Relational Trade

Evidence from the United States

Fariha Kamal Heiwai Tang

US Census
Johns Hopkins University and CESIfo

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Incomplete Contracting in Global Sourcing

- The world is complicated and unpredictable
  - contingencies are not contractible ex ante; outcomes are observable but not verifiable ex post;
  - $\rightarrow$ Severe hold-up and moral hazard;
  - $\rightarrow$ Ex ante underinvestment.
- The trade literature has examined how firms, in the absence of complete contracts, optimally integrate with suppliers to alleviate hold-up.
  - Antràs, 2003; Antràs and Helpman, 2004; Nunn and Trefler, 2013; Antràs and Chor, 2013; Antràs, 2015, among others.

Informal Agreements and Repeated Interactions

- Unwritten code, trust and informal agreement are important for business.
- Buyers and sellers expect repeated interactions.
- Expected future profits from joint production can induce parties to take actions that are profitable for both parties in the long run.
- Huge theoretical literature on relational contracts informal agreements sustained by the future value of the relationship.
  - see reviews by Macleod, 2007 and Malcomsom, 2012; seminal papers by Baker, Gibbons, and Murphy 2002, and Levin, 2003, among many others.
- Informal agreements and repeated interactions are largely overlooked in the trade literature, both theoretical and empirical (exceptions: Corcos, 2013; Antràs and Foley, 2014; Macchiavello and Morjaria, 2015)

What do GVC experts say?

- Gereffi, Humphrey, and Sturgeon in *The governance of global value chains* (2005):
  - *"Recognizing the importance of transaction costs need not lead to the conclusion that complex and tightly coordinated production systems always result in vertical integration. Rather, asset specificity, opportunism, and coordination costs can be managed at the inter-firm level through a variety of methods."*
- Hughes (2000), Henderson et al. (2002) and Dicken et al. (2001):
  - The key insight is that coordination and control of global-scale production systems, despite their complexity, can be achieved without direct ownership.

Five GVC Governance Types (Gereffi, et al. (2005))

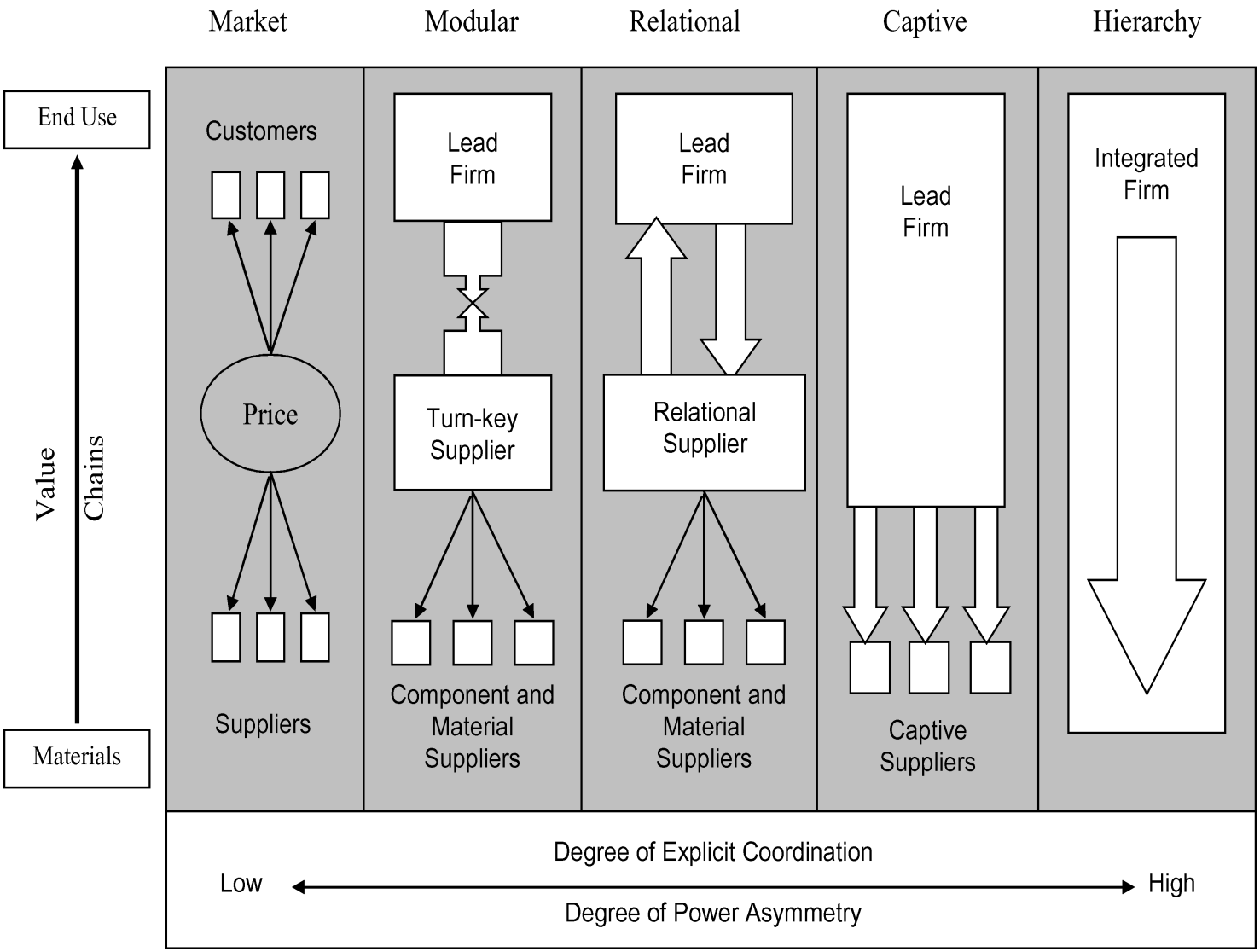


Figure 1 Five global value chain governance types.

This Paper

- Build a model to study how firms can use relational contracts, together with optimal organizational mode of production, to induce first-best investments and outcomes.
- Antràs-Helpman (2004) meets Baker-Gibbons-Murphy (2002).
- Study when informal and formal contracts (i.e., optimal organizational modes of production) are complements and substitutes.
- **Preliminary**: Use confidential US importer-exporter matched transaction-level data (1992-2011) to
  - verify the main predictions about the prevalence of different organizational modes of trade.
  - explore how a sudden increase in input suppliers from China affect the pattern of global sourcing pattern.

Importance of Relational Trade

Share in Total US Imports

Relational Trade: Age >= 3 years

%	Arms-Length	Related Party
Spot	8	3
Relational	31	57

Relational Trade: Age >=5 years

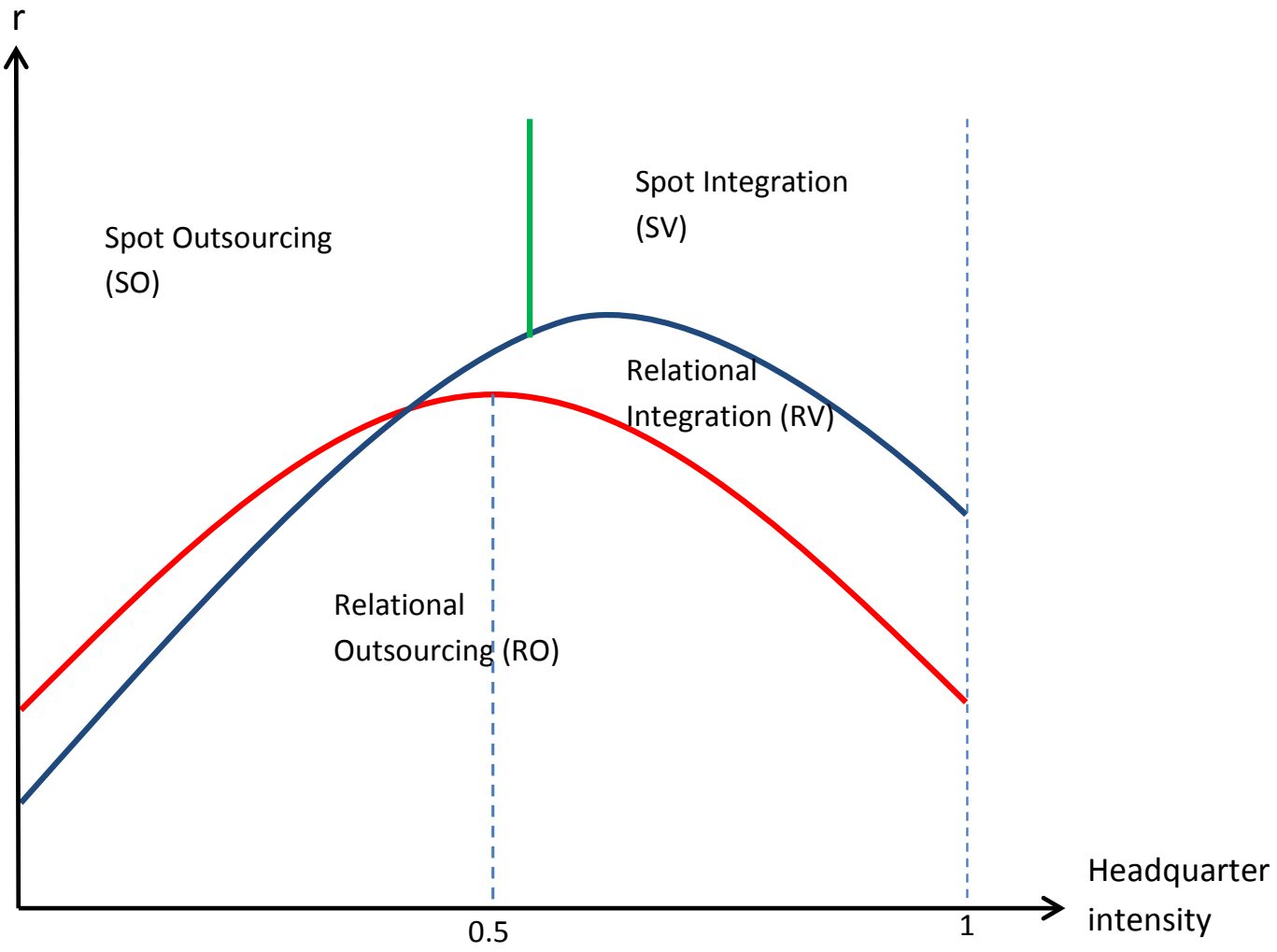
%	Arms-Length	Related Party
Spot	17	9
Relational	23	51

