Organizational Industrial Organization

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IOEA - May 2018

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Organizational Economics and Industrial Organization

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- In the IO of the last forty years, firm and industry behavior deviates from the Arrow-Debreu ideal mainly because of imperfections in the market
- Imperfect competition is only one source of distortion. So is the makeup of the industry's constituents, i.e., the internal organization of firms
- The time has come (back) for an industrial organization that is organizational

Organizational Economics and Industrial Organization

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  - recent empirical work in industries as diverse as airlines and concrete emphasizing ownership structure's relation to prices and performance
  - Public discussion and events: Enron, MCI, British rail, Continental 3407, lead toys, CEO pay, banking crisis

Questions for an "Organizational Industrial Organization"

- What deviations from the Arrow-Debreu benchmark can imperfections within firms be expected to generate?
- Do these departures differ from those generated by imperfectly competitive product markets? (OE helps IO)
- Two-way street: organization is endogenous, so the market could be expected to influence organization (IO helps OE)
- Start with perfect competition so that market imperfections don't cloud issues

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- What deviations from the Arrow-Debreu benchmark can imperfections within firms be expected to generate?
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- Start with perfect competition so that market imperfections don't cloud issues
  - This leaves open an important issue (future research) namely the structure of competition is itself endogenous to organizational design (e.g., firm boundaries)

Lecture Outline

- A perfectly competitive industry with organizational firms
- Some evidence
- Policy application:

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- Current work: the joint determination of ownership and market structure

Literature (1)

Legros and Newman, "Incomplete Contracts and Industrial Organization: A Survey"

- Incomplete contracting/ownership: Grossman-Hart (1986); Hart-Moore (1990); Aghion-Bolton (1992)
- Integration as a solution to coordination problems: Alchian-Demsetz (1972), Hart-Moore (2005); Mailath-Postlewaite-Volke (2002); Hart-Holmstrm (2002/10)
- X-inefficiency: Leibenstein (1966), Bertrand-Mullainathan (2003)

Literature (2)

Effects of markets on organizations and of organizations on markets

- Incentives: Hart (1983); Schmidt (1997)
- Monitoring in competitive settings: Legros-Newman (1996)
- Firm boundaries in competitive supplier markets: Legros-Newman (2008)
- Market foreclosure and firm boundaries: Bolton-Whinston (1993)
- Make-Buy decisions with monopolistic competition: Grossman-Helpman (2002)
- Hierarchies: Calvo-Wellisz (1979) and Garicano (2000)
- Delegation and imperfect competition: Marin-Verdier (2008), Alonso-Dessein-Mathouschek (2008)

Literature (3)

Empirics

- Industry studies on vertical/lateral integration
  - Airlines: Forbes-Lederman (2009, 2010)
  - Cement and Ready-Mix Concrete: Hortaçsu and Syverson (JPE 2007)
- Cross Industry studies (e.g. Aghion, Griffith, Zilibotti, 2006)
- Cross-country studies
  - Other aspects of organization: reporting structures (Guadalupe-Wulf, 2011); management practice, delegation/decentralization (Bloom, Sadun, vanReenen, 2010, 2012)
  - Vertical Integration: Acemoglu, Johnson, Mitton (2010); Alfaro et al. (2012)

"A Price Theory of Vertical and Lateral Integration"

Patrick Legros and Andrew Newman

- Look at an "incomplete contracts" model in which product market prices interact with organizational design decisions in a perfectly competitive environment
- Prices affect organizational design by affecting the trade-off between financial and private motives of managers
- Embed this organizational model into a standard supply-demand framework

What We Learn

- Determinants of organizational choices are often to be found *outside* the firm (i.e. in the market)
- In particular, **demand matters** as well as liquidity and surplus division
- Consumers — who are usually absent from organization theory — are affected by organizational choices
- An organizational IO can tell us whether the market selects "efficient" organizations.

Ingredients of a Model

- Efficient production requires coordination; managers disagree on which way is best (Hart-Holmström, 2002/10)
- Non-integration: managers make their decisions separately, and this may lead to inefficient production
- Integration: brings in an additional party ("HQ") who has only monetary motives and will therefore maximize the enterprise's output by enforcing a common standard
- Supplier and product markets are perfectly competitive

Results

- Relation between price and organization embodied in supply curve (the "OAS"): non-integration at low prices, integration at higher prices
- Changes in price lead to *coordinated* changes in organization: e.g., an increase in demand may lead to a flurry of integration, i.e., a "merger wave."
- Shocks to some firms (e.g., productivity) *propagate* and lead to reorganization of "unshocked" firms
- These organizational effects will in turn feed back to quantity, price, and welfare: possibly too little integration at low prices

Technology

- Two types of supplier: U and D; production requires one of each be paired
- Economy has large numbers of each type, with U's outnumbering the unit measure of D's
- Large number of HQ's (more than the number of D's)
- For each provider, a decision is rendered indicating the way in which production is to be carried out.
- decision $u \in [0, 1]$, and D decision $d \in [0, 1]$
- Minimizing output loss requires decisions made in each part of the firm should coincide: output is
  - 1, with probability $1 - \ell(u, d)$
  - 0, with remaining probability
  - outcomes independent across firms
  - For now, we take $\ell(u, d) = (u - d)^2$

Managers

- Each supplier run by a risk-neutral manager
  - U manager's payoff is $y - u^2$: "0" is best
  - D manager's payoff is $y - (1-d)^2$: "1" is best
  - $y \geq 0$ is income
  - cost functions reflect differences in the technology managers run, differences in conduct workforces find convenient, or disagreement over best ways to manufacture or market product (see Hart-Holmström, 2010 for discussion/motivation)
- U and D managers have zero cash endowments
- HQ's have zero opportunity cost, preferences y and cash endowments $h > 0$

Contracts

- Decisions are not contractible
- Costs are private and non-contractible
- Right to make decisions can be reassigned by contract (sale of assets)
- Output generated by the firm is contractible (for monetary incentives)
- Managers bear the cost of decisions even if they don't make them

Tradeoffs

Change of organization $\Longrightarrow$ change in incentive problem

- Non-integration: managers undervalue coordination, overvalue private costs.
- Integration: HQ undervalues managers' costs, overvalues coordination.

Markets

Supplier Market

- D managers match with U managers;
- U's are on the long side and D's are on the short side
- HQ market

Contracts

- Ownership structure of the relationship: nonintegration (N) or integration (I)
- Shares $\mathbf{s}$ (endogenous) of managerial revenue P accruing to manager U, D and HQ if relevant.
- Ex-ante transfers π_U, π_D from HQ to U, D.

Product Market

- Competitive; demand function is $D(P)$

Steps in constructing organizational industry equilibrium

Fix $\underline{u}_U$, P

Focus on a single U-D pair

- For each organization N, I, find s such that the Nash equilibrium outcome maximizes D's payoff given $\underline{u}_U$.
- Select the organization that maximizes D's payoff.

Derive industry equilibrium

- Stable match of U's and D's and a market clearing price P.
- For each P derive industry supply $S(P)$.
- Set $S(P) = D(P)$ to clear the product market.
- Yields organizational choices, as well as price and quantity.

Integration: Rigidity and Transferability

Conditions on Contracting

- HQ *must have a positive share*: "disinterested HQ" not possible since she could renegotiate her share once she has control of the firm decisions
- Debt can be used as long as HQ contributes at least some cash.

HQ's decisions and managers' payoffs

- HQ's payoff $s_H P(1-(u-d)^2)$; thus $u=d$ and $Q^I=1$.
- $u=d=1/2$ is Pareto optimal among such decisions
- Managerial payoffs fully transferable by $\mathbf{s}$ and $\pi=(\pi_U,\pi_D)$:

$$u_U^I(\mathbf{s},\pi,P)=s_U P-1/4+\pi_U,\ u_D^I(\mathbf{s},\pi,P)=s_D P-1/4+\pi_D$$

$$\pi_U+\pi_D=s_H P \Rightarrow W^I(P)=P-1/2$$

Nonintegration: Flexibility and Partial Transferability

Now $s_U + s_D = 1$
U chooses u to maximize $s_U P(1-(u-d)^2) - u^2$
D chooses d to maximize $s_D P(1-(u-d)^2) - (1-d)^2$
The unique Nash equilibrium is

$$u^N = \frac{s_U P}{1+P} \; ; \; d^N = \frac{1+s_U P}{1+P}.$$

Thus

$$d^N - u^N = \frac{1}{1+P},$$

and expected output is

$$Q^N(P) = 1 - \frac{1}{(1+P)^2}$$

independent of $\mathbf{s}$ and increasing in P.

