

CREI Lectures in Macroeconomics

Contracts and the Global Organization of Production

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Introduction

- In developing their global sourcing strategies, firms not only decide on where to locate the different stages of the value chain, but also on the extent of **control** to exert over them
 - **foreign outsourcing** versus foreign integration or (**vertical FDI**)
- In this last lecture, I will develop simple frameworks to study the control decision of firms
- I will begin with a very brief overview of some leading theories of firm boundaries
- I will then develop two simple models of the internalization decision
 - a transaction-cost model (brief)
 - a property-rights model
- At the end, I will discuss empirical evidence suggestive of the relevance of these theoretical frameworks

A Particular Example: The Boeing Dreamliner

- A few years ago, Boeing recognized a demand for a more fuel-efficient airliner and began designs for the 787 (or Dreamliner)
- 787 “Development Team” encompasses 50 suppliers located in 9 countries (Australia, France, Germany, Italy, Japan, Korea, Sweden, the United Kingdom and the United States)
 - 70 percent of the 787’s parts are produced abroad
 - not sure we should be teaching strategic trade policy using Boeing vs. Airbus as an example

A Particular Example: The Boeing Dreamliner



A Particular Example: The Boeing Dreamliner

- First deliveries of the aircraft were planned to begin in late 2008
- The first 787 was officially delivered on September 25, 2011
- Boeing ascribed production delays to the fact that multiple suppliers did not stand by their contractual obligations
- Boeing respond to these delays by bringing some of the problematic upstream production stages within its firm boundary
- From 2008-09, Boeing successively acquired Vought Aircraft Industries' operations in South Carolina, which produced rear sections of the Dreamliner's fuselage
 - This entailed forming a 50-50 joint venture between Boeing and a subsidiary of Italy's Alenia Aeronautica, another key supplier for Boeing with which it had struggled in recent years
 - Culminated in a full buyout in Jul 2009

Overview of the Theory on the Boundaries of the Firm

- **Neoclassical Approach:** the size of the firm is determined by cost minimization
 - Viner's U-shaped cost function analysis
 - increasing marginal costs eventually "kick in"
- Caveats:
 - 1 it ignores incentive problems inside the firm
 - 2 it has nothing to say about the internal organization of firms (hierarchical structure, extent of authority and delegation...)
 - 3 theory does *not* pin down firm boundaries (replication – it is better thought of as a theory of plant size)

Overview of the Theory on the Boundaries of the Firm

- **Coase-Williamson View:** firms emerge when certain transactions are less costly when undertaken inside the firm than through the market mechanism
- What are transaction costs? What is their source?
- Coase (1937) is somewhat vague on this topic
- Williamson (1975, 1985) provides better answers:
 - theory is based on three concepts: (1) bounded rationality, (2) opportunism and (3) asset specificity.

Williamson

- 1 Following Herbert Simon, Williamson assumes that economic actors are “*intendedly* rational, but only *limitedly* so”
 - **bounded rationality** provides a foundation for incomplete contracts and their renegotiation
- 2 By **opportunism**, Williamson means that economic actors are self-interested
 - renegotiation may not always occur in a joint profit maximizing manner
- 3 Finally, Williamson points out that certain assets or investments are **relationship-specific**, in the sense that the value of these assets or investments is higher inside a particular relationship than outside of it
 - at the renegotiation stage, parties cannot costlessly switch to alternative trading partners and are partially locked in a bilateral relationship (“*fundamental transformation*”)

Williamson: The Hold Up Problem Revisited

- What determines the terms of exchange ex-post? Standard bilateral bargaining problem
- Agents do not capture full marginal return from their investments (due to the “risk” of contractual breach) → rent-sharing
 - effect often referred as hold-up problem
- Foreseeing this hold-up problem, parties will underinvest and this will reduce efficiency
- Williamson showed that these transaction costs tend to increase in the difficulty of contracting and in relationship-specificity
- If vertical integration avoids these inefficiencies (perhaps at the cost of higher “**governance costs**”), his theory predicts more integration whenever contracting is more difficult or investments more relationship-specific

A Transaction-Cost Model of Vertical FDI

- Let us go back to the global sourcing model we have been working with in these Lectures
- h is controlled by a final-good producer (agent F), m is controlled by an operator of the production facility (agent M)
- The manager F has now four alternatives to obtain the intermediate input m
 - 1 **Domestic Outsourcing:** transact with an independent, domestic supplier in North
 - 2 **Domestic Integration:** transact with an integrated, domestic supplier in North
 - 3 **Domestic Outsourcing:** transact with an independent, foreign supplier in South
 - 4 **Foreign Integration:** transact with an integrated, foreign supplier in South
- Note that only the last option entails FDI or multinational activity

Domestic Outsourcing and Integration

- For simplicity, assume that contracting within the North is perfect (this is easily relaxable)
- This implies that options 1 and 2 are identical from the point of view of F
- And they both deliver a profit flow equal to

$$\pi_D(\varphi) = (w_N)^{1-\sigma} B \varphi^{\sigma-1} - w_N f_D \quad (1)$$

with

$$B = \frac{1}{\sigma} \left(\frac{\sigma}{(\sigma-1)P} \right)^{1-\sigma} \beta (w_N L_N + w_S L_S)$$

where P is the common price index in each country, given costless final-good trade

Foreign Outsourcing

- Assume that when transacting in the South via the market (i.e., via outsourcing) only 'totally incomplete' contracts are available
- For simplicity, assume for now symmetric bargaining, no credit constraints, full relationship-specificity and a single supplier
- This delivers profits from foreign outsourcing equal to (see Lecture 2)

$$\pi_O = \left((w_N)^\eta (\tau w_S)^{1-\eta} \right)^{1-\sigma} B \Gamma_O \varphi^{\sigma-1} - w_N f_O \quad (2)$$

where

$$\Gamma_O = (\sigma + 1) \left(\frac{1}{2} \right)^\sigma < 1$$

Foreign Integration or Vertical FDI

- Assume, following the transaction-cost approach, that hold-up inefficiencies disappear when transacting with an integrated foreign agent
- To have a trade off, assume that foreign integration entails extra supervision or other '**governance costs**' that:
 - ① magnify marginal costs by a factor $\lambda > 1$ (effective productivity is φ/λ)
 - ② also increase fixed costs of fragmentation, so $f_V > f_O$
- Under foreign integration F will then obtain