Source: US Census LFTTD (Average across 1992-2011)

Preview of the Theoretical Results

- The headquarter in the North chooses one of the four organizational modes (SO, RO, SV, and RV) to outsource input production to a supplier in the South, depending on the relative importance of headquarter intensity of final-good production and interest rates.
- When both parties are sufficiently patient (i.e., interest rates are low) and production is not too headquarter- or component-intensive, firms are more likely to rely on repeated interactions to sustain first-best investments.
  - With very low interest rates, arms-length trade prevails.
- For relatively component-intensive sectors, relational contracts and integration are substitutes. For relatively headquarter-intensive sectors, relational contracts and integration are complement.
- When interest rates are very high, spot relationships are the optimal production arrangements (the analysis is back to Antràs and Helpman (2004)).

Main Theoretical Arguments in One Graph



Preview of the (Preliminary) Empirical Results

- For exporters from high interest-rate countries (proxied by political risks or rule of law): positive relationship between headquarter (capital and skill) intensity and the share of imports through spot integration.
- For exporters from low interest-rate countries: a positive relationship between headquarter intensity and the share of relational integration.
- A sharp increase in suppliers from China reduces the average relationship age (i.e., probability of discontinuation) under outsourcing, but increases that under integration.
  - These effects are stronger for headquarter-intensive imports.

Literature Review (Incomplete)

1. Organization Modes of Global Sourcing
   - Theory: Antràs (2015) contains a comprehensive overview of his contributions and subsequent extensions.
   - Empirical Work: Nunn and Trefler (2008, 2013), Bernard et al. (2010), and Dez (2010) (survey by Antràs and Yeaple (2014)). several firm-level studies
2. Relational Contracts
   - Theory: Bull (1987), Klein (1995, 2000) Baker, Gibbons, and Murphy (1994, 2002), Halonen (2002), Levin (2003), Halac (2012), etc. (surveys by Macleod, 2007 and Malcomsom, 2012)
   - Empirical Work: Survey by Gil and Zanarone (2015).
3. Relational Contracting in Trade
   - Corcos (2013); Antràs and Foley (2014); Macchiavello and Morjaria (2015); Defever, Fischer and Suedekum (2015); Monarch and Schmidt-Eisenlohr (2015).

Road Map

- Model (One-shot then repeated game)
- Data
- Empirical Analysis (Preliminary)
  - Cross-section
  - Time-series at the importer-exporter pair level, taking import competition from China as exogenous.

Demand

- Our assumptions of preferences, market structure, and firm heterogeneity follow Melitz-Chaney.
- All firms face consumers in each country and period, with the same constant-elasticity-of-substitution preferences over differentiated products. A firm's demand:

$$q = EP^{\sigma-1}p^{-\sigma}, \quad \sigma > 1$$

- E is the total expenditure for the sector; P is the sector-specific price index; p and q stand for price and quantity.
- σ is the constant elasticity of substitution between different varieties (brands) within a sector.

Production

- Each period, production requires the non-cooperative, non-contractible investments by a (downstream) headquarter firm (H) in the North and a (upstream) input supplier (M) in the South.
- Production function of a variety:

$$q = \theta \left(\frac{m}{1-\eta} \right)^{1-\eta} \left(\frac{h}{\eta} \right)^{\eta},$$

  θ is productivity of the joint production unit, exogenously endowed to H, assumed to be transferred across border.
- Intermediate inputs (m) produced by M and headquarter services (h) produced by H.
- Final-good sectors differ in $\eta \in (0, 1)$, headquarter intensity.
- A production asset can be owned by H or M.
- The property-rights approach: vertical integration implies that H holds ownership of the asset.

Organization Choices and Bargaining

- Consider two organization mode: (spot) foreign outsourcing (O) and (spot) foreign vertical integration (V); f_k the sunk (fixed) costs; $f_V > f_O$.
- Contracts are incomplete.
- Symmetric Nash Bargaining: bargaining power equal to $1/2$ for each party.
- At the bargaining stage, the outside option of each party and thus the de-facto shares of joint surplus depends on the organizational form (V or O).
- Under Outsourcing:
  - Outside options for both H and M are 0.
- Under Integration:
  - If bargaining fails, H can fire M, seize M's inputs to complete the production with another plant.
  - H's outside option is $\delta R < R$, while M's outside option is 0.

Investment Decisions

- Denote by β_k H's expected share of the joint surplus under integration, and $(1-\beta_k)$ the expected share for M, for $k \in \{O, V\}$

$$\beta_V = \frac{1+\delta}{2} > \beta_O = \frac{1}{2}.$$

- H's maximization problem:

$$\max_{h,t} \beta_k p(q)q - w_N h - w_N f_k - t$$
$$\text{s.t.} \quad t + (1-\beta_k)\, p(q)q - \tau w_S m \geq 0$$
$$m^* = \max_m (1-\beta_k)\, p(q)q - \tau w_S m - t,$$

- t is the ex-ante transfer from M to H, which makes M indifferent between teaming up with different downstream buyers.

Choosing Optimal Spot Organization Modes

- H chooses the production mode to maximize her objective as follows:

$$\pi^*(B,\eta,\theta) = \max_{k\in\{V,O\}} \left\{ A\Gamma_k \left(\frac{\alpha\theta}{c(\eta)} \right)^{\frac{\alpha}{1-\alpha}} - w_N f_k \right\}$$

  H's choices depend on the slopes of Γ_k and the fixed costs f_k.

$$c(\eta) \quad = \quad (w_S)^{1-\eta}(w_N)^{\eta}$$

- The ratio of profitability:

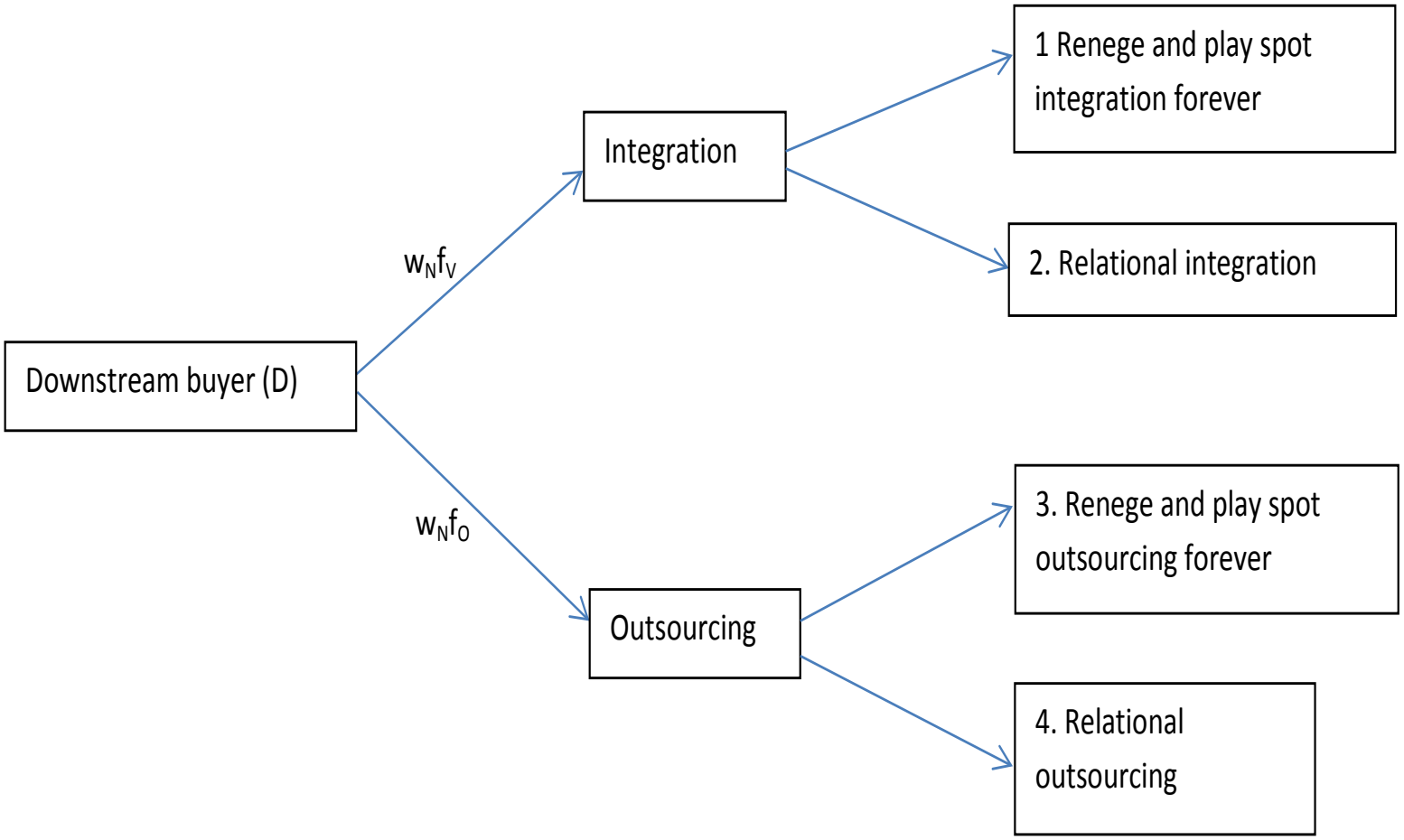
$$\frac{\Gamma_V}{\Gamma_O} = \frac{1-\frac{\alpha}{2}\left(1+(2\eta-1)\delta\right)}{1-\frac{\alpha}{2}} \left[(1+\delta)^{\eta}(1-\delta)^{(1-\eta)} \right]^{\frac{\alpha}{1-\alpha}}$$

