1 *Method Article*

Market Structures And Concentration Measuring Techniques

5 **ABSTRACT**

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

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

20 **1.INTRODUCTION**

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

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

34 When examining today's market formations, monopolistic competition and oligopoly market structures
35 appear to be predominantly located between the full competition market and the monopoly market.
36 The most commonly used methods in determining the market structures are the N-Firm Concentration
37 Rate and the Herfindahl-Hirschman Index in the context of the Structure-Conduct-Performance (SCP)
38 approach [1]. In the industrial economics studies, the relationship between market structure and
39 performance in the sector is generally considered. The key concepts here are structure, conduct and
40 performance (SCP) that help predict industry performance. Al-Obaidan [4], notes that the Paradigm of
41 Building Behavior and Performance supports a direct relationship between market concentration and
42 competition level. According to the market efficiency paradigm, which is an alternative to the structure,

43   behavior and performance paradigm, it is stated that competition is a process and that monopolization
44   alone does not cause negative results. According to this paradigm, firms should not be perceived as
45   negativity if they are in monopoly and if they are making various technological improvements and
46   lowering their profits and making consumers lose prosperity [5]. According to the competitive market
47   paradigm developed by Baumol, Panzar and Willig [6], the fundamental of monopolistic power is a
48   barrier to the process of entry and exit from market contrary to concentration and scale economies. In
49   other words, few numbers of firms operating in the industry, or the presence of large-scale companies
50   in the industry does not mean that industry performance is absolutely low [7].

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

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

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

73   1) election of the measure to be used

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

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

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

88

89 **2. LITERATURE REVIEW**

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

92 Kambhampati [13], examined the concentration of India's 33 industries in the period 1974-1985.
93 According to the study, concentration is growing faster than the Western countries, with less than
94 50%. It was determined that the concentration ratio is high in sectors with high dividends.

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

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

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

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

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

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

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

127 Kaynak [21], analyzed the level of concentration in the Turkish clothing sector using the CR_n (CR_4 ve
128 CR_8), Herfindahl-Hirschman and Entropy Indexes among the concentration criteria. In the analysis
129 covering the years 1995-2014, the concentration according to CR_4 was found high in some periods
130 and low in some periods. In the CR_8 analysis, the concentration rate was steadily high except for 2002
131 and 2003, especially the global economic crisis caused the sector to move away from the competitive
132 structure. According to the HHI analysis result, the concentration level of the firms operating in the

133   clothing sector was between 468 and 1357, while the low concentration level was valid until 2008,
134   whereas after 2008, there was a medium level concentration.

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

138   ## 3. CONCEPTUAL FRAMEWORK OF CONCENTRATION

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

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

145   - The concentration in an industry is independent from that industry's size. If the market share of ith
146   firm in an industry is Pi, the concentration is a function of Pi. In other words, proportional significance
147   of a firm is determined by its proportional share in the industry.

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

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

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

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

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

161   **3.1. CONCENTRATION MEASURING METHODS**

162   **3.1. 1.Partial Indexes**

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

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

171

172

173   **3.1.1.1. Concentration Rate**

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

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

180   Pi : the market share of ith firm(i=1,......,n)
181   XI : the sales of ith firm (or the other variables)
182   T : total sales of the sector(or the other variables)
183
184   The market share (concentration ratio) of a certain number of firms is calculated as follows.

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

186   CR_n: Concentration rate for n firms.
187   n   : Number of large firms in the industry
188   P_i : the market share of ith firm (i=1,......,n)
189
190   These figures, which are mentioned as percentages and determined according to specific firm
191   numbers, are called as concentration rate. Generally, these rates are called according to firm
192   numbers. For instance, four-firm concentration rate (CR4); eight-firm concentration rate (CR8); twenty-
193   firm concentration rate (CR20). So, it is possible to compare among the industries.

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

199   (0.15+0.12+0.06+0.04=0.37).
200

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

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

212   The question of whether the few numbers of the firms will be picked from the same group or from the
213   changing group is up to researcher's choice. The firms that enter the largest group can vary in time. If
214   the change in the firms' structure in time is intended to be seen, the firms that were covered in the

215 beginning should be covered in later periods, as well. As to second issue, only the change in the
216 structure of industry can be observed.

