributions and minimizes the *under-investment* problem for the relatively more important party.
Extension: Fixed costs and the organizational decision of heterogeneous firms

Note: Firms are heterogeneous/differ with respect to their productivity level $\varphi$.

1. The producer $H$ enters the industry and learns about the productivity level $\varphi$. He can then choose to exit immediately, or to remain active in the market. If he decides to remain active, he has to pay a fixed cost $f$.

2. The producer decides on the organization of the firm, i.e., if the component supplier $M$ is vertically integrated or outsourced.

3. The producer $H$ and the supplier $M$ independently decide on their non-contractible investment levels for the headquarter service $h$ and the component $m$, respectively.

4. Output is produced and revenue is realized. The producer and the supplier bargain over the surplus value.
Scenario 1: Fixed cost $f$ independent of the organizational structure

Note: Stages 2-4 analogous to the above analysis!

- **Only difference**: Profits are now given by:

  $$\pi = A \cdot \varphi^{\alpha/(1-\alpha)} \cdot \alpha^{\alpha/(1-\alpha)} \cdot \psi - f,$$

  with $\psi$ as given above

- Mechanism as in Melitz (2003):

  - Low productive firm: $\varphi \approx 0 \rightarrow \pi \approx -f < 0$, both with $\psi^O$ and $\psi^I$.
    \[ \rightarrow \text{Better to exit immediately!} \]

  - Survival in the market requires a productivity above some critical level $\varphi > \varphi^*$.  

  - Provided $\varphi > \varphi^*$, firm productivity is then monotonically increasing in $\varphi$.  

Headquarter-intensive sector ($\eta > \eta_2$)  

Component-intensive sector ($\eta < \eta_1$)

With $\eta > \eta_2$: $\psi^V > \psi^O \rightarrow \pi^V(\varphi) > \pi^O(\varphi)$

With $\eta < \eta_1$: $\psi^O > \psi^V \rightarrow \pi^O(\varphi) > \pi^V(\varphi)$
Scenario 2: Fixed cost differences depending on the organizational structure

\[ f^V > f^O \rightarrow \text{Assumption: Higher fixed costs with integration, e.g. because of managerial overhead costs} \]

(Note \( f^V < f^O \) may also be plausible due to economies of scope!)

Component-intensive sector

\[ \psi^O > \psi^V \rightarrow \pi^O(\varphi) > \pi^V(\varphi) \]

even with equal fixed costs

\( f^O < f^V \) reinforces decision to choose outsourcing

Headquarter-intensive sector

\[ \psi^V > \psi^O \]

with equal fixed costs: higher profits with integration

with \( f^V \gg f^O \): Least productive firms prefer outsourcing!

Only the most productive firms choose integration.
Headquarter-intensive sector ($\eta > \eta_2$)

Component-intensive sector ($\eta < \eta_1$)
Alternative bargaining concepts (property rights approach)

- **Nash bargaining**: comparison of fixed revenue shares $\beta^O$ and $\beta^V$ with
  - the producer’s revenue share with complete contracts or
  - the producer’s optimal revenue share $\beta^*(\eta)$ with incomplete contracts
  → Antràs (QJE 2003), Antràs and Helpman (JPE 2004)
  → Antràs and Chor (ECTA 2013): Vertical value chain with multiple stages (“snake”).
    Bargaining btw. producer and supplier over the incremental value-added in each stage.
  → Foundation of $\beta^O < \beta^V$: External supplier threatens to withhold the entire input level.
    Internal supplier threatens to withhold only a fraction $\delta$ ($\delta \sim \text{“degree of sophistication”}$)

- **Shapley value (SV)**: multilateral bargaining with *multiple* suppliers $j$.
  $SV_j = \text{average marginal contribution to all feasible coalitions (subsets of all players generating R>0)}$
  → Acemoglu, Antràs and Helpman (AER 2007)
  → Schwarz and Suedekum (JIE 2014)    \[ \text{“spiders”} \]
  → Nowak, Schwarz and Suedekum (WP 2013)
Location decision - vertical multinational activity:

→ with homogeneous firms
   [Helpman, E., (JPE 1984), A Simple Theory of International Trade with Multinational Corporations;

→ with heterogeneous firms
   [e.g. Antrás, P., Yeaple, S., (2015), Multinational Firms and the Structure of International Trade, Handbook of International Economics]

• Assumption (for the moment): Production always within the boundaries of the firm.

• Manufacturing input can be either produced in the home country or in a foreign country (vertical FDI, “intra-firm trade”).