- Antràs (2003, 2005, 2015):
  - $\frac{\Gamma_V}{\Gamma_O}$ is decreasing in η;
  - a unique $\eta^* < 1$ exists, such that $\frac{\Gamma_V}{\Gamma_O} > 1$ for $\eta > \eta^*$;

Relational Contracts

- Consider relational contracts by extending the model in an infinite-horizon repeated-game setting.
- Solve the model backward (rational expectation equilibrium) to determine the optimal organizational mode at t0.
- Assumptions:
  - Both M, H and the asset (i.e., zero depreciation) live forever
  - Discount next-period profits by $(1+r)^{-1}$.
  - Investment only affects production in the current period and does not affect production in future periods.
- Both parties continue to cooperate unless one side of the relationship reneges from the informal agreements, after which both parties forgo cooperation indefinitely.
- We solve for the trigger-strategy equilibrium that maximizes the firm's expected profits, subject to the supplier's participation (IR) and incentive-compatibility (IC) constraints.

Decisions at $t0$



Timing of Events

- t0 : D chooses the organizational mode (V or O) *and* whether to use relational contracts when forming a production relationship with M:
  - Spot contracts: offers M an up-front payment (t).
  - Relational contracts: offers M a compensation package that constitutes an up-front payment (t) and a promised future payment (b), conditional on investing at the implicitly agreed-upon level.
- t1 morning : H chooses h and M chooses m *simultaneously* in anticipation of the optimal and sustainable production mode.
- t1 afternoon : Observing m chosen by M, H decides whether to honor the relational contracts by paying b, if it was chosen at t0.
- t2 : If either party reneges at t1 afternoon, the game gets into the punishment phase and the spot (Antràs-Helpman) equilibrium prevails indefinitely. If both parties choose to honor the relational contracts, the events at t1 and t2 will repeat indefinitely until one party reneges.

Reneging Temptations

- Let us show how the first-best investments (m^*, h^*) and profits can be attained without formal contracts
- Pre-requisite: sufficiently low interest rates.
- Let us denote the first-best profits by π_i^f for $i \in \{H, M\}$. The following IC constraints need to hold:

$$M : (b - w_S m^*)\left(1 + \frac{1}{r}\right) \geq \pi_M^d + \frac{\pi_M^p}{r},$$

$$H : \left(\pi^f - w_N h^* - b\right)\left(1 + \frac{1}{r}\right) \geq \pi_H^d + \frac{\pi_H^p}{r},$$

- f, p, and d stand for first-best, punishment, and deviation, respectively.
- π_i^d is the one-time profit for party i if he deviates from the relational contract.

First-best Investments

- Ex ante, H designs a two-part contract (with t and b) to induce the first-best action by M.
- To solve for the level of bonus, b, which sustains the first-best investments in equilibrium, we need to first solve for π_i^f, π_i^d, and π_i^p for both $i = H, M$:
- The first-best investment levels:

$$\begin{aligned} \{h^*, m^*\} &\equiv \arg\max_{h,m} R(m,h) - w_N h - w_S m \\ &= \left\{ \begin{array}{c} A\eta \left[\alpha\theta^\alpha w_N^{\alpha(1-\eta)-1} w_S^{-\alpha(1-\eta)}\right]^{\frac{1}{1-\alpha}}, \\ A(1-\eta)\left[\alpha\theta^\alpha w_N^{-\alpha\eta} w_S^{\alpha\eta-1}\right]^{\frac{1}{1-\alpha}} \end{array} \right\} \end{aligned}$$

Reneging Investments

- $$\max_{m} \left\{ \left(1 - \beta_k\right) R\left(m, h\right) - w_S m \right\}$$
- Given h^*, the level of M's reneging investment can be solved:

$$m^d = \arg\max_{m} \left\{ \left(1 - \beta_k\right) R\left(m, h^*\right) - w_S m \right\}$$

- Given m^*, H's reneging level of investment can be solved:

$$h^d = \arg\max_{h} \left\{ \beta_k R\left(m^*, h\right) - w_N h \right\}$$

The One-time Profits after Reneging

- The corresponding profits for H and M by deviating from the first-best levels are

$$
\begin{aligned}
M \quad &: \quad \pi_M^d = (1-\beta_k)^{\frac{1}{1-\alpha(1-\eta)}} A \left[\theta\alpha w_N^{-\eta} w_S^{-(1-\eta)}\right]^{\frac{\alpha}{1-\alpha}} \left[1-\alpha(1-\eta)\right] \\
H \quad &: \quad \pi_H^d = \beta_k^{\frac{1}{1-\alpha\eta}} A \left[\theta\alpha w_N^{-\eta} w_S^{-(1-\eta)}\right]^{\frac{\alpha}{1-\alpha}} (1-\alpha\eta)
\end{aligned}
$$

- Recall that the per-period joint profit in the punishment phase is just the profit in the spot (AH) equilibrium

$$
\pi_k^p \equiv \pi_{Uk}^p + \pi_{Dk}^p = A\Gamma_k \left(\frac{\alpha\theta}{c(\eta)}\right)^{\frac{\alpha}{1-\alpha}} - w_N f_k, \text{ for } k \in \{O, V\}
$$

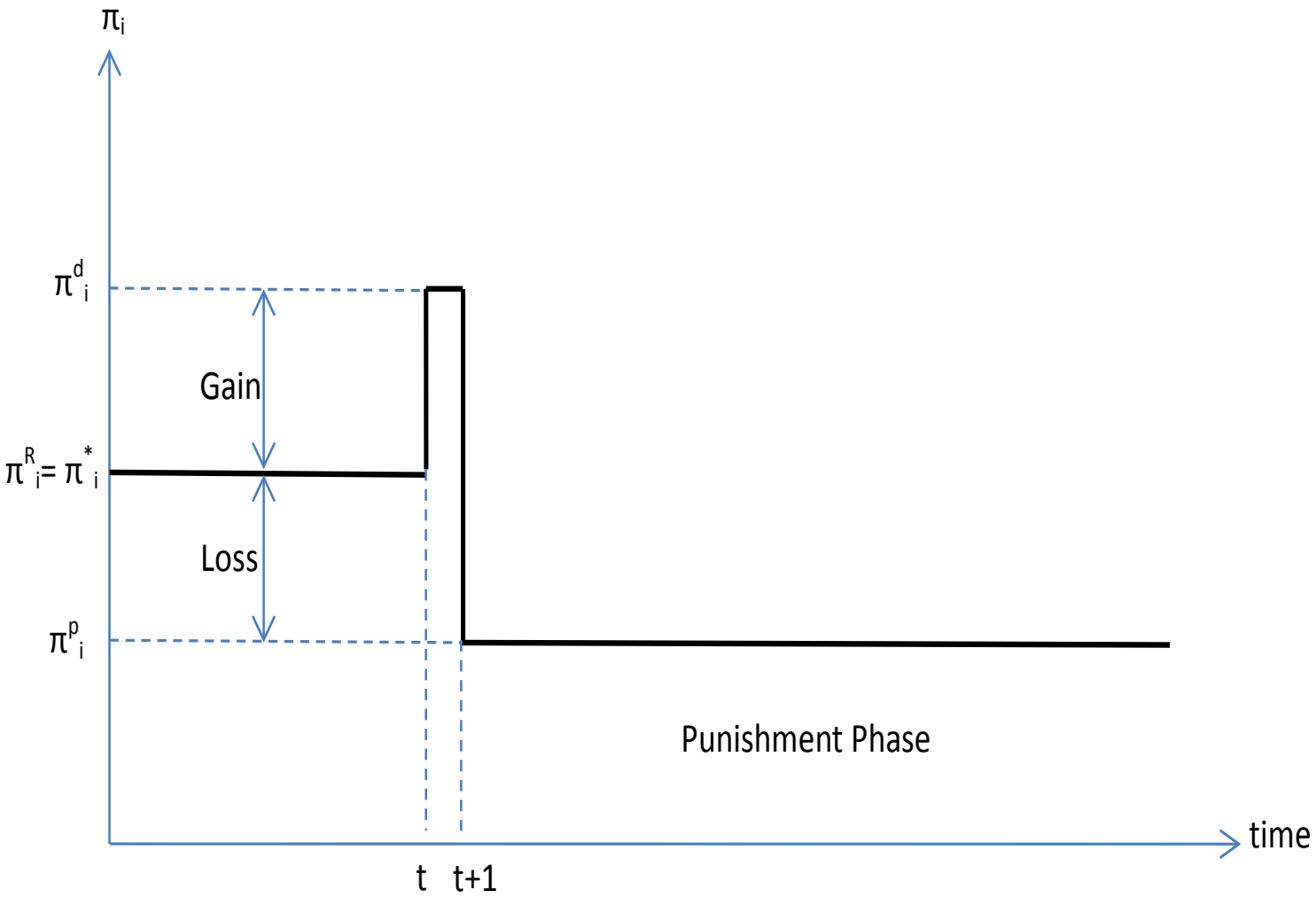
The interest rate that sustains the first-best outcomes

