

# **Sectoral Concentration in Industry Statistics – Opportunities and Challenges**

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## **Abstract**

To facilitate analysis of business concentration (or industry concentration) in selected economic sectors, the Census and Statistics Department (C&SD) in Hong Kong has developed a statistical framework for compiling statistics on sectoral concentration (SSC) since 2000s. The first set of SSC for the reference years of 2004 and 2005 was released in 2007. The statistical series are updated regularly with enhancements introduced as necessary. In addition to basic analysis on overall operating characteristics and analytical ratios, there is increasing interest in distribution analysis of individual economic sectors. Recent research on sectoral concentration indicates that its applications are useful in examining the extent of business concentration of economic activities in an industry. This paper will first introduce the statistical framework of SSC used by the C&SD. It will then present some statistical indicators relevant to SSC applied in other economies, followed by a discussion on the limitations and implications of concentration analysis.

Key Words: Business concentration, concentration ratio, Herfindahl-Hirschman Index, industry concentration

## **1. Introduction**

Industry statistics play an important role in providing quantitative and sometimes qualitative measures to describe the operating characteristics of selected economic sectors. While aggregated total, rate of change and structural/analytical ratios are the more popular statistical indicators in industry statistics, information regarding the distribution of salient variables may also be useful to industry analysts. For example, market share distribution analysis could facilitate the formulation of marketing and business strategy. Accordingly, the C&SD has developed a statistical framework for compiling statistics on sectoral concentration (SSC) since 2000s.

## **2. Methodology**

SSC indicate the extent to which the business activities in an economic sector are concentrated in a limited number of firms. They provide a better understanding of the market structure of the economic sector. Concentration Ratio (CR) and Herfindahl-Hirschman Index (HHI) are two commonly used statistical indicators for the measure. The former measures the importance of a given number of firms while the latter takes into account the shares of all the firms in the economic sector.

### **2.1. Concentration Ratio (CR)**

CR refers to the percentage of total sectoral output such as sales value, value added or employment size which a given number of firms (usually the largest  $n$  firms) account

for. It can be expressed as:

$$CR_n = \sum_{i=1}^n s_i = s_1 + s_2 + \dots + s_n \quad (1)$$

where  $s_i$  is the market share of the  $i^{\text{th}}$  largest firm in terms of market share.

The definition of the CR does not use the market shares of all the firms in the sector and does not provide the distribution of firm size.

## 2.2. Herfindahl-Hirschman Index (HHI)

HHI provides a more complete picture of concentration than CR as it is computed on the basis of all the firms in the sector. The HHI is obtained by taking the sum of squares of the market share of every firm in a sector. Algebraically it is:

$$HHI = \sum_{i=1}^N (s_i)^2 \text{ where } \sum_{i=1}^N s_i = 1 \quad (2)$$

and  $N$  is the total number of firms in the sector.

The market shares are squared in the calculation to place more weight on the larger firms. In other words, firms with larger market share make greater contribution to the HHI. In addition, if there is a shift in market share among the largest  $n$  firms, the value of  $CR_n$  will remain unchanged but that of HHI may vary depending on the extent of the shift.

## 2.3. Interpretations

The value of  $CR_n$  lies between 0 and 1. A near zero value indicates that the first  $n$  largest firms account for an insignificant share of the total output of the sector, while a value close to 1 refers to the situation in which the first  $n$  largest firms account for the total output of almost the entire sector. For a given value of  $n$ , higher values of  $CR_n$  indicate greater sectoral concentration. As for HHI, its value lies between  $1/N$  and 1. Similar to CR, higher values of HHI indicate greater sectoral concentration.

## 3. International Practices

In 2007, the C&SD published for the first time CR values in terms of business receipts for the reference years of 2004 and 2005. In view of the increasing interest in business concentration, the HHI has been made available together with the CR values since 2008. For the more significant sectors, SSC figures for detailed industry groups were also published.

Internationally, HHI values are released by some statistical offices. The published HHI values are mostly applicable to the manufacturing sector. Taking the Census Bureau in U.S. as an example, data collected from economic census are used to compile SSC figures for the largest 4, 8, 20 and 50 firms which are available once every five years. Figures currently available are compiled based on the 2007 Economic Census. For the Australian Bureau of Statistics, the proportion of total output for the first 20 largest firms of selected industries (i.e.  $CR_{20}$ ) and those for the corresponding five sub-groups of equal number of firms (say,  $P_1, P_2, P_3, \dots, P_5$ ) are published. The CR values can be derived by some simple calculations (i.e.  $CR_4 = P_1, CR_8 = P_1 + P_2, CR_{12} = P_1 + P_2 + P_3$  and  $CR_{16} = P_1 + P_2 + P_3 + P_4$ ).

## 4. Limitations

The following paragraphs will discuss the limitations in interpreting the SSC values.

