

ECN 453: Vertical Relationships 1

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Vertical relationships between firms

- **Vertical relationships:** relationships between two firms in a sequence along the value chain.

- **Examples:**

- Cement producers → sell cement to concrete producers → sell concrete to construction firms.
- Commodities → car parts → assembled into cars
- Manufacturer-retailer relationships



Motivation: how might vertical relationships be different to firm-consumer relationships?

- Demand faced by a manufacturer depends not just on the price it sets
 - ...but also on a host of other factors most of which is doesn't directly control (e.g. the retail price is set by the retailer)
- Manufacturers are selling to retailers who are competing with each other.
 - consumers usually do not compete with each other

Some jargon

- In this section of the course, we will usually simplify to the situation of a single manufacturer selling to one or several retailers.
- **Upstream firm:** the manufacturer e.g. cement producer, flour producer
- **Downstream firm:** the retailer e.g. concrete producer, bakery
- **Vertical integration:** when an upstream firm and a downstream firm are a single firm (e.g. through a merger, or just because that is the way the industry has evolved)

Plan

1. Vertical integration: graphical version
2. Vertical integration: math version
3. Alternative solutions to double marginalization

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Vertical integration: setup

- Consider an upstream firm (M) selling inputs to a downstream firm (R) which produces output.
 - e.g. M is an oil refiner and R is a gas station.
- Demand for final product: $D(p)$
 - Assume to produce one unit of output R needs one unit of input.
- Costs:
 - R pays the wholesale price w to its supplier (assume it has no other costs)
 - Assume M has constant marginal cost c
- **Questions:**
 - What are the joint profits of the firms if M and R are **vertically integrated**?
 - What are the joint profits of the firms if M and R are **vertically separated**?

Vertical integration: graphical version

- What are the joint profits of the firms if M and R are **vertically integrated**?
- Here the firm maximizes total profit:

$$\pi = (\underbrace{w - c}_{\text{what } M \text{ gets}} + \underbrace{p - w}_{\text{what } R \text{ gets}})D(p) = (p - c)D(p)$$

- Maximize profit \rightarrow our typical monopoly solution
- Denote p^M the price that maximizes total profit here (and q^M the resulting quantity)
- Then, $\pi_M = (p^M - c)q^M$

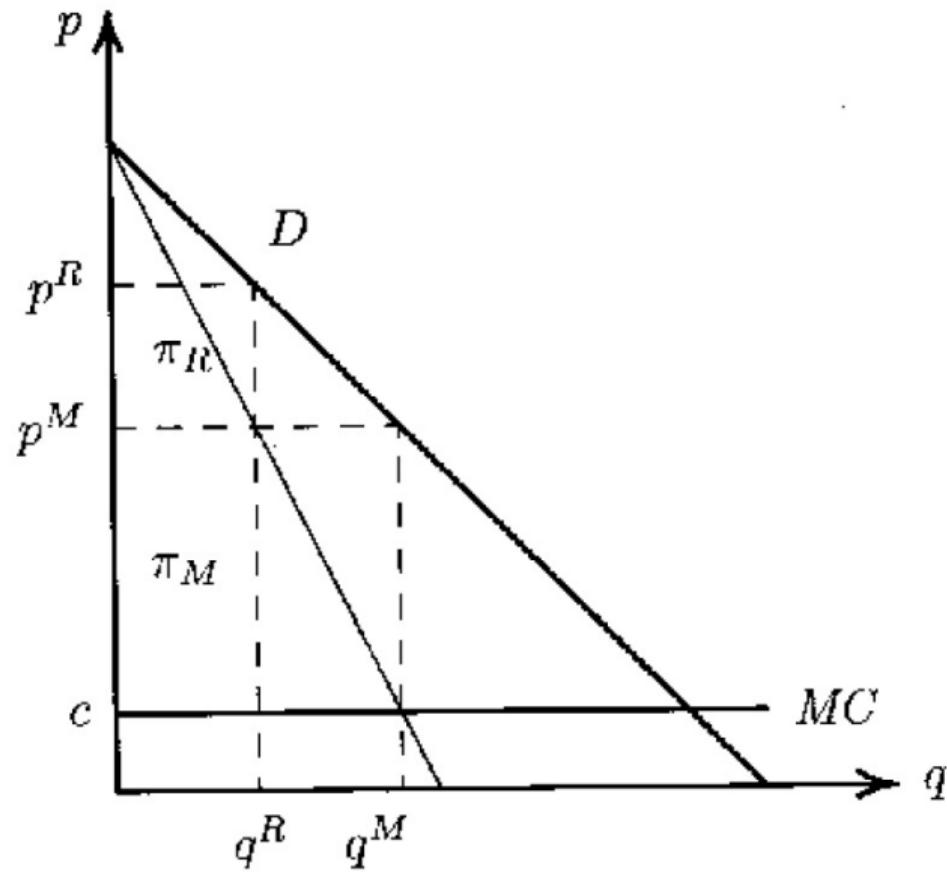
Vertical integration: graphical version

- What are the joint profits of the firms if M and R are **vertically separated**?
- R chooses p to maximize:

$$\pi = (p - w)D(p)$$

- Here, w is effectively R 's marginal cost.
- To replicate the solution under vertical integration, M would need to set $w = c$.
 - But, $w = c$ would result in M 's profit = 0.
- Instead, M sets w above marginal cost.
 - But then, R sets a price *greater* than the optimal price p_M (call this price p^R).
- On the graph on the following page, see graphically that the total profit for both firms under vertical separation ($\pi^M + \pi^R$) is smaller than under vertical integration.

