Industrial Organization

Market Structure: Measures of Concentration and Volatility

Game Theory: Static Games

Week 2

Measures of Concentration

HERFINDAHL-HIRSCHMAN INDEX

- Sum of the **squared** market shares of **all** firms in the market: $\boldsymbol{HHI = \sum_{i=1}^{N} s_i^2}$
- What is its maximum possible value, $\boldsymbol{HHI^{Max}}$?
- What is its minimum possible value, $\boldsymbol{HHI^{Min}}$?
- Advantages? Disadvantages?

- Most used measure of concentration by competition authorities.
- According to the European Commission, a market with a $\boldsymbol{HHI}$ smaller than 0,1 is said to be not concentrated a market with a $\boldsymbol{HHI}$ larger than 0,18 is said to be concentrated.

Measures of Concentration

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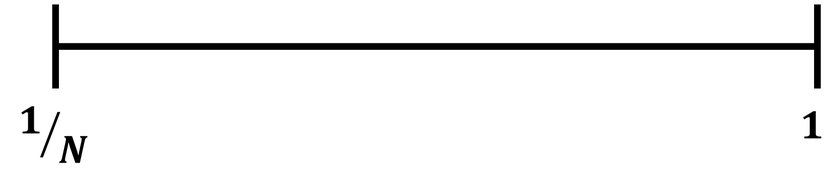
IN A *SPECIFIC* MARKET (WITH n FIRMS)



Measures of Concentration

CONCENTRATION RATIO

- Sum of the market shares of the $\boldsymbol{k}$ **biggest firms** in the market: $\boldsymbol{C_k = \sum_{i=1}^{k} s_i}$
- What is its maximum possible value, $\boldsymbol{C_k^{Max}}$?
- What is its minimum possible value, $\boldsymbol{C_k^{Min}}$?
- Advantages? Disadvantages?

Useful when:

- A group of firms dominate a market and on top of that there is a numerous group of small firms.
- Example: Car glass market

Firm	Market Share
Glassdrive	40%
ExpressGlass	25%
Carglass	25%
1000 other small firms	10%

Even though we have many firms in this market
$\boldsymbol{C_3 = 90\%}$ → Highly concentrated market

Other Measures of Concentration

STANDARD DEVIATION OF MARKET SHARES (EX. 2)

$$\sigma_s = \left(\frac{\sum_{i=1}^{N} (s_i - \bar{s})^2}{N} \right)^{\frac{1}{2}}$$

EQUIVALENT NUMBER OF ADELMAN (EX. 3)

$$Equivalent\ Number\ of\ Adelman = \frac{1}{HHI}$$

Number of firms with the same market share that would lead to a market concentration equal to HHI.

Other Measures of Concentration

EQUIVALENT NUMBER OF ADELMAN (EX. 3)

$$Equivalent\ Number\ of\ Adelman = \frac{1}{HHI}$$

Number of firms with the same market share that would lead to a market concentration equal to HHI.

Firm	Market Share
Firm A	35%
Firm B	25%
Firm C	19%
Firm D	16%
Firm E	5%

$\sim$

HHI of this market is also 0,25

Firm	Market Share
Firm F	25%
Firm G	25%
Firm H	25%
Firm I	25%

$$\boldsymbol{HHI = 0,25}$$
$$\boldsymbol{EN = 4}$$

A Measure of Volatility

THE INSTABILITY INDEX

$$I = \frac{1}{2}\sum_{i=1}^{N} |s_{i,t} - s_{i,t-1}|$$

- Dynamic, not static measure!
- What is its maximum possible value, I^{Max}?
- What is its minimum possible value, I^{Min}?

