Method Article

Market Structures And Concentration Measuring Techniques

ABSTRACT

The aim of this study is to determine the characteristics of the market structures and methods of measuring the concentration which are the most important issues of economics in recent period. Knowing the market structure and setting the level of competition is important for the policy to be followed for decision makers. In determining market structures, there are many concentration criteria such as concentration ratios, HHI, Lorenz curve, Gini coefficient, Rosenbluth index, entropy index, Linda index, Horwath index, Lerner index. The most widely used are the Company Concentration Rate (CRn) and the Herfindahl - Hirschman Index (HII). Concentration rate is the most common and widely used method because of its simplicity and ease of calculation. Concentration is the control of several indicators (production, sales, etc.) in a sector by few companies. The Herfindahl-Hirschman Index takes into account all firms in the sector and shows sensitivity to firm size. With concentration measurement techniques, it can be determined which of the competitive markets are in the scope of perfect competition.

Key words: Market structure, Concentration Rate, Herfindahl - Hirschman Index

1.INTRODUCTION

Today, the various activities of the firms cause the markets to move away from the full competitive structure and to form the fierce competition markets (monopoly, monopoly competition, oligopoly markets). The purpose of these activities is to increase their market share, to reduce their costs, to increase their income and hence their profits. To achieve this, it is necessary to go to differentiation of goods, to establish scale economies, to make agreements between firms, to apply various marketing techniques (especially advertising activities) [1].

In the case of perfect competition conditions in the market in economics theory, the most desired goods and services are produced by the firms with minimum cost and the resources are used in the most effective way. For this reason, since companies also earn normal profits, consumers are able to purchase goods and services they desire at a minimum price. In this respect, full competition market is considered as the most effective market structure [2]. However, in sectors where there is a lack of competition and a high concentration ratio, a disproportionate price system and misallocation of resources cause consumers to suffer damage [3].

When examining today's market formations, monopolistic competition and oligopoly market structures appear to be predominantly located between the full competition market and the monopoly market. The most commonly used methods in determining the market structures are the N-Firm Concentration Rate and the Herfindahl-Hirschman Index in the context of the Structure-Conduct-Performance (SCP) approach [1]. In ~~the~~ industrial economics studies, the relationship between market structure and performance in the sector is generally considered. The key concepts here are structure, conduct and performance (SCP) that help predict industry performance. Al-Obaidan [4], notes that the Paradigm of Building Behavior and Performance supports a direct relationship between market concentration and competition level. According to the market efficiency paradigm, which is an alternative to the structure, behavior and performance paradigm, it is stated that competition is a process and that monopolization alone does not cause negative results. According to this paradigm, firms should not be perceived as negativity if they are in monopoly and if they are making various technological improvements and lowering their profits and making consumers lose prosperity [5]. According to the competitive market paradigm developed by Baumol, Panzar and Willig [6], the fundamental of monopolistic power is a barrier to the process of entry and exit from market contrary to concentration and scale economies. In other words, few numbers of firms operating in the industry, or the presence of large-scale companies in the industry does not mean that industry performance is absolutely low [7].

Market concentration indices provide useful and practical indicators of market power. Because these indices are market-based values, they are much more useful when a firm's power in the market is determined along with other data. Market concentration indices are easy to calculate and give clues about how competitive the market is. The concentration diminishes and the competition increases within the ratio of the multitude of firms operating in the market and in terms of equivalence of these companies. To the extent that market structure is competitive, the power of firms operating in the market to influence market variables diminishes. For this reason, it is important to know the market concentration rates in determining how competitive the market is [3].

There have been efforts to develop a criterion putting forth the market structure since 1950s. The aim of this effort is to reveal all the relevant characteristics of a variable market structure. The purpose of the analysis of the market structure is to demonstrate that market structures that are theoretically explained in the relevant sector show closer characteristics, such as perfect competition, monopoly, monopolistic competition, oligopoly or other markets. The determination of the characteristics of the market structure is as important from the microeconomic point of view as regards the production and application of macroeconomics [8]. The fact that the markets do not work effectively and the risks that they may cause can cause the social welfare to be negatively affected. For example, concentration can lead to higher profits [9]. Therefore, the relationship between market structure and concentration in a sector is important. It is becoming a necessity to know the concentration rates especially in the control of the markets.

As it is known, the concentration, with its most general meaning, is the distribution of sales volume and number of the firms that are in buyer and seller markets. Therefore, the main debate in the framework of creating concentration criterion is the following:

1) election of the measure to be used

2) to decide whether ~~the~~ all or some of the firms, in a specific market, will be indexed.

3) the meaning and appropriateness of the distribution of firms' sizes within the criteria. The power to influence the concentration of variables to be used has been the subject of various investigations. Examples of these studies are entrance barriers [10,11] and scale economies [12].

The Herfindahl-Hirschman Index (HHI) is another important index used to measure concentration in a market. The shares of all companies in the sector are taken into account. When the index is calculated, the square of the market shares of each company in the market, then the sum of these squares are taken. When there are many companies of similar size in the market, the index value approaches 0. In this case, it is said that the market is approaching perfect competition. As the number of firms increases in the market, the value of HHI also grows. If there is only one firm in the market, ie if the monopoly market is valid, the HHI value will be 10,000. HHI values between 1000 and 1800 are considered acceptable limits. Sectors where the concentration is high in the United States are not permitted by laws against merger and acquisition monopoly, which would increase the index value by more than 100 points [8].