- Substituting π_U^d and π_k^p into M's IC (non-reneging) constraint $r \leq \frac{\left(b - w_S m^f\right) - \pi_U^p}{\pi_U^d - \left(b - w_S m^f\right)}$
- Substituting π_U^d and π_k^p into D's IC (non-reneging) constraint $r \leq \frac{\left(\pi^f - w_N h - b\right) - \pi_D^p}{\pi_D^d - \left(\pi^f - w_N h - b\right)}$
- b will be chosen by D to balance the benefits between H and M.
- Setting the RHS of the two IC constraints equal yields b^*, implying

$$r \leq r^f \equiv \frac{Loss}{Gain},$$

- $Loss = \left(\pi^f - w_N h - w_S m^f\right) - \left(\pi_U^p + \pi_D^p\right)$
- $Gain = \left(\pi_D^d + \pi_U^d\right) - \left(\pi^f - w_N h - w_S m^f\right)$.

Insights



Optimal Organizational Modes Revisited

- We can further express $r_k^f(\eta)$, for $k \in \{O, V\}$

$$r_k^f(\eta) = \frac{(1-\alpha) - \Phi_{pk}(\eta)}{\Phi_{dk}(\eta) - (1-\alpha)}$$

$$\Phi_{pk}(\eta) \equiv \left(\frac{(1+\delta_k)^{\eta} (1-\delta_k)^{(1-\eta)}}{2} \right)^{\frac{\alpha}{1-\alpha}} \left(1 - \frac{\alpha}{2} (1 + (2\eta - 1)\delta_k) \right)$$

$$\Phi_{dk}(\eta) \equiv \left(\frac{1-\delta_k}{2} \right)^{\frac{1}{1-\alpha(1-\eta)}} [1 - \alpha(1-\eta)] + \left(\frac{1+\delta_k}{2} \right)^{\frac{1}{1-\alpha\eta}} (1 - \alpha\eta).$$

$\delta_V = \delta$ for integration and $\delta_O = 0$.

The Relation between $r^f(\eta)$ and η

- $r_O^f(\eta)$ and $r_V^f(\eta)$ are inverted U-shaped with respect to η. $r_O^f(\eta)$ attained its maximum value when $\eta = \frac{1}{2}$, while $r_V^f(\eta)$ attained its maximum value at $\eta > \frac{1}{2}$.
- Intuition: the first-best actions are more likely to be sustained using relational contracts for an intermediate range of headquarter intensity.
  - Investment by either party is relatively important.
- Reason: temptation to renege by H (M) is increasing (decreasing) in headquarter intensity.
- Coordination can be more easily sustained if the contribution of joint production is relatively balanced.

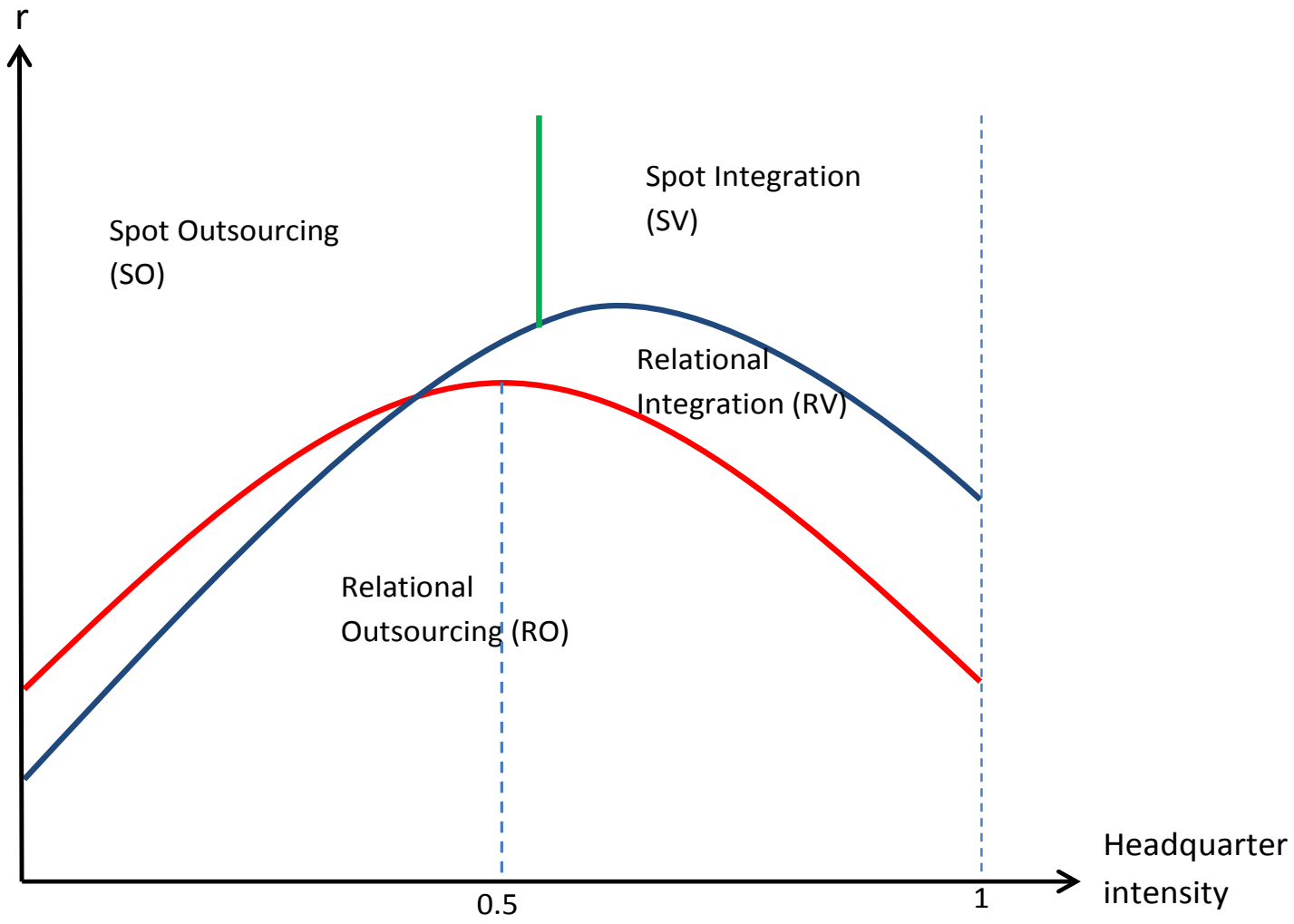
Lemma

The range of the interest under which relational outsourcing or relational integration are sustainable takes the inverted U-shaped against headquarter intensity of production. In other words, for intermediate headquarter-intensive sectors, the range of interest rate below which relational trade is sustainable is the widest.

What happens after either party reneges?

- When the interest rates are higher than $r^f(\eta) = \max\left\{r_O^f(\eta), r_V^f(\eta)\right\}$, relational contracts are not sustainable.
- Firms expect to play one-shot games every period, back to the analysis of Antràs and Helpman (2004).

Punch Line of the Model



When will integration and relational contracts be complements?

- When is $r_k^f(\eta)$ maximized, given η?

$$r_k^f(\eta) \equiv \left(\frac{Loss}{Gain}\right)_k, k \in \{O, V\}$$

$$\frac{Loss_V}{Loss_O} = \frac{(1-\alpha) - \Phi_{pV}(\eta)}{(1-\alpha) - \Phi_{pO}(\eta)},$$

  which is decreasing in η (Antràs, 2003).
- So it's not about maximizing loss; how about minimizing gains in the reneging period?
- In h-intensive sectors, M has lower de facto bargaining power under integration than outsourcing.
- Even though H he has higher bargaining power under integration, he has more incentive to invest closer to the first best in headquarter-intensive sectors. So the reneging investment level is not too different from the first best.