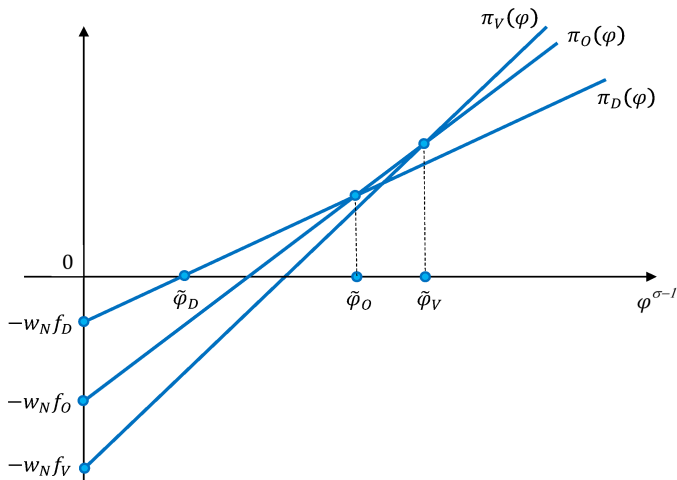
$$\pi_V(\varphi) = \left((w_N)^\eta (\tau w_S)^{1-\eta} \right)^{1-\sigma} B \Gamma_V \varphi^{\sigma-1} - w_N f_V \quad (3)$$

where

$$\Gamma_V = \lambda^{1-\sigma} < 1$$

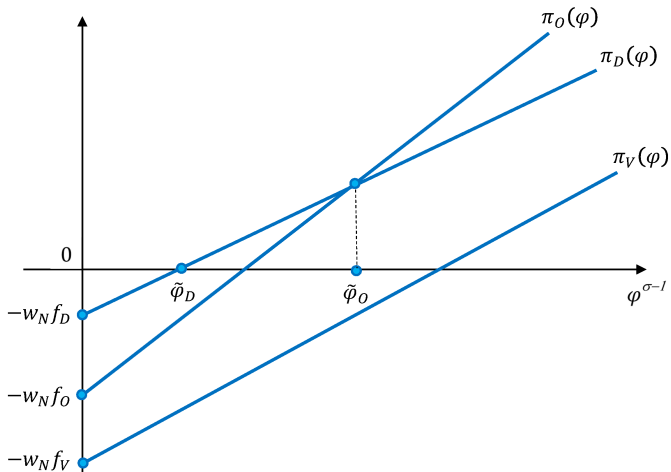
Equilibrium Sorting I

- The following sorting pattern will result whenever wage differences are large enough and λ is sufficiently small



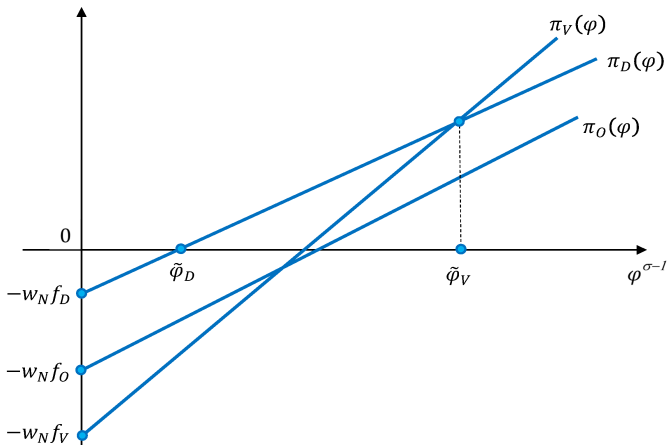
Equilibrium Sorting II

- If wage differences are large but λ is large too, FDI is never chosen



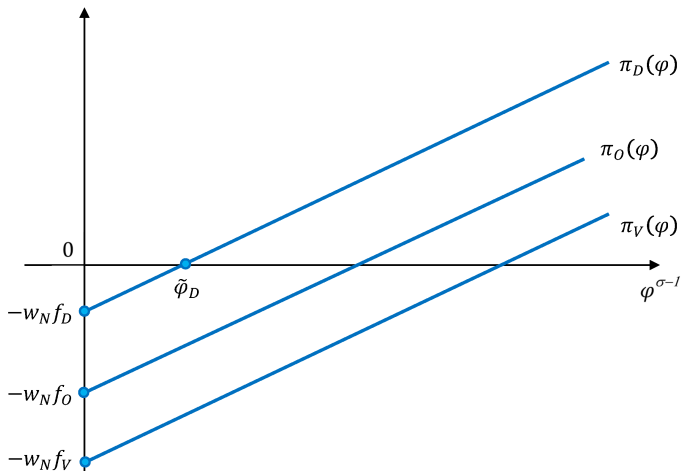
Equilibrium Sorting III

- If wage differences are moderate and $\lambda \rightarrow 1$, foreign outsourcing is never chosen



Equilibrium Sorting IV

- Finally, if wage differences are very small no form of offshoring is used



Anything Goes?

- It may seem that there are too many cases to consider
- But notice a **robust prediction**: when foreign outsourcing and foreign integration coexist within an industry (i.e., the intrafirm trade share is between 0 and 1)...
- ... integrating firms are more productive than outsourcing firms
- I will focus on Equilibrium Sorting I for the most part, but note that the model provides tools for dealing with 0, 1 and undefined (0/0) intrafirm trade shares

Some Implications

- As in the previous lecture, the share of offshoring firms (inside or outside the firm boundary) will tend to be higher...
 - the lower are headquarter intensity η and trade costs τ
 - the higher are wage differences w_N/w_S and productivity dispersion ($1/k$)
- This is true regardless of whether outsourcing and FDI coexist or not

Some Implications

- We can now also study the relative prevalence of foreign outsourcing and vertical FDI
- The share of **offshoring firms** doing FDI is then

$$\frac{\int_{\tilde{\varphi}_O}^{\infty} \varphi^{\sigma-1} dG(\varphi)}{\int_{\tilde{\varphi}_D}^{\tilde{\varphi}_O} \varphi^{\sigma-1} d\varphi} = \frac{1 - G(\tilde{\varphi}_V)}{1 - G(\tilde{\varphi}_O)} = \left(\frac{\tilde{\varphi}_O}{\tilde{\varphi}_V} \right)^k \quad (4)$$

where

$$\left(\frac{\tilde{\varphi}_O}{\tilde{\varphi}_V} \right)^{\sigma-1} = \frac{f_O - f_D}{f_V - f_O} \times \frac{(\Gamma_V - \Gamma_O) \left(\frac{w_N}{\tau w_S} \right)^{(1-\eta)(\sigma-1)}}{\left(\frac{w_N}{\tau w_S} \right)^{(1-\eta)(\sigma-1)} \Gamma_O - 1} \quad (5)$$

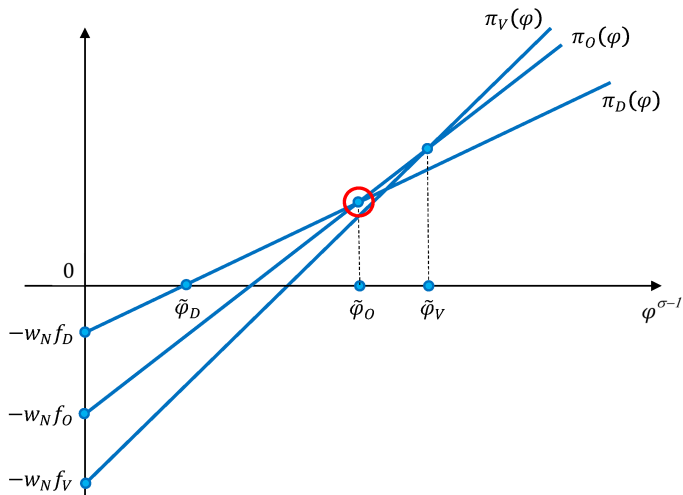
- Remember that $\Gamma_V = \lambda^{1-\sigma}$, so quite trivially, this share is decreasing in 'governance costs' λ

Some Implications: Comparative Statics

- Note also that the share of offshoring firms engaged in intrafirm trade is decreasing in $\left(\frac{w_N}{\tau w_S}\right)^{(1-\eta)(\sigma-1)}$
- As a result, the relative prevalence of intrafirm trade will be higher...
 - the higher are headquarter intensity η and trade costs τ
 - the lower are wage differences w_N/w_S
- The extensive margin of trade is key for these predictions (back to graph in next slide)
- Finally, this share is increasing in productivity dispersion (low k)

