AN ECONOMIC ANALYSIS ON THE DEGREE OF MARKET CONCENTRATION: COMPETITION INDICATORS

Mihail BUŞU[1]

ABSTRACT

The activity of competition authorities often involves the necessity of analyzing the relevant market. A starting point of such an analysis should be the assessment of market concentration's degree. Together with other information held by the competition authority, the degree of market concentration creates an overall image of the market. The economic theory indicates a direct connection between the degree of market concentration and companies' performance on the market. Moreover, the competition authorities establish decision thresholds in relation to the shares held by the market players.

KEYWORDS: *competition, market dimensioning, market concentration indicators*

JEL CLASSIFICATION: *L11*

1. INTRODUCTION

A core objective of the economic analysis on the competition field concerns the development of economic methodologies and indicators supporting the assessment of competition level on certain markets and economic sectors. The competition's evaluation in the economic sectors does facilitate the achievement of the attributions derived from the competition law and regulations and also the interaction with other supervisory and regulatory authorities activating in the economic field.

The construction of the indicators dedicated to the best functioning of the economic sectors needs the identification of publicly available data or of those that could be collected with a reasonable logistical effort, given the optimum use of human and time resources at the level of the competition authority.

In terms of the calculation method, the indicators of market concentration's degree could be of two types: absolute indicators and relative indicators.

We are supposed to notice that, in the case of market concentration indicators, the absolute and relative terms do not have the same meaning in the broadest sense of those terms. Here, the absolute indicators refer to the indicators calculated as weighted sums of market's shares and the relative indicators refer to those calculated as weighted averages of market's shares.

In the following steps, we will note the enterprise's market share „ i" with S_i. Market shares could be expressed in two ways: as a percentage value (range from 0 to 100%) or as an absolute value (range from 0 to 1).

Whenever we don't make a statement on our expression mode of market's shares, we are supposed to express those shares as percentage values. From an economic perspective, a market with a perfect competition is characterized by either the following issues: the enterprises' entries and exits on market are free, ie there are no barriers to enterprises' entries/exits on the market or the market is atomized – there are a large number of enterprises on the market and each of them has a very small market share, close to zero.

[1] Drd., Academy of Economic Studies, Romania, mibusu@gmail.com

If these conditions are not met, the market is one of imperfect competition. For example, if a small number of companies are activating on the market and they have a relatively similar market power, this market is an oligopoly. If a unique company activates on the market, this market is supposed to be a monopoly.

2. ADDRESSING MARKET SHARES

The typical procedure of competition authorities all over the world concerns firstly the definition of the relevant market and after that the assessment of enterprises' market power. For the second objective, the analysis is focused on market's shares. This is based on the fact that a monopolist, a company holding a 100% of market share, has the biggest market power. In the meantime, a company with a very small market share has not the capacity to influence the market and has not a market power.

We should take into account the fact that the issues mentioned above are generally valid. There are also some exceptions in which a monopolist has less market power than a company activating on an oligopolistic market (as a consequence of the regulations in this economic sector, of the lack of entry barriers etc.). In addition, the concept of *market power* is not synonymous with that of *market share.* For example, a company with a small market share controlling an input necessary to other market agents (a high market share upstream), is able to influence the market and therefore it has a market power (even if this is not expressed in the analysis of market shares).

However, there is no doubt concerning the powerful and positive relationships between the market power and the market share of an enterprise. Market shares and the concentration degree offer the first useful indications on market's structure and on the competitive importance, both for the parties to the market concentration as well as for their competitors.

In general, market shares are calculated on the basis of **the annual data concerning the value/volume of sales**. If the market in question is characterized by very homogenous products (a cheaper product could successfully replace another more expensive product), **then it is recommended to calculate the market shares based on sales volumes rather than on sales values.**

3. THE INDICATORS OF MARKET CONCENTRATION'S DEGREE

The concentration level of a market offers useful information for the analysis of the competition degree on the market in question. There are a number of market concentration indicators, each of them being based on the calculation of market shares. Market shares are generally calculated based on the value of the products/services sold but they could also be calculated based on the volume of the products/services sold (depending on the specific market). The main indicators of market concentration's degree are:

3.1. The Concentration Ratio – CR
It is the sum of market shares of the biggest *n* market players. In general, it involves a limited number of companies **in order to highlight the oligopolistic character of the market** (a small number of companies control a significant part of the market). The value of this indicator varies from 0 (perfect competition) to 100 (oligopoly if n > 1 and monopoly if n = 1).
The Concentration Ratio is calculated as:

$$CR_k = \sum_{i=1}^{K} s_i \qquad (1)$$

where s_i represents the market share of the enterprise i from the sector in question.