Nonintegration: Flexibility and Partial Transferability

Managers' total payoff is not fully transferable

$$u_U^N(\mathbf{s}, P) = Q^N(P) s_U P - s_U^2 \left(\frac{P}{1+P}\right)^2$$
$$u_D^N(\mathbf{s}, P) = Q^N(P) s_D P - s_D^2 \left(\frac{P}{1+P}\right)^2.$$

Total payoff $W^N(\mathbf{s}, P)$ maximized at $s_A = s_B = 1/2$, minimized at $s_A = 0$ or $s_A = 1$.

Comparing Organizations

Total Managerial Payoff Comparison

$$W^N\left(\frac{1}{2}, P\right) > W^I(P)$$

but $W^N(0, P) > W^I(P)$ only if $P < 1$.

Relative Positions depend on price

- For *low* (< 1) prices non-integration dominates,
- For *higher* (> 1) prices, the two frontiers cross.

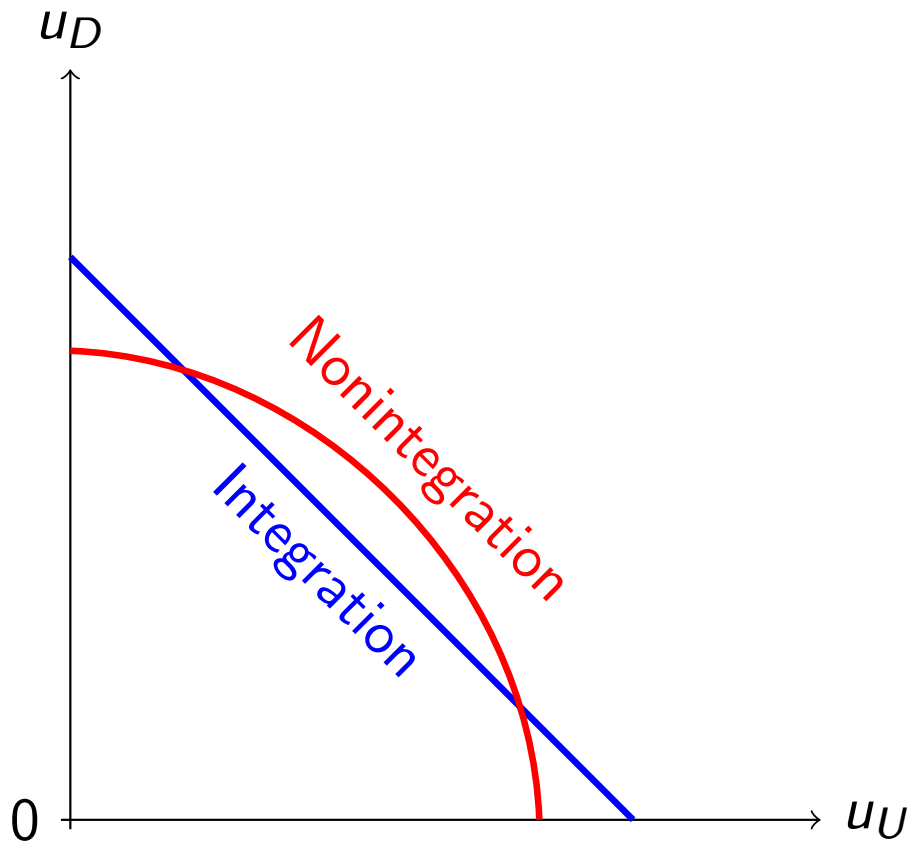
Case $\underline{u}_U = 0$

Optimal to have $s_U = 0$, $s_D = 1$: D gets $W^N((0,1), P) = \frac{P^2}{1+P}$ if $P < 1$ and gets $P - \frac{1}{2}$ if $P > 1$.