2. LITERATURE REVIEW

Some studies in the world and Turkey, which reveal the market structures of various sectors using the methods of concentration measurement, are given below.

Kambhampati [13], examined the concentration of India's 33 industries in the period 1974-1985. According to the study, concentration is growing faster than the Western countries, with less than 50%. It was determined that the concentration ratio is high in sectors with high dividends.

Symeonidis [14], examined the development of condensation using the four-digit panel data set after the removal of the cards from the UK manufacturing industry. Accordingly, the intensity of price competition reveals a positive attitude towards intensification and advertising intensity in outsourcing sunk cost-intensive industries and concentration in AR-GE intensive industries.

Pan [15], using metropolitan panel data in Taiwan, examined how various relevant service markets and locations of hotels influence the profitability of hotels. Pan revealed that ~~the market~~ concentration in the hotel market could significantly increase the profitability in international tourist venues and that the market intensity in the food and beverage markets had a positive but negligible effect on the profitability in the international tourist venues.

Staikouras and Fillipaki [16], the level of concentration and competition were measured in the European Union (EU) banking system during 1998-2002. Panzar and Rosse methodology was applied in the study and European banks were found to operate under monopolistic conditions.

Cetorelli et al. [17], found that policy makers and market players were very interested in the link between financial market concentration and stability, that the majority of the US wholesale credit and capital markets concentrated modestly, and that concentration trends decreased in some markets during the upswing.

Tung et al. [18], analyzed the international tourism industry in Taiwan according to market share, advertising and profitability indicators. According to this; It has been determined that the brand has a positive effect on the market share and that the profitability of the company has been affected positively and significantly by the market share while it has been adversely affected by the total operating costs and the capital concentration.

Mirzaei et al. [19], examined 40 emerging and developed economies in 1999-2008, combining traditional structure-conduct performance (SCP) and relative market-power (RMP) hypotheses. It has been observed that the higher bank profitability hypothesis has been confirmed with a larger market share in developed economies, but no hypothesis in developing economies supports profitability.

Sarıbaş and Tekiner [20], investigated the concentration level and level of competition of the Turkish Civil Aviation Industry for the period 2011-2013 and used the N-Firm concentration ratio and Herfindahl-Hirschman indices as a method. As a result of the research, it is determined that the concentration rate of Turkish civil aviation industry is very high and the level of competition is close to the oligopoly market. In the calculation made by excluding THY (Turkish Airlines) firm, a low degree of concentration was determined and the result is that the degree of high concentration is mostly caused by the size of THY's market share.

Kaynak [21], analyzed the level of concentration in the Turkish clothing sector using the CR_n (CR_4 ve CR_8), Herfindahl-Hirschman and Entropy Indexes among the concentration criteria. In the analysis covering the years 1995-2014, the concentration according to CR_4 was found high in some periods and low in some periods. In the CR_8 analysis, the concentration rate was steadily high except for 2002 and 2003, especially the global economic crisis caused the sector to move away from the competitive structure. According to the HHI analysis result, the concentration level of the firms operating in the clothing sector was between 468 and 1357, while the low concentration level was valid until 2008, whereas after 2008, there was a medium level concentration.

Auer and Schoenle [22], made an analysis of how firm-level market shares and pricing behaviors affect transit decisions and noted that the market structure failed to explain methods of influencing price adjustments at industry balances.

3. CONCEPTUAL FRAMEWORK OF CONCENTRATION

It is necessary to mention about some features of concentration measurement before the concentration measuring techniques. concentration measurement should have following features [23].

- The concentration must be a one-dimensional criterion. For example, if two industrials are the subjects, either one of them will be more concentrated than the other or less concentrated. Besides, their concentration degrees will be equal. In other words, the concentration measurement isn't uncertain.

- The concentration in an industry is independent from that industry's size. If the market share of i^{th} firm in an industry is Pi, the concentration is a function of Pi. In other words, proportional significance of a firm is determined by its proportional share in the industry.

- A concentration measurement must be sensitive against the changes in firm shares. For example, if the share of any firm increases against a small firm, the concentration must increase, as well.

- If all firms are divided into K equal parts, the concentration index will decrease by 1 / K.

- If an industry has N firms of equal size, the concentration measure N must be a decreasing function.

- A concentration measurement must take values between 0 and 1.

Concentration measurements can be examined by dividing them into two divisions. These are partial indexes and summary (aggregate) indexes [24]. While partial concentration indexes take into account only some of the firms in the market, summary indexes take account all of the firms in the market. Typically, summary indexes, too, stress the importance of marginal firms. Both the dispersion of the firm's volumes and the number of the firms in a specific market affect the firms' conduct and performance in that market. Each concentration index bears a torch on firms' numbers and important aspects of size distribution. That's why; the election of concentration index ought to be guidance according to measurement requirements as well as feature of the situation.

3.1. CONCENTRATION MEASURING METHODS

3.1. 1.Partial Indexes

Partial index is the most commonly used and debated of the entire concentration measurements. Partial indexes, typically, shows the percentage of the market value of a good (or other variable units), which firms (for example the largest 4, 8, 20 and 50 firms) in the subjected market sell in the market.

