

INDUSTRIAL ORGANIZATION  
VERTICAL RELATIONS

**Vertical Relations** refers to the relationship between two firms in the sequence along the value chain, where there is an **upstream firm** producing and selling to a **downstream firm**. This set of notes examines the variation in relationship from a simple per-unit price contract between these firms, using instead **Vertical Restraints**, particularly by the upstream firms. Why should this study be considered separately from the typical study of firm choices?

Although the typical characterization of the relationship between a firm and the market is a direct one, where the firm sells directly to the consumer, it is typically not true. For example, a furniture manufacturer may sell first to a regional distributor, who in turn sells to various furniture retailers in cities, and smaller towns. In the typical scenario you have considered in your study of economics, by assuming that firms sell directly to the consumers, you implicitly assume that producers retain control over selling price, advertising, sales service etc. However, in the scenario where this is not true, the producer would lose control over some of these variables which are vital to the determination of demand. Another critical issue is that where consumers are not thought to compete for the goods with each other, retailers do compete with each other, consequently the prices that the manufacturer charges them determines the marginal cost and their profits.

## 1 Double Marginalization & Two Part Tariff

Consider the scenario where you have a upstream firm  $U$ , and a downstream firm  $D$ . You can think of  $U$  as a upstream furniture manufacturer, while  $D$  is a downstream furniture retailer. Suppose further that neither firm has any competition, or that there products are sufficiently differentiated so that we can think of their product as unique to their segment, say a designer furniture company. If the two of them were owned by a single entity, the solution to profit maximization reduces to nothing but your standard  $MR = MC$ . The price that each entity sells to the other is nothing but a transfer

price. What is important is the cost of production which is captured by  $MC$

Now suppose that each firm is a separate entity. Let the demand of the final product be  $D(p)$ . Let the wholesale price from  $U$  to  $D$  be  $w$ . Given  $w$ ,  $D$  then chooses how much to buy from  $U$ . Let's solve the problem using backward induction, by first solving for the optimal choice by  $D$ ,

$$\max_p (p - w)D(p)$$

The first order condition of the problem is,

$$(p - w)D'(p) + D(p) = 0$$

This first order condition gives the standard marginal cost equal to marginal revenue condition, where the marginal cost is just  $w$ , and it implicitly defines their price,  $p^D \equiv p^D(w)$ . Given this,  $U$  then chooses the optimal  $w$  to maximize profits (suppose the marginal cost of production is  $c$ ),

$$\max_w (w - c)D(p(w))$$

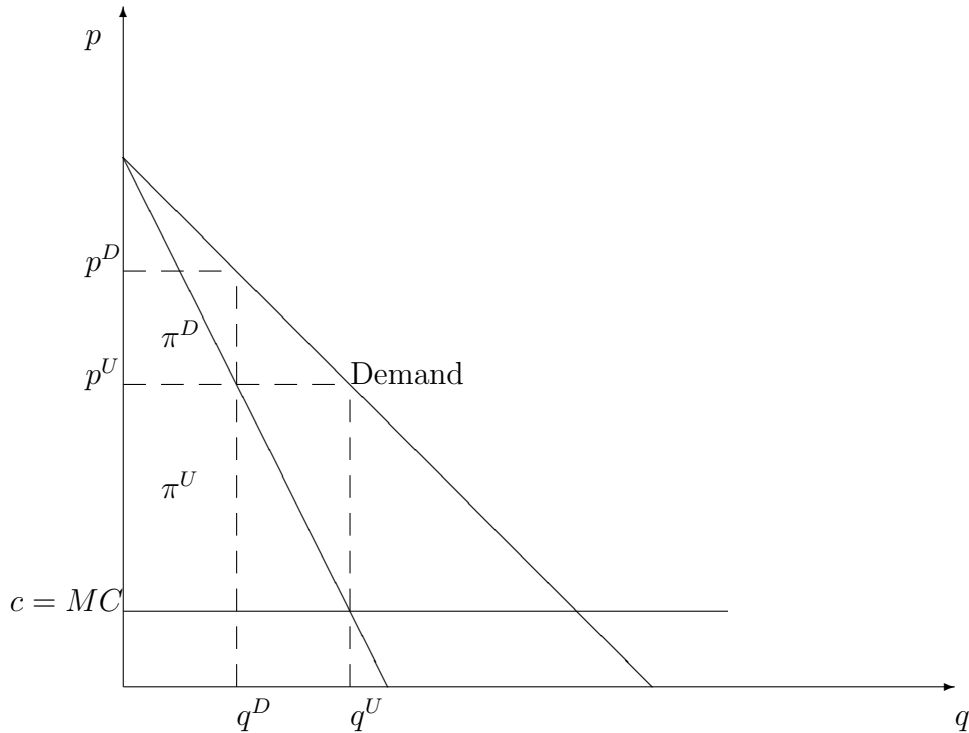
This manner of pricing will lead to the total profits of the two firms being less than the vertically integrated firm, since each firm acts as if it were a monopoly, creating a margin over their individual relevant marginal cost. This is known as **Double Marginalization**, and is depicted in the diagram below.

