MARKET COMPETITION: MEASUREMENT AND DYNAMICS

Dmitry Valentinovich Nikolaev,[1][2]

Victor Victorovich Sazonov[3]

Abstract

Competition acts as a driving force of economic development. Nonetheless its impact on the economy is not as explicit as it may seem. The lowest level of competition is as unfavorable for a society as well as excessively high level of competition. So, the level of competitive activity is extremely important. We made an attempt to measure market competition as a system which is based on the following elements: buyer-buyer competition, seller-seller competition and buyer-seller conflict of interests. Measuring of the level of competition is made on the basis of evaluation of goal achievement by a market participant (buyer, seller and society). We complemented the alternative goals in the Theory Of The Firm with an assumption that the main goal of a firm is aspiration to "monopoly-polypsony" market structure. Furthermore, the goal of the firm is in the conflict with the goal of the buyer which is striving for "monopsony-polypoly" structure. This hypothesis has a few assumptions. The approach has been tested based on the world market dynamics in the period of 1948-2013. As a result, it is proved that on the world market sellers were gradually losing their market power while buyers were becoming relatively stronger in this period. The substantial reinforcement of this trend can lead to the negative consequences for the world economy.

Key words: competition, alternative goals of the firm, the Theory Of The Firm, measuring of competition, competitive dynamics, world competition, world economy trends, competitive activity.

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Introduction

Even about two hundred years ago Adam Smith (1790) considered personal motives and competition as the most important aspects of market economy and nowadays the results of his work help us to understand how the market economy works. Obviously, the modern society cannot exist without competition since the very selfish behavior which always strives for better position and its own interest provides society's welfare.

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[1] Far Eastern Federal University (FEFU).

[2] Corresponding author. E-mail address: dnikolaev551@gmail.com and z1415@ya.ru.

[3] Far Eastern Federal University (FEFU).

Competitive actions attempted to reach selfish goals are not identical in terms of efficiency and intensity as well as successes they lead to. The most efficient market participants with high market power are capable of damping other comparatively less successful market participants. The very fact that competition has different degrees of intensity leads to the row of fundamental questions.

For example, what is the extreme level of competitive activity and inertness and what is the impact on the economy? How does the competitive intensity of buyers relate with the competitive intensity of sellers? Which kind of correspondence of competitive activities of buyers and sellers is the most favorable for a society?

In policies of governmental regulation measuring of competition is also extremely important. There are many scientific studies proving the substantial influence of competition on the economic development (Schumpeter, 1911), on innovations (Aghion and others, 2005), on income disproportions (Han, 2014), on the world trade (Krugman, 2002), and on many other spheres of economy. Consequently, creation and development of universal instruments of measuring of competitive intensity is of high importance.

In spite of the fact that the market competition is a popular section of economics, its measuring is difficult and still underexplored economic problem. Solving of this problem will lead to deep understanding of the essence of competition and mechanisms of its impact on the economy.

On the first stage of the investigation we attempted to systemize the basic theoretical and practical approaches to the measuring of competition. On the second stage we created the methodology of measuring of competition. The methodology synthesizes and complements the earlier approaches. On the third stage, we attempted to measure the level of the world competition while considering the world economy as a system. On the final stage we discuss the questions of comparability of our approach with the existing ones.

Systematization of approaches to measuring competition

We support that the existing approaches to measuring and evaluation of competitive activity can be classified and systemized on the basis of "Structure - Conduct - Performance approach" (Bain, 1959). The SCP approach uncovers the process of industries operations in which competitive activity is generated on every stage of this process. If all the market actions and the very fact of the market appearance are seen as the manifestation of competitive activity then it can be concluded that the market cannot exist and function without it. In this sense,

competitive activity equals any market actions while inactivity on the market equals market inertness.

All these market actions and its circumstances can have different forms and degrees of manifestation which in turn serve as a basis of approaches to measuring of competition. Indexes and factors of the structure characterizing the static state of market competition are the following: quantities of buyers and sellers, presence and degree of product differentiation, barriers of entry, diversification and so on (Stackelberg, 1952, Bain, 1959, Chamberlin, 1958, Rumelt, 1982, Datta, 1991, and others). Every index or factor used separately and solely cannot clearly characterize the state of competition, so in practice generalizing indexes and factors are used. These are Herfindahl-Hirschman Index (HHI), The Hannah-Kay Index, Tideman-Hall Index, Lind Index and others. On the basis of such indices we can identify the type of market structure, height of entry barriers, and probable strategy of behavior of market participants (Nikolaev, 2013).