The distinguishing characteristic of a partial index is based on only a fraction of the total number of firms in a given market. The concentration rates that bases on some large firms and shows the percentage (rate) of total volume of a specific market are commonly used in industrial organization researches as an indicator of competition level and a representative of technological changing criterion. Partial indexes split into two as concentration rates and concentration curves.

3.1.1.1. Concentration Rate

It is the most common and the oldest among the all concentration measurements. It is defined as “n” number of the firm’s cumulative share. It is based on the aggregate value ratios realized by the companies in terms of the criteria of the first "n" firms, which are listed on the basis of various sizes such as production, assets, sales, capacity, employment, value added. In other words, concentration rate shows the share of some big firms in the industry. Each firm’s share is found via following formula.

$$P_i = \frac{X_i}{T} \quad (1)$$

Pi : the market share of i^{th} firm(i=1,......,n)
XI : the sales of i^{th} firm (or the other variables)
T : total sales of the sector(or the other variables)

The market share (concentration ratio) of a certain number of firms is calculated as follows.

$$CR_n = \sum_{i=1}^{n} P_i \quad (2)$$

CR_n: Concentration rate for n firms.
n : Number of large firms in the industry
P_i : the market share of i^{th} firm (i=1,......,n)

These figures, which are mentioned as percentages and determined according to specific firm numbers, are called as concentration rate. Generally, these rates are called according to firm numbers. For instance, four-firm concentration rate (CR4); eight-firm concentration rate (CR8); twenty-firm concentration rate (CR20). So, it is possible to compare among the industries.

Since most countries publish four and eight firmed concentration rates, these rates have become the most common used criterion. That’s why; these rates are used basically as the indicator of monopolistic power. For example, CR4 specifies 4-firmed concentration rate. It is the sum of market shares of the four largest firms. If market shares of four firms in a specific industry are 15%, 12%, %6 and 4%, the concentration rate for this industry is 0.37.

(0.15+0.12+0.06+0.04=0.37).

Concentration rate is a highly used criterion, because its calculation is easy and some countries’ statistics give this figure directly. This rate only gives ~~the~~ information about one point on the concentration curve. If the monopolistic power, which exists, is intended to be measured instead of giving importance to development of the firms’ size distribution in the analysis, this criterion can be considered enough. Nevertheless, it should be mentioned that this criterion has some deficits. Two problems emerge right here [25]. The first problem is how many firms will be picked when we say few firms; the other one is the some chosen big firms will be picked within the same group or different group.

When we say “a few numbers of firms”, it generally means 4, 8, 20 and 50. While the concentration rates are calculated, whole firm size distributions, whereat number of firms aren’t sensitive to changes. This rate doesn’t reflect the changes among the low-rate firms in “n” after a specific “n” is picked.

The question of whether the few numbers of the firms will be picked from the same group or from the changing group is up to researcher’s choice. The firms that enter the largest group can vary in time. If the change in the firms’ structure in time is intended to be seen, the firms that were covered in the beginning should be covered in later periods, as well. As to second issue, only the change in the structure of industry can be observed.

Measurement methods' having dynamic features bring more sound comments.

The fact that the measurement methods are dynamic features brings more sound interpretations. Suppose, for example, that the shares of 8 firms in industry (M) are as follows (Table 1).

As can be understood from the table, the 4-company concentration ratio in year z is 75%. A, B, C, D firms constitute the largest 4 firms in this industry. However, despite the fact that the 4-company concentration ratio has not changed in the past 5 years, the first four firms have lost their place and proportional company shares have changed. If this industry branch had been evaluated only by looking that 4-firm concentration ratio in every two years didn't change, it would have been a unsound interpretation. This is because changing the proportional shares of the firms reveals that there is a certain competition in this industry.

Table 1. Distribution of Market Share of (M) Companies in Industry

Firms	Year Z (%)	Year Z + 5 (%)
Firm A	24	6
Firm B	21	6
Firm C	17	9
Firm D	13	9
Firm E	9	13
Firm F	9	17
Firm G	6	21
Firm H	6	24

Another problem encountered in the method of concentration ratio arises as to what level of this ratio is to be assumed to exceed the concentration threshold. Some researchers have taken the starting point for concentration to a level of 50-55% in their analysis based on a 4-firm concentration ratio. Scherer has identified oligopoly as the industrial sector with a concentration ratio of more than 40%, and monopoly markets with those with a high concentration ratio [26].

According to Bağrıaçık's classification, the absolute monopoly is that a single firm provides all the goods; while the partial monopoly has a share of 50% or more of the single largest firm, the rest of the market is shared by a large number of firms. Similarly, the absolute oligopoly is defined as a situation where all goods are received by five or fewer firms, while a partial oligopoly is where 50% of the market is satisfied by four or fewer firms. The competition market is that the whole supply is met by many companies [27].

On the evaluation made by TSI (Turkish Statistical Institute), Concentration Grades (CR4) in Turkish Manufacturing Industry; it is studied in four parts: from 0 to 30 at low level (competition exists), from 31 to 50 at medium level, from 51 to 70 at high level and very high level of concentration from 71 to 100 [28].

As concentration rates are frequently used in the analysis of industrial markets, it is important to identify potential weaknesses. The most obvious ones are [24]:

- The concentration rate based on the Standard Industrial Classification (SIC) system may not accurately reflect economic markets.

- Concentration rates do not reflect whether the competitors have potential market entry requests.

