

Monopsony Power and Upstream Innovation

Guillermo Marshall¹ Álvaro Parra¹

¹Sauder School of Business, UBC

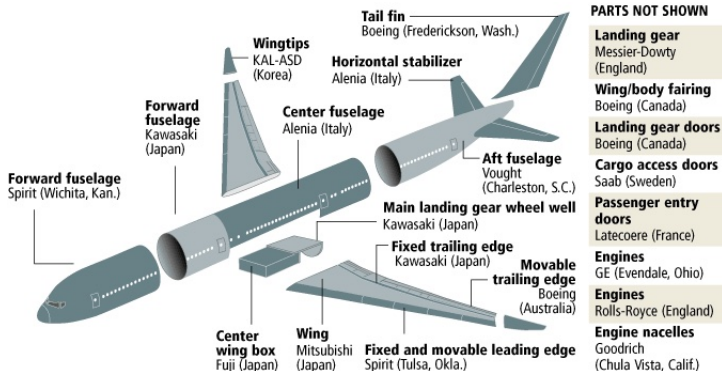
June 4, 2022

Motivation

Firms in innovative industries rely on global supply chains to create and manufacture products

- Some of the production and R&D is kept outside of the boundaries of the firm

Example: Boeing 787 Dreamliner



Motivation

- News reports suggest that companies like Tesla, Apple, Boeing, and other firms in innovative industries “squeeze” their suppliers:

Putting the Squeeze on Suppliers

Jet makers are getting a lot more aggressive in how they manage their global parts networks

Ford and GM Put the Squeeze On Parts Suppliers for Price Cuts

Tesla Asks Suppliers for Cash Back to Help Turn a Profit

Electric-car company, in memo, asks supplier to return a meaningful portion of money spent since 2016

Apple Squeezes Parts Suppliers to Protect Margins

- “Squeezing” happens even though suppliers play a crucial role along the innovation front

Motivation

How exactly are they squeezing suppliers?

- Apple (source: WSJ):

Suppliers say this year, Apple pushed to cut both component prices and order volume. The company told suppliers that despite the volume cuts, orders would rise significantly after new-device launches.

- Ford (source: WSJ):

For many Ford suppliers, the 3.5% price cut by Jan. 1 is just a start. For the full year, the Dearborn, Mich., auto maker said it wants suppliers to come up with design cost savings of 20% from 2003 levels, which suppliers are expected to achieve by re-engineering components, finding less costly materials or coming up with simpler designs, said Ford spokesman Paul Wood.

Pressure suppliers to invest in R&D by decreasing current purchases and prices

Research Questions

How does a monopsonist incentivize R&D that takes place outside of its boundaries?

- By manipulating input purchases, the monopsonist can impact R&D incentives: Arrow's replacement effect
- The anecdotal evidence in the news reports is consistent with the monopsonist's solution

What are the implications for the boundaries of the firm?

- When the size of the innovation is small, firms prefer to remain vertically disintegrated, performing faster R&D as a result.

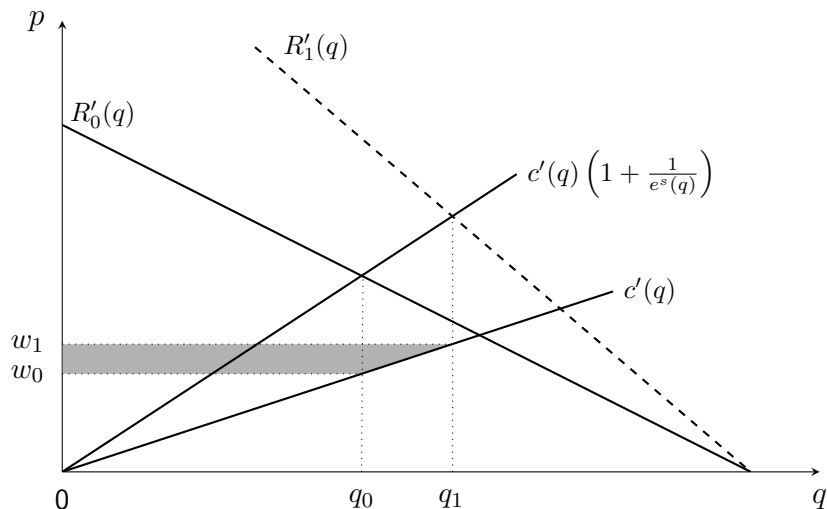
Model

- Continuous time, discount r
- Two players:
 - **Monopsonist** (buyer): chooses per unit price w
 - **Supplier**: Observes w and chooses quantity q at a convex costs $c(q)$
- Supplier can invest in R&D. The technology state is $i \in \{0, 1\}$
 - Innovation rate x has a convex flow cost $\kappa(x) = x^2/2$
- Monopsonist derives revenue $R_i(q)$.
 - $R_i(q)$ is increasing and concave in q ,
 - $R'_1(q) > R'_0(q)$
- Flow payoffs

$$\text{supplier: } \pi_s(w) = \max_q \{w \cdot q - c(q)\}$$

$$\text{monopsonist: } \pi_i^m(w) = R_i(q(w)) - w \cdot q(w)$$

Pre and Post Innovation Static Equilibrium (Benchmark)



Monopsonist FOC:
$$R_i'(q) = c'(q) \left(1 + \frac{1}{e^s(q)}\right)$$

Dynamic Model: Supplier

Let V_i^s be supplier's value function in innovation state i .