It is also important to mention Lerner Index (1934) which is popularly used for measuring of the market power of single firms and industries. Interestingly enough, for the industries Lerner Index equals the sum of indices of an industry's firms weighted on the basis of the shares of their revenues (Boone, 2008). The other name of the index is PCM. The PCM Index is calculated as follows:

$$\text{PCM} = \sum_{i=1}^{n} s_i \frac{p_i - c_i}{p_i}$$

where, p is equilibrium price of the firm i, s stands for the market share of the firm i, c stands for marginal costs.

It is worth mentioning that there are some specific drawbacks of the index. High intensity of competition can increase market shares of the most efficient firms with the highest profitability and, as a result, the PCM Index will rise. In this case, it means that the PCM Index can be high in the highly competitive environment (Boone, 2008). In the other case of oligopolistic collusion, the PCM Index increase can obviously take place while the environment is not quite competitive in terms of traditional standards.

As for behavioral indices, these are sensitive to the competitive actions of buyers and sellers in such arrears as price policy, collusion, strategy of firms' advertising, investments in R&D, tactics of settling law issues and others.

One of the most popular approaches to measuring the level of competitive activity is the Panzar-Rosse Model (1977, 1987), (Fischer & Kamerschen 2003). It is based on econometric evaluation of elasticity of total revenues with respect to changes in factor input prices which is describes by the following equation:

$$logTR = a + \sum_{i=1}^{n} \beta_i \log w_i + \sum_{i=1}^{n} \gamma_i \log CF_i + error$$

where TR denotes total revenue, wi is the i-th input factor, and CF other factors specific for an industry (Bikker, Shaffer & Spierdijk 2009). Regression coefficients related to the factor input prices are summed up and formed into H-statistics:

$$H = \sum_{i=1}^{n} \beta_i$$

Panzar and Rosse proved that H is a negative number for a neoclassic monopolist or a collusive oligopolist while changing from 0 to 1 in monopolistic competition. H equals 1 in the competitive market being in the long term equilibrium. Such configurations of H can be explained in the following way: in the market of perfect competition when costs go up, revenues rise as well while in the monopoly case an increase of marginal costs (MC) always leads to the decrease of revenues.

Coefficients of elasticity in the Bresnahan Model are also of high interest. In the model competition is measured by λ parameter which impacts the market power and the level of effectiveness of collusion of oligopolists. The model is presented in the following way:

$$P = c(Q, W, \beta) - \lambda \cdot h(Q, Y, a) + \text{Ŋ}, \text{ P} + \lambda \cdot \text{h( )} = \text{MR},$$

where P is price, Q is quantity, Y is an exogenous variable, and a is a parameter of the demand system, Ŋ is an error, W are exogenous variables on the supply side, β is the supply-function parameter, c is marginal cost. $\lambda = 0$ (therefore P=MC) means perfect competition, $\lambda = 1$ means perfect cartel, and intermediate λ's corresponds to other oligopoly solution concepts (Bresnahan, 1982).

Menezes and Quiggin's (2011) approach is similar to the Bresnahan's Model. They supported that the intensity of competition can be measured by the slope of the competitor's supply function curve.

It terms of behavioral approach, competition is presented by the degree to which one firms react to the behavior of the other ones and vice versa. On the internal market, for the evaluation of completion such reactions are measured by the coefficient of cross elasticity while on the external market modified coefficient of elasticity of demand for export is used for reflecting competitive relationships between domestic firms and foreign producers (Goldberg and Knetter, 1995).

Further, let us look at the factors of performance which serve to measure the degree to which competitive goals of firms and industries are achieved.

Boone, Ours и Wiel (2007) offered to measure the intensity of competition on the basis of elasticity of profit of a firm (PE) with respect to its marginal costs (MC). High PE means that active competition takes place while the firm has low market power. On the contrary, low PE shows that competitive activity is low. PE is calculated as follows:

$$\ln(\pi_i) = \alpha - \beta \ln(c_i),$$

where π is profit, β stands for PE and c is MC.