- Concentration ratios are based on national figures and therefore the regional market does not consider the strength or regional concentration.

- Concentration rates cannot account for the number and size distribution of all firms, but only some of them.

- Concentration rates do not take into account the role of imports in domestic markets.

- Concentration rates do not take into account the export values of domestic producers.

- Concentration rates do not give information about the volume and position of the firm groups within a ratio.

- Concentration rates fail to reflect "cycles" (changes in the positions and limits of certain firms).

- Concentration ratios are structural indications that explain the number and size distribution of certain parts of a firm in a market; they do not have to cover certain types of behavior through the companies in that market.

Even if you are confronted with these weaknesses, it is not inconvenient to use concentration ratios. One of the reasons for this is that it provides important information in terms of both the intensity of competition in the sector and the ease of entry into the industry (or strength). The concentration set here is an important indicator of market behavior and market outcomes. The concentration set here is an important indicator of market behavior and market outcomes.

Second, concentration rates are a simple and easy-to-understand indication of a particular segment of a market. For example, when the 4-firm concentration ratio for the aquatic products industry is 94, this statistic shows that the 4 largest firms have achieved 94% of the total sales value of the aquatic products.

The third and perhaps the most important is to publish statistics on concentration ratios, while there are no alternative data sets for manufacturing industries detailing other aspects of the market structure. For this reason, concentration rates are one of the most frequently used indicators to determine overall market structure. Concentration rates are a valuable helper in the analysis of the industrial organization, even though they are used with prudence.

3.1.1.2. Concentration Curve

The concentration curve is a curve drawn in a two-dimensional system formed by the percentages of firms with an axis number of cumulative firms, the other axis being the one of the indicators such as production, employment, sum of assets, sales, and added value, capacity [25]. The important thing here is to rank the firms from the greatest one. Thus, it is possible to obtain the concentration ratios from the concentration curve. For example, as seen in Figure 1., if the market share of the first four firms is to be seen, the concentration of the four firms will be given by the four firms and the place where the downtrend cuts the concentration curve.

For example, if the vertical axis indicator is taken as the sales quantities of the firms, it is seen that 4 firms account for 10% of sales in this industry, according to the concentration curve indicated by CC_1, which represents any industrial sector. According to the concentration curve indicated by CC_2 belonging to another industry, 40% of the sales are provided by 4 companies. Thus, it is also possible to make a comparison between the industries by determining the concentration curves on a common basis defined by the same indicator.

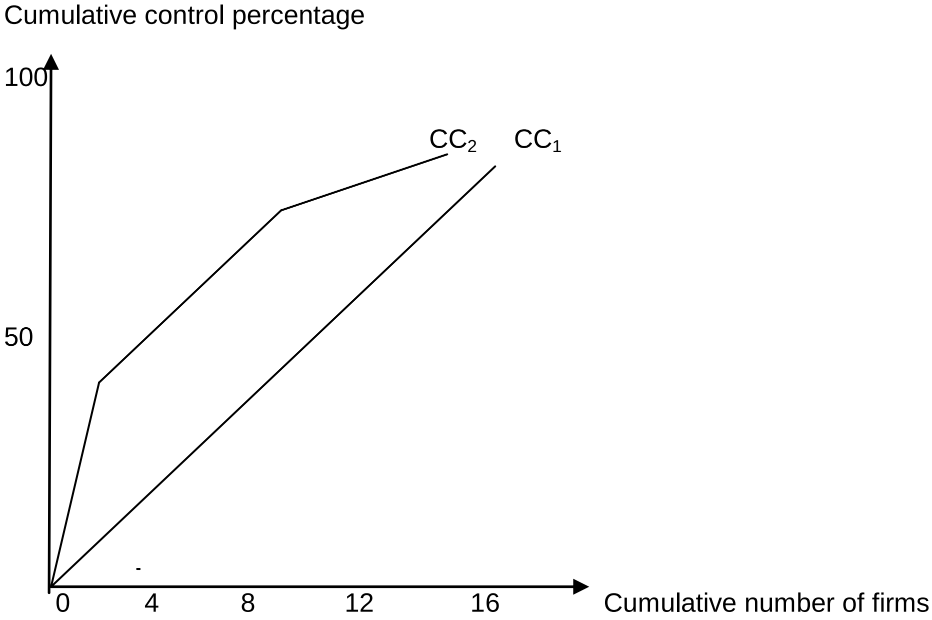

Figure 1. Concentration curves (CC)

3.1.2. Summary Indexes

Summary indexes give results by transforming the data in different ways on the same basis. Its superiority over partial indexes is to take account of all firms on the market. The problems that define the market in a proper way are the same as the indexes and concentration rates. Indexes use information more than concentration rates. The main difference of the indexes is that it brings together the data belonging to the small firm in the market. Some summary indexes are given below.