Comparative Statics and Selection into Importing

- Selection into offshoring is key for the effects of w_N/w_S , η , and τ



Partial Contractibility

- Let us now introduce partial contractibility of the Antràs and Helpman (2008) type
- For simplicity, assume that contracting is complete in the North, so only profits under foreign outsourcing will be affected
- Following the derivations in the last Lecture, we have

$$\Gamma_{O,Partial} = \left(\frac{\sigma}{\sigma - (\sigma - 1)\gamma_O} + 1 \right)^{\sigma - (\sigma - 1)\gamma_O} \left(\frac{1}{2} \right)^\sigma$$

with

$$\gamma_O \equiv \eta(1 - \mu_{hS}) + (1 - \eta)(1 - \mu_{mS})$$

Partial Contractibility

- It is then clear from (5) that improvements in contracting with South (an increase in μ_h or μ_m) will reduce the share of offshoring firms that engage in FDI
- This is an intuitive result characteristic of transaction-cost models
- Note that it operates via two channels:
 - the extensive margin of offshoring channel mentioned above
 - and the fact that integration becomes less necessary the easier is contracting (standard Coase-Williamson-type of result)

Other Work Using Transaction-Cost Approaches

- Early Approaches
 - Ethier (1986): implications of the nonenforceability of quality-contingent contracts for the structure of MNE activity
 - Ethier and Markusen (1996): internalization as a response to the risk of intellectual property-rights expropriation
- More recent approaches:
 - McLaren (2000): studies internalization in a market equilibrium featuring thick-market externalities (waves of outsourcing)
 - Grossman and Helpman (2002, 2003, 2005): similar model to the one developed above (in fact, it was an inspiration!), but does not include headquarter services

The Property-Rights Approach

- Williamson identifies transaction costs in market transactions, but why do these frictions disappear inside firms?
- As pointed out by Grossman and Hart (1986), this is not satisfactory
 - noncontractibilities, incentive problems and relationship-specific investments matter inside firms too!
 - what defines then the boundaries of the firm?
- Grossman and Hart suggest that ownership is a **source of power** when contracts are incomplete

Ownership = Power

- What does it mean for ownership to be a source of power?
- From a legal perspective, integration is associated with the acquisition of physical assets
- When contracts are incomplete, parties will often encounter contingencies that were not foreseen in the initial contract
- In those situations, the owner of the asset has the residual rights of control
- These residual rights of control are important because they are likely to affect how the surplus is divided ex-post
- Owner can 'insist' on courses of action that might be good for him/her but less appealing to the integrated party

Power and the Theory of the Firm

- In the presence of relationship-specific investments, these considerations lead to a theory of the boundaries of the firm in which both the benefits **and the costs** of integration are endogenous
- Because residual powers affect the ex-post division of surplus, they will also affect the efficiency of ex-ante relationship-specific investments
 - in particular, integration will tend to reduce incentives to invest of the integrated party
 - but they will increase the incentives to invest of integrating party
- Salient result: Residual rights of control should be assigned to the party whose investment contributes most to the relationship
- I next illustrate this result within the model of global sourcing we have been working with

A Property-Rights Model of Global Sourcing

- Continue to assume that when transacting in the South via the market (i.e., via outsourcing) only ‘totally incomplete’ contracts are available
- **Key new assumption:** When transacting with an internal division, incentive problems are still relevant and complete contracts are not available either
- For simplicity, assume that contracts are also ‘totally incomplete’ under integration
 - framework can flexibly incorporate variation in contractibility across organizational forms
 - but following Grossman and Hart (1986) and Hart and Moore (1990) I will not do so here

Power and Bargaining

- The timing of events is exactly as in Lecture 2 but it now applies to both foreign outsourcing and foreign integration
- Ex-post determination of price characterized by symmetric Nash bargaining (could easily accommodate general primitive bargaining power)
- What is then the difference between foreign outsourcing and foreign integration?
- The firm F has more **power** or control under integration than under outsourcing
- Reduced form: outside option of the firm is higher under integration than under outsourcing

Power and Outside Options

- More specifically, the outside options are as follows:
 - under outsourcing, contractual breach leaves both agents with 0 (as in Lecture 2)
 - under integration, F can selectively fire M and seize input m (at a productivity cost δ)
- Why can F seize input m ?
- Perhaps because it holds property rights over the input or perhaps because the input is stored in a factory which it owns
- Why is there a productivity loss? Perhaps agent M contributed to the process of combining h and m
- One can envision alternative ways in which power is exercised (e.g., reduction of production delays in Boeing's case)

Formulation of the Problem

- Remember that potential sales revenue is given by $r(h, m)$
- Given the specification of ex-post bargaining, F obtains a share $\beta_O = 1/2$ of sales revenue under outsourcing and a share $\beta_V = \delta^\alpha + \frac{1}{2}(1 - \delta^\alpha) > \beta_O$ under integration
- The optimal ownership structure k^* is thus the solution to the following program:

$$\begin{aligned}
 \max_{k \in \{V, O\}} \quad & \pi_k = r(h_k, m_k) - w_N h_k - \tau w_S m_k - w_N f_k \\
 \text{s.t.} \quad & h_k = \arg \max_h \{ \beta_k r(h, m_k) - w_N h_k \} \\
 & m_k = \arg \max_m \{ (1 - \beta_k) r(h_k, m) - \tau w_S m_k \}
 \end{aligned}
 \tag{P1}$$

- First-best level of investments would simply maximize π_k

A Useful Result

- The solution to the constrained program (P1) delivers the following result (see Antràs, 2003 for details):

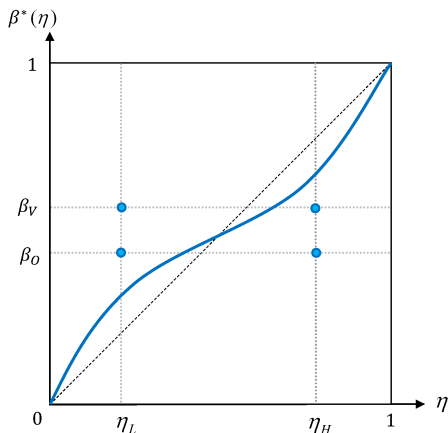
Proposition

There exists a unique threshold $\hat{\eta} \in (0, 1)$ such that for all $\eta > \hat{\eta}$, integration dominates outsourcing ($k^ = V$), while for all $\eta < \hat{\eta}$, outsourcing dominates integration ($k^* = O$).*

- So, ex-ante efficiency dictates that residual rights should be controlled by the party undertaking a relatively more important investment:
 - if production is intensive in the m input, then choose **outsourcing**
 - if production is intensive in the h input, then choose **vertical integration**
- Convenient Feature: threshold k^* is independent of factor prices (Cobb-Douglas assumption important)

Another Look at the Result

- Suppose that instead of $k \in \{V, O\}$, F could choose $\beta \in (0, 1)$.



$$\frac{\beta^*}{1-\beta^*} = \sqrt{\frac{\eta}{1-\eta} \frac{\sigma-(\sigma-1)(1-\eta)}{\sigma-(\sigma-1)\eta}}$$