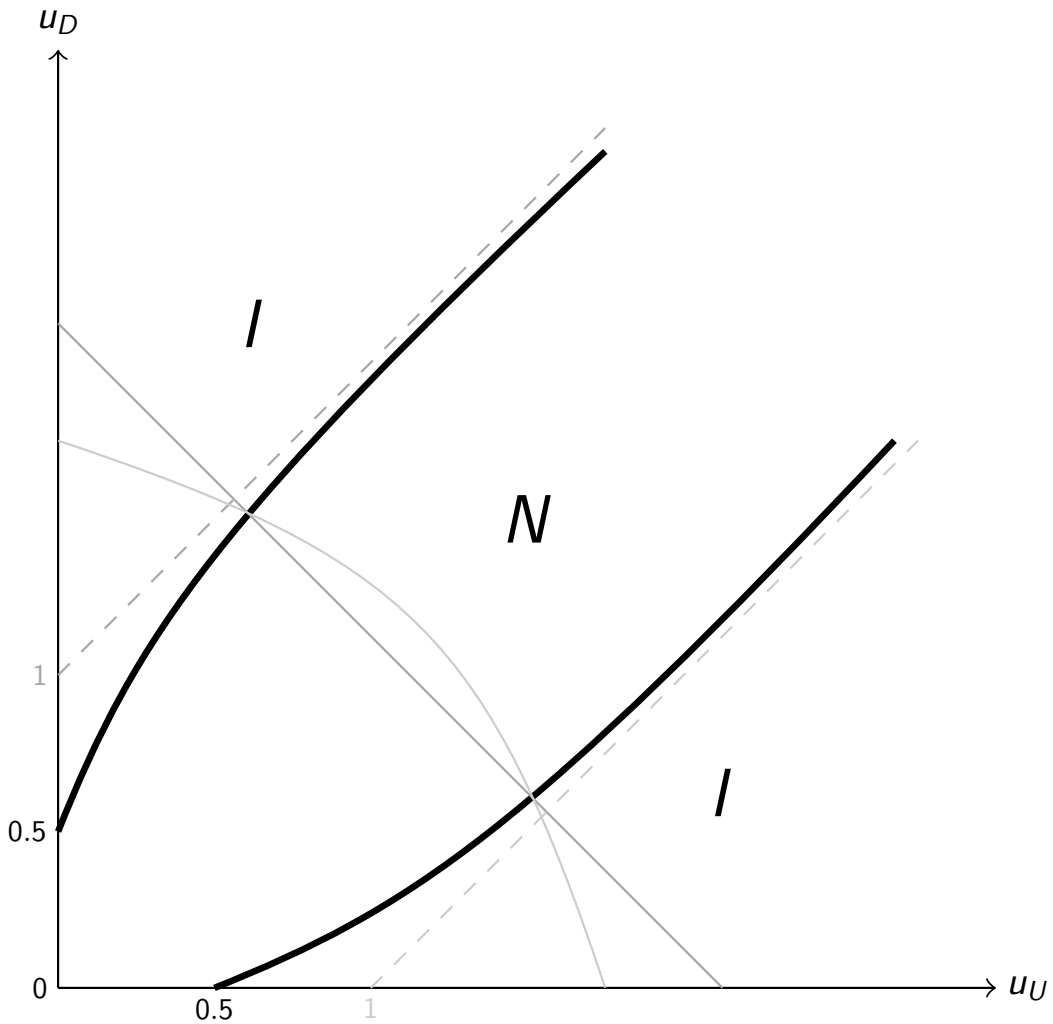
Typical Frontiers for High Prices

Choice of Organization: a function of A's payoff

The organizational choice depends on the "terms of trade" in the supplier market



Surplus Division and Integration



"The Organizationally Augmented" Supply Curve

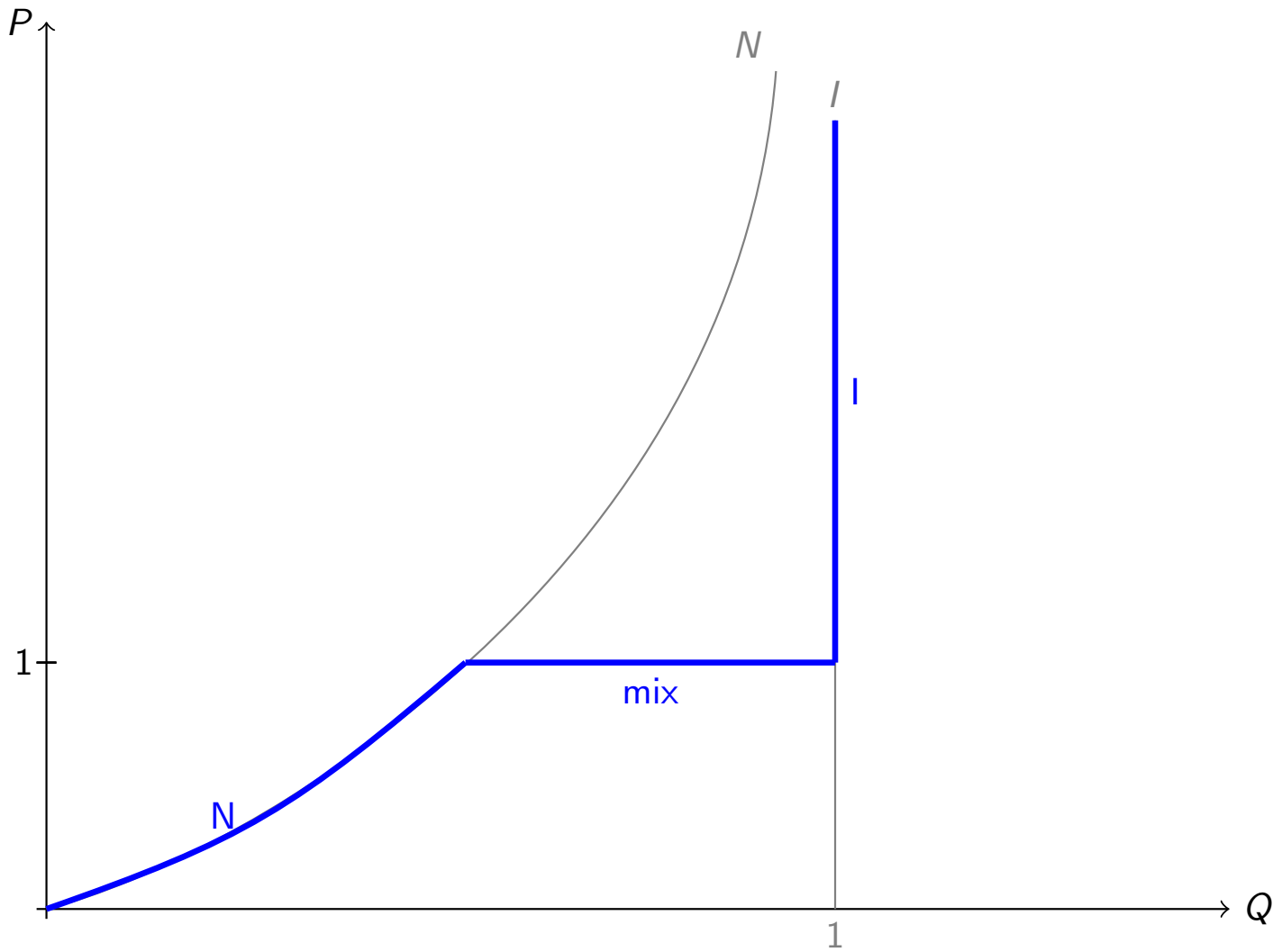
Assume $\underline{u}_U = 0$. Let α be the fraction of integrated firms; total supply at price P is then

$$S(P, \alpha) = \alpha \underbrace{(1)}_{\textit{integration}} + (1-\alpha) \underbrace{\left(1 - \left(\frac{1}{1+P}\right)^2\right)}_{\textit{nonintegration}},$$

where

$$\alpha = \begin{cases} 0 & \text{if } P < 1 \\ 1 & \text{if } P > 1 \end{cases}$$

Supply



Application: Organizational Dampening of Technological Shocks

- Observation: if enterprise success yields R instead of 1, integrate when $RP = 1$, hence $P = 1/R$.
- Consider technological shock in which $z \leq 1$ enterprises produce R instead of 1:

$$\Sigma(P) = \begin{cases} (1-z)Q^N(P) + zRQ^N(RP) & \text{if } P \leq 1/R \\ (1-z)Q^N(P) + zR & \text{if } P \in (1/R, 1) \\ 1 - z + zR & \text{if } P \geq 1 \end{cases}$$

- Compare two cases: all firms ($z_0 = 1$) with small shock (R_0) or few firms ($z < 1$) with large shock ($R_1 > R_0$), keeping the average productivity the same.

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$$zR_1 + 1 - z = R_0 \Leftrightarrow z = \frac{R_0 - 1}{R_1 - 1}$$

Consider an isoelastic demand $P^{-\epsilon}, \epsilon > 1$

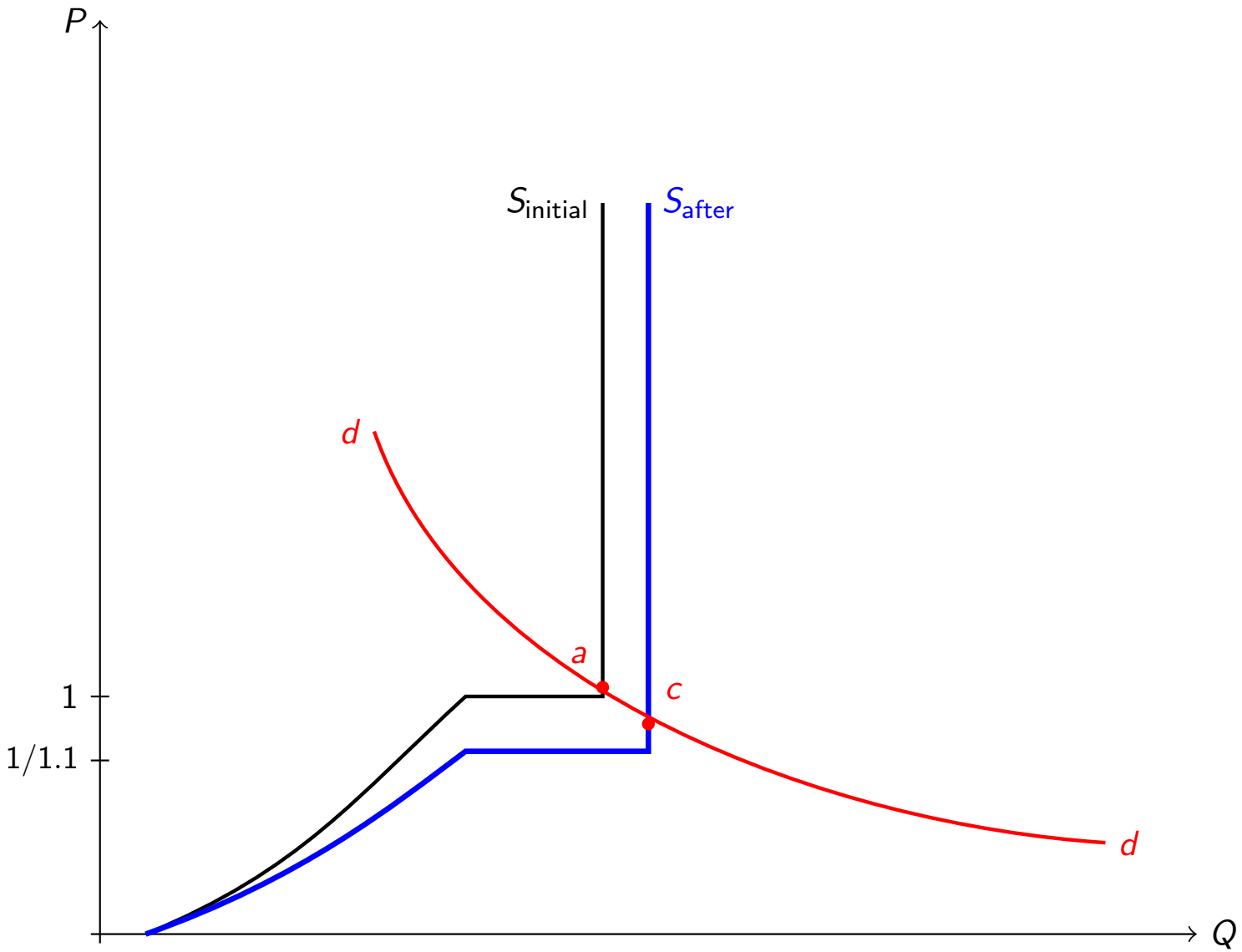
Widespread Small Shock

Reorganization

- Initial equilibrium is at $P = 1, Q = 1$ (all firms are integrated)
- After the shock, $R_0 > 1$,
  - the new equilibrium is at $P_0 = 1/R_0^{(1/\epsilon)}$
  - this is greater than $1/R_0$ (since $R_0 > 1$ and $\epsilon > 1$)
- Hence all firms stay integrated
- total output is R_0: **Perfect "pass-through" of the aggregate productivity shock**