3.1.2.1. Herfindahl- Hirschman Index (HHI)

It is the most commonly used method after concentration. It is also known as the Herfindahl-Hirschman Index (HHI), as mentioned in the method section. HHI is a measure of the distribution ranging from 0 to 1. This index is the sum of the squares of the relevant company shares which is determined as a ratio (percentage) of the total volume of the market and is calculated according to the following formula:

$$HHI = \sum_{i=1}^{N} P_i^2 \qquad (HHI = \sum_{i=1}^{n} P_i^2 = P_1^2 + P_2^2 + P_3^2 + ... + P_n^2) \tag{1}$$

N : Total number of firms in the industry
P_i : the market share of i^{th} firm (i=1, 2, N)

If there are an equal number of “N” companies in the industry, the index falls to the smallest value of 1 / N (Adelman, 1969). For this reason, the index is a function of the inverse of the number of firms.

$$\text{HHI}= \sum_{i=1}^{N} (1/N_i)^2 \tag{2}$$

$$HHI=N(1/N)^2 \qquad (3)$$

$$HHI=1/N \qquad (4)$$

If there is only one company in the industry, the index reaches the highest value of 1. The HHI considers firm distributions as being different from the concentration ratio. But since the squares of the shares are taken, the contribution to the index value of small firms will be low.

In other words, the HHI takes into account all the companies in the sector and weighs firms with proportional market shares. As the company shares become smaller, they participate in the lesser evaluation. The index reaches its highest value in the monopoly situation and the smallest value is that all firms have equal shares. When the number of firms with equal volumes is large, HHI approximates 0, when it is a single company; it takes the value 1, that is, as the index value approaches one, the concentration increases.

Assume there are four firms in a market with a total value of 100 and absolute volumes of 10, 20, 30, 40. For this market, HHI is the sum of (0.1) 2+ (0.2) 2+ (0.3) 2+ (0.4) 2, nely 0.30. When all firms in a market are of equal volume, they will be equal to HHI (1 / N).

The HHI has a special place in the oligopoly theory because it measures changes in market share and adds to the accounts of all the companies in the market. Data related to market share of each firm in the market are needed because HHI is a summary index and that's why it needs to be calculated technically correct. However, it is not easy to obtain the market shares. In HHI, market share of small firms emerge so small that, their effect is little against the size of the index. Thus, if the market shares of large firms are known, HHI, which relies on the information of all firms' market shares different from the real (current) value a little, can be guessed. For example, assume that in a market that contains 10 firms, market shares of firms are following:

Firm A=0.30, Firm B=0.20, Firm C=0.15, Firm D=0.10, Firm E=0.10, Firm F=0.10, Firm G=0.02, Firm H=0.01, Firm I=0.01, Firm J=0.01

The HHI is calculated as 0, 1832 for this market. Assume that only first six firm's market share is known. HI that relies on these first six firms can be calculated. This value is HHI=0, 1800. Then, if all the firms rest in the market are supposed as a single firm, the market share will be 0.05. (This value is the whole current market share of the rest of the firms). In that case, the HHI will be 0, 1825. The HHI will be said that it cannot be lower than 0, 1825 even if the real sales volume of the firms between firm G and J is known, when it is accepted that the rest of whole market shares of these firms are cumulated in one single firm. Thus, by using these techniques, it is possible to obtain close predictions to real HHI.

"Workable competition" can be said if the HHI is below 40%, firm market share is not fixed; pricing is flexible, low profit rate and little cooperation between firms. A country's competition power can be compared by using concentration ratios and HHI. For example, if the concentration rates show that market is in competition for a product, the competition power of that sector is high.

3.1.2.2 The Lorenz Curve

The Lorenz Curve is a cumulative curve which is used in the examination of gathering such as distributions of income, capital, population and land ownership or the distribution of the capital and production among the firms in a country. It doesn't measure any inequality. It is used in the concentration measurement by a similar approach.

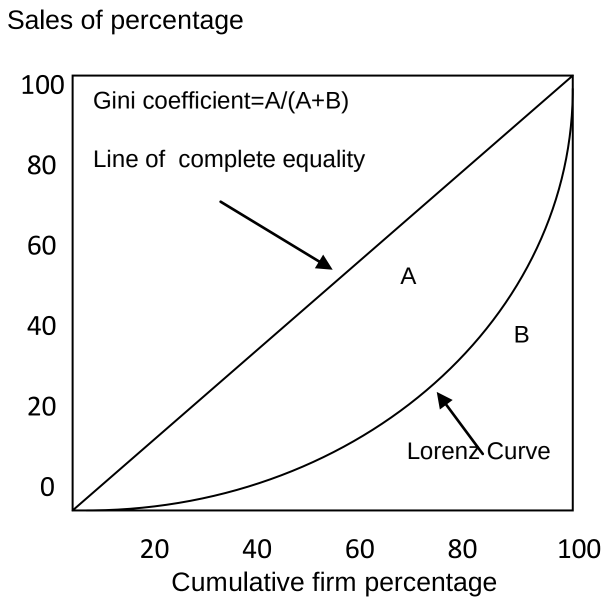

Figure 2. Lorenz Curve

In Lorenz curve, firms' cumulative percentages take place in horizontal axis from large to small; one of the indicators such as production, sale, and employment of the industry takes place in the vertical axis as percentage. Information that is obtained here is not as the concentration ratio belonging to 4, 8, 10, 20… firms in the concentration curve, but the largest 10%, 20% firm in the industry has share according to specific indicators. The importance of seeing these percentages is obvious in the issues where firm's numbers show great differences. A sample Lorenz curve is drawn in Figure 2.

The diagonal line joining the two squares of the unit square is called the "absolute equilibrium line". Lorenz curve will be determined as coincident on this line when the control shares in the market are equal. In this case, inequality in distribution will not be mentioned. The farther away from the diagonal, the more inequality will be encountered. Being away from the diagonal shows more monopolization tendency in the industry. The aim of the Lorenz curve is to demonstrate how much the distribution has diverged from this equality line.