Robustness

- One might worry that the result depends crucially on the Cobb-Douglas assumption on technology
- For a general revenue function (see Antràs, 2011) we have:

$$\frac{\beta^*}{1 - \beta^*} = \frac{\eta_{r,h} \cdot \zeta_{h,\beta}}{\eta_{r,m} \cdot (-\zeta_{m,\beta})}$$

where $\eta_{r,j} \equiv jr_j / r$ and $\zeta_{j,\beta} \equiv \frac{dj}{d\beta} \frac{\beta}{j}$

- When the revenue function is homogenous of degree $\alpha \in (0, 1)$:

$$\frac{\beta^*}{1 - \beta^*} = \sqrt{\frac{\eta_{r,h} (\sigma - 1) (1 - \eta_{r,m}) + (\epsilon_{h,m} - 1) \eta_{r,m}}{\eta_{r,m} (\sigma - 1) (1 - \eta_{r,h}) + (\epsilon_{h,m} - 1) \eta_{r,h}}}$$

where $\epsilon_{h,m}$ is the elasticity of substitution between h and m in r

- For any $\epsilon_{h,m}$, β^* increases in $\eta_{R,h}$ and decreases in $\eta_{R,m}$

Profit Functions

- As in the previous models, we can write the profit functions associated with the different forms of offshoring as

$$\pi_k(\varphi) = \left((w_N)^\eta (\tau w_S)^{1-\eta} \right)^{1-\sigma} B \Gamma_k \varphi^{\sigma-1} - w_N f_k$$

- And, in the case of foreign outsourcing

$$\Gamma_O = (\sigma + 1) \left(\frac{1}{2} \right)^\sigma < 1$$

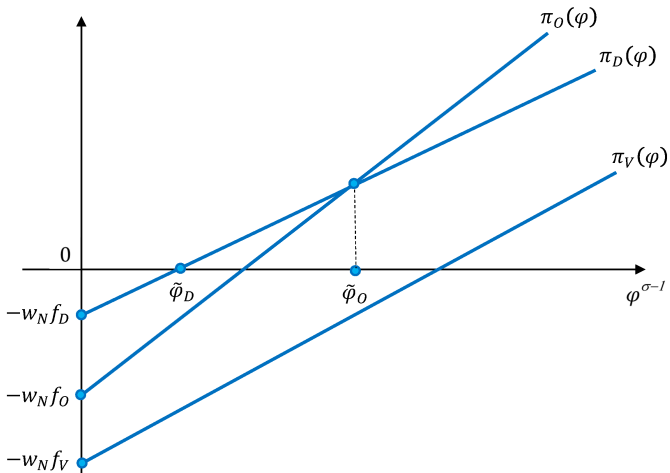
- In the case of foreign integration (or FDI), we can invoke the result in slide 37 in Lecture 2:

$$\Gamma_V = (\sigma - (\sigma - 1) (\beta_V \eta + (1 - \beta_V) (1 - \eta))) \left(\beta_V^\eta (1 - \beta_V)^{1-\eta} \right)^{\sigma-1}$$

- Whether $\Gamma_V > \Gamma_O$ or $\Gamma_V < \Gamma_O$ depends crucially on how large η is

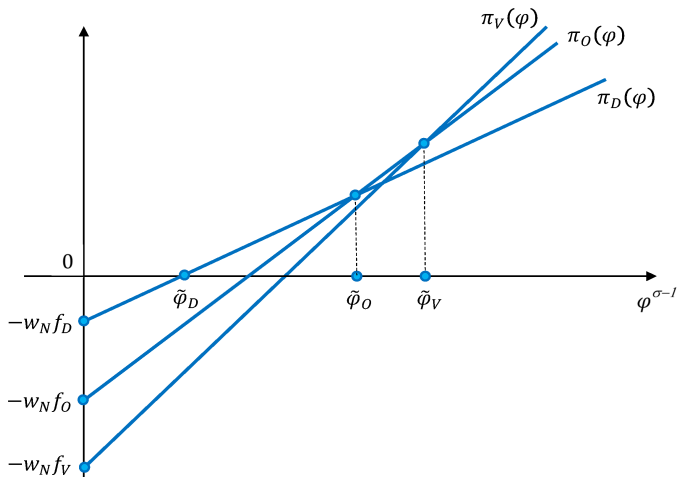
Sorting in a Low Headquarter Intensity Sector

- In such a case, $\Gamma_V < \Gamma_O$ and there is no intrafirm trade in the sector



Sorting in a High Headquarter Intensity Sector

- In such a case, $\Gamma_V > \Gamma_O$ and foreign outsourcing and FDI coexist



Comparative Statics

- Let us focus on a sector in which outsourcing and FDI coexist
- As in the transaction-cost model, the share of **offshoring firms** choosing FDI is given by

$$\frac{\int_{\tilde{\varphi}_O}^{\infty} \varphi^{\sigma-1} dG(\varphi)}{\int_{\tilde{\varphi}_D}^{\tilde{\varphi}_O} \varphi^{\sigma-1} d\varphi} = \frac{1 - G(\tilde{\varphi}_V)}{1 - G(\tilde{\varphi}_O)} = \left(\frac{\tilde{\varphi}_O}{\tilde{\varphi}_V} \right)^k \quad (6)$$

where

$$\left(\frac{\tilde{\varphi}_O}{\tilde{\varphi}_V} \right)^{\sigma-1} = \frac{f_O - f_D}{f_V - f_O} \times \frac{(\Gamma_V - \Gamma_O) \left(\frac{w_N}{\tau w_S} \right)^{(1-\eta)(\sigma-1)}}{\left(\frac{w_N}{\tau w_S} \right)^{(1-\eta)(\sigma-1)} \Gamma_O - 1} \quad (7)$$

Comparative Statics

- Note that Γ_V/Γ_O is an increasing function of η , and thus the share of offshoring firms that integrate is positively correlated with η for a reason **distinct** from that in the transaction-cost model
 - it's selection into FDI rather than just selection into importing/sourcing
- On the other hand, it continues to be the case (and for the same reason) that the share of offshoring firms integrating is:
 - increasing in productivity dispersion (lower k)
 - increasing in transport costs (τ)
 - decreasing in relative factor price differences (w_N/w_S)

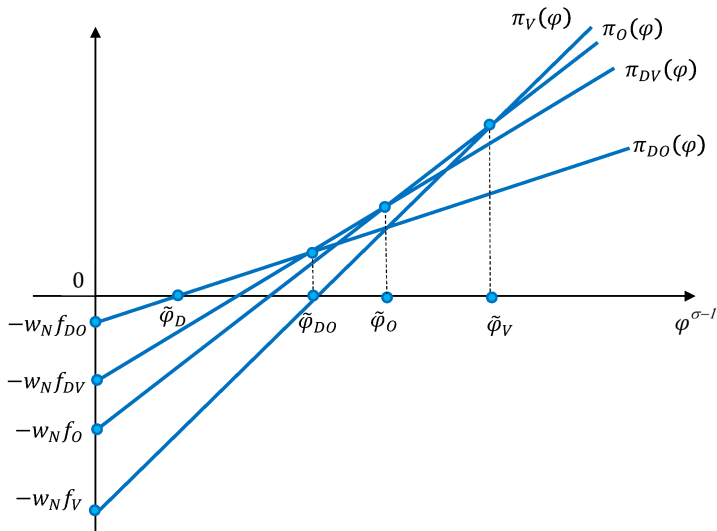
A Two-Factor Model: Antràs (2003)