3.2. The Hall-Tideman (Rosenbluth) Index (HTI)

As the Herfindahl-Hirschman Index (HHI), the Hall-Tideman Index involves the market shares of all the companies on the market but unlike it, the HTI puts more emphasis on enterprises with low market share. Its value is nil, being equal to 1 in the case of a monopoly. **The HTI Index is useful when**, although there are a series of companies with big market shares, **the market in question is influenced by the enterprises with a low market share.**

This index could be calculated as:

$$HTI = \frac{1}{2\sum_{i=1}^{n} is_i - 1}$$ (2)

where i represents the company's position on the market. The Hall-Tideman Index varies, as well as the HHI Index, from 0 to 1 and it tends to 0, as companies are equal.

3.3. The Herfindahl-Hirschman Index (HHI)

It represents the sum of squared market shares of all companies on the market. As a consequence, this index gives a greater importance to the enterprises with a bigger market share.

The *HHI* Index is calculated by summing the squares of market shares of all active companies on the market. This index could be calculated as:

$$HHI = \sum_{i=1}^{n} s_i^2$$ (3)

Where s_i represents the market share of company i and n represents the number of companies activating on the market in question.

The **HHI Index is the most widely used index of market concentration** by the competition authorities. Its value varies from 0 (perfect competition) to 10000 (monopoly).

However, there are no universally accepted levels of this index in order to classify a market in the following categories: a low concentrated market, a medium concentrated market or a high concentrated market.

We give below the levels used by The European Commission, respectively by DOJ-FTC:

Table no 1. The levels of HHI Index

Concentration degree	Value of HHI	
	European Commission	**DOJ + FTC**
low	< 1000	< 1500
medium	1000 – 2000	1500 – 2500
high	> 2000	> 2500

Source: European Commission and DOJ+ FTC

Even if the HHI is the most used index by the competition authorities in order to measure the degree of market concentration, its results are not always relevant for the market analyzed. We have two examples:

Example 1
When there are only companies with small market shares, the HHI utilization leads to underestimating the degree of market concentration. For such a reason, it is recommended to use the Hall-Tideman Index in the case of such a market;

Example 2
For the banking market, as a consequence of its specificity, it is recommended to use the Panzar-Rosse Index or other indicators related to this sector of economic activity.

3.3.1. Estimating the Herfindahl-Hirschman Index
Sometimes, because of the insufficient data held by a competition authority, it is not possible to calculate an exact value of Herfindahl-Hirschman Index. Such a situation appears when a number of companies are activating on a market and when the competition authority "knows" only the market shares of the greatest ones. However, as our goal is to fit the value of HHI Index in one of the intervals, using the limits specified by the European Commision: [0, 1000], [1000, 2000] or [2000,10000], in some cases it is possible to characterize a market in relation to its concentration degree, although we know only the market shares of the greatest companies activating on the market.

We present below the methodology for identifying an upper limit, respectively an inferior one for the Herfindahl-Hirschman Index.

We take into consideration a market where n companies are activating. We know only the market shares of the first k enterprises.

Being $S_i, i = \overline{1,n}$ the market shares of those n companies, ranked in descending order.