217 Measurement methods' having dynamic features bring more sound comments.

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

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

227 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

228

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

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

240 On the evaluation made by TSI (Turkish Statistical Institute), Concentration Grades (CR4) in Turkish
241 Manufacturing Industry; it is studied in four parts: from 0 to 30 at low level (competition exists), from 31
242 to 50 at medium level, from 51 to 70 at high level and very high level of concentration from 71 to 100
243 [28].

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

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

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

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

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

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

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

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

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

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

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

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

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

275   **3.1.1.2. Concentration Curve**

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

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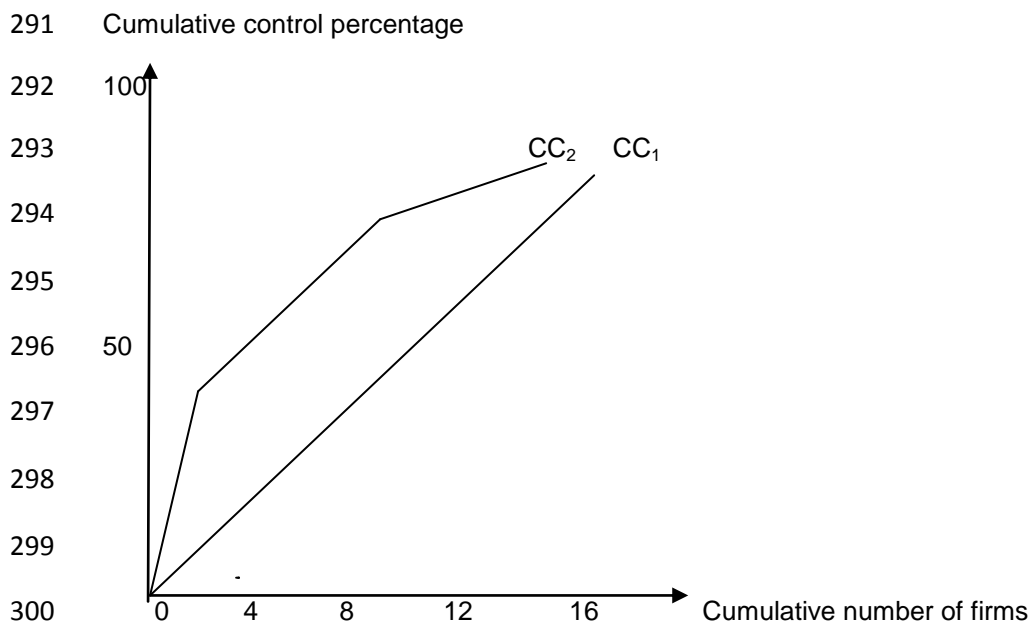288   basis defined by the same indicator.

289

290

Cumulative control percentage

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:

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

N : Total number of firms in the industry
P_i : the market share of ith 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.

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

324        $HHI=N(1/N)^2$ (3)

325        $HHI=1/N$ (4)

326

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

330   In other words, the HHI takes into account all the companies in the sector and weighs firms with
331   proportional market shares. As the company shares become smaller, they participate in the lesser
332   evaluation. The index reaches its highest value in the monopoly situation and the smallest value is that
333   all firms have equal shares. When the number of firms with equal volumes is large, HHI approximates
334   0, when it is a single company; it takes the value 1, that is, as the index value approaches one, the
335   concentration increases.

336   Assume that there are four firms in a market with a total value of 100 and absolute volumes of 10, 20,
337   30, 40. For this market, HHI is the sum of (0.1) 2+ (0.2) 2+ (0.3) 2+ (0.4) 2, namely 0.30. When all
338   firms in a market are of equal volume, they will be equal to HHI (1 / N).

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

347   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
348   H=0.01, Firm I=0.01, Firm J=0.01
349

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

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

362

363   **3.1.2.2 The Lorenz Curve**

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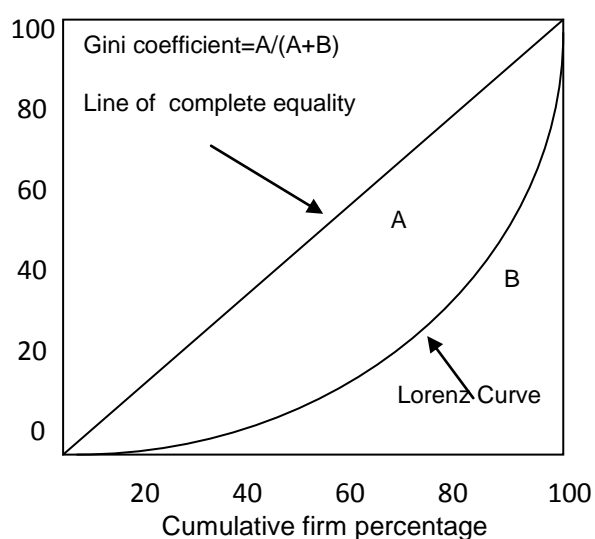
368   Sales of percentage