Application: Technological Shocks

Uniform 10% Productivity Increase



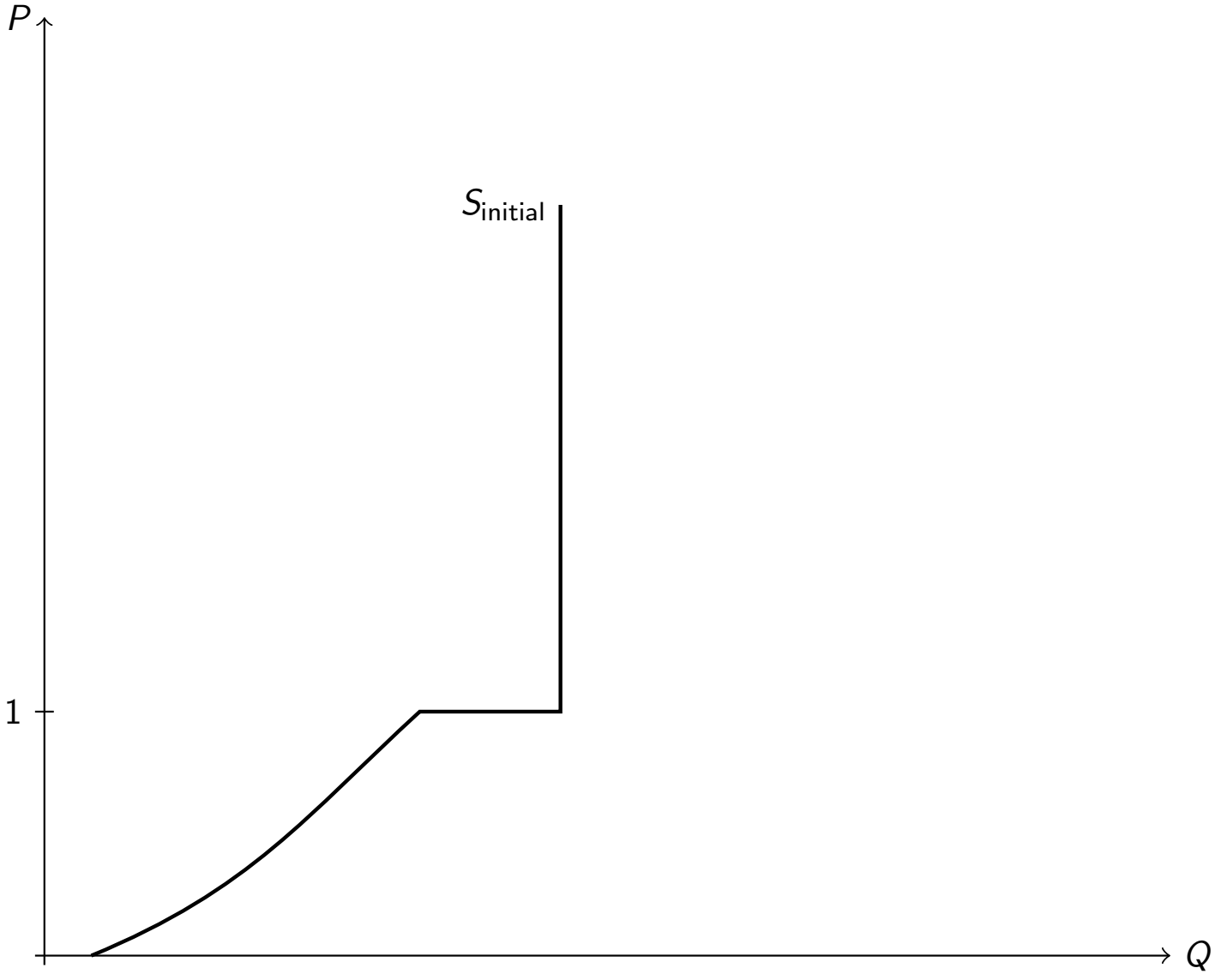
Concentrated Large Shock

Reorganization of *unshocked* firms

- Since the price decreases below 1 (more supply!), *unshocked firms shift to non-integration*
- The total supply is no more than R_0, hence price always at least $1/R_0 > 1/R_1$
- Hence all shocked firms *stay integrated*
- Total output is $zQ^N(P) + 1 - z < R_0$: dampening effect of re-organization
- Under some conditions ($4R_0 + z < 5$) there is complete absorption: no increase in industry output!

Application: Re-Organizational Dampening

10% of Firms Double Productivity



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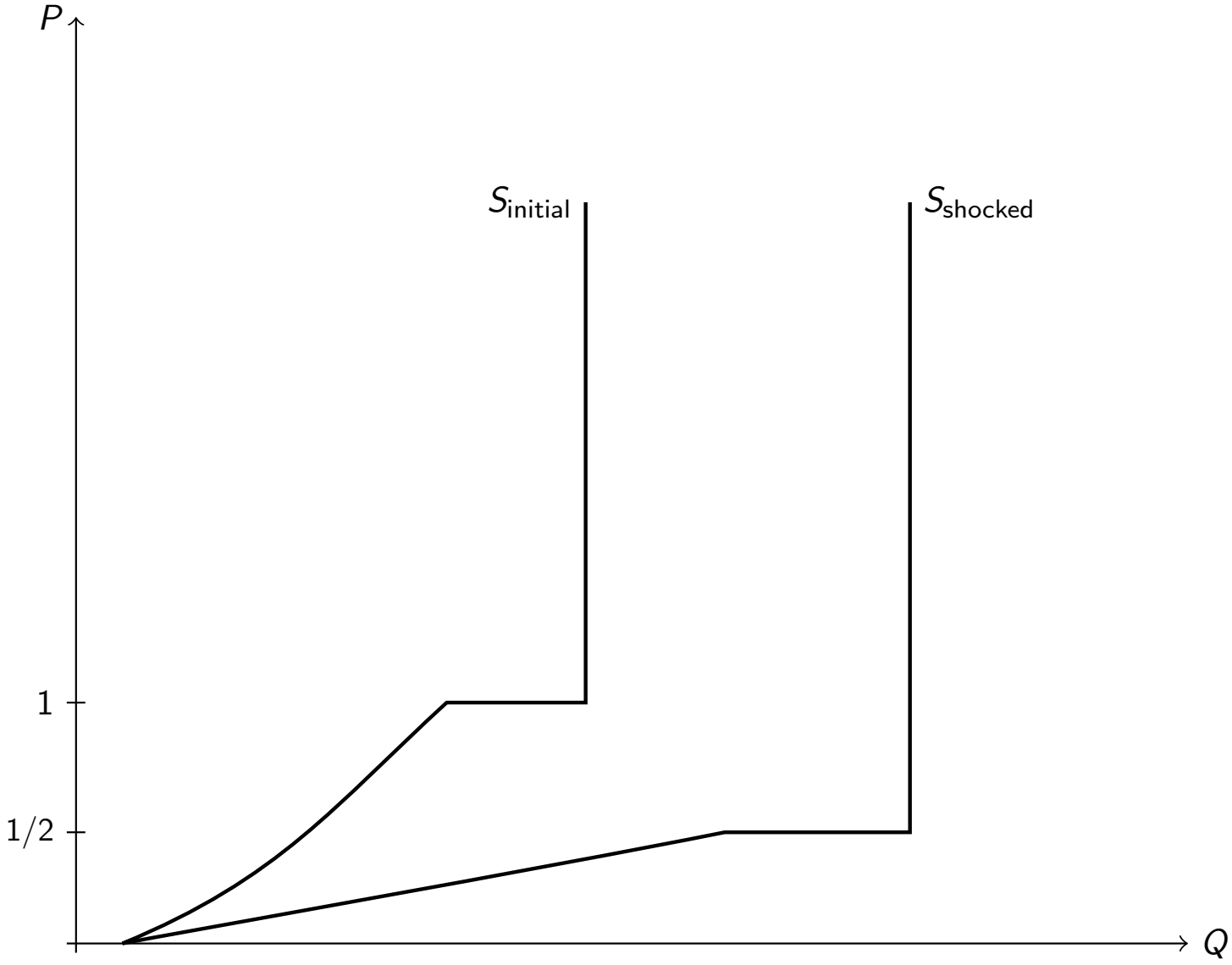

