

The Structural Approach of Market Competition

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Contributor: Kestutis Peleckis

Competition assessment in the economics is based on the theory of market structure. There are two perceptions of industrial competition—dynamical and statical. A statical picture shows—a long-term balance of industrial competition which will exist if the industry would be described as a market entity in perfect competition, having the constant technology [9]. Distorted competition arises from the advantages of various processes, economies of capacity, lower prices, which support greater market power of one against its competitors. Robust approach states—that the market is often imperfect. Distorted competition arises from modern innovation, product derivations, technological advances in production processes. In addition, monopoly situation is volatile because of creative destruction. Whereas factors connected with technological progress and firm innovation are difficult to detect from a dynamic point of view.

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1. The Structural Approach of Market Competition

Competition assessment in the economics is based on the theory of market structure [1]. There are two perceptions of industrial competition—dynamical and statical. A statical picture shows—a long-term balance of industrial competition which will exist if the industry would be described as a market entity in perfect competition, having the constant technology [2]. Distorted competition arises from the advantages of various processes, economies of capacity, lower prices, which support greater market power of one against its competitors. Robust approach states—that the market is often imperfect [1][2][3]. Distorted competition arises from modern innovation, product derivations, technological advances in production processes [1][4]. In addition, monopoly situation is volatile because of creative destruction [4]. Whereas factors connected with technological progress and firm innovation are difficult to detect from a dynamic point of view [4].

The structural view is reasoned on the structural-manner-performance method (SCP) and could be related with the market situation and firm's manner in the market. Intense of competition can be estimated by the firm's behavior [2]. Market situation is assessed by many criterias: the number, size of customers and vendors, conditions of entry, service differentiation. Behavior is indicated by the pricing policy, agreements, mergers, or business entities. Business activities are related to the industry results such as product/service quality, productivity, profit, distribution efficiency [4][5][6][7][8][9][10][11][12]. It estimates the competition intensity by industry parameters, as the concentration ratio, HHI index, which are commonly used as criterias of competition. In the industrial economy, these indices are often used for evaluating competition. The process of measuring these indices can show the importance of large firms in the industry, both internally and externally [4]. Knowing the possibilities and risks can help scientists to evaluate and interpret competition level of the branch correctly. The measurement of competition level is easy if there are uncomplicated data [5]. For choosing the right criterias, there are some important aspects that must be assessed. When calculating concentration ratio (CR), it is possible to make a mistake in choosing the number n of the best business entities. There are no rules of choice. However, choosing the number n of the best companies is not so important point. The main problem of adopting the concentration ratio as an indicator for estimating the degree of concentration, is strong limitations in interpreting amount of the distribution. According to Hannah and Kay, in case when existing companies merge, the size of the concentration should increase, therefore the rate of competition should be reduced, and in case if companies have grown therefore, and the level of competition will be reduced accordingly [3]. However, ratio fails to meet this parameter if business entities are small size companies.

The most important aspect is distribution in the best n companies. Situation when is a large distribution of the main top n companies, competition activity should be less in case of a lower distribution. Due to the CR limitations HHI is important indicator, which is used to estimate the market concentration level. HHI involves all firms and size of their distribution [4]. In summary, CR can be used as an indicator of competition if the number of sellers does not change, and the size of their distribution does not differ. Otherwise, in the event of structural changes in industries: mergers, start-ups, acquisition, and largely distorted distribution across construction market, the HHI may strongly reflect market concentration. Unstructured

view rely on the New Empirical Industry Organization (NEIO), it is also more complex than the structural view, talking about requirements for the information and estimation methodologies. Researches of unstructured approach does not allow to set the degree of competition according to the structure of construction market, indirectly monitoring the firm's behavior. Industry competition also can not be identified without taking advantage of firm behavior ^[4]. Currently, NEIO area of empirical research was mainly devoted for assessing the behavior of firms. Empirical industry research often uses balance sheets and income statements as a comparison of costs and results. In terms of intermediate modeling, there usually is used property, which is in the balance sheet. It can show the loans, but also show some earnable assets, securities, excess cash reserves. Often there are used three types of costs in the construction market: as input factors generating property, which are personal costs, other non-financial costs, and financial costs, that adequately reflect labor, physical capital, and deposits ^{[5][13][14][15][16][17][18][19][20][21][22][23][24]}. The table of concentration indices is given below (Table 1).

Table 1. The expressions and the limits of the indices ^{[25][1][2][3]}.