When new incomes and outcomes occur in the market, the Lorenz curve will reflect this situation as if the concentration has changed in the industry even though some large firms' shares don't change. But it will not be affected by changes in the number of firms of equal size. Another important point in detecting the Lorenz curve is that the number of firms in the industry is precisely determined and the drawing is based on the drawing. Numerous small firms that are considered as marginal and are not taken account may affect the shape of the curve largely. The interpretation according to drawing may be unsound because of this.

3.1.2.3. Gini Coefficient

The Gini coefficient, which can be calculated from the Lorenz curve, is used to measure the magnitude of the area between the Lorenz curve and the absolute equation line. This area reflects the proportional effect of the firm's size and control share. Whereat; the area becomes larger, the effect increases. The absolute equality line splits the unit square in two equal pieces. The area of each triangle can be identified as 0,5. The area between Lorenz curve and absolute equality line is called as "inequality area". Gini coefficient is calculated as;

G = inequality area / 0,5

In other words, Gini coefficient for a X market is obtained by dividing the shaded area to the whole area of OCD triangle. As it is seen here, the closer this coefficient is to zero, the closer the industry is to the conditions of the competition market. Gini coefficient's getting close to 1 shows the industry is approaching to the monopoly market. Since, when the G = 1, the inequality area will overlap with the area that absolute equality line determines.

This situation means that a single firm has the whole market and controls it. Gini coefficient, as other concentration criterions, has both advantages and disadvantages. Assume that the structure of a particular industry branch and the firms that make up the industry branch are known. After a while, when there are mergers between medium or small sized companies, the concentration ratio calculated based on the largest three or four firms will not be changed. But this change can be seen by using the Lorenz curve or the Gini coefficient.

In addition to these advantages, the Gini coefficient has two major disadvantages. This coefficient will give unfavorable results when there are few similar firms in an industry. The Gini coefficient for the triopolistic (triple firm) or duopolistic (dual firm) market, which is composed of companies with equal market share, will be zero. However, it cannot be said that monopoly market cannot be mentioned in such cases.

Second, as already mentioned, the Lorenz curve and the Gini coefficient are very sensitive to the mistakes that can be made in determining the numbers of firms in the industry. For this reason, detailed information about the size and number of firms in each industry sector is required. It is often difficult to reach such information.

3.1.2.4. Rosenbluth Index

The Herfindahl index was not ideal because it only weighted proportional quantities and a new index was developed. According to this,

$$\text{RHT} = \frac{1}{\left[2\sum_{i=1}^{n}\left({}^{x_i}\!/\!_{x}\right)-1\right]} \qquad i= 1,........,n,....N \qquad (1)$$

RHT = 1. i= 1,
xi :the sales of i^{th} firm
x :total sales of the sector
n:the number of the large firms in the industry

Here, the shares of the companies are weighted with the rank values. This index measures the area over the concentration curve. It is suggested that this index is more sensitive to changes in firms' size distribution.

3.1.2.5. Entropy Index

The Entropy Index (E) is an approach that involves identifying and evaluating the properties of a system, such as eligibility, irregularity, and uncertainty. Its use in economic theory has also been adopted in relation to the competition market, because the more unclear the competition conditions, the greater the uncertainty of the environment, the more difficult it will be for consumers to make choices, and the more systematic the system will be. The Entropy Index assesses whether there is a departure from the competitive market conditions in an industry, in a similar way to the Herfindahl Index. However, it resolves the deficiency that may occur because of taking squares of the firm shares in H index (since the squares of the market shares are taken, the proportional differences between firm sizes may be somewhat different) and the error, as well. For this, a correction is made by taking the log of the inverse of the firm share (Pi). So,

$$E= \sum_{i=1}^{n} P_i.(\log 1/P_i) \qquad (1)$$

As you can see, the Entropy value (E) will be between 0 and logn (the logarithmic value of the number of companies in the industry). Near-zero values will be interpreted as the absence of entropy in the system of closeness (high concentration) to monopoly and oligopoly markets. The opposite will be true as the number N grows. Likewise, as the inequality between firms' market shares increases, the value of E will decrease. When the market shares of the companies are equal (Pi = 1 / N), E is the maximum. In this case, the value of E is calculated using the following equation:

$$E= \sum_{i=1}^{n} (1/N)\log(1/(1/N)) \qquad (2)$$

$$E=\sum_{i=1}^{n} (1/N)\log N \qquad (3)$$

$$E=(1/N)\log N+(1/N)\log N+....+(1/N)\log N \qquad (4)$$

$$E =(N/N)\log N \qquad (5)$$

$$E=\log N. \qquad (6)$$

The entropy index has the same properties as the H index does. It takes into account the whole of the distribution and it is sensitive to changes in the number and size of firms.

3.1.2.6. Linda Index

One of the measures developed to measure the degree of inequality in an industry is the Linda index.

$$L = \frac{1 / \Sigma Q_i}{N(N-1)} \qquad (1)$$

Qi = the ratio of the average shares of the first largest firm to the remaining N-i firm shares. The index is based on the distribution of the largest firms, not the entire distribution within the sector, as it aims to measure the oligopolistic structure of the industry. The companies that are given examples should cover 2/3 of the related size change values.