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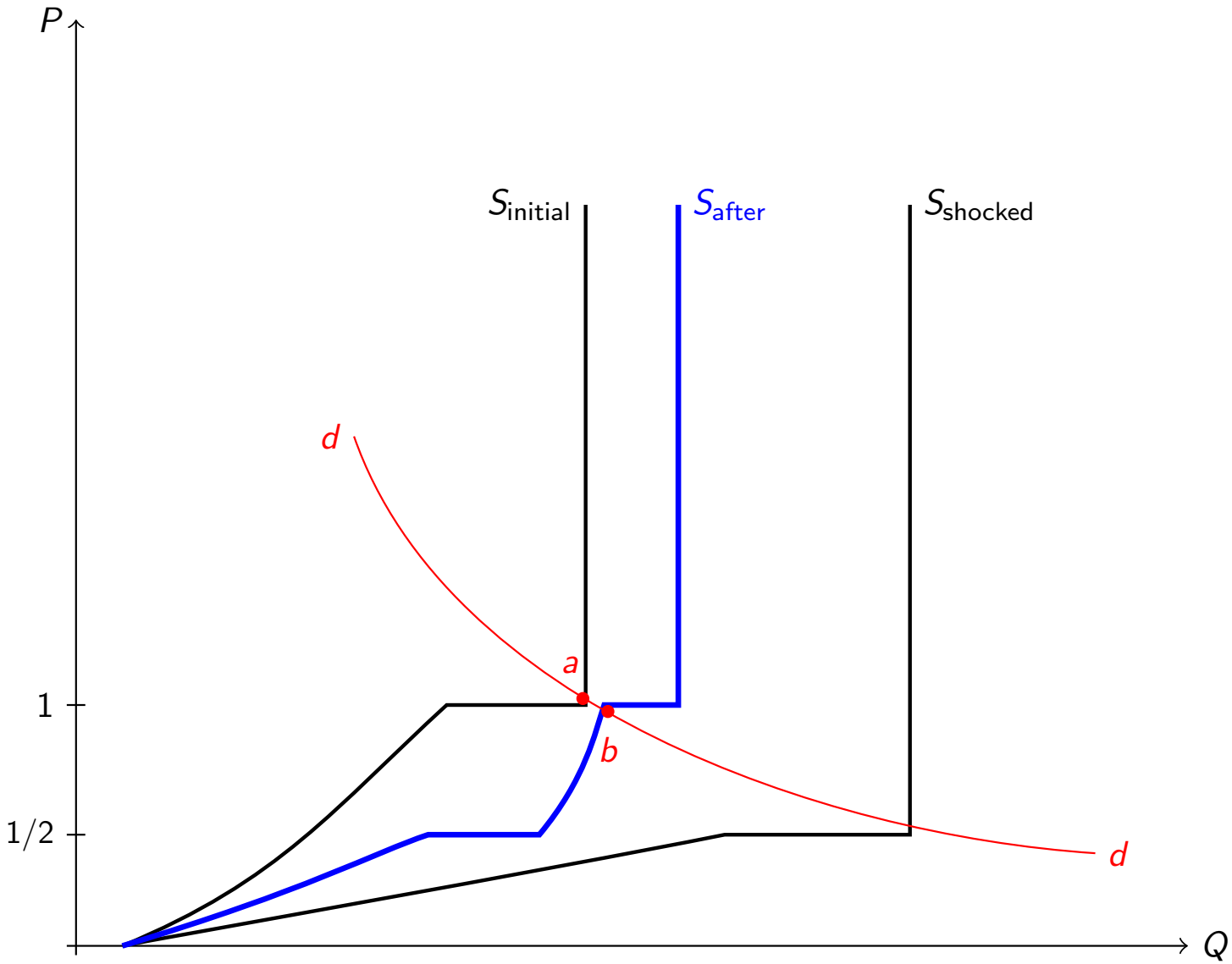


Summary

- A firm experiencing a technological shock may not re-organize
- A firm that undergoes a re-organization need **not** have experienced a change in technology
- **Re-organizational dampening** may substantially absorb the aggregate benefit of heterogenous technological change

Welfare

Definition

An equilibrium is ownership efficient if it is not possible to increase *total* welfare by changing firms' ownership structures.

Welfare

Second-Best Efficiency

Costs

- With non-integration, expected output is $Q = 1 - (1 - b)^2$, hence the managerial cost is $c(Q) = \left(1 - \sqrt{1 - Q}\right)^2$
- For manager B, the solution to $\max_b (1 - (1 - b)^2)r - b^2$ is then the same as the solution to $\max_Q Qr - c(Q)$.
- It follows that along the graph $\left(r, Q^N(r)\right)$, we have $r = c'(Q^N(r))$
- For integration, let $r = 1$; raising the probability of integrating by $d\alpha$ raises the expected output by $(1 - \frac{3}{4})d\alpha$ and the cost by $(\frac{1}{2} - \frac{1}{4})d\alpha$, so $c'(Q) = 1$

Welfare

Second-Best Efficiency

When managers have full residual claim on revenues, equilibria are ownership efficient. Supply and marginal cost schedules coincide in equilibrium.

Managerial Firms

- Managers internalize only a fraction γ of the firm's profits
- Output if price is P under non-integration is $Q^N(\gamma P)$
- Main consequence: price-expected output schedule does not coincide with marginal cost anymore.

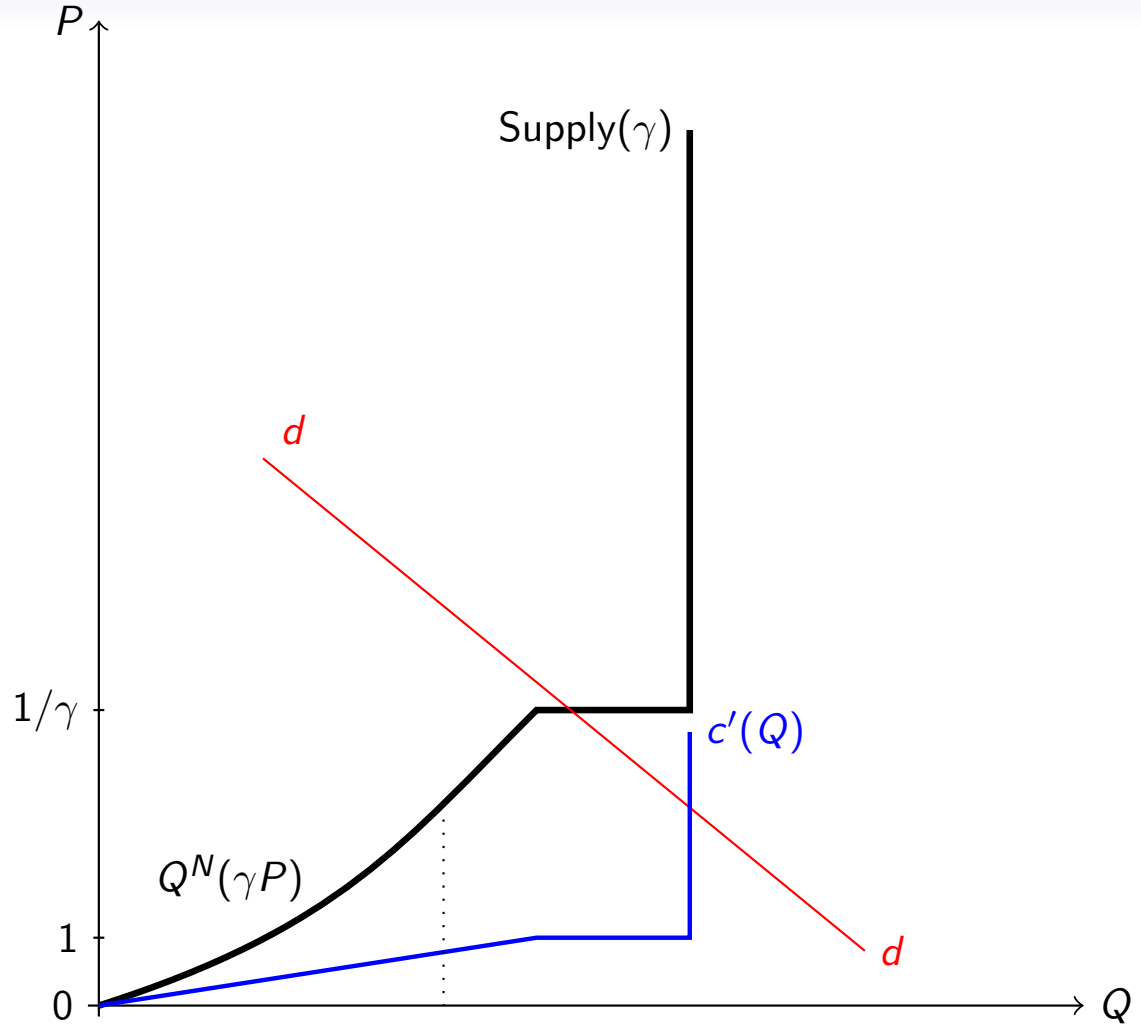
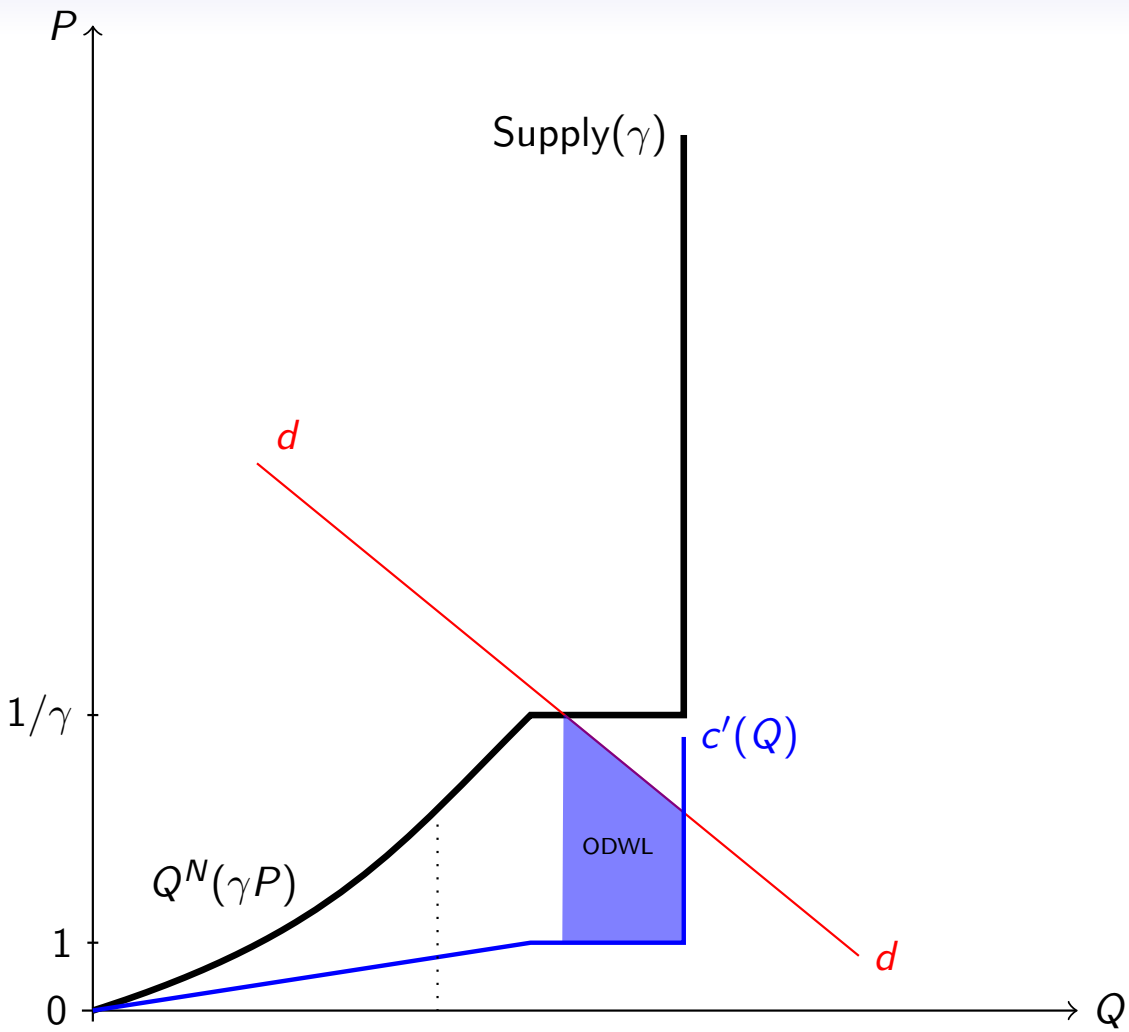