- In Antràs (2003), I assumed that F 's investment in h is capital intensive relative to M 's investment
- The model generates a positive correlation between a propensity to integrate suppliers and capital intensity (i.e., η)
 - even true in a model without heterogeneity (or an extensive margin)
- I then embedded the model in a Helpman-Krugman model, in which the interaction of relative capital abundance and relative capital intensity shapes comparative advantage
- I showed how these two results had implications for how the share of intrafirm imports should correlate positively with capital intensity across industries and relative capital abundance across countries
- The model developed above can also generate the latter result under the plausible scenario that relative wage differences w_N/w_S are increasing in aggregate capital-labor ratio differences
 - obviously, need to close model differently

Domestic Sourcing: Antràs and Helpman (2004)

- By assuming that contracting is complete in the North, the choice between domestic integration and outsourcing is both indeterminate and immaterial
- In Antràs and Helpman (2004), we assume that contracts are also 'totally incomplete' when transacting with M agents in the North
- Many possibilities can arise, but provided that the fixed costs of domestic integration are higher than those of domestic outsourcing the only equilibrium featuring all four organizational modes in equilibrium is as depicted in the next slide

Domestic Sourcing: Antràs and Helpman (2004)



Partial Contractibility: Antràs and Helpman (2008)

- Consider now the variant of the model with partial contractibility in international transactions, and let the degree of contractibility vary across inputs and countries
- New interesting feature: relative degree of contractibility of different inputs plays a central role in the integration decision
 - This has interesting implications for the choice between domestic and foreign sourcing
 - Also for the choice between foreign outsourcing and FDI

Equilibrium with Partial Contractibility

- In the last lecture, we derived

$$\Gamma_{O,Partial} = \left(\frac{\sigma}{\sigma - (\sigma - 1)\gamma_O} + 1 \right)^{\sigma - (\sigma - 1)\gamma_O} \left(\frac{1}{2} \right)^\sigma$$

with

$$\gamma_O \equiv \eta(1 - \mu_{hS}) + (1 - \eta)(1 - \mu_{mS})$$

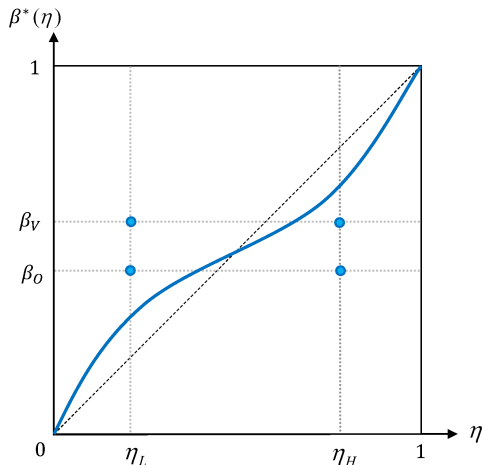
- For a general β , say $\beta_V > 1/2$, Antràs and Helpman (2008) derive

$$\Gamma_{V,Partial} = \left(\frac{\sigma - (\sigma - 1)(\beta_V \eta(1 - \mu_{hS}) + (1 - \beta_V)(1 - \eta)(1 - \mu_{mS}))}{\sigma - (\sigma - 1)\gamma_O} \right)^{\sigma - (\sigma - 1)\gamma_O} \\ \times \left(\beta_V^\eta (1 - \mu_{hS}) (1 - \beta_V)^{(1 - \eta)(1 - \mu_{mS})} \right)^{\sigma - 1}$$

- $\Gamma_{V,Partial} / \Gamma_{O,Partial}$ is monotonically increasing in μ_m and monotonically decreasing in μ_h

Towards an Intuition

- As in Antràs and Helpman (2004), there exists an optimal β_h



Effect of Contractibility

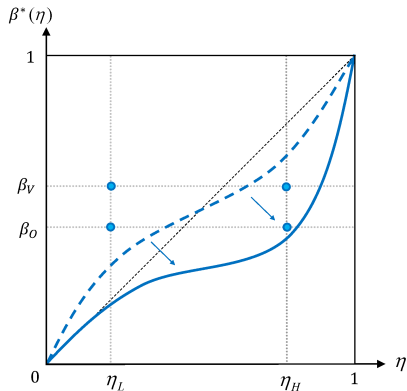


Figure: An increase in μ_h

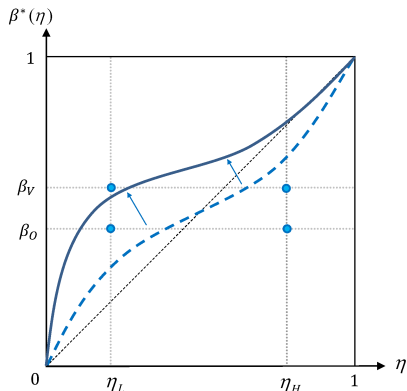


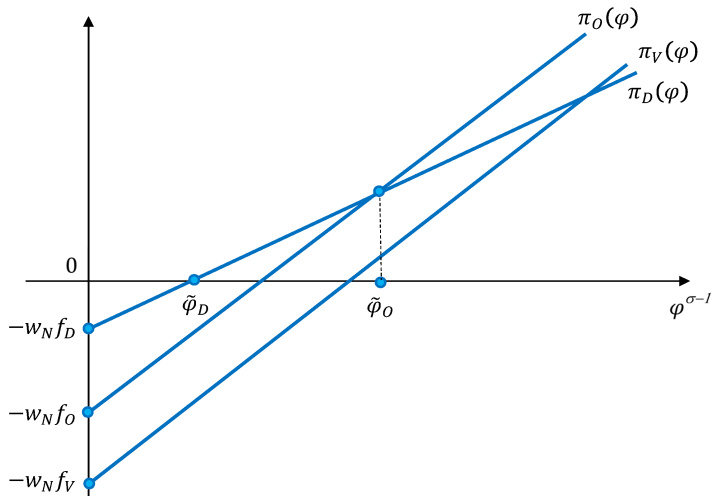
Figure: An increase in μ_m

Implications for Global Sourcing

- Improvements in the contractibility of headquarter services in international transactions always increase offshoring and the relative prevalence of outsourcing within offshorers
 - consistent with transaction-cost approaches
- The effects of improvements on the contractibility of input manufacturing or assembly are more subtle:
 - the share of firms offshoring again increases...
 - but the effect might be disproportionate for integrating firms, so that the share of integrating offshorers might well increase!
- Hence, certain improvements in contracting might be associated with **more** integration, not less
 - more likely the less important is the selection into offshoring effect identified above

Choice of Organization Form: Illustration

- Comparative statics can easily be derived as before



Multiple Suppliers

- Antràs (2011) develops variant of the model above with headquarter intensity and multiple suppliers
- The degree of input substitutability shapes the size of contractual inefficiencies, and also affects the integration decision
- He shows that the incentives **to integrate** are higher the **more complementary** are inputs in production
- Coupled with our result, in the last lecture, that foreign sourcing is more likely the more substitutable are the inputs, we thus get that the share of integrating offshorers will be unambiguously increasing in input complementarity:
 - again both the ‘selection into sourcing’ and ‘selection into FDI’ effects work in the same direction, as in the case of η and μ_h above