From the diagram, each firm obtains a positive profit of  $\pi^U$  and  $\pi^D$ , and the sum of which as may be easily discerned is less than the vertically integrated monopoly. This is because neither firm internalizes the externality their choice imposes. Further note the quantity ultimately sold is even lower than the integrated monopoly, implying a greater misallocation of resources. **This problem is created by the limited contractual options when all firms can do (upstream) is to charge a per-unit price to the downstream firm.**

There are two ways in which the upstream firm might exercise control over the downstream firm,

1. **Two Part Tariff/Nonlinear Contract:** To overcome the limited contractual option, the upstream firm could use a two part pricing system where there is a per-unit price,  $w$ , and a fixed lump-sum price  $f$ . The latter is sometimes referred

Figure 1: Double Marginalization



to as a **Franchise Fee**. How would the upstream firm choose a optimal level of both parameters so as to achieve the first best integrated monopoly profits? Consider the following pricing scheme: The upstream firm sells each unit at  $w = c$ , which is the marginal cost of their production, and choose  $f = \pi^U$ . This means that the downstream firm on account of the unit price set at the marginal cost of production, will price at the monopoly price of  $p^M$ , which in turn gives them a profit of  $\pi^M$ . It is the latter profit that the upstream firm would fully extract, and obtain all of the rents of the downstream firm, and the aggregate profit now is the optimal monopoly profits. The problem of the downstream firm is,

$$\max_p ((p - c)D(p) + f)$$

Noting that  $f$  is entering as a constant, and consequently does not affect the choice of the downstream firm in its pricing decision.

2. This of course could be easily achieved by **Maximum Retail Price**, by setting

it equal to the monopoly price,  $p^M$ . In which case, the upstream firm usurps the power to make the pricing decision from the downstream firm.

**If nonlinear contracts are allowed, or are legal, then the optimal solution under vertical separation is identical to that under vertical integration.**

There are of course caveats to the above illustrative solution,

1. No competition in both stages from production to sale, or some intermediate level of production.
  - What if the competition occurs downstream? Suppose there are two firms in the downstream sector. Retaining the price setting nature of the downstream sector, we know that such a Bertrand Competition setup would imply that  $p^D = w$ . In this case, the upstream firm could extract all the rents by simply setting  $w = p^M$ . **Write the arguments down in a succinct and clear fashion.**
  - What if the downstream firm were exercising Cournot competition? **Solve exercise 11.9 of your text.**
  - What if it is the upstream firm that is competitive, that is there is at least two firms there? Does the nonlinear contract still work? Intuitively, since both firms are competing on price, both firms have an incentive to undercut each other in their pricing of both  $w$ , and  $f$ . **Write down the arguments clearly**
2. Implicit assumption that there is complete information, where the upstream firm knows the downstream firms marginal cost. If this is not true, then it may be worthwhile for the upstream firm to set a variable fee that is greater than the average marginal cost it believes is true.

## 2 Investment Externalities

In the preceding discussion, the competition among the downstream firms were based on each having the same marginal cost, and compete on either prices and quantity

choices. But there are other parameters that are open to downstream firms, such as retailers, such as **sales quality** and **advertising**.

1. Let's consider first the situation where we have two downstream firms, who are sold the output by an upstream firm. Suppose one of the firms trains its sales staff well, so as to provide better **service quality** through better advice on the right product. This would typically increase the sales to the firm. However, the other firm in the market could always choose not to invest in service quality, but instead compete on setting lower prices (knowing that sales quality involves raising cost to the firm). Given that consumers are price conscious, and those with lower willingness to pay might more likely embark on greater search for the "best price", would free ride on the servicing effort of the first firm. Consequently, this problem reduces the incentive for retailers or downstream firms to improve service quality, which eventually translates to lower sales for the upstream firm.