The Prevalence of Intra-firm Trade Revisited

- Embedding the model in Melitz and imposing Pareto distribution of firm productivity, we can derive the share of each production mode in close form.

For high interest rates:

For intermediate interest rates:

For low interest rates:

Data

- Linked/Longitudinal Foreign Trade Transactions Database (LFTTD) from the U.S. Census Bureau.
- A confidential database that contains detailed information (value, quantity, and date of the transaction) for the universe of import transactions at the firm-product (10-digit HS) level.
- The novel feature: information about the foreign party involved for each trade transaction.
- U.S. Customs Border Protection (CBP) requires importers in the U.S. to report information about their foreign exporters, which can be producers or intermediaries.
- A foreign exporter is uniquely identified by the "Manufacturer ID" (MID), a required field on Form 7501, the form U.S. importers are required to fill out by the U.S. CBP.
- Period: 1992-2011.

Descriptive Statistics

Table 1. Descriptive Statistics, 2011.

	Overall	
	Related Party	Arms Length
% of buyers	16	84
% of sellers	14	86
Sellers/buyer, mean	7.28	11.96
Sellers/buyer, median	2	2
Buyers/seller, mean	1.19	1.65
Buyers/seller, median	1	1
Share trade, top 10% buyers (%)	95	91
Share trade, top 10% sellers (%)	96	88
Log max/median imports	10.64	10.43
Log max/median exports	13.38	12.74
Share in total U.S. imports, %	47	53

Source : Longitudinal Foreign Trade Transactions Database. Exclude Mineral Imports Only.

Relationship Age (Country Ranking)

Average Duration of Importer-Exporter Relationships by Country

Top 10 in terms of the weighted average age of relationship

Related Party		Arms Length	
Japan	5.81	Iceland	3.85
Denmark	5.10	Haiti	3.78
Ireland	5.05	Japan	3.65
Germany	4.90	Taiwan	3.32
Venezuela	4.79	Denmark	3.08
Sweden	4.79	Mexico	3.04
Mexico	4.78	Ireland	3.04
Belgium	4.66	Germany	3.03
Philippines	4.56	Sweden	3.01
Austria	4.46	Austria	3.00

Bottom 10 in terms of the weighted average age of relationship

Related Party		Arms Length	
Czech Republic	2.92	Oman	1.63
United Arab Emirates	2.92	Tanzania	1.63
Turkey	2.64	Nepal	1.60
Bulgaria	2.57	Brunei	1.50
Guatemala	2.54	Kazakhstan	1.50
Slovakia	2.50	Ukraine	1.47
China	2.45	Syria	1.36
Greece	2.30	Nigeria	1.23
Vietnam	2.26	Qatar	1.20
Romania	2.07	Iran	1.11

Source: Authors' computation based on the U.S. Linked/Longitudinal Foreign Trade Transactions (LFTTD) Database. Year = 2005.

Relationship Age (Industry Ranking - Top 5)

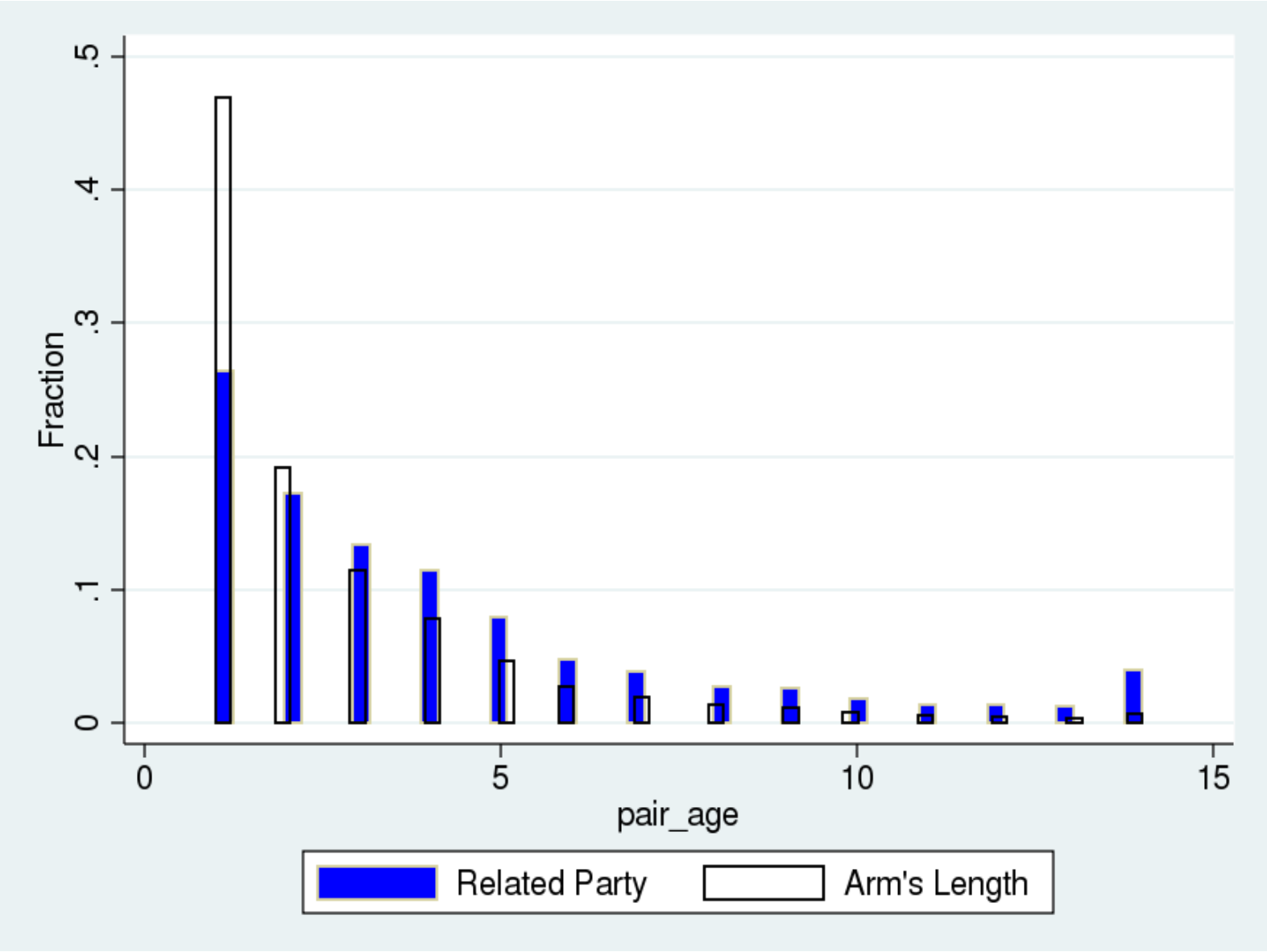
Table: Average Age of Importer-exporter Relationships by Sector

Top 5 in terms of Weighted Average Age			
Related Party		Arms Length	
87: Vehicles other than railway or tramway rolling stock, etc.	7.46	80: Tin and articles thereof	5.74
37: Photographic or cinematographic goods	7.22	14: Vegetable plaiting materials	5.11
75: Nickel and articles thereof	6.48	67: Prepared feathers and down and articles made of	4.59
30: Pharmaceutical products	5.16	88: Aircraft, spacecraft, and parts thereof	4.35
92: Musical instruments	4.86	51: Wool, fine or coarse animal hair ...	4.29

Relationship Age (Industry Ranking - Bottom 5)

Bottom 5 in terms of Weighted Average Age			
Related Party		Arms Length	
64: Footwear, gaiters and the like; parts of such articles	1.23	79: Zinc and articles thereof	2.22
67: Prepared feathers and down and articles made of feathers	1.22	30: Pharmaceutical products	1.85
14: Vegetable plaiting materials	1.21	87: Vehicles other than railway or tramway rolling stock	1.84
41: Raw hides and skins (other than furskins) and leather	1.21	75: Nickel and articles thereof	1.84
66: Umbrellas, sun umbrellas, walking sticks, ...	1.07	37: Photographic or cinematographic goods	1.57

Relationship Age Distribution



Regression Specification

$$Sh_{ict} = \alpha_c + \alpha_t + \beta h_i \times Int\_rate + \epsilon_{ict},$$

- where i, c, and t stand for sector (HS2), country, and year, respectively. Sh_{ict} stands for one of the following four measures – the share of imports that belong to SO, SV, RO, and RV at the country-sector-year level.
- H1: High interest rates: positive relationship between headquarter intensity and spot integration.
- H2: Intermediate interest rates: same but for an intermediate range of headquarter intensity, relational integration can be prevalent.
- H3: Low interest rates: a positive relationship between headquarter intensity and relational integration; and NO relationship between headquarter intensity and spot integration.
- 2 exogenous measures of the exporting countries to proxy for the interest rates: political stabilityand rule of law.