- After the innovation arrives

$$V_1^s = \pi_s(w_1)/r$$

- Before the innovation, for a given input price w :

$$rV_0^s(w) = \max_x \{ \pi_s(w) + x (V_1^s - V_0^s(w)) - \kappa(x) \}$$

Dynamic Model: Supplier

Let V_i^s be supplier's value function in innovation state i .

- After the innovation arrives

$$V_1^s = \pi_s(w_1)/r$$

- Before the innovation, for a given input price w :

$$rV_0^s(w) = \max_x \{ \pi_s(w) + x(V_1^s - V_0^s(w)) - \kappa(x) \}$$

The FOC implies (Arrow's Replacement effect!)

$$x^*(w) = V_1^s - V_0^s(w)$$

Using the envelop theorem

$$\frac{\partial x^*(w)}{\partial w} = -\frac{\partial V_0^s(w)}{\partial w} = -\frac{\pi'_s(w)}{r + x^*(w)} = -\frac{w}{r + x^*(w)}$$

Dynamic Model: Monopsonist

Let V_i^m be monopsonist's value in state i

- After the innovation arrives

$$V_1^m = \pi_1^m(w_1)/r$$

- Before the innovation, monopsonist chooses w

$$V_0^m = \max_w \{ \pi_0^m(w) + x^*(w) (V_1^m - V_0^m) \}$$

Dynamic Model: Monopsonist

Let V_i^m be monopsonist's value in state i

- After the innovation arrives

$$V_1^m = \pi_1^m(w_1)/r$$

- Before the innovation, monopsonist chooses w

$$V_0^m = \max_w \{ \pi_0^m(w) + x^*(w) (V_1^m - V_0^m) \}$$

The FOC implies

$$\frac{\partial \pi_i^m(w)}{\partial w} + \frac{\partial x^*(w)}{\partial w} (V_1^m - V_0^m) = 0$$

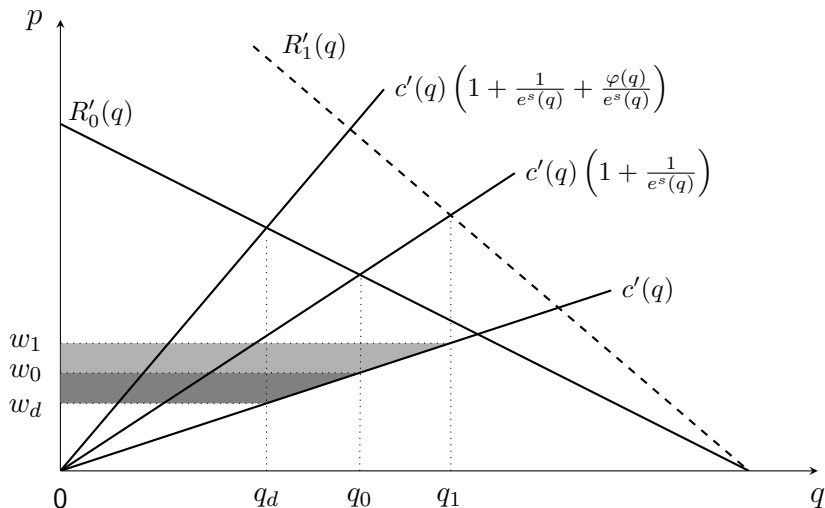
- Using $\frac{\partial x^*(w)}{\partial w} = -\frac{w}{r+x^*(w)}$ from the previous slide, the FOC becomes

$$R'_0(w) = w \left(1 + \frac{1}{e^s(w)} + \frac{\varphi(w)}{e^s(w)} \right)$$

where

$$\varphi(w) = \frac{V_1^m - V_0^m}{r + x^*(w)} > 0$$

Dynamic Equilibrium



Dynamic FOC:
$$R_0'(q) = c'(q) \left(1 + \frac{1}{e^s(q)} + \frac{\varphi(q)}{e^s(q)}\right)$$

Extensions and Comments

Post-innovation Competition

- Price w_1 assumes that monopsonist keeps its post-innovation power
- Not crucial for the result

$$\frac{\partial \pi_i^m(w)}{\partial w} + \frac{\partial x^*(w)}{\partial w} (V_1^m - V_0^m) = 0$$

- We need $V_1^m > V_0^m$ in Eq (Monopsonist to want the innovation!)

Extensions and Comments

Post-innovation Competition

- Price w_1 assumes that monopsonist keeps its post-innovation power
- Not crucial for the result

$$\frac{\partial \pi_i^m(w)}{\partial w} + \frac{\partial x^*(w)}{\partial w} (V_1^m - V_0^m) = 0$$

- We need $V_1^m > V_0^m$ in Eq (Monopsonist to want the innovation!)

Post-innovation hold-up?

- May emerge in a single innovation framework
- Lack of future rents leads to no innovation today.
- Under sequential innovation contracts can be self-enforced. A deviation to extract surplus is punished by no future innovations.
- Path of prices is lower than static price, but innovation is also lower.

Boundaries of the firm

We also show that squeezing is robust to non-linear contracts.

Is squeezing solved by vertical Integration?

- Starting from a situation that without innovation, firms don't VI
- Supplier under invest in R&D due to lack of full-rent appropriation
- This incentivize VI but squeezing countervails this effect.
- When size of innovation is small, disintegrated firm performs more R&D and firms prefer to remain disintegrated.
- When innovation is large, firms prefer to VI.

Comments Welcome!
Thank you in Advance