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## LEVEL 1: ECONOMICS

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Reading 9 (2<sup>nd</sup> out of 7): FIRM & MARKET STRUCTURE

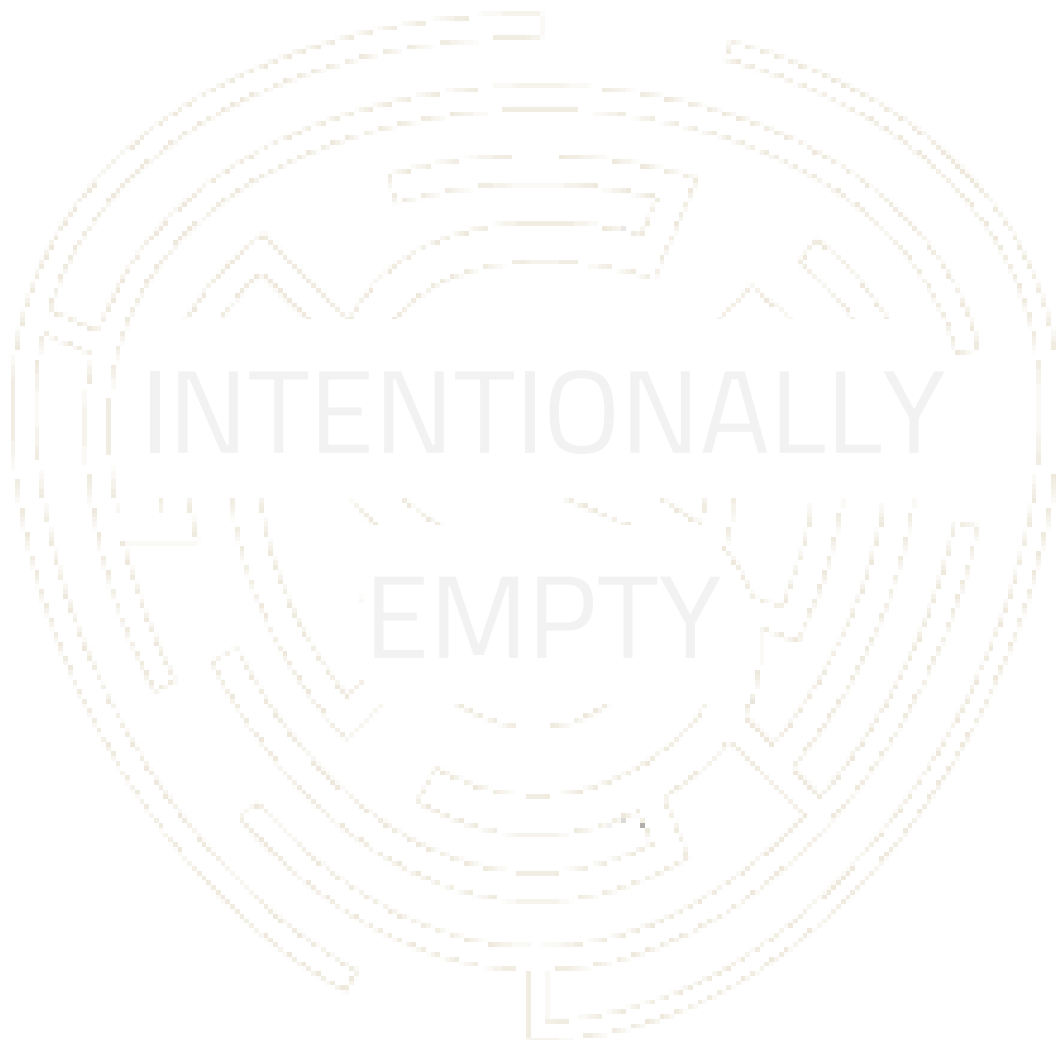
Difficulty:

**medium**

Benchmark Study Time:

**2.8h**

2022





**THIS E-BOOK:**

- ❖ is a selective summary of the corresponding Reading in your CFA® Program Curriculum,
- ❖ provides place for your own notes,
- ❖ helps you structure your study and revision time!