Sequential Production

- Antràs and Chor (2012) consider how the incentive to integrate a supplier depends on the position of the supplier in the value chain (upstream vs. downstream)
- Production is sequential so this generates asymmetric bargaining at different stages of the value chain
- We show that the pattern of integration along the value chain depends crucially on the relative size of input complementarity ρ and the elasticity of demand σ faced by the final-good producer
 - outsource upstream / integrate downstream when inputs are relatively complementary or demand is relatively elastic
 - integrate upstream / outsource downstream when inputs are relatively substitutable or demand is relatively inelastic

Overview of Empirical Work on MNE Boundaries

- I will next briefly review a few contributions that have attempted to bring the property-rights approach to the theory of the multinational firm to the data
- Empirically validating the property-rights theory poses at least two important challenges
 - ① Predictions are associated with marginal returns to investments that are generally unobservable in the data
 - ② Data on integration decisions are not readily available
- Two main types of studies:
 - Empirical tests using country- and product-level data (mostly U.S. data)
 - Empirical tests using firm-level data (data from Japan, France, and Spain, and Orbis database)

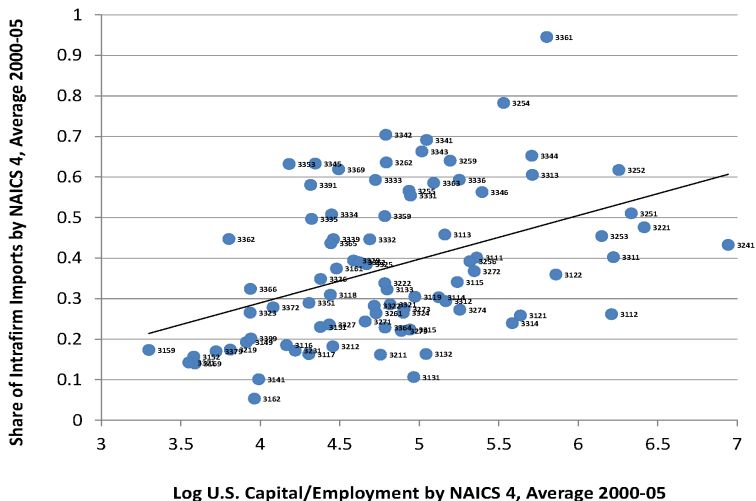
Pros and Cons of Using Related-Party Trade Data

- Some pros:
 - Compiled from administrative records of official import and export merchandise trade statistics
 - There is plenty of variation in the data (remember Lecture 1)
 - Easier to spot “fundamental” forces that appear to shape whether international transactions are internalized or not
 - Potential to exploit ‘exogenous’ changes in sector characteristics or in institutional features of importing/exporting countries
- Some cons:
 - Aggregates firm decisions; can't control for firm-level determinants
 - Information only on the sector of the good being transacted
 - Not always clear which sector is buying on the import or export side
 - Not always clear whether inputs or final goods are traded
 - Not always clear who is integrating whom (backward vs. forward integration) and how large is the ownership stake
 - U.S. firm level sourcing decisions might not be reflected in U.S. trade data (remember the iPad 2 example) – affiliates as intermediaries

The Effect of Headquarter Intensity

- A central result in the property-rights approach is that efficient ownership decision produces a positive correlation between headquarter intensity in production and the vertical integration decision
- But headquarter intensity of what? And how do we measure it?
- Antràs (2003) provides evidence suggestive of a positive correlation between the share of intrafirm trade in U.S. imports and capital intensity (as well as R&D intensity) of the imported good as measured in U.S. data
 - Yeaple (2006) confirms these correlations using more detailed (confidential) BEA dataset for 1994
- Similar results arise when looking at the U.S. census data, which is much more disaggregated (see Nunn and Trefler, 2008)

The Effect of Headquarter Intensity



Sources: U.S. Census Related-Party Trade Database and NBER-CES Manufacturing Industry Database

Alternative Measures of Headquarter Intensity

	Dependent Variable: Share of Intrafirm Imports							
	I	II	III	IV	V	VI	VII	VIII weighted
Log (s/l)	0.168*** [0.033]			0.070* [0.037]	0.057 [0.042]	0.058 [0.041]	0.027 [0.021]	-0.165* [0.094]
log (k/l)		0.086*** [0.014]		0.076*** [0.015]	0.063*** [0.016]	0.052** [0.021]	0.003 [0.010]	0.023 [0.026]
log (0.001+R&D/Sales)			0.046*** [0.007]	0.035*** [0.006]	0.043*** [0.008]	0.043*** [0.008]	0.022*** [0.004]	0.061*** [0.015]
Dispersion					0.029** [0.012]	0.028** [0.012]	0.007 [0.007]	0.020 [0.014]
log (materials/l)						0.017 [0.025]	0.003 [0.012]	0.066* [0.039]
Observations	3419	3419	2912	2912	2408	2408	185659	185659
R-squared	0.09	0.1	0.17	0.27	0.33	0.33	0.18	0.55

Robust standard errors in brackets (* significant at 10%; ** at 5%; *** at 1%)

Regressions include year fixed effects

Some Obvious Caveats

- 1 Even when we relate headquarter intensity to capital intensity, what should be relevant is the importance of **noncontractible**, relationship-specific capital investments in production
 - Nunn and Trefler (2011) find support for this prediction
 - They break up capital expenditures into (1) expenditures for buildings and other structures, (2) expenditures for machinery and equipment (computers, automobiles, other machinery)
 - The effect is **not coming** from buildings, computers or automobiles
- 2 The theory tells us that what should matter is the headquarter intensity of the **whole production process**, not just of the imported good
 - how can we know who is buying the goods being imported? Antràs and Chor (2012) use I/O information
- 3 Our models above suggest that this is a test with little power
 - transaction-cost model has same implication! But for a different reason, so there is hope...

What is Behind the Effect of Capital Intensity?

	Dependent Variable: Share of Intrafirm Imports						
	I	II	III	IV	V	VI	VII weighted
log(s/l)	0.058 [0.041]	0.088** [0.042]	0.063 [0.065]	0.043 [0.059]	0.032 [0.059]	0.051** [0.024]	-0.122** [0.048]
log(k/l)	0.052** [0.021]						
log (buildings/l)		-0.062** [0.027]	-0.044 [0.027]	-0.037 [0.028]	-0.025 [0.030]	-0.048*** [0.014]	-0.063 [0.040]
log (equipment/l)		0.095*** [0.028]					
log (auto/l)			-0.050*** [0.016]	-0.035** [0.016]	-0.030* [0.016]	-0.022** [0.009]	0.001 [0.024]
log (computers/l)			0.051 [0.034]	0.020 [0.029]	0.016 [0.030]	0.002 [0.015]	0.076** [0.037]
log (other equipment/l)			0.075*** [0.027]	0.097*** [0.030]	0.080*** [0.031]	0.048*** [0.013]	0.093** [0.036]
log (0.001+R&D/Sales)	0.043*** [0.008]	0.042*** [0.008]	0.035*** [0.008]	0.030*** [0.008]	0.030*** [0.008]	0.012*** [0.004]	0.036*** [0.012]
Dispersion	0.028** [0.012]	0.026** [0.011]	0.028** [0.011]	0.022** [0.010]	0.021* [0.010]	0.004 [0.005]	0.013 [0.014]
log (materials/l)	0.017 [0.025]	0.024 [0.024]	0.025 [0.023]	0.027 [0.021]	0.032 [0.021]	0.006 [0.009]	0.005 [0.023]
Relationship specificity (Nunn)				0.163** [0.071]	0.185** [0.072]	0.012 [0.034]	0.306*** [0.083]
Intermediation				-0.352** [0.145]	-0.394** [0.152]	-0.362*** [0.055]	-0.430** [0.212]
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	No	No
Country-Year fixed effects?	No	No	No	No	No	Yes	Yes
Dropping final goods (as in Wright, 2012)?	No	No	No	No	Yes	No	No
Observations	2408	2408	2408	2408	2312	185659	185659
R-squared	0.33	0.35	0.39	0.44	0.43	0.19	0.65