One way out of the predicament for the upstream firm would be to adopt a **Resale Price Maintenance**, i.e. imposes a minimum price on retailers. This takes away the incentive of consumers to search by price, and thereby allowing retailers to raise their sales by raising service quality.

2. Advertising decisions by downstream firms is another parameter of choice that is easily subject to free rider problem from competition within a particular market, and discourages them from advertising. This could be circumvented by allocated **Exclusive Territories**, which prevents other retailers, or downstream firms from locating in, so that the incentive for downstream firms to raise their sales through advertising is increased, and protected.

### 3 Indirect Control

The above discussion on **RPM** and **Exclusive Territories** is principally valid for markets where service quality are important such as consumer electronics, automobile, etc. However, in other retail operations, such as clothing, toys etc. service quality is less of a valid parameter to raise sales. Here the parameter would most likely be **sales**

**effort**, besides the usual price. We know that sales effort is not a parameter of choice among competing downstream firms, a two part tariff can still achieve monopoly profits for the entire vertically related set of firms.

But when sales effort is important, the upstream firm faces a dilemma,

1. First, when downstream firms compete with each other, they will drive prices down to marginal cost, thus forcing the upstream firm to price the sale price to the downstream firms high, high  $w$ .
2. Second, when sale effort is important, the marginal benefit from sales effort to the downstream firm is proportional to  $p - w$ . Further, as far as the entire industry is concerned, the marginal gains are greater and is proportional instead to  $p - c$ , where  $c$  as before is the marginal cost of production, which thus needs the upstream firm to price  $w$  low.

Given these concerns, what the upstream firm could do would be to use **RPM**, which forces the retailers to price at the minimum require price,  $\underline{p}$  due competition, i.e.  $\underline{p} = p^M$ . Consequently, forcing the downstream firms to compete on sales effort,  $s$ , since the margin to them would be  $p - c$ , i.e.  $w = c$ . How would you structure the model. Let demand be  $D \equiv D(p, s)$ . So that with **RPM**, the profit maximizing problem for the downstream firm is,

$$\max_s (p^M - c - S(s))D(p^M, s)$$

where  $S()$  is the cost of sales effort, and assuming that it is increasing and convex in sales effort,  $s$ . This profit could then be extracted either in full or in part by a two part tariff by the upstream firm. **What is the equilibrium condition to the problem of sales effort for each of the competing downstream firms?** Note that this problem arose because it was not possible for the upstream firm to contract on a appropriate level of sales effort, i.e. the problem of **contractual limitation** again.

## 4 Manufacturer Competition

The world is far more complicated than we have depicted them to be thus far, since upstream firms are typically also engaged in competition. This competition constrains them in terms of the optimal contracts they can enter into with the downstream firms, and further all contracts have a strategic component now as well.

**Retailer Market Power:** In some industries, it is the manufacturers market that is intense, and not retailers'. Consider the number of grocerc chains in Canada, versus the number of manufacturers in each aisle that is vying for shelf space. In this situation, the power to extract rents is instead reversed, so that the fixed fee,  $f$ , in a two part tariff is negative, that is it is the retailer that is extracting the rents.

Just as there may be **externalities** that competing downstream firms could free ride off of each other, if upstream firms offers training in sales quality, or some technical skill that are general in nature, other manufacturers could free ride off the training. One way out of the predicament is to impose on retailers the **vertical restraint** of **Exclusive Dealing** so that the downstream firm cannot work with other upstream firms.

However, it is not always clear whether this practice of exclusive dealing is for efficiency purposes, or to prevent free riding, or as a means of raising market share through foreclosure of a portion of a market from other competing upstream firms.

In the extreme case when both upstream and downstream firms are price setters only, the overriding incentive would be for all firms to set at their marginal cost, so that all firms earn zero profits, which is highly unrealistic. Though if true, it does imply that consumers welfare are higher than in any of the cases we have discussed thus far. Thought of in this way, instruments such as **RPM** serves as a way for firms to soften competition, thereby collude towards greater profits at the expense of consumers.