Maximum possible change: assume that all firms that existed in $t-1$ disappear and are replaced by new firms in t:

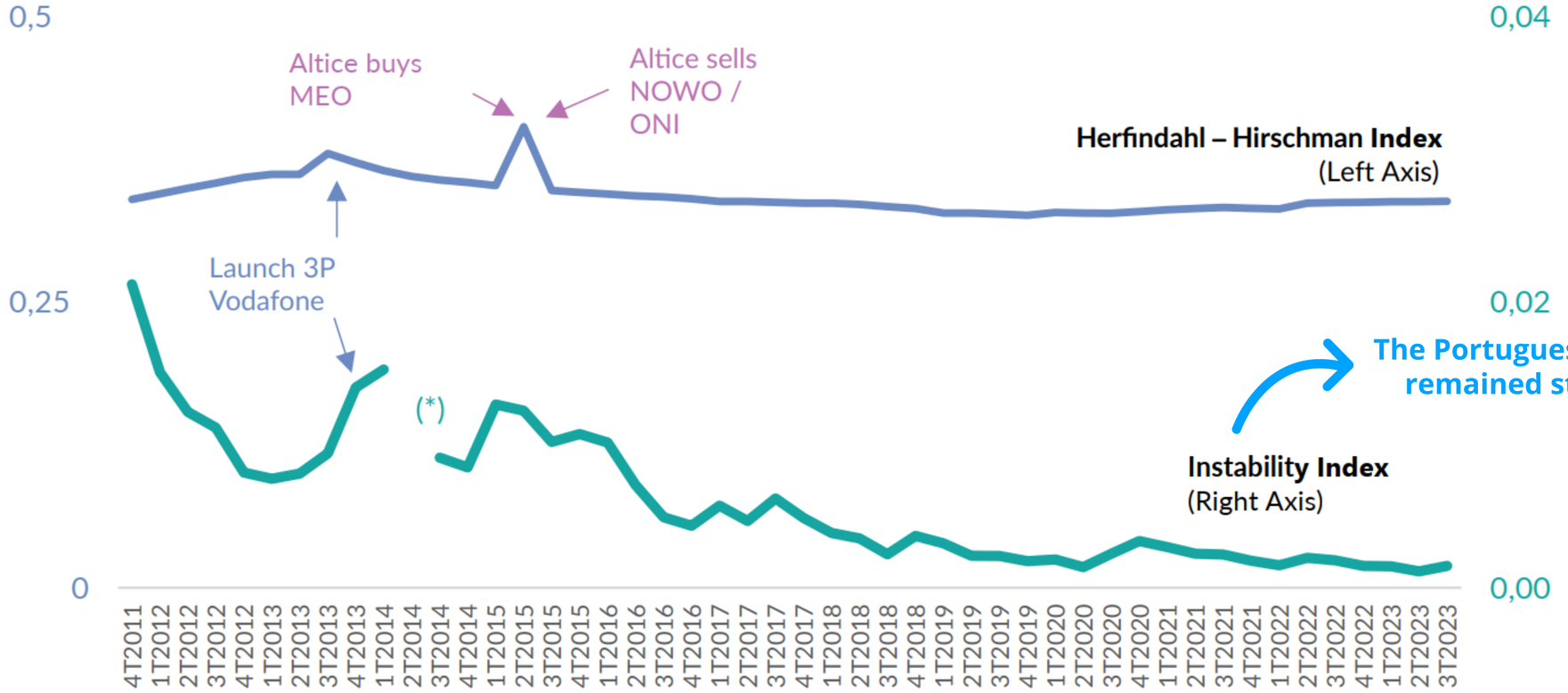
$$I^{Max} = \frac{1}{2}[|0-1| + |1-0|] = 1$$

Meanwhile, if market shares remain constant between the periods $t-1$ and t:

$$I^{Min} = 0$$

A Measure of Volatility

THE INSTABILITY INDEX – EXAMPLE: THE PORTUGUESE TELECOM MARKET



Market Structure

EXERCISE

5. [ADAPTED] In 2010 the diaper industry in Portugal consisted of 5 firms producing identical diapers. Showing your computations, fill-in the missing items in table 3. Explain and calculate the Equivalent Number of Adelman.

Year	Firms					Concentration Measures	
	1	2	3	4	5	C4	HHI
2010	40%	15%	15%	15%	15%	?	?

Market Structure

EXERCISE

1. **With table 1, find the interval of values for the Herfindahl-Hirschman Index for the PC market in the US. Find the interval of values for the instability index.**

- Maximum and minimum possible values for HHI?
- Maximum and minimum possible values for the Instability Index?