Vertical integration: graphical version



Plan

1. Vertical integration: graphical version
2. **Vertical integration: math version**
3. Alternative solutions to double marginalization

Vertical integration: math version

- **Setup:**

- 1. Manufacturer has a constant marginal cost $c = 1$ and sets input price w to maximize profit.
- 2. Retailer buys input from manufacturer for price w . Retailer sets price p to maximize profit with demand $D(p) = 9 - p$.

- **Question:**

- 1. What are the total profits (i.e. the joint profits of both firms) under vertical integration?
- 2. What are the total profits (i.e. the joint profits of both firms) under vertical separation?
- 3. Are profits higher under vertical integration or vertical separation?

Vertical integration: math version - solution

- 1. What are the total profits (i.e. the joint profits of both firms) under vertical integration?
- Here, $MR = 9 - 2q$. Set $MR = MC$:
- Then, $q^M = 4$, $p^M = 5$
- Profit = 16.

Vertical integration: math version - solution

- 2. What are the total profits (i.e. the joint profits of both firms) under vertical separation?
- Start with retailer's problem.
 - Optimal price: $MR = 9 - 2q$. $MC = w$.
 - So, $q = \frac{9-w}{2}$, $p = \frac{9+w}{2}$.
- Now consider the manufacturer:
 - Manufacturer's profit: $\pi_m = (w - c)q = (w - c)\frac{9-w}{2}$.
 - Take derivative of profit with respect to w and set to 0 to find the optimal wholesale price w .
 - Solving for w and then substituting w into the retailer's problem: $w = 5$, $p^R = 7$, $q^M = 2$.
- Total profits: W gets 8, R gets 4. Total profits = 12.

Vertical integration: math version - solution

- 3. Are profits higher under vertical integration or vertical separation?
- Profits are higher under vertical integration. Under vertical separation the retailer's price is too high due to *double marginalization*.

Solving double marginalization problems: math steps

- Vertical separation:
 - 1. Begin with retailer's problem. Find the price and quantity that maximizes profit given the wholesale price w is the retailer's marginal cost.
 - 2. Next, solve the (upstream) manufacturer's problem. Find the wholesale price w which maximizes profit given the retailer's optimal choice.
- Vertical integration:
 - Solve using the standard monopoly solution.

Double marginalization: example - regional sport networks

- Regional sport networks: 90% of the 116.4 million television households subscribe to multichannel TV.
- Content providers like Disney and ESPN sell to Distributors like Comcast and TimeWarner.

Double marginalization: example - regional sport networks

- Regional sports networks: variation in ownership.
 - E.g. in 2007 Comcast Sport Northwest (owned by Comcast) was carried by Comcast but not DirectTV and Dish.
 - Independently owned YES (Yankees Entertainment and Sports) was carried by TimeWarner and DirectTV but not by Dish.



Double marginalization: example - regional sport networks

- In this market, when there is vertical integration:
 - 1. Price paid by consumers is lower
 - 2. Likelihood that a RSN is carried by a distributor is higher
 - 3. Likelihood that RSN is carried by rival distributor is lower

Plan

1. Vertical integration: graphical version
2. Vertical integration: math version
3. **Alternative solutions to double marginalization**

Alternative solutions to the double marginalization problem: nonlinear contracts

- Strong assumption in the previous analysis: payment between the firms is given by a single wholesale price w .
- What if the firms can write a more complicated contract? Recall, a two-part tariff looks like:

$$\text{tariff} = f + wq$$

- Fixed fee: f
- Wholesale price: w

Alternative solutions to the double marginalization problem: nonlinear contracts

- Consider the following nonlinear contract (which the retailer pays to the manufacturer):
 - $w = c$
 - $f = \pi^M$ (the monopoly profit of an integrated firm)
- Three things:
 1. This contract maximizes joint profits of the firms (i.e. achieves the monopoly outcome). Why?

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 2. The retailer R will enter the contract. Why? The retailer receives gross profits π^M so is willing to pay a fixed fee up to π^M .
 3. The manufacturer receives 0 in terms of variable profit (since $w = c$) but is able to recover monopoly profit through the fixed fee.

Alternative solutions to the double marginalization problem: nonlinear contracts

- Bottom line of previous discussion:
- **If nonlinear contracts are possible, then the optimal solution under vertical separation is identical to that under vertical integration.**
- Qualification: assumed no competition at either stage.

Summary of key points*

- Know how to compute the profit under vertical integration and also under vertical separation
- Understand that vertical separation may result in a *double marginalization problem*
- Know that an alternative solution to vertical separation that eliminates double marginalization is a correctly specific two-part tariff.

*To clarify, all the material in the slides, problem sets, etc is assessable unless stated otherwise, but I hope this summary might be a useful place to start when studying the material.