PE and PCM coefficients have advantages in comparison with HHI. These two are sensitive to all forms of collusion. HHI and PE are not correlated with the reallocation effect. The reallocation effect means that increase in competition redistributes output from less efficient firms to more efficient ones. At first, the PCM Index goes down as the reallocation rises. But further rise results in increase of profits and causes high intensity of competition which finally drives up the PCM Index (Boone, 2007, 2008).

PCM and PE are related in some way. PCM can be presented as a coefficient of elasticity of profit in relation to revenue. Both coefficients can be used for analysis of efficiency of company's strategy in the areas of costs reduction and market expansion.

Boone (2008) also offered a coefficient of related profit differences (RPD):

$$RPD = \frac{\pi(n'') - \pi(n)}{\pi(n') - \pi(n)} > 0$$

where, π(n) – is variable profit of a firm related to the level of efficiency n. In this model, for any three firms the following inequation is appropriate: n''>n'>n. RPD is measured in the following way: the lower the number of normalized profit with the same or higher level of efficiency, the higher the level of intensity of competition.

The degree of competitive activity can be implicitly valuated using such factors as firms' mortality rate and firms' birth rate in an industry. This idea is made on the basis the Model of Organizational Ecology of Michael T. Hannan and John H. Freeman. The Organizational Ecology is a social theory which explains patterns of interactions and processes taking place in populations of organizations.

The approach which is based on the quantity of firms on the market was complemented by dividing competition into two main categories: one which exists in a sector and the other taking place between different sectors. (Saviotti and Pyka, 2008) The sector consists of groups of companies producing unique and highly-differentiated product. Quantity of sectors results in a variety of goods and services. Thus in the model two different kinds of competition are analyzed: classic competition (within a sector) and Schumpeter competition (between sectors). The relation of these two kinds of competition to the competitive intensity is also considered. The part of the model describing this relation is presented as follows:

$$IC = k_{ic} \frac{N_i \cdot N_{tot}}{N_i + R_{II} \cdot N_{tot}}$$

where, kic is general competitive environment. An in kic is associated with the more competitive environment. RII is the level of the competition within a sector and between sectors. R ≤ 1 means the competition within a sector. R ≥ 1 means that the competition between sectors prevails. As a result of imitation modeling, the authors concluded that IC and RII are correlated in a nonlinear way. At first, when RII increases, competitive intensity goes up as well, but then the intensity falls. This approach has its value in theory but in practice it is hardly implemented.

The main disadvantage of all the approaches described is perception of intensity of competition of buyers as an exogenous constant. This disadvantage does not exist in our approach.

Methodology of measuring of competitive activity

Competition between market participants is a fight for the market power. Victory in that fight is possible only in the case of survival of one participant and departure from the market of the other participants. But the market power will not be absolute when there are conditions restricting it. These conditions are: presence of existing competitors, suppliers' power, danger of appearance of new competitors (Bain, 1956, Porter, 1985), risk of appearance of substitute goods and the market power of buyers (Porter, 1985).

In theory, there is market structure close to the described one. It is called "monopoly-polipsony" structure. In this state, seller has the absolute market power while buyers are deprived of it. In the case of double-sided monopoly, the seller's power can be restricted (Hicks, 1935). Low power of the buyer causes an increase in the power of the seller.

In relation to the buyer, absolute market power is possible in the "monopsony-polypoly" market structure. While having the absolute market power, the buyer can influence the market situation when the sellers of the market of polypoly have to sell goods and services at the price equal to average and marginal costs. Consequently, the main goal of every market participant is to reach the absolute market power which provides the best conditions for economic activity.

Goals of buyers and sellers are in the conflict with each other. The buyer reaches the goal when the seller finds himself in the worst conditions. So, it is clear that the goal of the seller is contrary to the buyer's one.

Moreover, sellers compete with each other for the dominant position on their markets. Buyers can be presented as competing with each other on their side as well. In this sense, market is a system in which "buyer-buyer" competition and "seller-seller" competition are related with each other on the basis of the conflict of interests. These kinds of competition are not separate in

the market relations. Corresponding with this, we attempted to measure competitive activity of the market system as a whole. In our approach, competition is measured based on the level of success reached by the market participants striving to reach their goals.