Figure 2. Lorenz Curve

379 In Lorenz curve, firms' cumulative percentages take place in horizontal axis from large to small; one of
380 the indicators such as production, sale, and employment of the industry takes place in the vertical axis
381 as percentage. Information that is obtained here is not as the concentration ratio belonging to 4, 8, 10,
382 20… firms in the concentration curve, but the largest 10%, 20% firm in the industry has share
383 according to specific indicators. The importance of seeing these percentages is obvious in the issues
384 where firm's numbers show great differences. A sample Lorenz curve is drawn in Figure 2.

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

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

398 3.1.2.3. Gini Coefficient

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

405 G = inequality area / 0,5

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

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

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

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

426 **3.1.2.4. Rosenbluth Index**

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

429 $$\text{RHT} = \frac{1}{\left[2\sum_{i=1}^{n} \left(\frac{x_i}{x} \right) - 1 \right]} \qquad \qquad i = 1,........,n,....N \qquad \qquad (1)$$

430 RHT = 1. i= 1,
431 x_i :the sales of ith firm
432 x :total sales of the sector
433 n:the number of the large firms in the industry
434

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

438 **3.1.2.5. Entropy Index**

439 The Entropy Index (E) is an approach that involves identifying and evaluating the properties of a
440 system, such as eligibility, irregularity, and uncertainty. Its use in economic theory has also been
441 adopted in relation to the competition market, because the more unclear the competition conditions,
442 the greater the uncertainty of the environment, the more difficult it will be for consumers to make
443 choices, and the more systematic the system will be. The Entropy Index assesses whether there is a
444 departure from the competitive market conditions in an industry, in a similar way to the Herfindahl
445 Index. However, it resolves the deficiency that may occur because of taking squares of the firm shares
446 in H index (since the squares of the market shares are taken, the proportional differences between

447 firm sizes may be somewhat different) and the error, as well. For this, a correction is made by taking
448 the log of the inverse of the firm share (Pi). So,

449 $$E= \sum_{i=1}^{n} P_i.(\log 1/P_i) \qquad (1)$$

450

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

457 $$E= \sum_{i=1}^{n} (1/N)\log(1/(1/N)) \qquad (2)$$

458 $$E= \sum_{i=1}^{n} (1/N)\log N \qquad (3)$$

459 $$E=(1/N)\log N+(1/N)\log N+....+(1/N)\log N \qquad (4)$$

460 $$E =(N/N)\log N \qquad (5)$$

461 $$E=\log N. \qquad (6)$$

462

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

465 **3.1.2.6. Linda Index**

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

467 $$L = \frac{1 / \Sigma Q_i}{N(N-1)} \qquad (1)$$
468
469

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

474 **3.1.2.7. Horwath Index**

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

477 $$CCI= P_i+ \sum_{j=2}^{N} P_j (1+(1-P_j)) \qquad i=1 \text{ ve } j=2,.......,N \qquad (1)$$

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

483   CCI = 0,344 + ((0,317)) (1+ (1-0.317)) + ((0,279) (1+ (1-0.279)) + ((0,057) (1+ (1-0.57)) + ((0,002) (1+
484   (1-0.002)) = 0.654008.

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

488   **3.1.2.8. Lerner Index**

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

496    $L = (\text{Price-Marginal Cost}) / \text{Price} = (P-MC) / P$

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

504   **3.1.2.9. Logarithmic Variance**

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

510   Logarithmic variance can be calculated by the following formula.

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

512

513   **3.1.2.10. Firm Numbers**

514   It can also be interpreted by looking at the number or the number of firms in an industry. However, as
515   mentioned earlier, as the number of firms in a market decreases, it will be far from competitive market
516   qualities, and it will be wrong to make a comment based only on the absolute number of firms. What is
517   important is how many companies of the market are under control. When measuring concentration in
518   an industry branch, it can be determined how many companies are in the industry branch. It is also
519   possible to try to make a comment based on the lack of the total number or the excess in terms of

520   concentration. However, interpretation is certainly useful after other indicators and measurement
521   methods have been applied.

