Improving the Methodology of Market Structures Analysis with Innovative Concepts for "Phase-Structure States" and "Set Concentration Index"

Iliyan Petrov*

Summary:

The article focuses on the methodological aspects of a recent comprehensive economic study in the area of market structures and competition in the global energy sector. It was developed as a doctoral dissertation in the Russian State University for Oil and Gas (the Gubkin University) in Moscow.

An exhaustive overview of existing competition theories provides the solid grounds for the application of a target-oriented approach based on innovative notions, indictors and models for "structural information" and "system hierarchy" in the most difficult areas – the assessment of individual players and leaders, synergy effects, classification of market structures and competition interactions. Simple and logical mathematical instruments support theoretical system thinking and applied research modeling.

Key words: market structure, market concentration, phase-structure states, set concentration index, competitive force, market power, coalition synergy.

JEL Classification: C1 (Econometric and statistical methods and methodology); D4 (Microeconomics - Market structure, Pricing and Design), F12 (Models of trade with imperfect competition…), L11 (Production, pricing and market structure; Size distribution of firms), L12 (Monopoly; Monopolization strategies), L13 (Oligopoly and other imperfect markets), L4 (Antitrust issues and policies); L5 (Regulation and industry policy).

1. Introduction

Imbalance between energy supply and demand and oil price fluctuations reflect the objective processes of important structural changes and dynamic competition, as well as geopolitical interactions in the field of the security of energy supplies and new infrastructure projects. Major national and international oil and gas companies refine their strategies to gain privileged access to resources and networks of supply and to sustain monopolistic advantages. In these conditions, logically, increases the concern of other market players (industry and private consumers, financial institutions and public regulators) about preserving competition and regulating monopolies.

Among other factors, the relevance of improving methodology aspects is determined by the fact that the globalization processes and the world financial crisis in the beginning of the 21st century increased the role of market structures as the key element

* PhD in Economics, independent researcher; e-mail: petrovindex@gmail.com; www.concentration-index.net

in industry organization and competition strategies (Tirole, 1988, 2002), (Krugman, 2008), (Stiglitz, 2010). Structural aspects have specific importance in countries with transition economies, where national governments face constant challenges in carrying out market reforms posed by the imbalances in several industrial sectors, including energy, transport, finance, among other sectors. (Greenberg, R., Rubinshtein, A., 2013) (Livshitz, 2013), (Kolesov, V., Lukyanenko, D., 2013), (Dimitrov, M., Andreff, W. and Csaba, L. (eds.), 1999), (Statev, 2007).

2. Improving methodology of studying market structures and system analysis

The complexity of problems raises the need to reconsider the effectiveness of some models, and to adjust the definitions of major competition-related notions, to enhance market and industry studies with more transparent, flexible, formalized and practice-oriented methods and instruments.

2.1. Market structure definition

Market structures have a complex multilevel character, which cannot be defined in a short or simplistic statement. For the purposes of this study and without any claims about the universality or exhaustiveness of its definition, market structure *in the narrow sense* may be assumed to be some kind of metric space in which distances between the elements are known. From another perspective, it may be defined as a partially ordered set of entities that have fixed states and operations at the input, undergo inner transformation and form a (sub)system at the output. *In broader terms*, the structure should be examined as a complex of interrelated components characterizing the interactions of market players in specific technological and economic, institutional and information context.

- The composition of players reflects their number and market shares as key factor for market concentration and competition models.

- The institutional framework defines the main forms of business and regulation activities in terms of legal status, wholesale and retail trade channels, ease of market access and exit, and other elements.

- The technical and microeconomic factors involve the quantitative and qualitative characteristics of players in terms of access to natural resources, level of technology, cost efficiency, transport logistics, and other factors.

- The information background reflects the content of data flow about market players and the formats of its' processing in the public space (i.e. accounting standards, stock market reports, industrial indices, etc.).