## How to use this e-book to maximize your knowledge retention:

1. **Print** the e-book in duplex and bind it to keep all important info for this Reading **in one place**.
2. **Read** this e-book, best twice, to grasp the idea of what this Reading is about.
3. **Study** the Reading from your curriculum. **Here add** your notes, examples, formulas, definitions, etc.
4. **Review** the Reading using this e-book, e.g. write your summary of key concepts or revise the formulas at the end of this e-book (if applicable).
5. **Done?** Go to [your study plan](#) and change the Reading's status to **green** :  
(it will make your Chance-to-Pass-Score™ grow ☺).
6. **Come back** to this e-book from time to time to **regularly review for knowledge retention!**

**NOTE:** While studying or reviewing this Reading, you can use the tables at the end of this e-book and mark your study/review sessions to hold yourself accountable.



## MARKET STRUCTURES

Type of Market Structure	Perfect Competition	Monopolistic Competition	Oligopoly	Monopoly
Number of Firms in a Market	many firms with a small market share	many firms	a few firms	one firm
Barriers to Entry and Exit	very low	low	high	very high
Product	homogeneous	differentiated	usually homogeneous / sometimes differentiated	unique
Marketing (non-price competition)	low	high expenditure on advertising and promotion	high expenditure on advertising and promotion (especially in the case of a differentiated product)	high expenditure on advertising and promotion
Pricing Power of the Firm	none	some	considerable	high



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## MATH RECAP

NOTE: It is not a required part of material per se but it will help you derive some of the formulas presented in this e-book:

### LINEAR FUNCTION:

$$f(x) = a \times x + b$$

the first derivative of a linear function:

$$f'(x) = a$$

### QUADRATIC FUNCTION:

$$f(x) = a \times x^2 + b \times x + c$$

the first derivative of a quadratic function:

$$f'(x) = 2a \times x + b$$

## Price vs Marginal revenue vs Marginal cost vs Economic profit vs Elasticity of demand

- P – per-unit price of the product,
- Q – quantity of products sold,
- TR – total revenue,
- MR – marginal revenue (an increase in total revenue resulting from the sale of an additional unit of product),
- AR – average revenue,
- MC – marginal cost.

Total revenue is equal to price times quantity:

$$TR = P \times Q$$

Average revenue equals total revenue divided by price:

$$AR = \frac{TR}{Q} = \frac{P \times Q}{Q} = P$$

Average revenue is always equal to price.



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**Marginal revenue** is an increase in total revenue resulting from the sale of an additional unit of product. The calculation of marginal revenue depends on whether we are dealing with perfect competition or some other market structure. Only under perfect competition the price is fixed and doesn't depend on quantity sold. Under other market structures, price is related to quantity.

Let's compute the marginal revenue starting with perfect competition:

Marginal revenue is the first derivative of total revenue with respect to quantity:

$$MR = \frac{\Delta TR}{\Delta Q} = (P \times Q)' = P$$

As you can see  $P \times Q$  is a linear function, so the first derivative is simply equal to  $P$ .

So, in perfect competition the marginal revenue, price, and average revenue are equal, and the **demand curve for each company in the market** is horizontal, which implies that demand is perfectly elastic.

Let's compute the marginal revenue for other market structures:

Under other market structures, price is related to quantity. Let's assume for simplicity that the demand function is linear:

$$P = b + a \times Q$$

In this case, the total revenue is equal to:

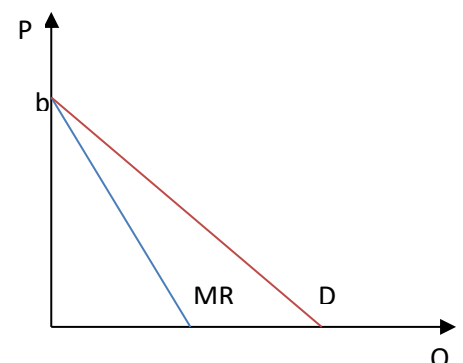
$$TR = P \times Q = (b + a \times Q) \times Q = b \times Q + a \times Q^2$$

So, the total revenue is a quadratic function. Now, we can compute the marginal revenue as the first derivative of total revenue with respect to quantity:

$$MR = \frac{\Delta TR}{\Delta Q} = (b \times Q + a \times Q^2)' = b + 2a \times Q$$

If you compare the demand function and the marginal revenue function, you'll notice that the marginal revenue function is always below the demand function (price and average revenue) because:

- ▶ the slope coefficient of the MR function ( $2a$ ) is twice as big as the slope coefficient of the demand function ( $a$ ),
- ▶  $a$  is negative (because generally when the price is higher, the quantity demanded is lower),
- ▶ the intercept for both functions is the same and equal to  $b$ .







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## Own-price elasticity of demand

$$E_P = \text{own-price elasticity of demand} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}} = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

Where:

- Q – quantity demanded,
- P – price,
- $\Delta P$  – small change in price,
- $\Delta Q$  – small change in quantity demanded.