Ratio	Ration Range	Ratio Form
Lerner Index	0 = L = 1	$L = P - MCP$
The k concentration ratio	$0 < CR_k = 1$	$CR_k = \sum_{i=1}^k S_i$
Gini Coefficient	0 = G = 1	$G = 1 - 2 \int_0^1 F(x) dx$
The Herfindahl Hirschman Index		$HHI = CH = \sum_{i=1}^n S_i^2$
The Hall-Tideman Index	$0 < HTI = 1$	
The Rosenbluth Index	$0 < RI = 1$	$RI = 1/(2C)$
The comprehensive industrial concentration index	$0 < CCI = 1$	$CCI = s_1 + \sum_{i=1}^n S_i^2 \cdot (1 + (1 - S_i))$
The Hannah and Kay Index		$HKI = (\sum_{i=1}^n S_i^{\alpha})^{1/(1-\alpha)}$, $\alpha > 0$ or $\alpha \neq 1$,
The U Index		$U = (\sum_{i=1}^n S_i \cdot (S_i^{\alpha} - 1)) / \alpha$
The Hause Index	$0 < H_m = 1$	$H_m(\alpha, \{S_i\}) = \sum_{i=1}^n S_i^{\alpha} - (S_i^{\alpha} \cdot (HHI - S_i^2)) / \alpha$
Entropy Measure	$0 = E = \log n$	$E = - \sum_{i=1}^n S_i \cdot \log S_i$

Empirical studies were performed according to the unstructured method. To assess competition are commonly used two main indicators: the Lerner Index (LI) and the Panzar-Rosse H (PRH) statistics ^{[22][24][26][27][28][29][30][31]}. In practice, when choosing the right one between these two indicators, interpretation of competition is important. Pros and cons should therefore be determined. One of the most useful and popular indicators is the LI, which is used to determine the companies market power in the construction industry according to mark-ups above the marginal price. One of the most distinguishing factors is opportunity to check the change of pricing per time. In addition, LI helps to monitor the company's power in different markets, as this do not require a structure to be defined.

However, according to neoclassical view, market power cannot show the degree of competition sufficiently. Criterias to be considered, such as service/product differentiation, obstacles of market access. In addition, when calculating LI by using ordinary method, perfect technical and distributional efficiency are naturally accepted, and it is difficult to confirm circumstances related to optimal efficiency ^{[4][5]}. Differently than LI, the PRH was widely used in the assessment of competitors. The PRH is one of the indicators in terms of a static approach to competition. The PRH always takes into account the long period balance by using a monopolist equilibrium according to the oligopoly view. In an equilibrium situation, when marginal prices are equal to the marginal income, factors of entry price are raised, marginal prices will increase consequently. The construction market monopolist will react to the price increment of input elements by reducing their volume.

Neoclassical theory states, that indicator of market power merely cannot adequately describe the level of competition. Market competition level can be evaluated according to the elasticity of total company income, considering the prices of input factors ^[31]. Transition from input criterias to total income may show the competition level. Like LI, the PRH dont ask the market definition to assess revenue ^[5]. Among these indicators of competition, there are problems in the theory and in empirical aspects of competition researches on the stability and monetary policy ^[10]. Indices are shown in 1 table.

The economists are calculating competitive price comparing it with marginal costs and are using LI, which is associated with a percentage mark-up from marginal costs to residual demand functions elasticity as a measure of the market power

in construction sector. Noteworthy, approach of market power is described as price higher than the marginal cost and it can be different from the concept of market power in Competition Law [32][33][34]. Perfect competition market level is the concept based on assumptions that must be met. Competitiveness economists have offered a concept of competition that is related with prices above marginal costs [4].

Equilibrium prices in ideal competition are referred to marginal costs and may be competitive pricing. However, the concept of competitive pricing often is not so accurate, if there are no violations of competition law, and can be viewed as competitive prices, although if they are above the marginal costs and the market cannot be described as perfect. Lerner index formula [1][2]:

$$L = \frac{P - MC}{P} \quad (1)$$

(1)

here:

P —the price of the goods, set by the business entity.

MC —the business entities marginal cost.

The Lerner index measures the percentage markup, which business entity can charge over its marginal line. Range i from 0 to 1. The higher value more the business entity can charge over its marginal cost, and its monopoly power is greater.

The LI results are from the profitability conditions maximization and has relation with the margin to the price elasticity of demand [2].

$$\frac{p_i - c_i}{p_i} = \frac{1}{\varepsilon_i} \quad (2)$$

(2)

The trade price for service/product i , the price ductility and the marginal cost of demand. Ductility of price demand for one product/service is described:

$$\varepsilon_1 = \frac{\delta Q_1(p_1, p_2, \dots, p_n)}{\delta p_1} \frac{p_1}{\varepsilon_i} \quad (3)$$

(3)

There is shown how the demand of one service/product is declining together with a price increase of one percent by service/product. The price ductility takes an adverse valuation, in absolute. The higher ductility level, is the lower LI number, and the less market power the firm will acquire.