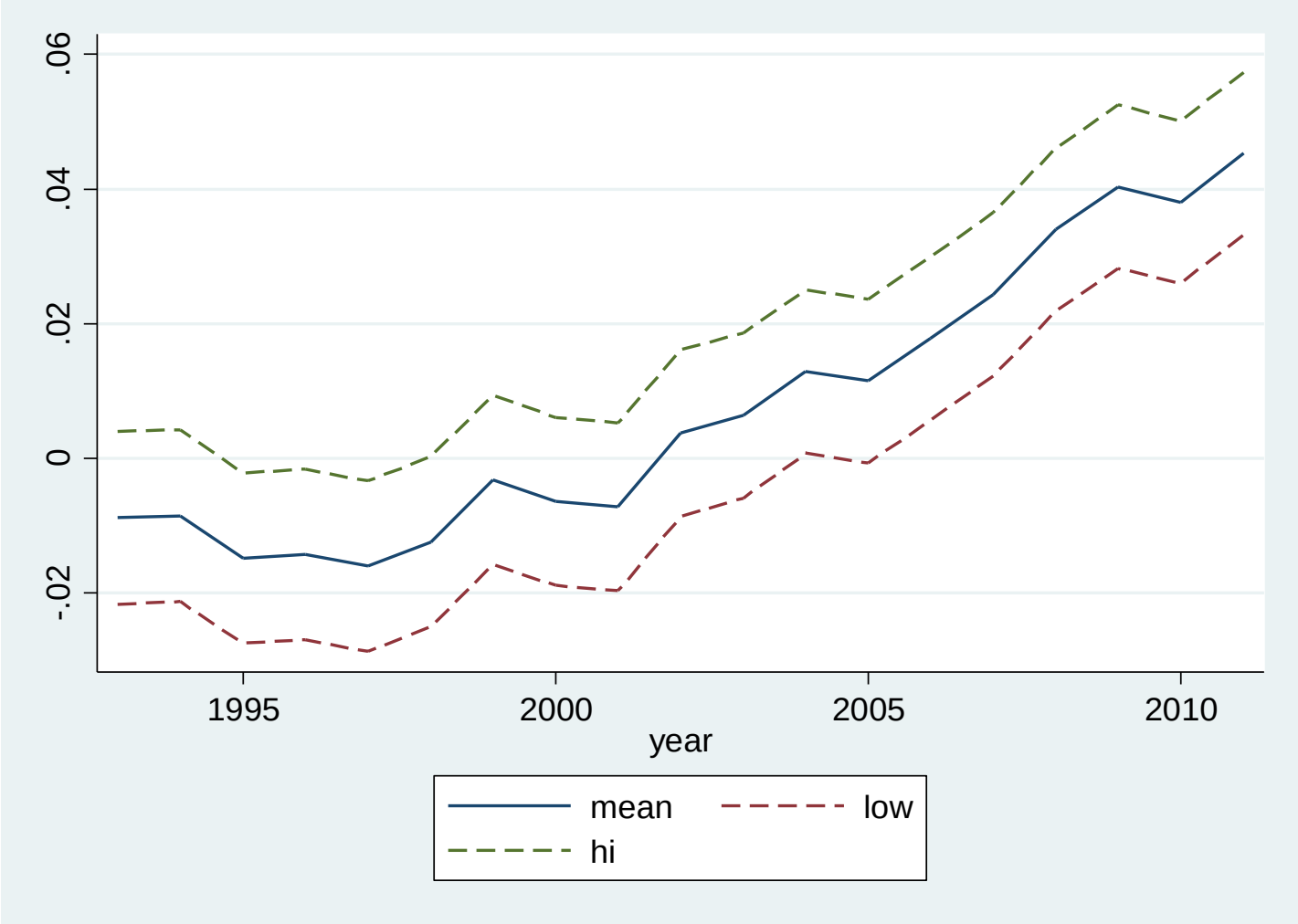
Results - Organizational Forms, Interest Rates, Factor Intensity (Sector-Country Level)

The Share of Relational Trade by Interest Rate Groups (at the sector-country level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep Var	Share of SV		Share of RV		Share of SV		Share of RV	
Proxy for Interest Rates	Rule of Law				Political Stability			
Definition of Relational Trade	>=3 years	>=5 years	>=3 years	>=5 years	>=3 years	>=5 years	>=3 years	>=5 years
log (Skill Intensity) x								
High r Dummy	0.0396***	0.0566***	0.0407	0.0237	0.0236***	0.0423***	0.0869***	0.0682***
	(0.012)	(0.020)	(0.028)	(0.021)	(0.008)	(0.013)	(0.027)	(0.022)
Intermediate r Dummy	0.0265***	0.0445***	0.127***	0.109***	0.0312***	0.0479***	0.139***	0.122***
	(0.006)	(0.013)	(0.033)	(0.027)	(0.007)	(0.014)	(0.036)	(0.029)
Low r Dummy	0.0163**	0.0423***	0.165***	0.139***	0.0148*	0.0440***	0.158***	0.129***
	(0.008)	(0.014)	(0.038)	(0.032)	(0.008)	(0.015)	(0.039)	(0.033)
log (Capital Intensity) x								
High r Dummy	0.00579	0.0100	0.0102	0.00594	0.00358	0.0106	0.0212**	0.0142*
	(0.006)	(0.009)	(0.012)	(0.009)	(0.004)	(0.007)	(0.010)	(0.008)
Intermediate r Dummy	0.00945***	0.0207***	0.0338***	0.0225**	0.0135***	0.0288***	0.0512***	0.0360***
	(0.003)	(0.006)	(0.013)	(0.010)	(0.004)	(0.007)	(0.016)	(0.013)
Low r Dummy	0.00936***	0.0237***	0.0597***	0.0453***	0.00761**	0.0193***	0.0513***	0.0396***
	(0.003)	(0.006)	(0.016)	(0.014)	(0.003)	(0.006)	(0.016)	(0.014)
Fixed Effects	Country, Year							
N	79107	79107	79107	79107	79107	79107	79107	79107
Adj. R-sq	0.03	0.05	0.19	0.17	0.03	0.05	0.19	0.17

Notes: Observations are at the sector-country-year level. Standard errors clustered at the sector (HS2) level are reported in the parentheses. Significance at *10%, **5%, ***1% levels.

Rising Importance of Intra-firm Trade



Time trend, controlling for country and sector (HS2) fixed effects.

Can increasing outside option of US buyers contribute to the rise of its intra-firm imports?

- Consider now both H and M have higher outside options due to increased opportunities to work with alternative partners.
- Denote $\epsilon_H \in [0,1]$ the degree of specificity of H's inputs to the relationship. H can recoup only $1-\epsilon_H$ of the marginal product of his input, $\frac{\partial R}{\partial h}$, by working with another supplier.
- The ex ante (perceived) share of revenue for M and H under outsourcing are

$$\beta_O^M = \frac{1}{2}; \quad \beta_O^H = 1 - \frac{\epsilon_H}{2}.$$

- The (perceived) share of revenue for M and H under integration are:

$$\beta_V^M = \frac{1-\delta}{2}; \quad \beta_V^H = 1 - \frac{(1-\delta)\,\epsilon_H}{2}$$

Can increasing outside option of US buyers contribute to the rise of its intra-firm imports?

$$\frac{\Gamma_V}{\Gamma_O} = \frac{\left(1-\alpha\eta\left(1-\frac{(1-\delta)\epsilon_H}{2}\right)-\frac{1}{2}\alpha\left(1-\eta\right)\left(1-\delta\right)\right)}{\left(1-\alpha\eta\left(1-\frac{\epsilon_H}{2}\right)-\frac{1}{2}\alpha\left(1-\eta\right)\right)} \times \left[\left(1-\delta\right)^{1-\eta}\left(\frac{1-\frac{1}{2}\left(1-\delta\right)\epsilon_H}{1-\frac{1}{2}\epsilon_H}\right)^{\eta}\right]^{\frac{\alpha}{1-\alpha}}$$

$$\frac{\partial}{\partial\left(-\epsilon_H\right)}\ln\left(\Gamma_V/\Gamma_O\right) \leq 0$$

When the specificity of the H's investment becomes lower due to a thicker input market as a result of globalization, integration should become less attractive, inconsistent with the observed upward trend of intra-firm trade.