Firm	Market Share	
	2020	2024
HP	30%	24,2%
Dell	25%	22,3%
Lenovo	15%	17,2%
Apple	8%	15%
Others	22%	20,5%

Game Theory

BASICS

- **A *game* is…**

John von Neumann
Founder of Game Theory

"*a conflict situation where one must make a choice knowing that others are making choices too and the outcome of the conflict will be determined in some prescribed way by all the choices made*" – John von Neumann

GAME THEORY HELPS US TO MODEL STRATEGIC INTERACTIONS

Game Theory

BASICS

- **A *game* needs…**

Players:

- Participants in the game

Strategy:

- A detailed plan of action for strategic interactions

Payoffs:

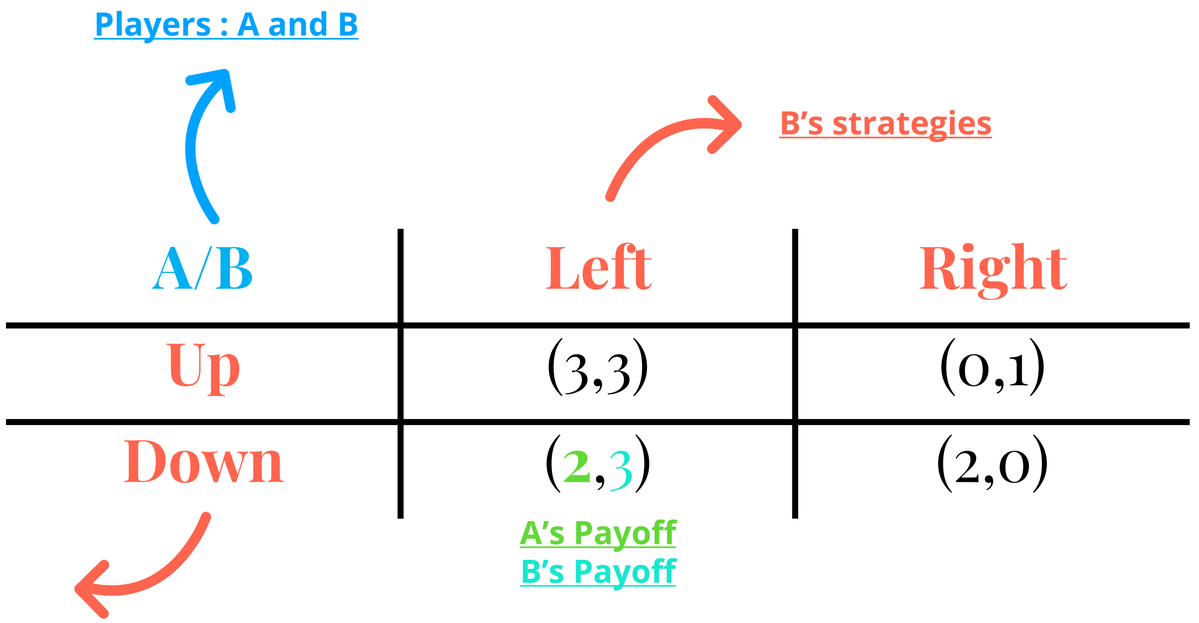
- Final utility the player obtains in the game as consequence of all the player's strategies

Game Theory

SIMULTANEOUS GAMES

SIMULTANEOUS GAMES:

- ✓ Games in which players choose their strategy at the same time
- ✓ Representation: **Payoff Matrix**
- ✓ Solution concept: **Nash Equilibrium (NE) ***
- ✓ How to get to the NE? **Iterative Elimination of Dominated Strategies (IEDS) or Best Response**



***A Nash Equilibrium is a situation in which no player has an incentive to unilaterally deviate from their chosen strategy.**

Game Theory

EXERCISE

1. Determine the equilibrium using iterative elimination of dominated strategies in the following game and by checking the best response to each player's strategy. Determine the Nash Equilibrium.

	U	D
U	8,8	0,15
D	15,0	2,2

3. Determine the equilibrium using iterative elimination of dominated strategies in the following game.

	L	C	R
T	-1,-2	-2,0	0,0
M	-2,0	0,-2	0,0
B	0,0	0,0	1,1

Recommended readings

CABRAL, LUIS MB. INTRODUCTION TO INDUSTRIAL ORGANIZATION. MIT PRESS, 2017.

- ✓ Chapter 9.1: Concentration and Market Power
- ✓ Chapter 4.1: Dominant Strategies, Dominated Strategies and Nash Equilibrium