Robust standard errors in brackets (* significant at 10%; ** at 5%; *** at 1%)

Further Robustness Tests

	Dependent Variable: Share of Intrafirm Imports				
	I	II weighted	III	IV	V
log (s/l)	0.051** [0.024]	-0.122** [0.048]	0.049** [0.024]	0.062*** [0.021]	0.061*** [0.022]
log (k buildings/l)	-0.048*** [0.014]	-0.063 [0.040]	-0.047*** [0.014]	-0.039*** [0.014]	-0.038** [0.015]
log (auto equipment k/l)	-0.022** [0.009]	0.001 [0.024]	-0.022** [0.009]	-0.025*** [0.009]	-0.025*** [0.009]
log (computers equipment k/l)	0.002 [0.015]	0.076** [0.037]	0.002 [0.015]	-0.009 [0.015]	-0.010 [0.015]
log (other equipment k/l)	0.048*** [0.013]	0.093** [0.036]	0.046*** [0.014]	0.043*** [0.014]	0.041*** [0.014]
log (0.001+R&D/Sales)	0.012*** [0.004]	0.036*** [0.012]	0.012*** [0.004]	0.010*** [0.004]	0.011*** [0.004]
Dispersion	0.004 [0.005]	0.013 [0.014]	0.004 [0.005]	0.006 [0.005]	0.005 [0.005]
log (materials/l)	0.006 [0.009]	0.005 [0.023]	0.007 [0.010]	0.012 [0.011]	0.013 [0.011]
Relationship specificity (Nunn)	0.012 [0.034]	0.306*** [0.083]	0.006 [0.034]	0.009 [0.033]	0.003 [0.034]
Intermediation	-0.362*** [0.055]	-0.430** [0.212]	-0.376*** [0.056]	-0.311*** [0.055]	-0.324*** [0.056]
Dropping final goods (as in Wright, 2012)?	No	No	Yes	No	Yes
Restricted sample (Nunn-Trefler)?	No	No	No	Yes	Yes
Observations	185659	185659	181957	89261	87721
R-squared	0.19	0.65	0.2	0.17	0.17

Robust standard errors in brackets (* significant at 10%; ** at 5%; *** at 1%)
Regressions include country-year fixed effects

Seller vs. Buyer Headquarter Intensity

- One can use I/O Tables (see Antràs and Chor, 2012) to distinguish between buyer and seller headquarter intensities

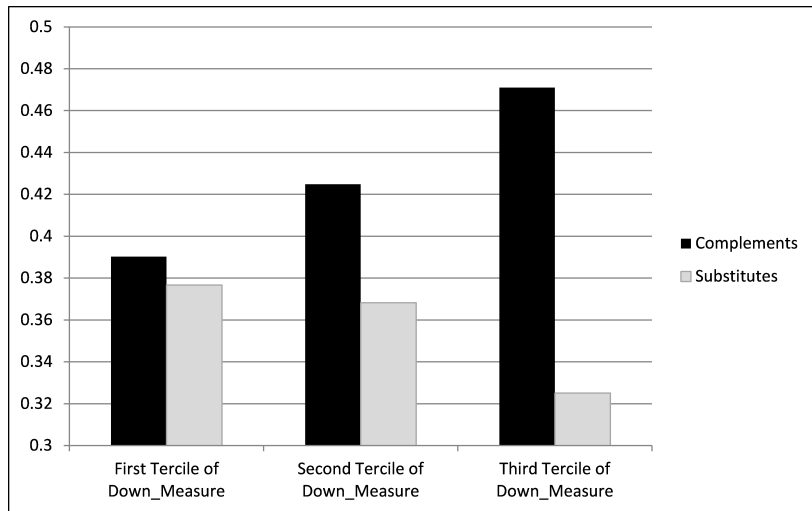
	Dependent Variable: Intrafirm Import Share						
	I	II	III	IV	V	VI Weighted	VII Weighted
Log (s/l)	0.110*** [0.038]	0.118*** [0.037]	0.019 [0.043]	0.037 [0.041]	-0.001 [0.020]	-0.094* [0.054]	-0.136* [0.082]
Log (k/l)	0.036* [0.021]						
Log (equipment k/l)		0.068*** [0.024]	0.083** [0.032]	0.125*** [0.035]	0.038** [0.017]	0.138*** [0.047]	0.120* [0.069]
Log (plant k/l)		-0.049 [0.032]	-0.064 [0.044]	-0.101** [0.049]	-0.061*** [0.021]	-0.116** [0.052]	-0.130* [0.072]
Log (materials/l)	0.018 [0.026]	0.023 [0.026]	0.063* [0.034]	0.049 [0.032]	0.018 [0.014]	0.047 [0.043]	0.083 [0.055]
Log (0.001+R&D/Sales)	0.029*** [0.007]	0.030*** [0.006]	0.054*** [0.009]	0.054*** [0.009]	0.033*** [0.004]	0.071*** [0.014]	0.065*** [0.021]
Dispersion	0.128** [0.062]	0.148** [0.060]	0.122 [0.075]	0.152* [0.079]	0.114*** [0.043]	0.159 [0.113]	0.058 [0.088]
DownMeasure X 1 (Elas < Median)				0.020 [0.065]	-0.004 [0.035]	-0.005 [0.091]	-0.013 [0.120]
DownMeasure X 1 (Elas > Median)				0.300*** [0.081]	-0.041 [0.033]	0.442*** [0.090]	0.557*** [0.113]
1 (Elas > Median)				-0.115* [0.062]	0.023 [0.031]	-0.284*** [0.072]	-0.370*** [0.082]
Industry controls for:	Seller	Seller	Buyer	Buyer	Buyer	Buyer	Buyer
Year fixed effects?	Yes	Yes	Yes	Yes	No	No	No
Country-Year fixed effects?	No	No	No	No	Yes	Yes	Yes
Final goods dropped and restricted sample?	No	No	No	No	No	No	Yes
Observations	3036	3036	3036	3036	227829	227829	105685
R-squared	0.29	0.3	0.28	0.33	0.18	0.61	0.58

Robust standard errors in brackets (* significant at 10%; ** at 5%; *** at 1%)

Substitutability and Downstreamness

- Notice that the results in the last Table are also supportive of some other predictions of the property-rights model
- The share of intrafirm trade is higher in sectors with low Broda-Weinstein elasticities **of the buying industry**
- The effect of downstreamness on the prevalence of integration is crucially affected by this demand elasticity
 - and in the way predicted by the model in Antràs and Chor (2012)