3.1.2.7. Horwath Index

It is a comprehensive concentration measure consisting of the combination of partial and cumulative indices (concentration ratio and H index) and calculated as

$$CCI= P_i+ \sum_{j=2}^{N} P_j\,(1+(1-P_j)) \qquad i=1 \text{ ve } j=2,.......,N \qquad (1)$$

This index consists of the weighted sum of the largest firm (i) market share (Pi) and the market shares of other firms (Pj). To facilitate understanding of this index, an example can be given from an earlier work. In 1969, there were five private firms in the construction of tire inner and outer tires in the industrial sub sector of the Turkish Manufacturing Industry. Their market shares according to their employment values were 0.344, 0.317, 0.279, 0.057 and 0.002 respectively [25]. From here,

CCI = 0,344 + ((0,317)) (1+ (1-0.317)) + ((0,279) (1+ (1-0.279)) + ((0,057) (1+ (1-0.57)) + ((0,002) (1+ (1-0.002)) = 0.654008.

CCI is a measure giving the absolute and proportional concentration at the same time. This index, too, handles the biggest firms together with their values and increases the difference between these two groups much more.

3.1.2.8. Lerner Index

The Lerner index measures how much the marginal cost of a sales price for a firm or industry is above its marginal cost. In other words, it tries to determine the magnitude of the difference between the selling price and the marginal cost in the firm or industry. An interest is established between this difference and concentration. The higher the marginal cost (MC) of an industry or the price (P) determined by a firm, the more concentrated the industry is, the more profitable it will be. The Lerner index tries to measure the dimensions of such a relationship. The Lerner index is calculated as follows.

L = (Price-Marginal Cost) / Price = (P-MC) / P

As can be understood, the value of L can be between 0 and K with an ambiguous number. It can be said that the closer the index value (L) is to 0, the closer competitive market conditions are. However, in order for the index to be calculated and interpreted, the market for the application must be in equilibrium with maximization of profit. In the absence of MC = MR, the application and interpretation of this index will not yield healthy results. It can also be said that this index leads to a subjective evaluation due to the use of data for firm performance. It is also very difficult to find the data required for the calculation of the index, especially the marginal cost.

3.1.2.9. Logarithmic Variance

It is only one of many parameters (such as arithmetic mean, median) that can be obtained from the same distribution, which is calculated as the variance of the logarithmic distributions of firm size. By using these parameters together with the variance values, information about the population distribution can be reached by moving from the sample distribution. For example, the Lorenz Curve and Gini coefficient allows this.

Logarithmic variance can be calculated by the following formula.

$$V=1/N \sum_{i=1}^{n} (\log P_i)^2 - 1/N^2\left(\sum_{i=1}^{n} \log P_i\right)^2 \qquad (3)$$

3.1.2.10. Firm Numbers

It can also be interpreted by looking at the number or the number of firms in an industry. However, as mentioned earlier, as the number of firms in a market decreases, it will be far from competitive market qualities, and it will be wrong to make a comment based only on the absolute number of firms. What is important is how many companies of the market are under control. When measuring concentration in an industry branch, it can be determined how many companies are in the industry branch. It is also possible to try to make a comment based on the lack of the total number or the excess in terms of concentration. However, interpretation is certainly useful after other indicators and measurement methods have been applied.

3.1.2.11. Net Profitability

In this method, which is called profitability index, net profit realized by every firm in an industry branch, both the profitability ratio for each company and the average profitability rate for the entire industrial sector are calculated by proportioning to its capital stock. After this calculation, two separate comments can be made. First, it can be said that if there are few companies with a profitability ratio that is well above the average profitability rate in this industry, they concentrate in this industry by means of these companies. According to another interpretation, if the average profitability ratio in an industry is above a reasonable profitability ratio that can emerge in competitive market, it can be said that there is concentration in this industry. Research shows that there is a significant relationship between profitability and concentration [29].

This approach, which seems to be a fairly consistent method, also has some drawbacks. The main ones are; The differences that may arise in calculating the firm net profit amount, the effects that may arise from the accounting systems, the depreciation calculations and the fact that the industry is not in equilibrium. The question of which of these concentration criteria, which is quite a lot here, can be used emerges. The use of proportional valuation methods such as concentration ratio as well as methods with only absolute approach, such as the number of firms in an industry or net profitability methods will make it easier to reach more healthy interpretations.

3.2. Comparison of Concentration measurements

Table 2 provides market share and concentration measurements for various firms in order to make a comparison between various concentration measurements. There are firms, each of them are equal by size but in different numbers, in A, B, and C markets. It can be assumed that the competition on the C market is bigger than the market B and the competition on the market B is bigger than the market A. The greatest deficiency of the variance and Gini coefficient of the logarithms of the concentration criteria arises at this point. These metrics do not give information about the number of firms of equal size. They reflect unequal quantities between firms.