Thus, we have the following relation:

$$S_1 \geq S_2 \geq ... \geq S_k \geq S_{k+1} ... \geq S_n \qquad (4)$$

where $S_1, S_2, ... S_k$ values are known, but where $S_{k+1}, S_{k+2}, ... S_n$ values aren't.
We calculate HHI on that market:

$$HHI = S_1^2 + ... + S_k^2 + S_{k+1}^2 + ... + S_n^2 \qquad (5)$$

3.3.2. Calculating an upper limit for HHI

Proposition 1

Being $a_1, a_2, ... a_n$ n positive numbers, so $a_1 \geq a_2 \geq .... \geq a_n$. Then the following inequality will take place:

$$(a_1^2 + a_2^2 + ... + a_n^2) \leq (a_1 + a_2 + ... + a_n) \cdot a_1 \qquad (6)$$

Proof:
We loosen the brackets and we get:

$$a_1^2 + a_2^2 + ... + a_n^2 \leq a_1 \cdot a_1 + a_1 \cdot a_2 + ... + a_1 \cdot a_n \qquad (7)$$

We move all the terms to the right part of the inequality and by grouping the alike terms, we will obtain:

$$0 \leq a_1(a_1 - a_1) + a_2(a_1 - a_2) + ... + a_n(a_1 - a_n) \qquad (8)$$

This is an equality that is always true, because it has only positive terms, according to the stated hypothesis.

Further on, we will calculate an upper limit of HHI, by applying the above proposition, for the unknown market shares, respectively for $S_{k+1}, S_{k+2}, ... S_n$. Therefore,

$$HHI = S_1^2 + ... + S_k^2 + S_{k+1}^2 + ... + S_n^2 \qquad (9)$$

$$HHI \le S_1^2 + ... + S_k^2 + (S_{k+1} + S_{k+2} + ... S_n) \cdot S_k \qquad (10)$$

Because of the fact that n, k, $S_1, S_2, ... S_k$ are known, M could be treated as an upper limit for HHI,

$$\text{where } M = S_1^2 + ... + S_k^2 + [100 - (S_1 + S_2 + ... + S_n)] \cdot S_k \qquad (11)$$

3.3.3. Calculating an inferior limit for HHI

For calculating this inferior limit, we need the inequality of averages (the square average of n positive numbers is bigger or equal to their arithmetic average/mean) as follows:

Proposition 2:
Being $a_1, a_2, ... a_n n$ positive numbers. Therefore it takes place the following inequality:

$$\frac{a_1 + a_2 + ... a_n}{n} \le \sqrt{\frac{a_1^2 + a_2^2 + ... + a_n^2}{n}} \qquad (12)$$

By squaring, this inequality could be rewritten as:

$$\frac{(a_1 + a_2 + ... + a_n)^2}{n} \le (a_1^2 + a_2^2 + ... + a_n^2) \qquad (13)$$

Proof:
The above inequality could be also rewritten as:

$$(a_1 + a_2 + ... + a_n)^2 \le n(a_1^2 + a_2^2 + ... + a_n^2) \qquad (14)$$

We raise the left side of the inequality squared, then we move all the terms to the right and we will get:

$$0 \le (a_n - a_{n-1})^2 + ... + (a_2 - a_1)^2 \qquad (15)$$

This relation is true, because on the right side of the inequality we have a sum of perfect squares that is always positive. The equality takes place only when the numbers are equal.
After that, we will calculate an upper limit of HHI, by applying the proposition above for the unknown market shares, respectively for $S_{k+1}, S_{k+2}, ... S_n$.

Thus, by applying this relation (4), we will obtain:

$$HHI = S_1^2 + ... + S_k^2 + S_{k+1}^2 + ... + S_n^2 \ge S_1^2 + ... + S_k^2 + \frac{(S_{k+1} + ... + S_n)^2}{n-k} \qquad (16)$$

Because of the fact that n, k, $S_1, S_2, ... S_k$ are known, N could be treated as an inferior limit for HHI,

$$\text{where } N = S_1^2 + ... + S_k^2 + \frac{(S_{k+1} + ... + S_n)^2}{n-k} \qquad (17)$$

Therefore we could sustain that we have just found two limits for $HHI : N \le HHI \le M$

4. APPLICATION: THE INSURANCE SECTOR IN ROMANIA

4.1. A general presentation of the sector

Insurances play a vital role in the management and risk transfer in the economic environment, providing protection for both individuals as well as for the companies. The strategic importance of insurances sector for the economy in general and particularly for specific sectors such as

transportation and real estate, is obvious and it derives from the capacity of insurance companies to take individual risks and to handle them at an aggregate level.