So, own-price elasticity is the first derivative of quantity with respect to price times  $\frac{P}{Q}$ .

Assuming that the demand function is linear, the price is equal to:

$$P = b + a \times Q$$

So, the quantity equals:

$$Q = \frac{1}{a} \times P - \frac{b}{a}$$

Therefore, the elasticity is equal to:

$$E_P = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \left( \frac{1}{a} \times P - \frac{b}{a} \right)' \times \frac{P}{Q} = \frac{1}{a} \times \frac{P}{Q} = \frac{P}{a \times Q}$$

Now, using the demand function, we can compute the intercept b:

$$b = P - a \times Q$$

Finally, let's take the formula for MR and see what we can do with it:

$$MR = b + 2a \times Q$$

Let's substitute b with  $P - a \times Q$ :

$$MR = b + 2a \times Q = P - a \times Q + 2a \times Q = P + a \times Q = P \times \left( 1 + \frac{a \times Q}{P} \right)$$

Because (i)  $\frac{a \times Q}{P} = \frac{1}{E_P}$  and (ii) elasticity is presented as a positive number (even though the relationship between quantity and price is inverse), then the relation between the marginal revenue, price, and elasticity looks as follows:

$$MR = P \times \left( 1 - \frac{1}{E_P} \right)$$



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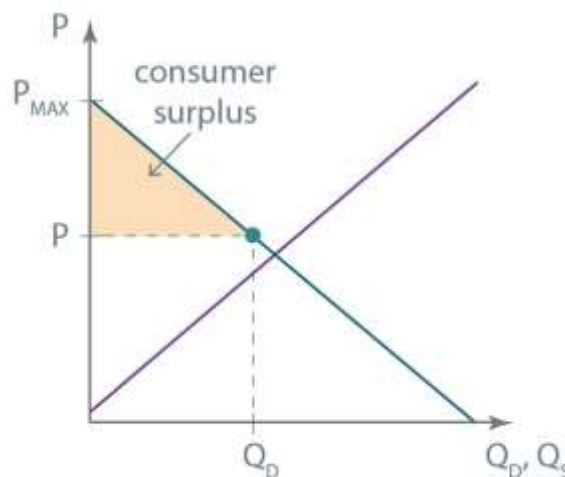
Please note that the equation above is correct for any market structure, even perfect competition. In the case of perfect competition, we are dealing with infinite elasticity of demand, so the formula given above looks as follows:

$$MR = P \times \left(1 - \frac{1}{E_P}\right) = P \times \left(1 - \frac{1}{\infty}\right) = P \times (1 - 0) = P$$

## Consumer surplus

Consumer surplus is the difference between the value that a consumer places on units purchased, i.e. the amount a consumer is willing to pay, and the amount of money that he or she is required to pay for them.

$$\text{consumer surplus} = 0.5 \times Q_D \times (P_{\text{MAX}} - P)$$



## EQUILIBRIUM CONDITIONS

- ▶ The marginal cost schedule crosses the average cost schedule at the level of output where the average cost is minimized.
- ▶ In equilibrium, marginal revenue equals marginal cost.

Only in the case of perfect competition marginal revenue is equal to price. Under other market structures, price is higher than marginal revenue because firms may sell more items thanks to lowering the price.

Perfect competition:

- ▶ marginal revenue = price,
- ▶ firms realize no economic profit.

Other market structures:

- ▶ price > marginal revenue.



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## Perfect competition

Equilibrium conditions under perfect competition in the short-run:

- ▶  $P = MR = MC$ ,
- ▶ demand is perfectly elastic,
- ▶ economic profit for an individual company is possible if the average price is higher than the minimum average cost. However, if an economic profit is possible in the short-run, new companies will enter the perfectly competitive market.

Equilibrium conditions under perfect competition in the long-run:

- ▶  $P = MR = MC$ ,
- ▶ demand is perfectly elastic,
- ▶ no long-run economic profit.

Important: Even though each company in perfect competition faces the horizontal demand line,  
the demand function for the whole market is downward sloping.

## Monopolistic competition

Under monopolistic competition, a large number of firms deliver differentiated products to the market. Because the products are close substitutes but are differentiated, the demand function for each company is downward sloping. There is no well-defined supply schedule.