Figure: Ownership Inefficiency when Managers have a Partial Claim on Revenues



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Proposition

Suppose that $\gamma < 1$. Then there is a generic set of demands leading to equilibria that are ownership inefficient

- In fact, heterogeneity implies ownership inefficiency
- The set of inefficient equilibrium prices is an interval

Demand Elasticity

- The *more* elastic market demand is, the *larger* is the ODWL
- Opposite relationship with market power: there the *more* elastic the *lower* the DWL.

Evidence: Forbes-Lederman (2009, 2010)

- Papers srtudy ownership relationships between major U.S. carriers (D's) and regional airlines (U's).
- Integration is more productive
- Heterogeneity of ownership structures
- Integration more likely on routes that are more valuable (i.e. higher P)
- Airline integration appears to be partly **demand driven** (movement along the OAS)

Evidence: McGowan (2017)

- Relationships between coal processing plants and coal mines in Eastern U.S.
- Documents substantial productivity benefits from vertical integration
- About 9% of mines are vertically integrated with processors
- Two major coal regions for thermal coal, East and West. Mining is less costly in West.
- Major railroad deregulation in 1980 greatly reduced marginal cost of transporting coal around the U.S.
  - small effect on delivered coal prices in the West – power plants there already had access to cheaper western coal
  - Large (32%) drop in coal prices in East
- Background upward trend in vertical integration of coal processing and mines through the 1980s.
- By the end of the 1980s, vertical integration of coal processors and coal mines rose 33% less in the East than in the West

Evidence: Alfaro et al. (2016), "Do Prices Determine Vertical Integration?"

- Examine the price-integration relationship in a large cross section of industries and countries
- In contrast to the value theory of integration illustrated by the above model (higher prices $\rightarrow$ more integration), IO has tended to be concerned with the *effect* of VI *on* prices:

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  - It lowers them ("efficiency theories")
  - It raises them ("foreclosure theories")
- Empirical challenge for the value theory of integration: find sources of price variation that are exogenous to firms' VI decisions

Empirical Strategy: MFN Tariffs

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- MFN tariff bounds vary substantially both across sectors within countries and across countries within sectors.
- Set in long rounds of multilateral trade negotiations (most recently, the Uruguay round in 1994): governments commit not to exceed agreed tariff bounds, which can only be renegotiated in a new round.
- MFN tariffs are persistent, significantly more so than integration choices (firm data from 2004).
- They must be applied in a non-discriminatory manner to imports from all countries, which severely limits negotiators' flexibility to respond to lobbying; instead, if governments respond, they resort to other measures for regulating imports, such as anti-dumping and countervailing duties.

Overview of Results

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- The magnitude is sizable: implied price elasticity of VI between 0.4 and 2.1.
- The positive effect of tariffs on firm-level vertical integration is robust to
  - Including sector-, country-, and sector-country FE, as well as standard drivers of VI

Basic Logic

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  - Price-taking supply chain solves $\max_{q,n} Pq - C(q, n) - h(n)$
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  - Optimal q and therefore optimal n increase with P

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  - If $C(\cdot,\cdot), h(\cdot)$ increasing in q, and $C_q(\cdot,\cdot)$ decreasing in n, then profit is supermodular in the choices (n,q) and has increasing differences in (P,q)
  - Optimal q and therefore optimal n increase with P
- To verify this prediction, we could simply regress VI measures on industry prices

Basic Logic

- Reduced-form extension of the binary integration effect to a continuous one:
  - Price-taking supply chain solves $\max_{q,n} Pq - C(q,n) - h(n)$
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  - Optimal q and therefore optimal n increase with P
- To verify this prediction, we could simply regress VI measures on industry prices
- Problem: distinguishing this theory (higher prices $\rightarrow$ more vertical integration) from market-foreclosure theories (vertical integration $\rightarrow$ higher prices)
- Trade policy generates an exogenous source of price variation: import tariffs affect prices and are unlikely to be driven by firms' vertical integration decisions

- In a an import-competing industry with price-taking firms in a small open economy, an ad-valorem tariff t increases the domestic price to $P = (1 + t)P^*$, where $P^* =$ the world price; higher t implies firms choose higher n

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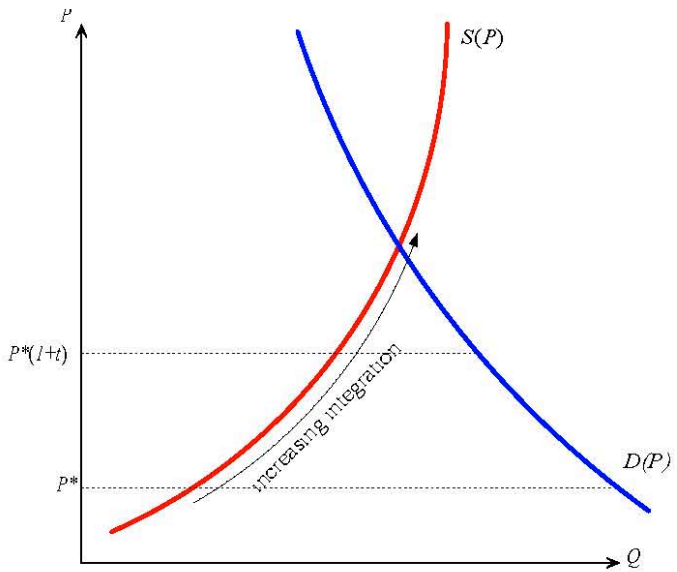