How may relational contracts explain the trend?

$$r_k^f(\eta) = \frac{(1-\alpha) - \Phi_{pk}(\eta)}{\Phi_{dk}(\eta) - (1-\alpha)}$$

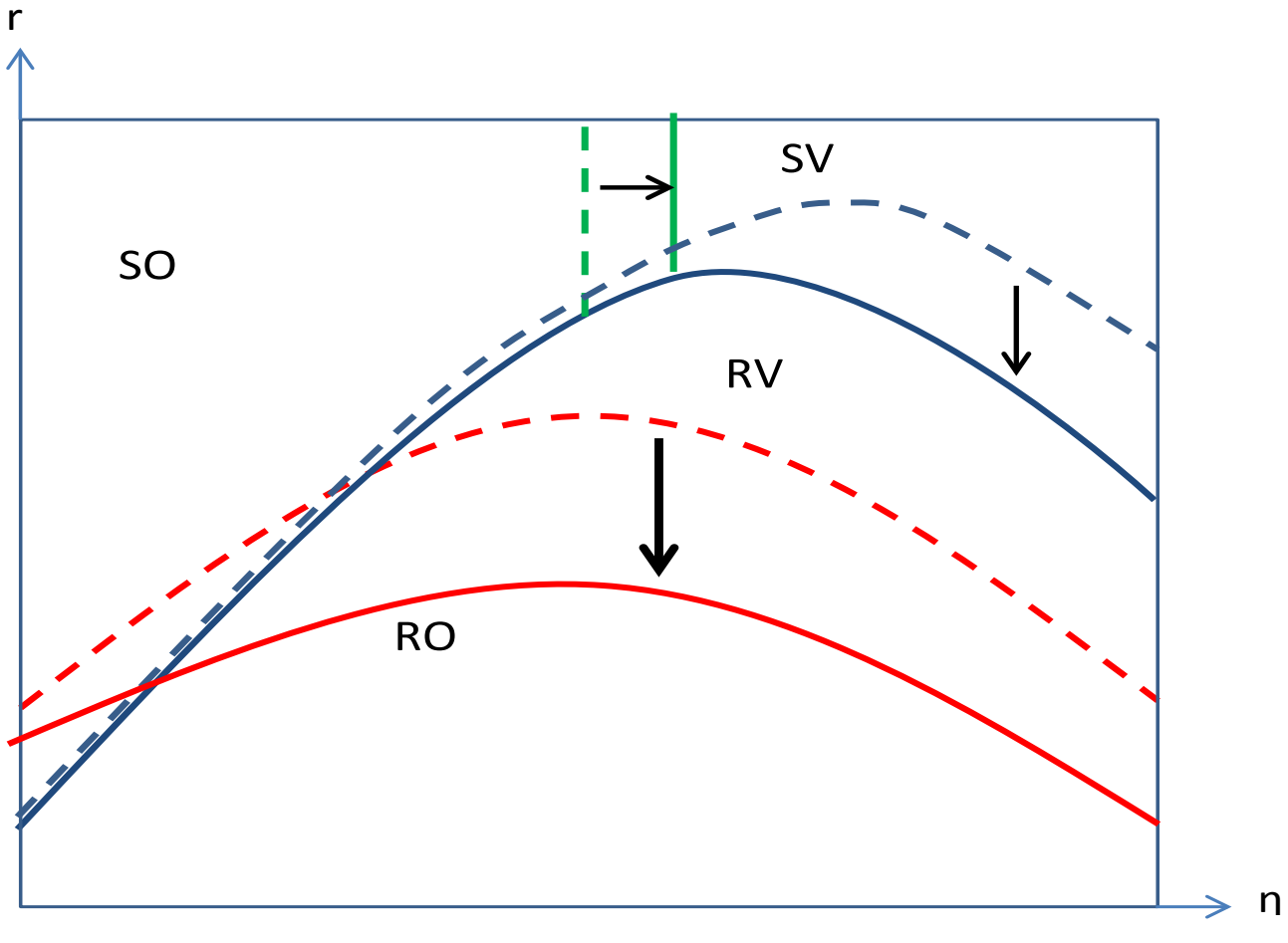
$$\frac{\partial \Phi_{dO}(\eta)}{\partial(-\epsilon_H)} > \frac{\partial \Phi_{dV}(\eta)}{\partial(-\epsilon_H)} > 0$$

$$\frac{\partial}{\partial \eta}\frac{\partial \Phi_{dO}(\eta)}{\partial(-\epsilon_H)} > \frac{\partial}{\partial \eta}\frac{\partial \Phi_{dV}(\eta)}{\partial(-\epsilon_H)} > 0$$

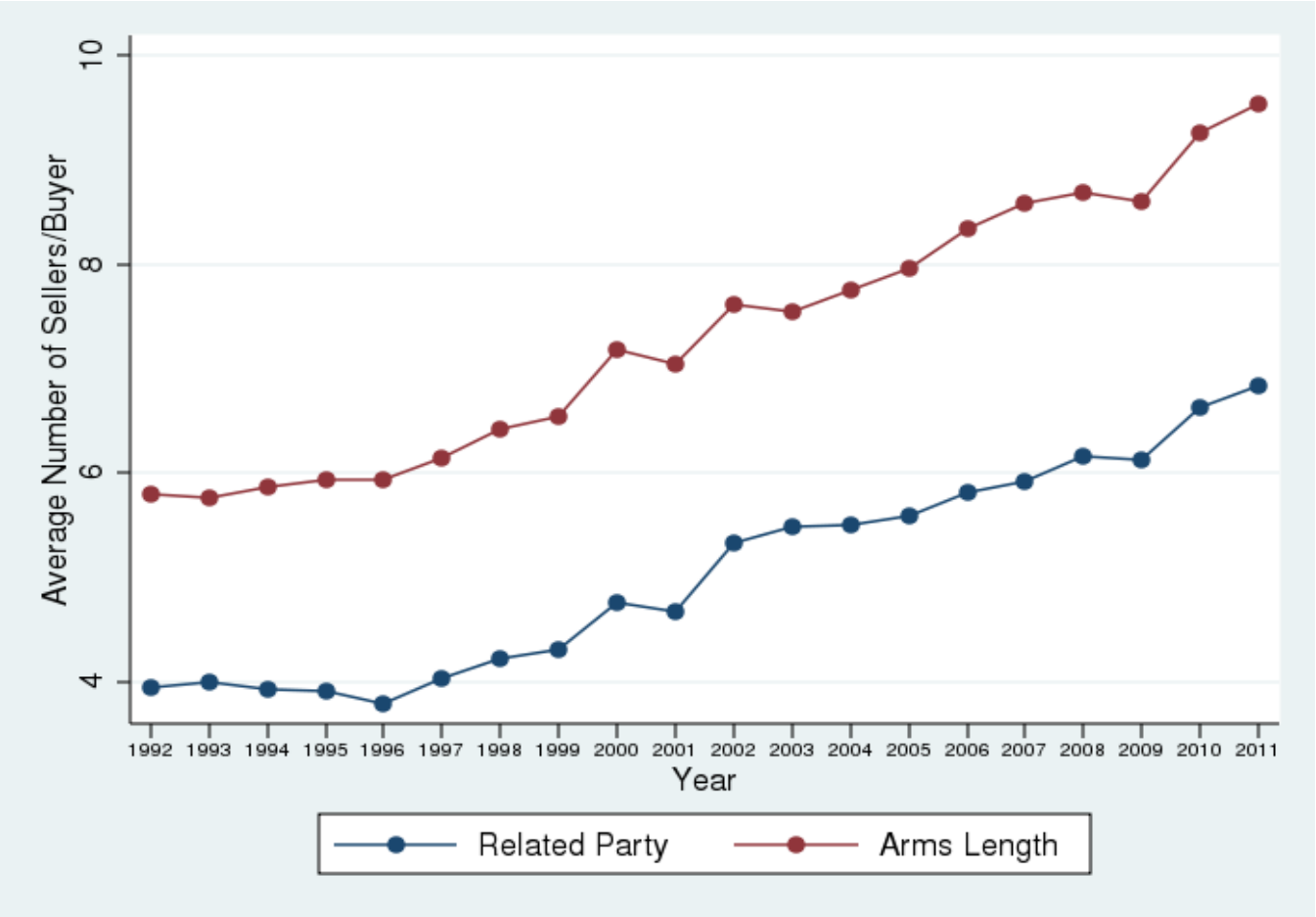
$$\frac{\partial \Phi_{pO}(\eta)}{\partial(-\epsilon_H)} > \frac{\partial \Phi_{pV}(\eta)}{\partial(-\epsilon_H)} > 0$$

$$\frac{\partial}{\partial \eta}\frac{\partial \Phi_{pO}(\eta)}{\partial(-\epsilon_H)} > \frac{\partial}{\partial \eta}\frac{\partial \Phi_{pV}(\eta)}{\partial(-\epsilon_H)} > 0$$