In Romania, the insurance activities are supervised by the Insurance Supervisory Commission (CSA).
The general regulatory framework of the insurance sector is represented by:
  i)   Law no 136/1995 on insurance and reinsurance in Romania, with all the amends and supplements;
 ii) Law no 32/2000 on the insurance activity and on insurance supervision.

4.2. Relevant market in insurance sector

The European practice distinguishes three distinct markets for the insurance sector: the life insurance market, the general insurance market and the market of reinsurance services. Also, for the cases in which, a narrower definition of this market, on risk classes, leads to the estimation of a higher market share and to its consolidation, both the National Competition Authority and the European Commission have indicated that those markets could be subdivided according to the covered risk classes.

In this respect, it was shown that, in terms of demand, there is no substitutability between the different categories of risks (for example, the insurances against fire damages could not be seen as substitutes for liability insurances etc.), because of the distinct characteristics, of the insurance cost level and because of the final objective pursued.

However, from the supply perspective, the insurance conditions for different classes of risks are similar and most of the insurance companies propose insurances for different classes of risks. This shows that the different categories of risk classes could be included in the same market of the product – a market concerning the general insurances. Thus, the main general insurances categories could form the same number of relevant markets, as following:

Graph no.1. **The approximate share in the total of general insurances during 2011**
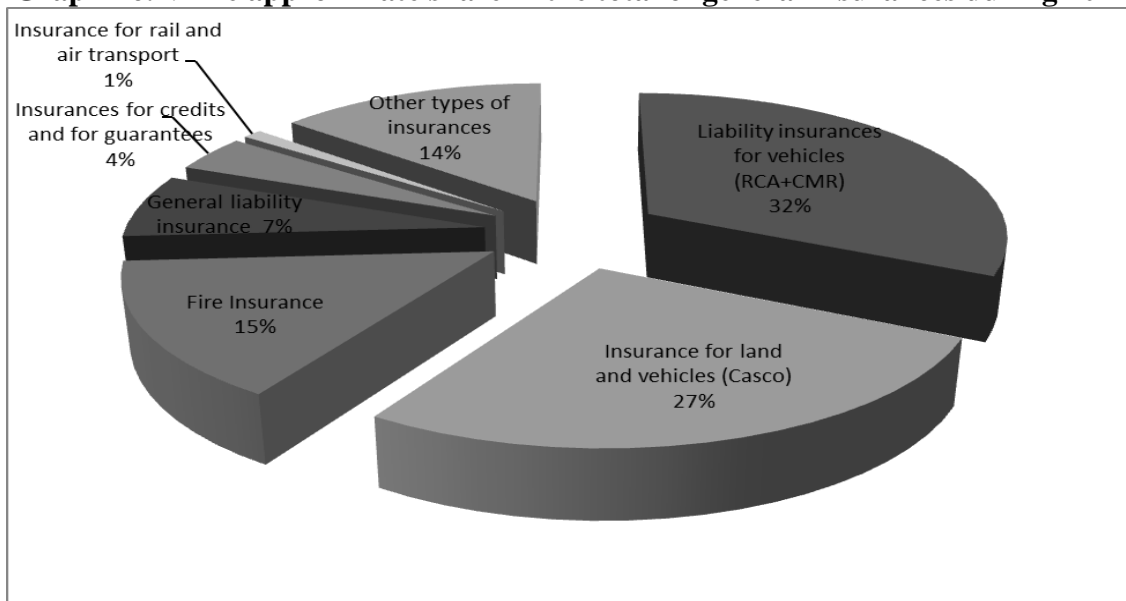
Source: CSA and own processing

Meanwhile, life insurances, calculated as a sectorial share, represent about 20% of gross subscribed insurance premiums.

4.3. Concentration on insurance market

A number of 43 insurance companies developed an insurance/reinsurance activity during 2011, as follows:
- 20 insurance companies conducted activities of general insurances;
- 12 insurance companies conducted activities of life insurance;
- 11 insurance companies conducted a composite activity (general and life insurance).