522   **3.1.2.11. Net Profitability**

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

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

539   **3.2. Comparison of Concentration measurements**

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

547   Table 2. Comparison of Some Market Concentration Criteria

548

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

549

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

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

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

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

565   **4. CONCLUSION**
566
567   In today's economies, the disruptions in the competition system bring forth monopolistic competition,
568   oligopolistic and monopolistic structures. This necessitated the examination of the concept of
569   "concentration" which played an important role in explaining the behavior of firms towards production,
570   sales, price and employment policies. Concentration means that a small number of firms in an
571   economy are in the first place in terms of various indicators and control the sector. The concentration's
572   being high results in economics' or an industry field's being controlled by a certain number of firms.
573   The consequence of the concentration is that increasing monopolistic tendencies, along with higher
574   costs and prices, and lower production volumes, lead to poor economic performance as a result of the
575   shift away from the competition market. This situation reaches to the points of deterioration of resource
576   distribution and decrease of welfare level. Such negativities created by oligopolistic and monopolistic
577   structures are not welcomed by societies; prevention of unfair competition, protection of consumers is
578   always on the agenda. Despite the fact that there are many studies on market structures and results in
579   developed countries, the fact that the studies in our country are inadequate has increased the
580   importance of this study. In the study, the concept of concentration was discussed, then the most
581   commonly used methods of concentration measurement were given together with their strengths and
582   weaknesses.

583   The concept of concentration used in determining the market structure by exploiting different sources
584   in the study is theoretically explained. The information about the reasons for condensation, the factors
585   leading to condensation and the criteria used to determine condensation has been given. Positive and
586   negative aspects of sales volume, production, capacity, assets, employment, and added value used to
587   determine concentration are explained. Concentration measurement methods mentioned in literature
588   have been introduced and application studies have been done with samples. The most commonly
589   used among them are concentration ratios and Herfindahl index. The concentration ratio is based on
590   the total value ratios of the eight firms in the first four quarters, which are listed by the various sizes
591   listed above, in the industry in which the firms are located. In other words, the concentration ratio
592   shows the proportional share of a few largest firms in a company. Concentration grades are classified
593   as low (0-30), medium (31-50), high (51-70) and very high (71-100) condensation by CR4
594   concentration ratio. This classification is also used in this study. The most commonly used method
595   with concentration ratio is the Herfindahl index. It is composed of the squares of the market shares of
596   the firms determined for a market. This index takes values between 0 and 1. An index value of 1
597   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.

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Author has declared that no competing interests exist

REFERENCES

1. Polat Ç. Structural Analysis of the Turkish Cement Industry in the Context of Concentration and Market Structure. Anadolu University Journal of Social Sciences. 2007; (7) 2: 97-116.

2. Akan M. Policy Implications of Solutions of Dynamic Optimal Production and Inventory Problems for Turkey. Central Bank Review, 2002; (2):64-73.

3. Durukan T, Hamurcu Ç. Market Convergence in Mobile Communications: Turkey vs Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. Black Sea Investigations. 2009; (6) 22: 75-86.

4. Al-Obaidan AM. Market structure concentration and performance in the commercial banking industry of emerging markets. European Journal of Economics, Finance and Administrative Sciences. 2008; (12):104–115.

5. Akay A. Concentration in Turkish Manufacturing Industries: A Panel Data Analysis, Hacettepe University Social Sciences Institute. Unpublished master's thesis .. 2007.Ankara.

6. Baumol WJ, Panzar, JC., and Willig RD. Contestable Markets and the Theory of Industry Structure. New York: Harcourt Brace Jovanovich, Inc. 1982.

642   7. Competitive Market Approaches and Competition Policies. Journal of Gazi University Faculty of
643   Economics and Administrative Sciences. 2002; 4 (3): 49-65.

644   8. Uzgören E. ve Tarhan A. Concentration in the Banking Market in Turkey - Cr4 and Herfindhal-
645   Hirsman Indexes and Analysis- Academic Review Journal. 2012;. (28) January - February 2012,
646   ISSN: 1694-528, 1-16.