Example: there is an oligopolistic construction market in which companies incur certain fixed costs, they compete in production quantities and produces homogeneous product. This can be demonstrated by the Cournot model when the price exceeds marginal costs in the presence of high competition. From a long lasting view whereby description, there are no strict costs however in a free market—a competitive price may be described as the same to the longer period marginal or longer period average increment price. The demand faced by one business entity usually depends not only on consumer behavior, as well as on the prices of the alternatives or supplements of the firm's relevant services/products, as well as on behavior of other companies supply [2][35][36][37].

Therefore, the specific or residual demand function of a particular firm must be considered if demand and supply can be changed as the most important restriction of competition is faced by the company. Price ductility of residual demand feature covers the restrictions of competition, which company faces are demand and supply substitutes. An increase in a company's prices, can direct to changes in the customer's behavior—buyer's will change the product by buying less, choosing its replacement, buying in other area, or buying something else. The behavior of suppliers may change, due to

production amounts, increasing product (or substitute products) supply by other companies, changing the composition of their services/products, expanding the capacity.

The price balance is associated with parameters such as level of differentiation, alternative replacements, the limitation of amounts, the construction product, the market competition, the buyer power. From a long period perspective to evaluate competitive price is the need to consider barriers to entry into construction sector's market, barriers to development, possible relocation of products and the effects of possible competition.

2. Rosenbluth Index

The calculation of the Rosenbluth index, which reflects the level of market concentration, is based on a limited number of market participants [2]. This method evaluates all companies, which are operating in a particular market. Rosenbluth index from other methods of determining the level of market concentration stands out very sensitive reaction to the changes in market shares and the company's position in the market. Change in firm size in the market also determines the different importance of market share when calculating the index. For market share of each participant is assigned a coefficient of different importance. The HHI is less reactive to changes in market's share of small market participants. The Rosenbluth index is calculated according to the formula [1][2]:

$$R = \frac{1}{2 \sum i S_i - 1}; \quad (4)$$

(4)

there:

S_i is the the i -th companie's market share,

i —relevant market firm's rating.

The values of the RI are evaluated in the same way as in the case of HHI. It should be noted that the RI is calculated only when the number of market participants is finite and when one company has a larger market share than others. This means that the level of concentration cannot be calculated according to the RI if there are companies with the same market share in the market.

3. Maurel–Sedillot Index

In 1999 Maurel and Sedillot proposed a different formula for calculating the level of market concentration [38]:

$$MS = s_1 + \sum_{i=1}^n S_i^2 (2 - s_i); \quad (5)$$

(5)

here:

S_1 —the the i -th companie's market share.

S_i —is the market share of the i -th company.

n —is the enterprises number of the relevant market.

According to the Maurel-Sedillot model, the company with the biggest share of the market is given a higher relative weight in the market. In order not to impede effective competition in the market, the result obtained by this formula should not exceed 0.45.

4. Industrial Concentration Index

To measure concentration in markets more indexes are used also. Bikker and Haaf [25], in addition to the above, distinguished the Industrial Concentration Index (CCI) [1]. This index is expressed as squares sum of the dominant

undertaking's market share and the squares of the remaining undertakings' shares multiplied by the remaining market share [1]:

$$CCI = s_1 + \sum_{i=2}^n S_i^2 * (1 + (1 - S_i)) \quad (6)$$

(6)

here:

S_1 —the largest market share of the company.

S_i —the the i -th companie's market share.

n —is the count of enterprises in the relevant market.

5. Hannah and Kay Index

The value of the comprehensive industrial concentration index is equal to one. With a larger number of firms and an index approaching zero, a declining market concentration, the Hannah and Kay Index (HKI), is shown. This aggregate index assesed according tothe [1][2]:

$$HKI = \left(\sum_{i=1}^n S_i^\alpha \right)^{\frac{1}{1-\alpha}}, \quad \alpha > 0 \text{ ir } \alpha \neq 1, \quad (7)$$

(7)

S_i —is the the i -th companie's market share.

n —is the count of enterprises in the relevant market.

α —coefficient of elasticity, $0 < \alpha \neq 1$, optional, reflects the change in concentration depending on entry/exit/market barriers and trade between firms. α freedom of choice allows an overview of different scenarios. When $\alpha \rightarrow 0$, it shows the number of business entities in the market, and when $\alpha \rightarrow \infty$, the index approaches the analogue of the business entities largest market share.