During 2011, the situation of competition on insurance market in Romania, depending on the market shares of the main players, is described in the next chart as follows:

Graph no 2. Market shares in insurance sector during 2011
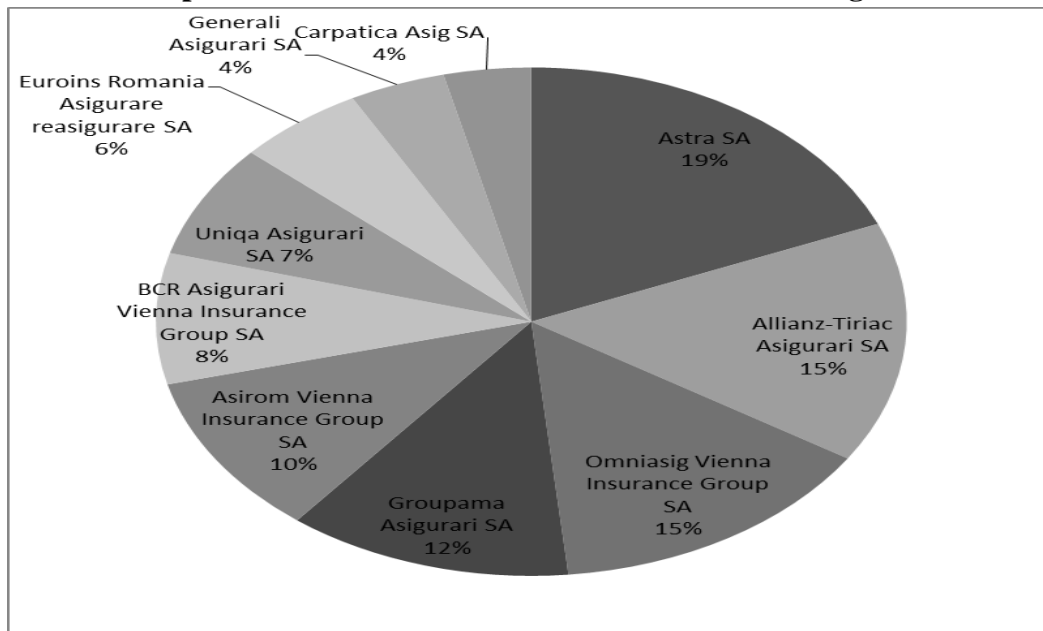
Source: CSA and own processing

As seen from the graph above, the sum of the market shares corresponding to the top 10 players in the sector is 87.09%. Totally, there are 43 players in this sector, which means that the remaining 33 players share only 13% of the market (aggregate market share calculated by difference, respectively 100-87.09 =12.91).

According to the information mentioned above, we will try to calculate the upper limit and also the inferior one of the Herfindahl-Hirchman Index in order to estimate the degree of market concentration.

For this purpose, we ranked in descending order the first 10 companies from this sector, in reverse order of their market shares.

Company	1	2	3	4	5	6	7	8	9	10
Market share	16.3	13.35	12.52	10.71	8.98	7.25	6.3	4.8	3.6	3.28

$$HHI = S_1^2 + S_2^2 + ... + S_{10}^2 + S_{11}^2 + ... + S_{43}^2 \quad (18)$$

$$= (16.3)^2 + (13.35)^2 + (12.52)^2 + (10.71)^2 + (8.98)^2 + (7.25)^2 + (6.3)^2 + (4.8)^2 + (3.6)^2 + (3.28)^2 + S_{11}^2 + ... + S_{43}^2$$

$$= (16.3)^2 + (13.35)^2 + (12.52)^2 + (10.71)^2 + (8.98)^2 + (7.25)^2 + (6.3)^2 + (4.8)^2 + (3.6)^2 + (3.28)^2 + S_{11}^2 + ... + S_{43}^2$$

$$= 938.02 + S_{11}^2 + ... + S_{43}^2 \qquad (19)$$

Next, we will calculate the two limits, N and M, according to formulas (3) and (4) as presented above:

$$M = S_1^2 + ... + S_k^2 + [100 - (S_1 + S_2 + ... + S_n)] \cdot S_k \qquad (20)$$