### 4.1. Definition of Firm

The definition of firm<sup>1</sup> is a basic concept in the compilation of CR and HHI, and should be stated clearly when presenting the SSC values. Suppose the economic activities in an industry are concentrated in the top two firms and the market shares of the remaining  $N-2$  firms are almost the same. Assume there are 100 firms in the sector ( $N=100$ ) and let  $s_1=0.30$ ,  $s_2=0.21$ ,  $s_3 = s_4 = \dots = s_{100} = 0.005$  where  $s_1 + s_2 + \dots + s_{100} = 1$ . By substituting  $s_i$ 's into (1) and (2), we have

$$CR_{10} = 0.30 + 0.21 + 0.005 * 8 = 0.550 \text{ and } HHI = 0.30^2 + 0.21^2 + 0.005^2 * 98 = 0.137.$$

If the largest two firms are grouped together and counted as one firm for some reasons, the market shares become  $s'_1 = s_1 + s_2 = 0.51$ ,  $s'_2 = s_3 = 0.005$ ,  $s'_3 = s_4 = 0.005$ , ...,  $s'_{99} = s_{100} = 0.005$  where  $s'_1 + s'_2 + \dots + s'_{99} = 1$ . By substituting  $s'_i$ 's into (1) and (2), now

$$CR'_{10} = 0.51 + 0.005 * 9 = 0.555 \text{ and } HHI' = 0.51^2 + 0.005^2 * 98 = 0.263.$$

In this example, both  $CR_{10}$  values are very close but the HHI value almost doubles in the latter case when the largest two firms are no longer counted as two separate firms. It illustrates that the SSC values for the same group of firms may differ when the definition of firm changes.

This scenario may occur in reality which may be explained by changes in business environment such as mergers and acquisitions. Also, it is sometimes debatable in counting the firms operating in certain specific modes. Some typical examples are company-owned chain stores operating under different brand names and franchised stores run by different operators under the same brand name and control of franchisor. In view of the diversifying trade practices and limitation in the definition of firm, readers should interpret the SSC results with caution.

### 4.2. Comparison across Industries

SSC values are not strictly comparable across industries because the size of individual sectors may differ widely from one another. Smaller-sized industries generally tend to have higher values of  $CR_n$  for a given value of  $n$  in the same period. Thus, it is more meaningful to study the business concentration of the same sector over time and analysis of SSC figures would focus on temporal comparison rather than cross-industry comparison.

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<sup>1</sup> In Hong Kong, an establishment (or firm) is an economic unit which engages, under a single ownership or control, in one or predominantly one kind of economic activity at a single physical location. Where separate figures relating to different activities or different locations under the same management are not available, a combined return is accepted and in this case, the reporting unit is treated as an establishment.

### 4.3. Data Confidentiality

Suppression of SSC values may be needed under some special circumstances in order to safeguard confidentiality of data provided by individual firms. HHI values of an industry group could not be published if the number of firms in the industry group is too small or the largest firm in the industry group has accounted for an overwhelming proportion of market share. Otherwise, close estimates of the market shares of the largest firms may be derived.

As the HHI places larger weights to firms having larger market share, the range of HHI value would narrow when the market share of the largest firm increases. The following table illustrates the range of HHI and the corresponding CR<sub>5</sub> values under different scenarios of the market share of the largest firm:

**Table 2: Range of HHI and CR<sub>5</sub> Values for Different Market Shares of the Largest Firm**

Market share of the largest firm (%)	HHI	CR <sub>5</sub>
50	0.25 – 0.50	0.5 – <1.0
60	0.36 – 0.52	0.6 – <1.0
70	0.49 – 0.58	0.7 – <1.0
80	0.64 – 0.68	0.8 – <1.0
90	0.81 – 0.82	0.9 – <1.0

The HHI value becomes distinctly high in case the largest firm accounts for a significant proportion of market share. In other words, a very close estimate of the market share of the largest firm can be easily deduced by making reference to the HHI value of the corresponding sector and relevant information from some other sources. This is highly undesirable as this implies that information of individual firms may be disclosed. Taking into account the possible HHI value under different scenarios, it would be desirable that the HHI value of an industry group would not be published if the HHI value is higher than 0.6 or if the largest firm accounts for over 80% of total market share.

## 5. Conclusion

SSC can throw light on the extent to which the economic activities in an industry are concentrated. In Hong Kong, CR and HHI are regularly released to describe the business concentration in selected industries. As compared with CR which denotes the total market share of a specified number of top firms in a sector, HHI takes the sum of squares of the market share of every firm with more weight placed on the larger firms. Internationally, SSC figures are released by some statistical offices. Issues such as definition of firm, choice of industry grouping, comparison across industries, data confidentiality and other practical limitations sometimes present challenges to compilers of SSC. Statistics at a more disaggregated level could facilitate users in examining the underlying composition of a specific industry. As such, it would be desirable to review the data dissemination plan from time to time through engaging users so that statistics at an appropriate level of disaggregation could be disseminated.

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