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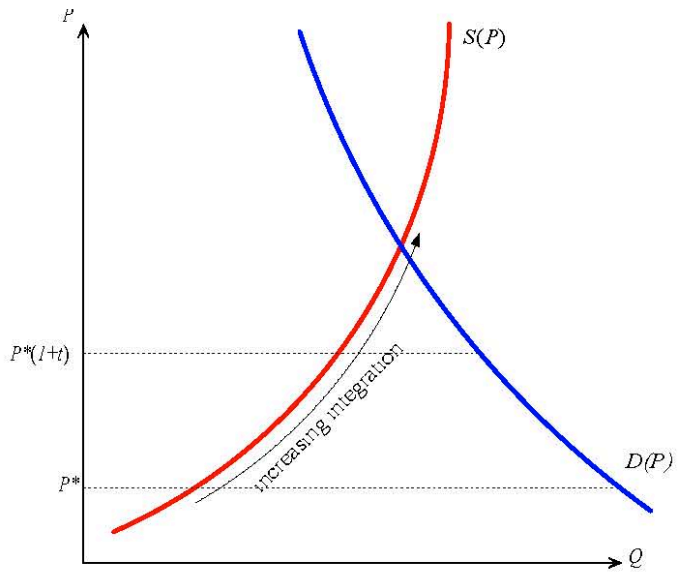

- Logic for non-competitive industry is similar, though "pass-through" issues imply different (usually smaller) effect

From Tariff Effects to Price Effects

- Empirical analysis will yield estimates of the tariff elasticity of vertical integration, but what we are really interested in is the effect of product prices on integration.

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- Import tariffs are expressed in ad-valorem terms: allows deriving the price elasticity of integration (without knowing the price).
  - Tariff elasticity of integration: $\beta = \frac{\partial n}{\partial t}\frac{t}{n}$
  - Tariff elasticity of domestic price: $\frac{\partial P}{\partial t}\frac{t}{P} = \frac{t}{1+t}$
  - Price elasticity of integration: $\frac{\partial n}{\partial P}\frac{P}{n} = \beta\frac{1+t}{t}$
- For the average tariff of 5%, the price elasticity exceeds the tariff elasticity by twentyfold

Data: The WorldBase Dataset

- Database compiled by Dun and Bradstreet, providing plant-level information on public and private firms operating in more than 200 countries and territories
  - Primary industry and up to 5 secondary industries (at 4-digit SIC) of each plant
  - Information on ownership: legal status (domestic and global parent)
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  - Location information (country, state, city)
- Unit of analysis: firms (join plants via parent or headquarters), though most firms are single-plant
- Focus on manufacturing; exclude non-WTO countries, low observations, firms with < 20 employees, MNEs

The Vertical Integration Index

- Combine firms' production activities with data from US input-output tables (Fan and Lang, 2000)
- Firm-level vertical integration indices: fraction of value-added from inputs used in the production of a firm's final good that can be produced in house.

$$\text{VI}_{f,k} = \sum_i IO_{ik} * \mathbb{I}_i^f$$

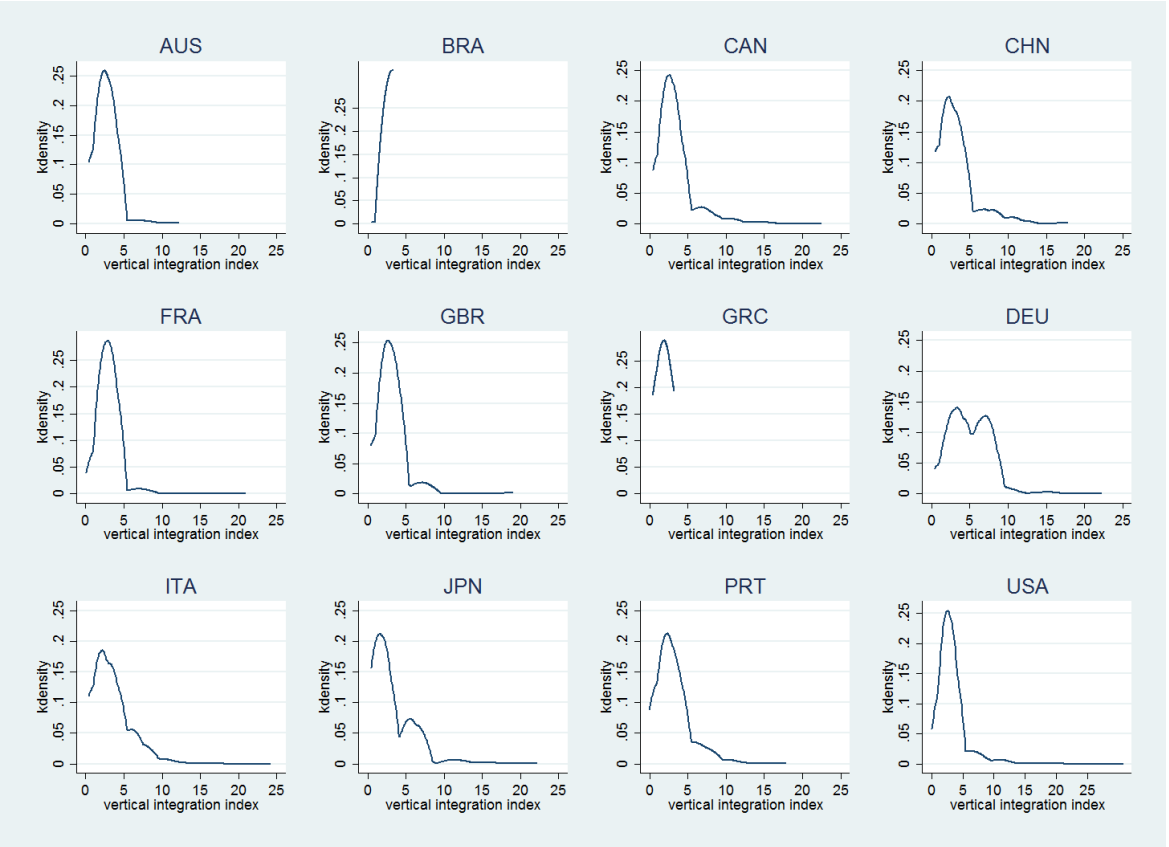
Example: a Japanese shipbuilder f, k (k = SIC 3731) has two secondary activities, Fabricated Metal Structures (SIC 3441) and Sheet Metal Work (SIC 3444). IO_{ik} coefficients are:

		Output (k)
		Ships
Input (i)	*Ships*	0.0012
	Fab. Metal	0.0281
	Sheet Metal	0.0001

Then $\text{VI}_{f,k} = \mathbf{0.0294}$.

Heterogeneity in VI

Ready-Mix Concrete:



Tariffs and Vertical Integration

- **Prediction 1** VI increases with MFN tariff:

$$V_{f,k,c} = \beta_0 + \beta_1 T_{k,c} + \beta_2 \mathbf{X}_{f,k,c} + \delta_k + \delta_c + \epsilon_{f,k,c}$$

- **Prediction 2** The effect of MFN tariff on VI is larger for firms that only sell domestically:

$$V_{f,k,c} = \gamma_0 + \gamma_1 T_{k,c} \text{x} \mathbb{D}_f + \gamma_2 T_{k,c} + \gamma_3 \mathbb{D}_f + \gamma_4 \mathbf{X}_{f,k,c} + \delta_k + \delta_c + \epsilon_{f,}$$

$$V_{f,k,c} = \phi_0 + \phi_1 T_{k,c} \text{x} \mathbb{D}_f + \phi_2 \mathbb{D}_f + \phi_3 \mathbf{X}_{f,k,c} + \delta_{k,c} + \epsilon_{f,k,c}$$

- $V_{f,k,c} = \log(1 + \text{VI}_{f,k,c})$; $T_{k,c} = \log(1 + \text{MFN Tariff}_{k,c})$; $\mathbb{D}_f$ is a domestic dummy

Tariffs and Vertical Integration

	(1)	(2)	(3)	(4)	(5)
$Tariff_{k,c}$	**0.0203*** **	**0.0202*** **	0.0034	0.0035	
	(0.0061)	**(0.0060)**	(0.0088)	(0.0086)	
$Domestic_f$			-0.0926***	-0.0923***	-0.0880***
			(0.0108)	(0.0109)	(0.0092)
$Tariff_{k,c}$× $Domestic_f$			**0.0214*** **	**0.0212*** **	**0.0189*** **
			(0.0054)	**(0.0054)**	**(0.0046)**
$Capital\ Intensity_k$		0.0322**		0.0321**	
× $Financial\ Development_c$		(0.0142)		(0.0144)	
$Capital\ Intensity_k$		-0.0833		-0.0823	
× $Legal\ Quality_c$		(0.0564)		(0.0573)	
# Observations	196,586	196,586	196,586	196,586	196,586
# Sectors	386	386	386	386	
R^2	0.117	0.117	0.119	0.119	0.002
Sector FE	YES	YES	YES	YES	NO
Country FE	YES	YES	YES	YES	NO
Sector-Country FE	NO	NO	NO	NO	**YES**

Interpretation and Extensions

- Tariff elasticity estimate of 0.02 translate into price elasticity of about 0.4 at the mean tariff (=5%)

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- Tariff elasticity estimate of 0.02 translate into price elasticity of about 0.4 at the mean tariff (=5%)
- Restrict sample to "competitive sectors" to control for possible confounding effects of reduced competition on integration
  - homogeneous goods
  - low concentration
  - foreign presence
  - large numbers of firms
  - low tariff rates ¡ 10%
- Result: *larger* estimates (0.025-0.098), implying price elasticities up to about 2.