$$= 935.02 + (100 - 87.09) \cdot 3.28$$

$$= 935.02 + 42.34$$

$$= 977.36$$

$$N = S_1^2 + ... + S_k^2 + \frac{(S_{k+1} + ... + S_n)^2}{n - k} \qquad (21)$$

$$N = 935.02 + \frac{(100 - 87.09)^2}{43 - 10}$$

$$= 935.02 + \frac{(100 - 87.09)^2}{43 - 10}$$

$$= 939.46$$

Thus, although we are not able to calculate the exact value of HHI, we know that it is between 939.46 and 977.36. Formally, we could appreciate that:

$$939.46 \leq HHI \leq 977.36 \qquad (22)$$

5. CONCLUSIONS

According to **table no 1**, because of the fact that HHI < 1000, we could conclude that on this market the concentration degree is a low one.

The evolution of the concentration degree on insurance market during the last 3 years could be regarded as it is presented in the following table:

Graph no 3. The evolution of the concentration degree on insurance market during 2009-2011
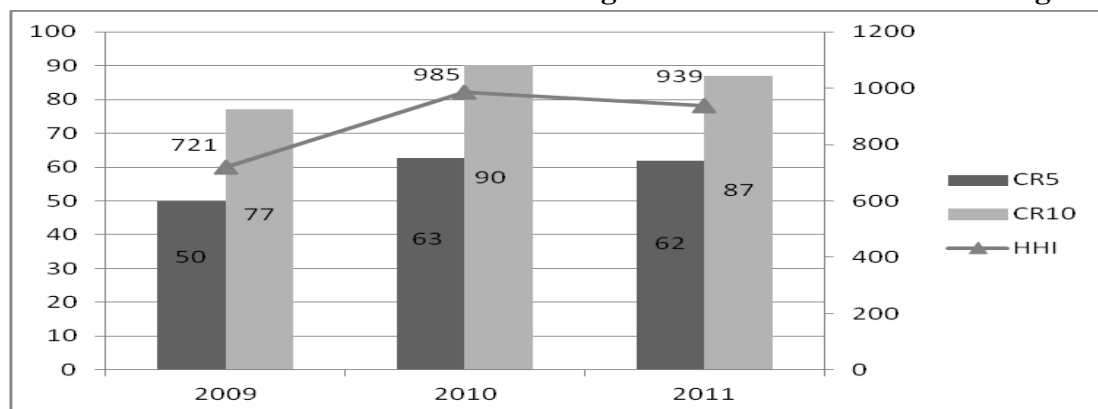
Source: CSA and own processing

Concentration ratio values for the first five and respectively ten companies from this sector show us that on this market, the concentration ratio value knew a relative increase during the last three years. The low concentration degree of the insurance market is obviously correlated with a high competition degree. However, as we mentioned above, the market share of the players is not the only one determinant of market structure. In particular, the adopted distribution channels may have

a significant effect so that, as they rely more on direct sales and on merger agents, thus it could be potentially reduced the competition power.

Despite all these, an increase of concentration degree could not be seen only as a bad issue. First of all, if companies grow in size, they may be able to benefit from economies of scale, achieving lower average costs. This is probably possible to occur in industries with high fixed costs and with opportunities for specialization.

Meanwhile, because of the actuarial principles that characterize insurance products and because of the complexity of clauses corresponding to insurance contracts, there is a low transparency on insurance market and this fact consolidates the market power of the active companies on particular markets.

The new architecture of the European financial supervisory system imposed to national regulatory authorities from insurance field a new dimensioned management of market, given the authorities the right to vote and to express their position concerning the common issues having an impact on national markets.

In such a context, the insurance supervisory authorities are motivated to participate actively in developing the EU legislation, due to the advantages proposed by a closer approach to the real conditions characterizing the member state that they represent.

One of the fundamental objectives pursued by the Treaty concerning the European Union functioning is that of maintaining and stimulating a competitive environment, propitious to innovation and supporting the final consumer. Regulatory authorities are supposed to cooperate with competent institutions in competition sector in order to develop the competitive market. Thus, we mention here the protocol established by the Insurance Supervisory Commission with the Competition Council. Such actions are expected for opening the market to potential competitors.

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