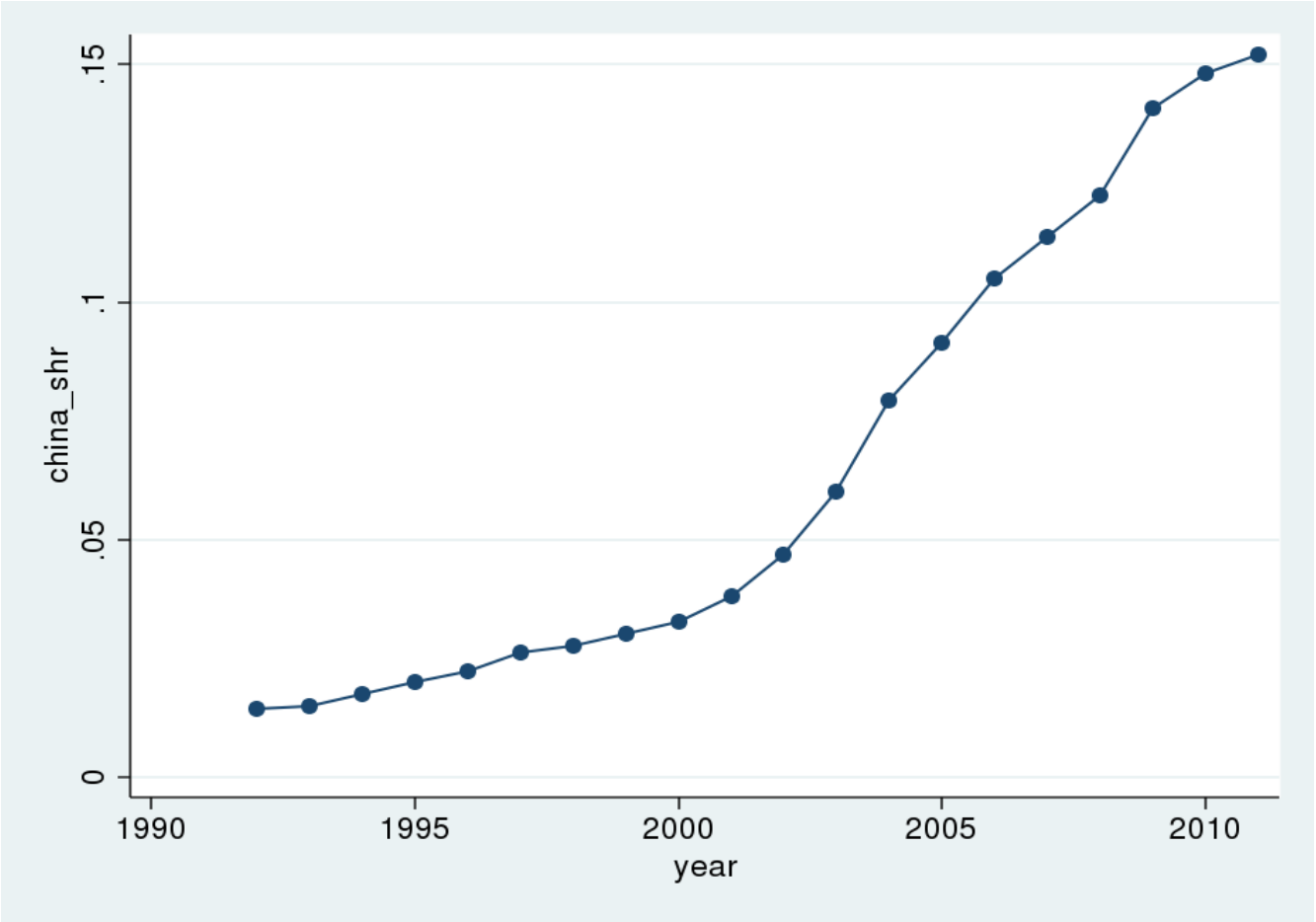
How may relational contracts explain the trend?



Increasing number of sellers per buyer, esp after 2001



Increasing Share of Chinese Imports, esp after 2001



Regression Specification (Sector-country level)

$$Age_{ict} = \delta M_{it}^{Ch} + \gamma M_{it}^{Ch} \times h_i + \alpha_i + \alpha_c + \alpha_t + \xi_{ict},$$

- where i, c, and t stand for sector (HS2), country, and year, respectively. Age_{ict} is the (weighted) average age of the importer-exporter relationship.
- For arms-length imports: $\delta < 0$; $\gamma < 0$;
- For related-party imports: $\delta > 0$; $\gamma > 0$.

Results - Chinese Trade Shocks and Relationship Age

Chinese shock and weighted average pair age (at the sector-country-year level)

Sample		
Dependent Variable	Weighted Average Pair Age	
	Related Party	Arms-Length
Chinese Shock (= Imp/Total US Imp, sector-year)	1.695	-1.067
	(1.829)	(0.779)
Chinese shock x		
Skill Int.	3.445**	-1.364
	(1.712)	(0.897)
Capital Int.	0.757	-0.559*
	(0.820)	(0.318)
Fixed Effects	Country, Sector, Year	
Observations	38753	72690
Adjusted R-squared	0.23	0.18

Notes: Observations are at the sector-country-year level. Links with Chinese suppliers are excluded in the calculation of age. Standard errors clustered at the sector (HS2) level are reported in the parentheses. Significance at *10%, **5%, ***1% levels.

Results - Chinese Trade Shocks and Relational Trade

Chinese shock and relational trade (at the sector-country-year level)

	(1)	(2)	(3)	(4)
Dep. Var: Share of	RO	RV	RO	RV
Definition of Relational Trade	>=3 years		>=5 years	
Chinese Shock (= Imp/Total US Imp, sector-year)	-0.0478	-0.00970	-0.0767	-0.0124
	(0.119)	(0.144)	(0.109)	(0.133)
Chinese shock x	-0.179	0.178	-0.174	0.140
Skill Int.	(0.120)	(0.161)	(0.119)	(0.143)
Capital Int.	-0.140**	0.117*	-0.127**	0.102**
	(0.058)	(0.061)	(0.057)	(0.051)
Fixed Effects	Country-year, Sector			
N	76910	76910	76910	76910
Adj. R-sq	0.12	0.25	0.11	0.22

Notes: Observations are at the sector-country-year level. Links with Chinese suppliers are excluded in the calculation of age. Standard errors clustered at the sector (HS2) level are reported in the parentheses. Significance at *10%, **5%, ***1% levels.

Regression Specification (Importer-exporter-pair level)

$$Drop_{mnit} = \eta M_{it}^{Ch} + \phi M_{it}^{Ch} \times h_i + \alpha_m + \alpha_n + \alpha_i + \alpha_t + \zeta_{mnit},$$

- where m, n, i, and t stand for importing firm, exporting firm, sector (HS2), and year, respectively. $Drop_{mnit} = 1$ if the trade relationship between firms m and n is discontinued between $t-1$ and t, 0 otherwise.
- For arms-length imports: $\eta > 0; \phi?$
- For related-party imports: $\eta < 0; \phi?$

Results - Chinese Trade Shocks and Relationship Termination

Drop rates and the Chinese shock

Dep Var	Drop_ijct					
	All		Related Party		Arms-Length	
Chinese shock (at sector-year level)	0.079***	0.267***	-0.036**	0.117	0.096***	0.243***
	(0.013)	(0.084)	(0.018)	(0.117)	(0.015)	(0.093)
Chinese shock x						
Capital Intensity		-0.064***		-0.032		-0.057***
		(0.016)		(0.021)		(0.017)
Skill Intensity		-0.067**		0.005		-0.073***
		(0.027)		(0.005)		(0.030)
Fixed Effects	importing firm, exporting firm, sector and year					
Observations	4,773,463	4,773,463	914,781	914,781	3,858,682	3,858,682
Adjusted R-squared	0.41	0.41	0.56	0.56	0.37	0.37

Notes: Observations are at the buyer-seller pair level. Standard errors, clustered at the importer level, are reported in the parentheses. The sample excludes mineral products; obs. with missing measures for skill and capital intensity, and country rule of law and political stability. Significance at *10%, **5%, ***1% levels.

Conclusions

- One of the first to examine how relational contracts play a role in shaping international trade.
- Develop a model to show that low-interest rates and an intermediate level of headquarter intensity are favorable for relational contracts to alleviate contractual problems.
- Enrich existing models on intra-firm trade, in particular, Antràs and Helpman (2004), to study when integration and relational contracts are complements.
- Preliminary evidence from US importer-exporter matched transaction-level data confirm the model predictions, and show that increasing supply of Chinese input producers may explain the upward trend of imports within firm boundary.
- On-going research: explore the correlation between the dynamics of trade value and the **future** value of a relationship.

APPENDIX

Non-zero Outside Options

- M chooses the (privately) optimal level of m:

$$\frac{1}{2}\left(\frac{\partial R}{\partial m} - (1-\epsilon_M)\frac{\partial R}{\partial m}\right) + (1-\epsilon_M)\frac{\partial R}{\partial m} = w_S.$$

- H chooses the optimal level of h, which satisfies the following

$$\frac{1}{2}\left(\frac{\partial R}{\partial m} - (1-\epsilon_H)\frac{\partial R}{\partial h}\right) + (1-\epsilon_H)\frac{\partial R}{\partial h} = w_N.$$

Incorporating the Model into the Melitz Framework

- Embed the above relational contracting model in the PE version of Melitz (2003).
- H chooses the optimal production mode to maximize joint surplus:

$$\pi^*(B,\eta,\theta) = \max_{k\in\{RO,SO,RV,SV\}} r^{-1}\pi_k(B,\eta,\theta).$$

- Imposing Pareto distribution of firm productivity, the share of intra-firm trade in spot equilibrium:

$$Sh_{SV} = \frac{\Gamma_V/\Gamma_O}{\left[\left(\frac{\widetilde{\theta}_V}{\widetilde{\theta}_O}\right)^{\kappa-\sigma-1} - 1\right] + \Gamma_V/\Gamma_O},$$

where

$$\frac{\widetilde{\theta}_V}{\widetilde{\theta}_O} = \left[\left(\frac{f_V}{f_O} - 1\right) \times \frac{1-(w_N/w_S)^{-(\sigma-1)(1-\eta)}/\Gamma_O}{\Gamma_V/\Gamma_O - 1}\right]^{\frac{1}{\sigma-1}},$$

- and κ captures the dispersion of the productivity distribution.