Equilibrium conditions under monopolistic competition:

- ▶  $P > MR = MC$ ,
- ▶ depending on the point on the demand curve, the demand can be elastic or inelastic,
- ▶ short-run economic profit for an individual company is possible if the average price is higher than the minimum average cost. However, if an economic profit is possible in the short-run, new companies will enter the market and drive long-run economic profit to zero.
- ▶ In comparison with perfect competition, the level of output and the price are higher (above the minimum average cost).



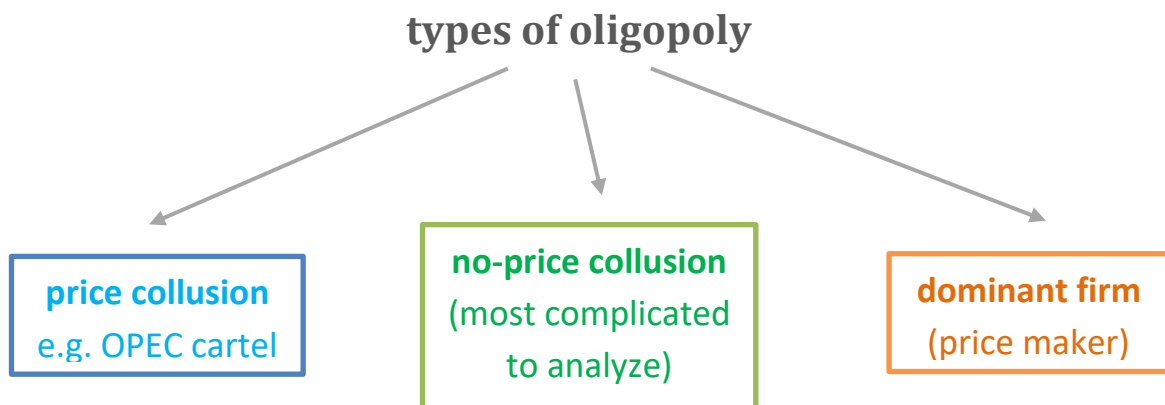
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## Oligopoly

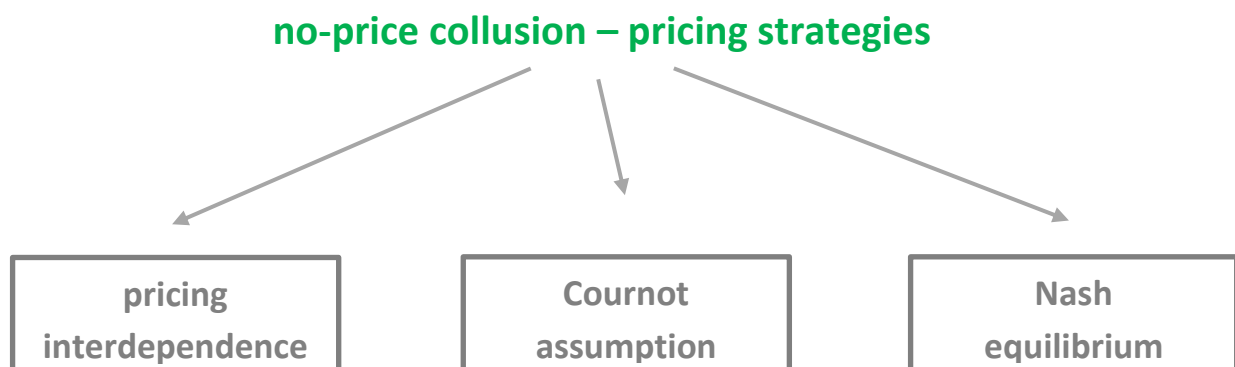
Oligopoly is characterized by:

- only a few companies present,
- the complex pricing strategy, because companies' decisions depend on their competitors' reactions and the optimal price and output are associated with cost structures in other companies and their reactions to price changes made by competitors.



**collusion** = agreement of producers to have market shares divided among them in order to maximize total profit in the industry

**dominant firm model** = one company has a dominant position in the market and maximizes its profits at a particular price (other companies are price takers)





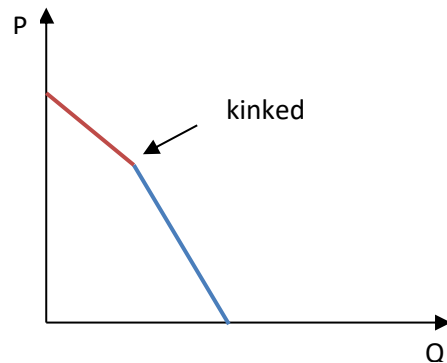


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### Pricing interdependence and kinked demand curve

- results in price wars,
- a firm will decrease the price if the competitor decreases the price (not to lose demand), but will not increase the price while the competitor increases the price (to gain demand) → the demand structure consists of two demand functions, which translates into the so-called kinked demand curve.