Some Policy Implications: "Demand-Driven Integration and Divorcement Policy"

- A regulator observes a trend increase in consumer prices and vertical integration. What should she do?

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- A regulator observes a trend increase in consumer prices and vertical integration. What should she do?
- Armed with the standard IO tools, it might be natural to regard the price increase as having been caused by vertical integration (foreclosure)
- Regulating integration (forcing divestitures) might be a sensible pro-competitive response

Does It Work?

Not always: British Beer

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What the Ale Happened?

- MMC assumed **integration** $\rightarrow$ **prices** and didn't take account of the possibility of the reverse causality **prices** $\rightarrow$ **integration**
- The model we have been considering would have predicted rising costs and falling profits (and industry opposition)
- This leaves out an important element: market power and the possibility of collusion
  - Indeed, the MMC was also concerned that vertical integration was facilitating collusion
- What added insight is added to this analysis if we account for market power? Does integration facilitate collusion?

A Crude Model

A Crude Model

- There are $k > 1$ supply chains competing only in the market for a final good
- Time is infinite $t = 1, 2, 3, ...$, common discount factor δ
- Each supply chain i has the cost function $C(q_i, n_i) + h(n_i) = (\bar{c} - n_i)q_i + \frac{n_i^2}{2}$, where n_i is the degree of integration
- Complete information repeated game. Each period
  - Chain i chooses n_i.
  - Chain i observes $\mathbf{n}$ then chooses q_i in Cournot competition with the $k-1$ other chains.
  - Price clears the market characterized by demand $D(\sum_i q_i) = a - \sum_i q_i$, $\mathbf{q}$ observed.

Stage-Game Equilibrium

- n acts like a cost-reducing investment, but is reversible
- $n^* = \frac{(a-\bar{c})k}{k^2+k+1}$ $\qquad$ $p^* = \frac{a+k(k+1)\bar{c}}{k^2+k+1}$
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  - We have

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- Business stealing effect makes Cournot oligopolists overinvest (from their p.o.v.) in integration.
- Placing a binding ceiling n^R on n only serves to raise costs and increase prices.
- In fact, it would be doing non-collusive chains a favor!

Repeated-Game Equilibrium

- What about the claim that VI facilitates collusion?

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- What about the claim that VI facilitates collusion?
- Trigger strategies to support (q^M, n^M)
- Reversion to (q^*, n^*) in case of deviations

  (A within-period IC for n and the usual across-period IC for q; only the second binds)
- Let $\pi^d(\mathbf{n}) > \pi^M(\mathbf{n}) > \pi^*(\mathbf{n})$ be the deviation, collusive and Cournot profit when the vector of integration levels is $\mathbf{n}$
- $\pi^M(\mathbf{n})$ and $\pi^*(\mathbf{n})$ are decreasing in $\mathbf{n} > \mathbf{n^P}$
- If collusion sustains $\mathbf{n^M} = n^M\mathbf{e}$ and punishment imposes $\hat{\mathbf{n}} = \hat{n}\mathbf{e}$, the minimum discount that permits collusion is

$$\underline{\delta}(\mathbf{n^M}, \hat{\mathbf{n}}) \equiv \frac{\pi^d(\mathbf{n^M}) - \pi^M(\mathbf{n^M})}{\pi^d(\mathbf{n^M}) - \pi^*(\hat{\mathbf{n}})},$$

decreasing in $\hat{\mathbf{n}}$.

Does VI Facilitate Collusion?

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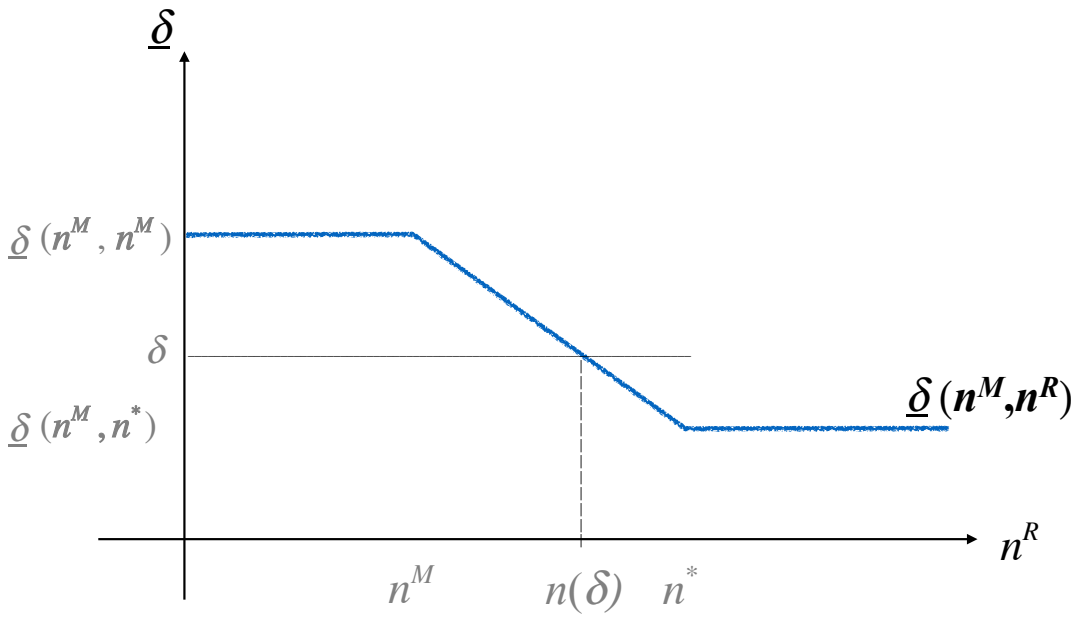
- *Low* equilibrium levels ($n = n^M$) are indicative of collusion!
- But *the possibility* of high levels of integration, to be used off-path, does facilitate collusion
- Regulation may "change conduct," i.e., break collusion, by increasing the off-path payoffs that are used to punish deviations (c.f. Chassang-Ortner, *JPE, forthcoming*, in a procurement auctions context)

Policy

- Regulator imposes ceiling n^R on the degree of integration.
  - If ceiling is below the equilibrium level, forcing chains to divest some assets, it is (sometimes) called *divorcement*.
  - Even if ceiling is above the equilibrium level, it can have an effect



Effects of Divorcement

- Regulator sets n^R below its equilibrium level

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δ	Collusion breaks?	p	Gross Profits	Firms' Payoffs
$< \underline{\delta}(n^M, n^*)$	N/A	$\uparrow$	$\downarrow$	$\uparrow$
$[\underline{\delta}(n^M, n^*), \underline{\delta}(n^M, n^M))$	yes	$\downarrow$	$\downarrow$	$\downarrow$
$\geq \underline{\delta}(n^M, n^M)$	no	$\uparrow$	$\downarrow$	$\downarrow$

- In the middle case, regulator could have set $n^R = n(\delta) - \epsilon$ and still broken collusion; n would increase from n^M to n^R, and prices would have fallen more
- Evidence from Beer Orders episode consistent with last case (collusion before and after divorcement)

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- Since the extent of horizontal integration is itself an ownership structure, market structure should depend at least in part on the forces that determine ownership
- Paper pursues that precept by building a model of endogenous market structure: Cournot competition meets property rights theory meets coalition formation

Conclusion

Demand and Market Structure Matter for Organizations

Coordination device, "clustering" of organizational changes. Prices may increase following entry of low cost suppliers. Shocks propagate. Market structure affects integration and organizational decisions of firms.

Organization Theory Matters for Industrial Organization

Organization is an important determinant of the behavior of firms and the structure, conduct, and performance of the industry.

Governance Matters for Consumers

Consumers have an interest in the internal organization of firms even absent market power

Mind your P's and Q's: IO as a proving ground for OE

Other models of the firm can be embedded in the market and would lead to different versions of the OAS; may distinguish them empirically based on price, quantity, and other "traditional" IO data

Merci!