Downstreamness



Contractibility

- The above Table identifies a negative effect of contractibility on the prevalence of integration
 - higher intrafirm trade shares in sectors that use relationship-specific inputs (Nunn's measure)
 - and in sectors that make intensive use of intermediaries
- I next attempt to identify a separate effect of 'buyer' (or headquarter) contractibility and 'seller' (or manufacturing) contractibility
- Results are broadly supportive of the theory
- Note also the negative effect of input 'importance' (from I/O tables) on integration

Headquarter vs. Manufacturing Contractibility

	Dependent Variable: Intrafirm Import Share					
	I	II	III	IV	V Weighted	VI Weighted
DownMeasure X 1(Elas < Median)	0.078 [0.062]	0.002 [0.066]	0.042 [0.064]	-0.002 [0.036]	-0.139 [0.089]	-0.104 [0.099]
DownMeasure X 1(Elas > Median)	0.313*** [0.077]	0.285*** [0.075]	0.273*** [0.076]	-0.040 [0.031]	0.308*** [0.054]	0.431*** [0.092]
Value-added / Value shipments			0.231* [0.119]	0.082 [0.056]	0.177 [0.132]	0.081 [0.195]
Input "Importance"			-0.753 [1.406]	-0.692 [0.430]	-3.627*** [0.558]	-3.198*** [0.951]
Intermediation	-0.492*** [0.104]		-0.447*** [0.103]	-0.205*** [0.048]	-0.346*** [0.114]	-0.526*** [0.159]
Own contractibility		0.060 [0.046]	0.056 [0.044]	0.037* [0.022]	0.207*** [0.060]	0.172** [0.078]
Buyer contractibility		-0.236*** [0.065]	-0.194*** [0.064]	-0.147*** [0.028]	-0.527*** [0.088]	-0.424*** [0.106]
Additional buyer industry controls included: 1(Elas > Median), Log (s/l), Log (equipment k/l), Log (plant k/l), Log (materials/l), Log(0.001+R&D/Sales), Dispersion						
Year fixed effects?	Yes	Yes	Yes	No	No	No
Country-Year fixed effects?	No	No	No	Yes	Yes	Yes
Final goods dropped and restricted sample?	No	No	No	No	No	Yes
Observations	3036	3036	3036	227829	227829	105685
R-squared	0.39	0.37	0.42	0.19	0.65	0.62

Robust standard errors in brackets (* significant at 10%; ** at 5%; *** at 1%)

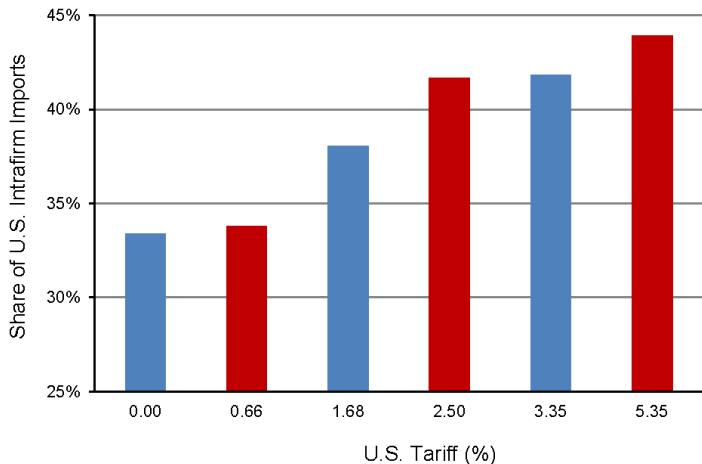
Cross-Country Evidence

	Dependent Variable: Intrafirm Import Share (HS6)				
	I	II	III	IV	V
		Weighted	Weighted	Weighted	Weighted
Log (K/L)	0.093 [0.057]	0.543*** [0.147]	0.345* [0.201]	0.488 [0.320]	0.737* [0.359]
Years of schooling	0.017 [0.040]	-0.043 [0.105]	-0.081 [0.123]	0.032 [0.331]	-0.091 [0.243]
Rule of law	0.082 [0.060]	-0.056 [0.136]	-0.219 [0.142]	-0.439 [0.544]	
Violent crime					0.652*** [0.156]
Organised crime					-0.322* [0.163]
Fairness of judicial process					-1.005*** [0.231]
Enforceability of contracts					0.071 [0.465]
Speediness of judicial process					-0.591*** [0.138]
Confiscation/expropriation					0.612*** [0.180]
Protection of intellectual property rights					0.437** [0.180]
Protection of private property					1.089*** [0.149]
Private credit/GDP (WDI)			0.156* [0.090]	0.094 [0.395]	0.069 [0.169]
Trade freedom			0.1 [0.125]	0.343 [0.621]	0.857*** [0.149]
Investment freedom			0.101 [0.118]	0.138 [0.343]	0.039 [0.121]
Effective tax rate			-0.009 [0.077]	-0.023 [0.185]	-0.079 [0.188]
Population			-0.086 [0.053]	0.329 [0.556]	1.102*** [0.132]
Restricted Sample (Nunn)?	No	No	No	Yes	Yes
Observations	1488223	1488223	1150010	361044	361044
R-squared	0.03	0.13	0.16	0.07	0.16

Robust standard errors in brackets (* significant at 10%; ** significant at 5%; *** significant at 1%)
 Regressions include year fixed effects

Effect of Trade Frictions

- Díez (2012) has studied the effect of U.S. import tariffs on the relative prevalence of integration

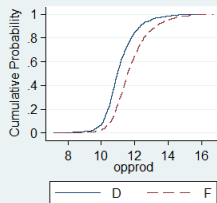
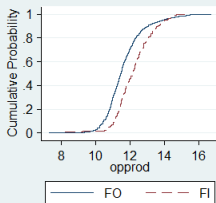
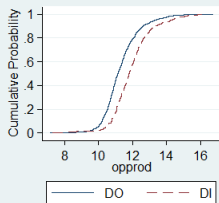
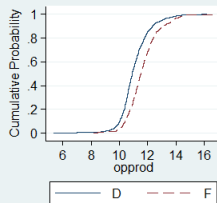
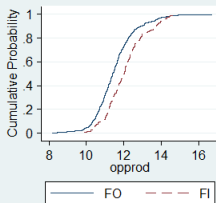
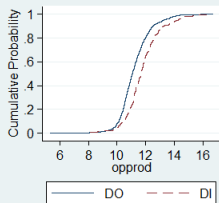


Firm-Level Studies

- Firm-level datasets allow to test directly the sorting implied by the frameworks developed above
- Tomiura (2007, JIE) uses a very rich sample of Japanese manufacturing firms to test directly the pattern of sorting of firms into organizational models implied by the models above
 - finds supportive evidence: Japanese firms engaged in offshore outsourcing, are generally less productive than firms engaged in foreign investment
- Defever and Toubal (2009) find more mixed evidence for French firms
- Kohler and Smolka (2009) use data from the Spanish Survey on Business Strategies (ESEE) from the Fundación SEPI
 - they find strong support for the sorting results implied by the theory
- Corcos et al. (2012) have also used French firm-level data and find a positive correlation between headquarter intensity **at the firm level** and the relative importance of intrafirm trade

Sorting Patterns

TFP Level Differences 2006 in Row 1, 2007 in Row 2



Concluding Remarks

- Testing the models developed in this Lecture is not straightforward
- Tests developed so far are suggestive but it is arguable that they have much power against alternative theories of internalization
- Product and firm-level data offer complementary approaches to testing the theories
- I can only hope that these Lectures will facilitate the development of more convincing tests of these theories