This approach suggests the possibility for big sellers to influence the market structure of the buyers and the possibility for big enough buyers to impact the sellers' market structure. The instruments of such influence can be economic and uneconomic. The uneconomic instruments can be well described by the following examples: lobbying of laws, restricting practices of the market participants and influencing the market structures using government regulation. The economic instruments aimed at increasing the number of buyers are illustrated by such activities as price policy, diversification, advertising, product differentiation, marketing, R&D investments and others. Based on purely economic instruments the buyer's impact on the market structure of the sellers is hardly implemented.

Change in the seller's market concentration can be caused by the buyer as well as by some external conditions and without any participation of the buyer. In this sense, it is hard to guess whether the high competitive activity is a result of an influence of market participants on the opposite market structure. Any external influence on the participants of competition and adaptation to this influence are the natural processes of competition. Furthermore, relatively successful adaptation to the external conditions can be considered as an influence on the competitors and this also can be measured.

For the purpose of simplification of theoretical analysis, it can be assumed that external factors influence on the market structure is eliminated, i.e. exogenous variables are constant.

We offer to use the following coefficient for measuring of the competitive activity of sellers in relation to buyers and competitive activity of buyers in relation to sellers:

$$\text{Ʊ}'_s = \frac{s(x;y) - b(x;y)}{s(x;y) + b(x;y)}, \text{Ʊ}'_s = -\text{Ʊ}'_b$$

where $\text{Ʊ}'_s$ is relative competitive activity of sellers, $\text{Ʊ}'_s \in [-1; 1]$, s is potential market power of sellers, $s \in (0; 1]$, b is potential market power of buyers, $b \in (0; 1]$, $\text{Ʊ}'_b$ is relative competitive activity of buyers. $\text{Ʊ}'_b \in [-1; 1]$. Higher Ʊ means higher competitive activity. Further, x is power of influence on the opposite market stricture, y is relative market power.

In case of "monopoly-polipsony" structure, when $\text{Ʊ}'_s = 1$, it means that the seller reached the main goal which is the absolute market power. When $\text{Ʊ}'_s = -1$, $\text{Ʊ}'_b = 1$ we have "polypoly-monopsony" structure. This situation indicates the worst conditions for the sellers and the best conditions for the buyers. In other words, the buyer gained the absolute market power.

If the market has low concentration of market shares and its participants are not big enough to impact the opposite market structures, than it is obvious that the coefficient will not show us

the evident results of such activities and it will indicate merely relative conditions on the market. In this situation it is appropriate to measure competitive activities of buyers' and sellers' markets separately.

It is important to underline that the majority of approaches described earlier consider evaluation of competition from the position of a company, not from the consumer position and not from the society viewpoint. As was stated above, the conflict of interests between the firm and the consumer is evident.

Either when the firm reaches the main goal and the consumer gets defeated or when the opposite occurs – both scenarios are negatively impact society's welfare. Obviously, the extreme states are unfavorable and only competitive equilibrium between the two ($O'_s = O'_b = 0$) provides equal distribution of welfare between buyers and sellers.

In addition to all the basic measures we offer to use the Index of Market Activity. The index is based on the weighted absolute increase of market shares with variable base:

$$\mu_s = \sum_{i=1}^{n} s_{i,t+1} \cdot \left| s_{i,t+1} - s_{i,t} \right|$$

where, μ_s is the Index of Sellers Market Activity, $s_{i,t}$ is the market share of i firm in the t period, n is the number of participants analyzed.

The index shows the average change of weighted absolute increase of firms' market shares in the certain period. New firms which enter the market in the (t+1) period are represented in terms of the actual market share while in the t period they are considered with the 0% share of the market. Similarly, when a firm goes out of the market it means that it has 0% market share in the (t+1) period while in the t period it is represented with the actual market share. It is notable that $\mu_s \in [0; 1]$ and the closer μ_s to 1, the higher the activity on the market of sellers.

On this stage we compare the Index of Market Activity with HHI and with dispersion. Unlike HHI and dispersion, the Index of Market Activity is sensitive to the equivalent change of market shares. The equivalent change of market shares is such change which takes place when in the current period of time the market share of one participant increased to the level equal to the competitor's previous market share while the competitor's share of the market decreased to the same degree. To put it simply, the market participants exchanged their market shares with each other.

So, in this case, HHI and dispersion and some other indexes of market concentration do not show us any changes on the market. It is one of the main disadvantages of implementing of HHI and dispersion when analyzing the dynamics of market concentration.