647   9.Jacquemın AP, Phılıps, L. Concentration, Size and   Performance of European Firms. Markets,
648   corporate behaviour and the state. editors A.P. Jacquemin and H. W. de Jong. Nijenrode
649   Studies in Economics Volume I. Martinus Nijhoff/The   Hague/1976. Netherlands, 353p. (55-77).

650   10.Caves R.E. Multinational Enterprise and Economic Analysis. Second Edition, Cambridge
651   Surveys of Economic   Literature. Cambridge University Press 1996;322p.

652   11.Neumann M, Weigand J, Gross A, Münter, MT. Market Size, Fixed Costs and Horizontal
653   Concentration. Internatioanl Journal of Industrial Organization. 2001; (19): 823-840.

654   12.Ratnayake R. Industry Concentration And Competition: New Zeland Experience. International
655   Journal of Industrial Organization. 1999; (17):1041-1057.

656   13.Kambhampati U. Market Structure Dynamics in Indian Industry? Bulletin of Economic Research.
657   1998; 50 (2):133-153. ISSN 1467-8586

658   14.Symeonidis G.   Prıce Competıtıon And Market Structure: The Impact Of Cartel Polıcy On
659   Concentratıon In the Uk. The Journal Of Industrıal Economıcs 0022-1821. Volume XLVIII March
660   2000 (1):1-26.

661   15.Pan CM. Market structure and profitability in the international tourist hotel industry. Tourism
662   Management. 2005; (26): 845–850.

663   16.Staikouras CK, Fillipaki AK. Competition and Concentration in the New European Banking
664   Landscape. European Financial Management. 2006;(12)3:443–482.

665   17.Cetorelli N,   Hirtle B, Morgan DP,   Peristiani S,   Santos JAC. Trends in Financial Market
666   Concentration and their Implications for Market Stability. Economic Policy Review. 2007;(13)1:33-
667   51.

668   18.Tung GS, Lin CY and Wang CY.   The market structure, conduct and performance paradigm re-
669   applied to the international tourist hotel industry. African Journal of Business Management. 2010;
670   4(6): 1116-1125, ISSN 1993-8233 ©2010 Academic Journals.

671   19.Mirzaei A, Moore T, Liu G. Does market structure matter on banks' profitability and stability?
672   Emerging vs. advanced economies. Journal of Banking & Finance. 2013; (37): 2920–2937.

673   20. Sarıbaş H, Tekiner İ. Concentration in Turkish Civil Aviation Sector. Finance Political & Economic
674   Comments. 2015; 52 (610): 21-35.

675   21. Source S. Apparel Manufacturing Market Structure and Concentration Rate: An Application on
676   Turkey's Top 500 Industrial Establishments. International Management Journal of Economics and
677   Business Administration. 2016; 12 (30): 21-37.

678   22.Auer RA, Schoenle RS. Market structure and exchange rate pass-through. Journal of International
679   Economics. 2016; (98): 60–77.

680   23.Hall M,   Tıdeman N. Measures of Concentration. Jurnal of the American Statistical Association,
681   March 1967; (62):162-168.

682 24. Koch JV. Industries Organization and Prices. Second Edition. Prentice/Hall International Inc.
683   Editions, London. 1980.   504p. 171-211.

684 25. Erlat G.   Measures of Industrıal Concentration With An Aplication To The Turkish Manufacturing
685   Industry. June 1975; 93 p. *unpublished* master's thesis.

686 26. Scherer EM. Industrial Market Structure and Economic Performance. 2nd ed. Chicago Rand Mc
687   Nally and Company. 1980.

688 27. Özhan M. European Community Industry Structure and Turkish Manufacturing Industry. Industry
689   Yearbook 93. Türkiye Kalkınma Bankası A.Ş. 1993. Ankara. 347p.

690 28. TSI (Turkish Statistical Institute); 2015. http://www.tuik.gov.tr/PreHaberBultenleri.do?id=18859#.
691   (Accessed on 20.06.2017).

692 29. Aksoy MA. Concentration in Private Manufacturing Industry in Turkey: Profitability and Wage
693   Relations. METU Development Magazine. 1983; 10 (3): 367-386.

694 30. Bain JS. The General Explanation of the Development of Concentration: Monopoly Power and
695   Economic   Performance,   The   Problem of Industrial Concentration.   Edited by Edwin
696   Mansfield.   Fourth Edition. New York W.W. Norton $ Company Inc. 1978; 338p. 90-94.

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