The **kinked demand curve** explains why oligopolistic firms that maximize their profit can keep their prices at the same level despite changes in production costs. Within the discontinuous marginal revenue structure, the company does not react to an increase in marginal costs.

Since there are only a few companies present in oligopoly, decisions made by them are correlated. These correlations can be explained by the game theory (e.g. Cournot assumption, Stackelberg model, Nash equilibrium).

### Cournot assumption

**Cournot assumption** = each company assumes that its competitors will not change the output if the company changes its output

- The company doesn't expect retaliation from the competitors after changing the output.
- The long-term equilibrium can be reached if the price and output for each company is stable and profit is maximized.
- The level of price is higher and the level of output for the whole market is lower than in the case of perfect competition.

**Stackelberg model** = similar to Cournot assumption but assumes that the actions are taken sequentially, so the first mover has a clear advantage over all other companies, which may even lead to pushing some of the companies out of the market



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### Nash equilibrium

The company expects retaliation from the competitors after changing the output, so when changing the output in order to maximize profit, it takes possible reactions of the competitors into account. When all the firms in the oligopoly market take the actions of all the competitors into account (both "in response" and independent actions), the Nash equilibrium is reached.

To sum up, equilibrium conditions under oligopoly:

- ▶  $P > MR = MC$ ,
- ▶ a positive long-run economic profit is possible.

### Monopoly

Equilibrium conditions under monopoly:

- ▶  $P > MR = MC$ ,
- ▶ no long-run economic profit.

**first-degree price discrimination** = the monopolist takes all consumer surplus, i.e. it's able to charge each consumer the max price the consumer is ready to pay for the product

**second-degree price discrimination** = the product is offered in different versions (differences in quality and quantity), so the customer can choose + the "better" version costs more

**third-degree price discrimination** = consumers are segregate by demographic, geographic, or other dimensions

### Optimal price and pricing strategy – summary

Companies under all market structures maximize their profits at the output level at which marginal revenue is equal to marginal cost.

The quantity of output and quantity sold are **the highest** in perfect competition.

Under remaining market structures, prices are higher because producers attempt to **differentiate their products**.

In monopolistic competition, companies sell a **smaller quantity at a higher price**, which gives them the benefit of larger margins.



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## MEASURING MARKET POWER

Measures of market power:

- ▶ the concentration ratio for N firms,
- ▶ the Herfindahl-Hirschman index.

**concentration ratio for N firms** = the sum of the market shares of the largest N firms

**Herfindahl-Hirschman index (HHI)** = the index where the market shares of the top N companies are first squared and then added

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## Summarizing key concepts:

- ☐ Price vs Marginal revenue vs Marginal cost vs Economic profit vs Elasticity of demand

My summary:

- ☐ Own-price elasticity of demand

My summary:

- ☐ Perfect competition

My summary:

- ☐ Monopolistic competition

My summary:





☐ Oligopoly

**My summary:**

☐ Cournot assumption, Stackelberg model, Nash equilibrium

**My summary:**

☐ Monopoly

**My summary:**

☐ Measuring market power

**My summary:**



## Reviewing formulas:

$$TR = P \times Q$$

Write down the formula:

$$AR = \frac{TR}{Q} = \frac{P \times Q}{Q} = P$$

Write down the formula:

$$E_P = \text{own-price elasticity of demand} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}} = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

Write down the formula:

$$MR = P \times \left(1 - \frac{1}{E_P}\right)$$

Write down the formula:



## Keeping myself accountable:

### TABLE 1 | STUDY

When you sit down to study, you may want to **try the Pomodoro Technique** to handle your study sessions: study for 25 minutes, then take a 5-minute break. Repeat this 25+5 study-break sequence all throughout your daily study session.



Tick off as you proceed.

POMODORO TIMETABLE: study-break sequences (25' + 5')													
date		date		date		date		date		date		date	
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### TABLE 2 | REVIEW

Never ever neglect revision! Though it's not the most popular thing among CFA candidates, regular revision is what makes the difference. If you want to pass your exam, **schedule & do your review sessions**.

REVIEW TIMETABLE: When did I review this Reading?													
date		date		date		date		date		date		date	
date		date		date		date		date		date		date	