Implementation of Approach

We chose the world market of goods and services as a subject of our analysis because of the scale of our research and the purpose of it. In this sense, exporting and importing countries were the participants in our research. This approach is conditioned by many facts. Firstly, countries are the main powerful participants of the world market in terms of their capability to influence the opposite market structure by using political and economic means. Distribution of corporations among the countries is caused by the fact that they operate in similar economic and institutional conditions. Gross volumes of export and import of the world countries served as a basis for calculating their market shares.
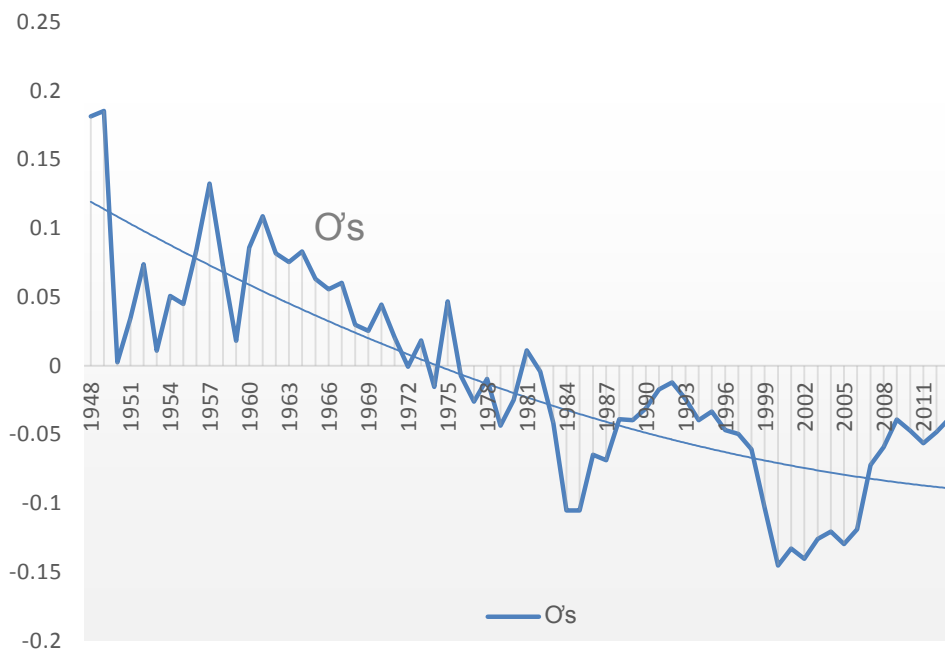

Figure 1 – O'_s **dynamics on the world market[4]**

From the graph on Figure 1 it can be seen that the competitive activity of sellers on the world market was falling for 54 years. The sellers were gradually moving away from the absolute market power. Developing countries were increasing their role in the world trade which resulted in decreasing of market shares of big sellers. Sellers' HHI decreased by 40% while buyers' HHI increased by 13% in the period of 1948-2002.

The graph of O'_b looks like the upturned graph from the Figure 1. Through the whole analyzed period of 1948-2013, the market power of buyers were increasing in relative terms and decreasing in absolute terms.

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[4] We used HHI for evaluation of market power potential. Calculations of O_s were made by the authors based on the WTO data which included information about export and import of more than 200 countries in the period of 1948-2013. Until 1980, export of goods was measured and after 1980 export of goods and services was measured.

