Industrial Organization

Problem Set #1 Solution

Universidade Nova de Lisboa
Faculty of Economics
Fall 2008

Instructor: Vasco Santos
Grader: David Henriques

1 Concentration and Volatility Measures

a. *(10 points)*

Year	Firms						Concentration Index		
	1	2	3	4	5	Other(s)	C_4	$\inf H$	$\max H$
2000	40%	15%	15%	15%	15%	0%	**0.85**	**0.25**	**0.25**
2006	45%	11%	11%	11%	11%	11%	**0.78**	**0.2509**	**0.263**

- **Year 2000**

$$
\begin{aligned}
C_4 &= \sum_{i=1}^{4} s_i = 0.4 + 0.15 \times 3 = 0.85 \textit{ (0.5 points)} \\
\inf H &= \sum_{i=1}^{5} s_i^2 = 0.4^2 + 4 \times 0.15^2 = 0.25 \textit{ (0.5 points)} \\
\max H &= \inf H = H = 0.25. \textit{ (0.5 points)}
\end{aligned}
$$

- **Year 2006**

$$
\begin{aligned}
C_4 &= \sum_{i=1}^{4} s_i = 0.45 + 0.11 \times 3 = 0.78 \textit{ (0.5 points)} \\
\inf H &= \sum_{i=1}^{n} s_i^2 = 0.45^2 + 4 \times 0.11^2 = 0.2509 \textit{ (1 point)} \\
\max H &= 0.2509 + 0.11^2 = 0.263. \textit{ (1 point)}
\end{aligned}
$$

According to the four-largest firms' concentration index, in the year 2000 the industry was more concentrated than in the year 2006. *(1 point)*

According to the Hirschman-Herfindahl concentration index the conclusion is reversed, i.e., the industry was more concentrated in 2006 than in 2000. Notice that $\inf H_{2006} = 0.2509 > 0.25 = \max H_{2000}$. *(1 point)*

Adelman's equivalent number (EN), is the number of equal-sized firms that yields a given level of market concentration in the Herfindahl index. *(0.5 points)*

- Year 2000 equivalent number, $EN_{2000} = \frac{1}{H_{2000}} = \frac{1}{0.25} = 4.0$. *(0.5 points)*
- Year 2006 equivalent number range,

$$\begin{aligned} \frac{1}{\max H_{2006}} &\leq EN_{20006} < \frac{1}{\inf H_{2006}} \Longleftrightarrow \frac{1}{0.263} \leq EN_{20006} < \frac{1}{0.2509} \\ \Longleftrightarrow 3.8023 &\leq EN_{20006} < 3.9857. \text{ (1 point)} \end{aligned}$$

Instability index

$$I = \frac{1}{2}\left[|0.45 - 0.4| + 4 \times |0.11 - 0.15| + |0.11 - 0.0|\right] = 0.16. \text{ (2 points)}$$

b. *(10 points)*

i)

$$\begin{aligned} C_4 &= \sum_{i=1}^{4} s_i = 0.6 + 0.1 + 0.05 + 0.05 = 0.8 \text{ (1 point)} \\ H &= \sum_{i=1}^{8} s_i^2 = 0.6^2 + 0.1^2 + 6 \times 0.05^2 = 0.385. \text{ (1 point)} \end{aligned}$$

ii)

$$\begin{aligned} \hat{C}_4 &= \sum_{i=1}^{4} s_i = 0.6 + 0.15 + 0.05 + 0.05 = 0.85 \text{ (1point)} \\ \hat{H} &= \sum_{i=1}^{7} s_i^2 = 0.6^2 + 0.15^2 + 5 \times 0.05^2 = 0.395. \text{ (1 point)} \end{aligned}$$

iii)

$$\begin{aligned} \Delta C_4 &= 0.85 - 0.8 = 0.05 \text{ (0.5 points)} \\ \Delta H &= 0.395 - 0.385 = 0.01. \text{ (0.5 points)} \end{aligned}$$

iv)

$$\begin{aligned}\bar{C}_4 &= \sum_{i=1}^{4} s_i = 0.6 + 0.15 + 0.1 + 0.05 = 0.9 \textit{ (1 point)}\\ \overline{H} &= \sum_{i=1}^{6} s_i^2 = 0.6^2 + 0.15^2 + 0.1^2 + 3 \times 0.05^2 = 0.4. \textit{ (1 point)}\end{aligned}$$

v)

$$\begin{aligned}\Delta C_4 &= 0.9 - 0.8 = 0.1 \textit{ (0.5 points)}\\ \Delta H &= 0.4 - 0.385 = 0.015. \textit{ (0.5 points)}\end{aligned}$$

vi)

For the merger between 2 and 3, $\hat{H} = 0.395 > 0.18$ and $\Delta H = 0.01 > 0.005$. Thus, this merger may be challenged. *(1 point)*

For the merger between 6, 7, and 8, $\overline{H} = 0.4 > 0.18$ and $\Delta H = 0.015 > 0.005$. Hence, this merger may also be challenged. *(1 point)*