• Trade-Off: Wages are lower in the foreign country \( c_M^d > c_M^{fo} \).
  However, vertical FDI induces trade costs \( \tau > 1 \) and additional fixed costs \( f_{fo} > f_d \).

Note: Related to the proximity-concentration trade-off for horizontal FDI but different underlying logic!
Scenario 1: Only location decision, no internalization decision ("complete contracts")

- Profits and cutoff productivity for domestic component manufacturing:

\[
\pi^*_d(\varphi) = A \cdot (1 - \alpha) \cdot \left( \frac{\varphi \alpha}{c_H^\eta \cdot (c_M^d)^{1-\eta}} \right)^{\alpha/(1-\alpha)} - f_d \iff \pi^*_d(\varphi) = 0 \iff \varphi^* = \left( \frac{f_d}{A \cdot (1 - \alpha)} \right)^{(1-\alpha)/\alpha} \cdot \frac{c_H^\eta \cdot (c_M^d)^{1-\eta}}{\alpha}
\]

- Profits with foreign component manufacturing (vertical FDI):

\[
\pi^*_f(\varphi) = A \cdot (1 - \alpha) \cdot \left( \frac{\varphi \alpha}{c_H^\eta \cdot (\tau \cdot c_M^{f^o})^{1-\eta}} \right)^{\alpha/(1-\alpha)} - f_{f^o}
\]

- Offshoring cutoff:

\[
\pi^*_f(\varphi) = \pi^*_d(\varphi)
\]

\[
\varphi^*_{f^o} = \left( \frac{f_{f^o} - f_d}{A \cdot (1 - \alpha) \cdot \left( \left( c_M^d \right)^{(1-\eta)/(1-\alpha)} - (\tau \cdot c_M^{f^o})^{(1-\eta)/(1-\alpha)} \right)} \right)^{(1-\alpha)/\alpha} \cdot \frac{c_H^\eta \cdot (c_M^d)^{1-\eta} \cdot (\tau \cdot c_M^{f^o})^{1-\eta}}{\alpha}
\]
• Comparing the cutoff productivity levels gives:

\[
\frac{\varphi_{fo}^*}{\varphi^*} = \left( \frac{f_{fo} - f_d}{f_d \left( \left( c_M^d \right)^{\alpha(1-\eta)/(1-\alpha)} - \left( \tau \cdot c_M^{fo} \right)^{\alpha(1-\eta)/(1-\alpha)} \right)} \right)^{(1-\alpha)/\alpha} \cdot \left( \tau \cdot c_M^{fo} \right)^{1-\eta} > 1 \text{ if } f_{fo} > f_d \left( \frac{c_M^d}{\tau \cdot c_M^{fo}} \right)^{\alpha(1-\eta)/(1-\alpha)}
\]

→ Since \( f_{fo} > f_d \), we must have \( c_M^d > \tau \cdot c_M^{fo} \) in order for vertical FDI to arise!

I.e., the foreign country needs to have lower total unit costs.

→ If \( f_{fo} > f_d \left( \frac{c_M^d}{\tau \cdot c_M^{fo}} \right)^{\alpha(1-\eta)/(1-\alpha)} \) holds, firms that choose vertical FDI are more productive than firms that choose domestic component production!
Scenario 2: Location and internalization decision ("incomplete contracts")

<table>
<thead>
<tr>
<th>Location decision</th>
<th>Internalization decision</th>
<th>Outsourcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>Domestic integration</td>
<td>Domestic outsourcing</td>
</tr>
<tr>
<td>Foreign</td>
<td>Vertical FDI</td>
<td>Arm’s length trade</td>
</tr>
</tbody>
</table>

- Assumptions:
  - Total unit costs (including trade costs) are lower in the foreign country: $c^*_d > c^*_f$
  - Fixed costs are higher in the foreign country than in the domestic country: $f_{fo} > f_d$
  - Fixed costs of integration are higher than fixed costs of outsourcing: $f_V > f_O$

→ Two possible cases: $f_{fo}^V > f_{fo}^O > f_d^V > f_d^O$ or $f_{fo}^V > f_d^V > f_{fo}^O > f_d^O$
Component-intensive sector

- $\psi^O > \psi^V$: Outsourcing has higher variable profits and lower fixed costs than integration.

→ Always outsourcing!

- Only the most productive firms choose outsourcing in the foreign country, i.e., arm’s length trade.
Headquarter-intensive sector

- \( \psi^V > \psi^O \): Vertical integration has higher variable profits than outsourcing, but also higher fixed costs!

→ Both outsourcing and vertical integration arise.

- In this constellation, all four organizational forms may arise across the productivity spectrum!