In 2013 the biggest sellers on the world market in terms of export volumes of goods and services were the following countries: China (10.32% share of the world market export), USA (9.58%), Germany (7.44%), Japan (3.68%) and the United Kingdom (3.57%). The biggest buyers were the following countries: USA (12.34% share of world import), China (10.1%), Germany (6.67%), Japan (4.42%) and France (3.58%).
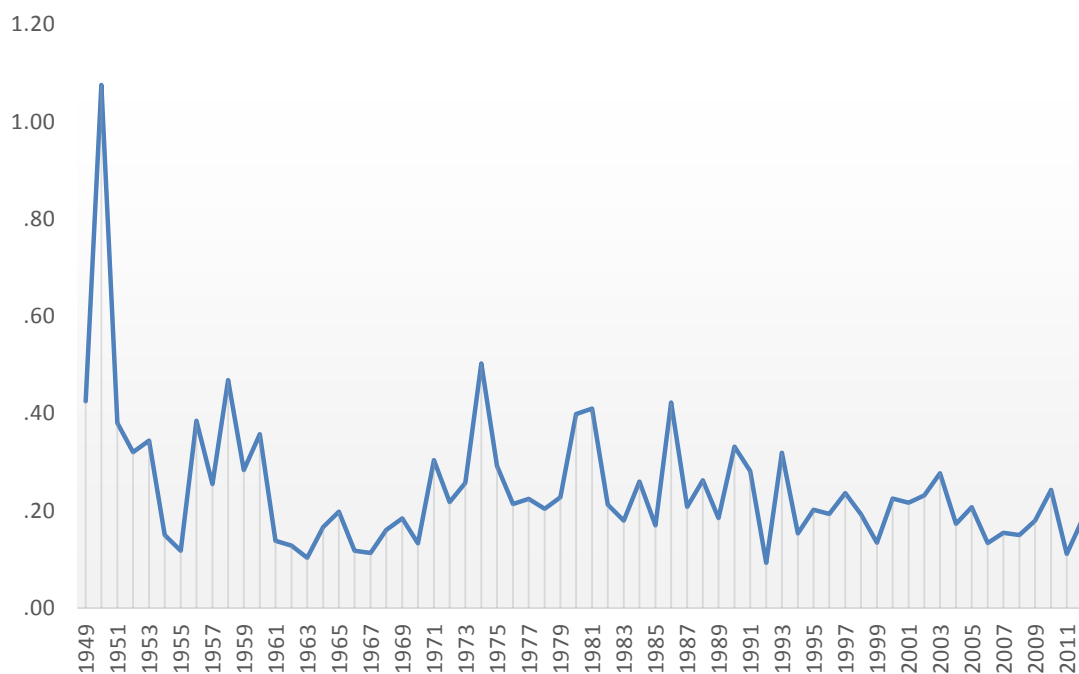

Figure 2 – Dynamics of μ_s on the world market

The world market was the most active in 1950 since there was a change of market shares. Decrease in the shares of export took place for the following economies: USA (from 20.48% to 16.39%), the United Kingdom (from 11.89% to 10.38%), Canada (from 5.27% to 4.59%). The shares of world export increased in the following countries: Germany (from 1.7% to 3.27%), Malaysia (from 1.03% to 1.65%) and USSR (from 2.48% to 2.94%).[5]

After the World War II, Many countries we restoring their economies and actively participating in the world economy trade while competing with the biggest producers such as USA and the UK.

In the process of investigation we made a hypothesis about the prevailing role of concentration of sellers' market in forming of the structure of the buyers' market but the correlation analysis did not proved the hypothesis (linear coefficient of correlation was equal to 0.15).

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[5] Calculated by the authors based on WTO statistics.

We also did not find any correlation between the activity of the market and its concentration (correlation between μ_s and HHI were equal to 0.27). High correlation between them would show that decrease in market activity causes decrease of HHI.

As regard the future dynamics of $\mho_s$, there are few scenarios. The first scenario can be presented is such a way that the main trends will be well in place and $\mho_s$ will be close to -1. This can be supported by the fact that through the whole considered period the speed of losing power of buyers is higher than the one of sellers. In this situation the market of sellers will be close the perfect competition state as much as possible. Substantial loss of sellers' market power can lead to negative effects such as slowdown of innovation processes (Aghion and others, 2005), decrease of scientific and technological progress and decrease of economic development.

Taking into account that on the analyzed market the participants act as buyers and sellers at the same time, the second scenario is that the structure of the buyers' market will tend to be close to the sellers' market structure ($\mho_s \to 0$).

The last and the least possible scenario is that $\mho_s$ will rise to the level higher than one of 1948. In this situation, there will be scarcity of basic goods and services for the most consumers while the world trade and economic development will be decreasing.

Discussion

In the modern science of the analysis of behavior of the firm, it is prevailingly stated that the firm is striving for maximization of profit (Marshall, 1897, 1890). However, recently alternative theories, which originated from the direct investigation made by the real firms, are becoming more substantial and popular.

The alternative goals do not deny the motive of profit maximization but uncover new priorities such as striving for sales maximization (Baumol, 1958) and maximization of firm's growth (Marris, 1963, 1964).