6. Hause Index

Hause proposed his variants for calculating market concentration [20]: Hause Multiplier (H_m). Hause presented a numerical model that with increasing n , competition grows much more slowly at a lower value of α , that is, at a high degree of agreement, than the HHI predicts [1]:

$$H_m(\alpha, \{S_i\}) = \sum_{i=1}^n S_i^{2-(S_i * (S_i * (HHI - S_i^2)))^\alpha} \quad (8)$$

(8)

S_i —the the i -th companie's market share.

n —the count of enterprises in the relevant market.

α —coefficient of elasticity, $\alpha > 1$.

7. Entropy Index

The entropy index (E) is expressed by the formula [1]:

$$E = - \sum_{i=1}^n S_i - \log_2 S_i \quad (9)$$

(9)

The values of the index are between 0 and $\log_2 n$ and are not limited. The entropy index changes vice versa in proportion to the level of concentration. The index decreases in the presence of inequality. The closer the market is to the monopoly, the value of the index is closer to zero. $E = \log n$, when all firms in the market have equal shares and concentration is the lowest.

8. HHI Index

The HHI is broadly used to determine the merger in a competitive business [29]. Measuring the construction sector's market concentration remains an important issue for understanding the level of diversification and systemic risk. The market influence on merger performance should be evaluated by index which shows the concentration degree. [7][8]. HHI was created to determine diversification [29]. Regulators often use HHI to assess competitiveness and secret behavior effect to concentration. HHI letsto understand the effective structure of controversy and competitive behavior [39]. In most cases, an indirect method is used to assess competitive effects—to identify the competitive constraints faced by the undertaking and to evaluate if the undertaking has market power or the merger strengthened a merger. It is usually gathered by competition authorities usually: there is formulated description of the analyzed market and analyzed the conditions of competition in this market. When the market has been described, it is possible to identify competitors and attribute the relevant market shares to market participants. These market shares and related concentration measures are used for the conclusions about the market power of the undertaking or, unless otherwise specified, the strength of the undertaking's restrictions of competition. The market share is directly related with market power, the level of concentration in the market points to competition, and the higher prices than in less concentrated industries [40][41][42][43]. The Theory of market concentration and HHI is written by Cournot method of quantitative competition for business entities producing a similar product with fixed marginal prices. According to the Cournot model, the average margin, measured in terms of market shares, is similar to the HHI which contains the price ductility of demand. The HHI shows more strength to bigger market shares, a market in which one entity has a very large market share, few smaller entities receive a high HHI size. Situation when there is only a small number of companies with the same market share, market power may not be used. In addition, if there are only a few companies in the market with symmetrical market shares, this may lead to coordinated behavior. Consideration is given here to a homogeneous product market. Another relationship between HHI and harmonized behavioral stability is indicated in Stigler's work. He revealed that the stability of coordinated behavior is the opposite proportional to the HHI. Situation when the market concentration is high, a fraudulent company can be found and deterred by the agreed result. The differences in the index are thought to be related to increase of the price. According to the Cournot model, linear demand and the fixed marginal prices wealth becomes lower with increasing concentration—with the condition that there will be no efficiency gains and potential competition [4].

If there is no synergy merger in the market, compared to the Cournot model, may mean that competition leads to price increases. The relevant market description, the calculation of market shares and the concentration measurements obtained from these shares were used to set the thresholds. In the European Commission's Guidelines, the digital HHI levels and the difference in HHI caused by the merger are used for specifying the range, which will not be subject to any further merger analysis. These limits allow to perform initial merger control therefore, they can be considered as safe ports. The Herfindahl-Hirschman index is mostly used in the EU as a much more detailed model for calculating the construction sector's concentration. HHI determine the degree of concentration in the important market and its geography. It is based on the market shares squared and sum:

$$HHI = C_H = \sum_{i=1}^k S_i^2 \quad (10)$$

(10)

here:

S_i —the the i -th companie's market share.

n —the count of enterprises in the relevant market.

The values of the indexes are determined:

$HHI < 0.1$ —not concentrated market.

$HHI = 0.1–0.18$ —concentrated moderately.

$HHI > 0.18$ —highly concentrated market.

The main limitation of HHI is that predictions are not possible. This is because it is difficult to determine the size of the market because it changes very often. Predictions are possible if the number of construction sector's players is available, and are known their market shares. All enterprises should be included in the calculation of the HHI, and the lack of information about very small enterprises may be insignificant as they do not have great impact on the outcome.

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