Table 2. Comparison of Some Market Concentration Criteria

	Markets						
Firms	A	B	C	D	E	F	G
1	33.3	20	10	33.3	40	40	38
2	33.3	20	10	33.3	30	30	28
3	33.3	20	10	31.4	25	15	13
4	----	20	10	1.0	5	10	10
5	----	20	10	1.0	----	5	5
6	----	----	10	----	----	----	1
7	----	----	10	----	----	----	1
8	----	----	10	----	----	----	1
9	----	----	10	----	----	----	1
10	----	----	10	----	----	----	1
11	----	----	----	----	----	----	1
Concentration Measure							
N=3(CR3)	100	60	30	98	95	85	79
N=4(CR4)	100	80	40	99	100	95	89
HHI	0.33	0.20	0.10	0.321	0.315	0.285	0.253
Entropy	1.10	1.61	2.30	1.19	1.22	1.39	1.65
Log. Varience	0	0	0	2.92	0.654	0.562	2.03
Gini Coefficient	0	0	0	0.420	0.275	0.360	0.638

Here it is seen that the markets A and D are very similar. The two companies added to the D market have a market share of 1%. The fact that the competition effect of these two firms is negligible is given by the Gini coefficient and measures outside the variance of logarithms. However, the last two measures show significant changes regarding the decline of competition.

E, F and G markets cover a larger number of companies. While the market G expects to have a more competitive structure of F and the market F has a more competitive structure, the variance of the logarithms and the Gini coefficient yield opposite results. For example, the 1% market share added as from the sixth firm shows that the G market is less competitive with significant impacts.

All this causes the Gini coefficient and the variance of logarithms to give satisfactory results when the number of firms remains constant. (The fact that these criteria have a zero value indicates that all firms in the market are of equal size).

Entropy and HI indices seem to be appropriate to the expectations. In fact, there is no optimal concentration index because the normative judgments that can guarantee optimality are not clear, which can explain different behaviors in different industries. For empirical research, the index, which depends on the specific nature of the firm's behavior, will be the most appropriate.

4. CONCLUSION

In today's economies, the disruptions in the competition system bring forth monopolistic competition, oligopolistic and monopolistic structures. This necessitated the examination of the concept of "concentration" which played an important role in explaining the behavior of firms towards production, sales, price and employment policies. Concentration means that a small number of firms in an economy are in the first place in terms of various indicators and control the sector. The concentration's being high results in economics' or an industry field's being controlled by a certain number of firms. The consequence of the concentration is that increasing monopolistic tendencies, along with higher costs and prices, and lower production volumes, lead to poor economic performance as a result of the shift away from the competition market. This situation reaches to the points of deterioration of resource distribution and decrease of welfare level. Such negativities created by oligopolistic and monopolistic structures are not welcomed by societies; prevention of unfair competition, protection of consumers is always on the agenda. Despite the fact that there are many studies on market structures and results in developed countries, the fact that the studies in our country are inadequate has increased the importance of this study. In the study, the concept of concentration was discussed, then the most commonly used methods of concentration measurement were given together with their strengths and weaknesses.

The concept of concentration used in determining the market structure by exploiting different sources in the study is theoretically explained. The information about the reasons for condensation, the factors leading to condensation and the criteria used to determine condensation has been given. Positive and negative aspects of sales volume, production, capacity, assets, employment, and added value used to determine concentration are explained. Concentration measurement methods mentioned in literature have been introduced and application studies have been done with samples. The most commonly used among them are concentration ratios and Herfindahl index. The concentration ratio is based on the total value ratios of the eight firms in the first four quarters, which are listed by the various sizes listed above, in the industry in which the firms are located. In other words, the concentration ratio shows the proportional share of a few largest firms in a company. Concentration grades are classified as low (0-30), medium (31-50), high (51-70) and very high (71-100) condensation by CR4 concentration ratio. This classification is also used in this study. The most commonly used method with concentration ratio is the Herfindahl index. It is composed of the squares of the market shares of the firms determined for a market. This index takes values between 0 and 1. An index value of 1 indicates that the condensation increases.

Concentration is an undesirable situation because of factors such as production, price, employment, technology selection and investment, which are caused by the decisions of a few large firms in the industry, resulting in increased distortions in income distribution, disparity in resource allocation and utilization. There are several suggestions for preventing this situation.

The primary aim is to prevent concentration and to focus on antitrust laws. Such an effort should not be taken in the form of examining the concentration of market shares only. From the control of raw material markets to multi-dimensional understanding extending from the organic links between the firms to the profit lines, it is necessary to take part in such a legal practice. As constraints to concentration, antitrust legislation, legal constraints, entrepreneurial dominance, and the ability of large businesses to grow at the same pace in spite of market growth, reduce concentration [30]. The implementation of the Competition Act, which entered into force in 1994, is more important in this regard. The implementation of laws and regulations is particularly important in terms of prevention of distortions in the developing economic structure, protection of consumers and ultimately control of inflation.

The analysis of the issue of condensation, its measurement and its dimensions in terms of economic structure depends on a very important factor. This means that the necessary statistical information can be explained in a healthy and satisfactory manner. Today, all financial situations, market shares etc. of companies forming economies and industries are not considered as hidden information but are considered as necessary data for the evaluation of economic performance and firms. It has also been an important task for public authorities to ensure that such data are reported in a healthy manner. A wide variety of data, from the employment and capacity of firms to the amount of profits, to the amount of profits they have, to other proprietors, to the sales promoting elements and to the spending they allocate, is important in this sense.

It has become a necessity to fulfill them in order to process an environment suitable for market economy conditions, to protect consumers, to properly distribute and use scarce resources, and even to control inflation.

COMPETING INTERESTS
Author has declared that no competing interests exist

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