Our concept of the firm's goal substantially complements the existing theories and does not contradict to all of them. We made an attempt to develop the alternative way of measuring the level of intensity of competition in the concentrated market. Increase in concentration is usually considered to show decrease in competitive activity. This is explained by the fact that mutual suppression of firms rises along with the growth of competition. If the suppression declares itself by the decrease in profits, than this will drive PCM down (if MC are constant and FC equals zero). The identification of the level of competition based on the PCM Index and other similar indices accentuate attention only on the mutual suppression of competitors.

In our approach, when the sellers' market power rises and buyer's market power drops or remains constant, competitive activity increases.

We tried to take into account not only the effect of mutual suppression but also the effect of forcing out competitors from the market which illustrates the ultimate power and success of active market participants. Attainment of the rational goal of a market participant means unlimited market power and is possible in case of generating competitive activity powerful enough to suppress active and potential competitors and to be able to influence the opposite market structures.

However, in some exceptional cases, the equivalent results can be got by using PCM, PE and RPD and σ'_s. This can be the case, for instance, when the decrease in coefficients is related to price wars between competing companies and increase in sellers' market concentration. But in most cases, when the concentration goes up, PCM, PE and RPD will show the decrease in competitive intensity while σ'_s will show the rise of it.
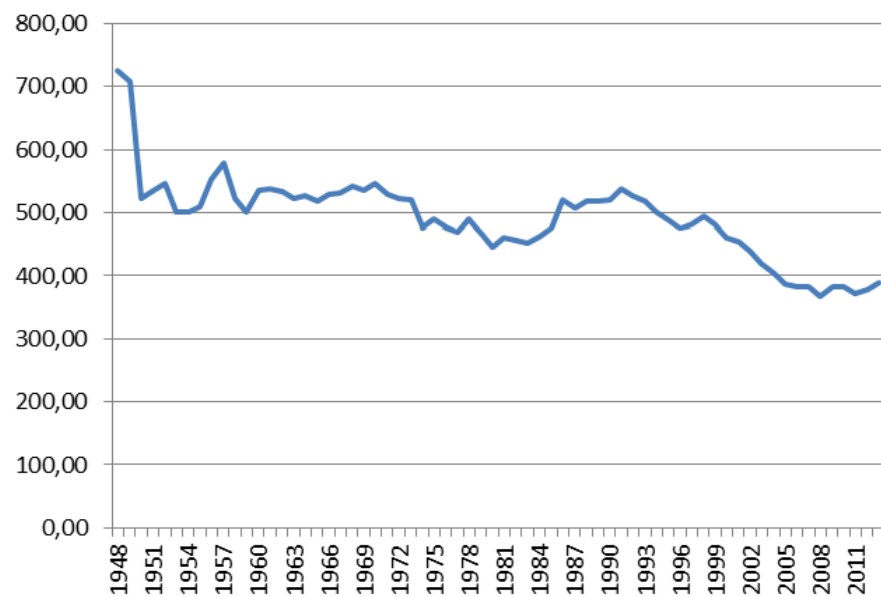
Additional Materials

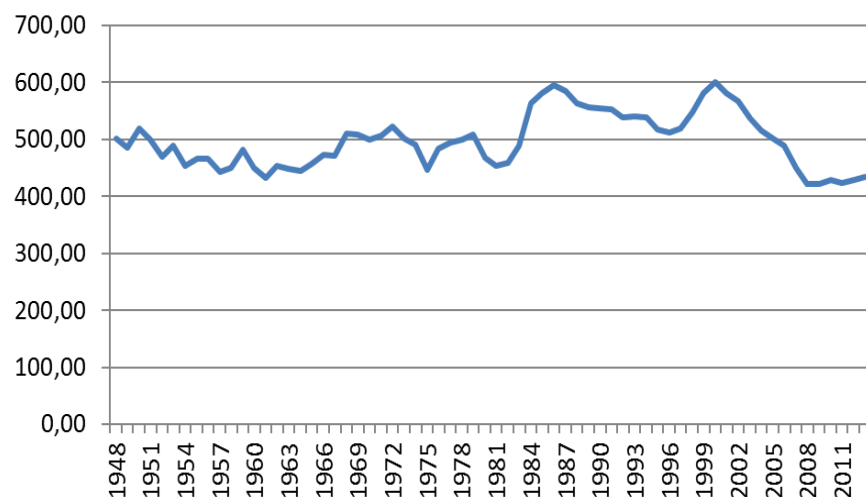Figure 3 – Sellers' HHI dynamics in the world

Figure 4 – Buyers' HHI dynamics in the world

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