It is beyond any douby that the systematic analysis of market structures requires a reliable methodology and instruments. In this study our target-oriented approach focuses on two main areas: a) improvement of methodology for the assessment and classification of market structures (discussed in this article); b) the practical application of new concepts and models for deepening the studies of industrial organization and the dynamics of energy markets (to be discussed into details for oil and gas sector in a next issue in *EAJ*).

Currently there are several indicators designed to measure concentration or diversification of with different, but often simplistic concepts. Most of them are based on inflexible mathematical functions which actually postulate to economic theory and system thinking inadequate concepts and controversial methods of data treatment, instead of being logical and adaptive tools for analysis and forecasting. Good examples in this respect

are Shannon-Wiener Index (SWI), which measures diversification (entropy), and the most popular *Herfindahl-Hirschman Index (HHI)*, which measures concentration. (Herfindahl, 1950), (Hirschman, 1945). A thorough review of literature and analysis of the conceptual limitations in *HHI*, *SWI* and other indicators (*Lorenz curve, Gini coefficient, Concentration ratio, Lerner index for monopoly power, Lind index, etc*.) are presented in previous publication (Petrov, 2015).

2.2. "Phase-structure states" as a concept in industry and market structures evolution

To improve the methodology of structural analysis we developed innovative and well balanced concepts, models and indicators. In terms of phase development we propose an original concept of *phase-structural states (PhSS)*, which describes the complete cycle of evolution of a system. Actually, it is quite universal and applicable to any "measure of diversity" (incl. HHI, SWI) with a format:

$F(s_i)=\sum_{i=1}^{N} f(s_i)$, where ***"N"*** stands for number of players, ***"s_i"*** - player's share in a system; **- basic nonlinear function of individual player's development; "*F (s_i)*" – system status function summing the states of individual players.**

Individual/coalition player's belonging to certain structural phase is defined by its relative share in the system ***"s_i"***. Phase boundaries are determined very clearly by the values of symmetric states, in which all participants have equal market shares (1-0,5-0,33-0,25-0,2 ... etc.). Thus, participants with a share si=0.99÷0.5 belong to the 2nd structural phase; with s_i=0.33÷0.5 to the 3rd structural phase, etc.[1].

To classify a system we have to take into account not only the number of players, but also the overall structure concentration defined by ***"F".***

PhSS concept allows to create a family of basic functions ***"f(s_i)"*** which analytically describe various "scenarios" of player's evolution as *individual continuous trajectories*. Further, based on different scenarios the *summation function* ***"F(s_i)"*** allows to define adequate and *discrete system trajectories*. Such simulation approach is extremely helpful for plausible evaluation and classification purposes. It enables researchers to describe the key *PhSS* (*minimum, maximum and mean states of individual entities and systems*) with a compact set of 5 logically interrelated functions (*basic, summing, minimizing, maximizing, and mean/averaging*).

3. Innovative and flexible modeling the "structure information"

The center point in all *diversity measures (indices)* is their ***basic conceptual model (BCM)***, which defines the principles of spatial growth of individual entities. Unlike other similar indices, our model, defined as a new ***Set Concentration Index (SCI)***, describes a more plausible growth profile, which tries to take into account (to the extent of possible and pragmatically affordable) the concern about the aspect of resource-limited environment of economic systems. Its *basic compliance function* ***SCIbas*** (equation 3 in table 1) measures nonlinearly the importance of a player by comparing information on its share ***(s)*** with the market size as a whole ***(1)*** and some important information about the structure of a self-regulating and regulated system. Hence, for the first time we are able to take into account key aspects of both competition and regulation and to combine

[1] It is important to point out that the new notion of phase-structure state (PhSS reflects the complexity of usually open and nonlinear socio-economic systems. Also, PhSS should not be regarded as an analog of the limited number of phases of physical states (PhPhS) in usually more simple, closed and linear mechanical and thermo-dynamical systems.

the process of producing internal entropy/ hierarchy by objective competition interactions and the process of inducing controlled values from external regulation factors (creating external flows of entropy/ hierarchy).

As a result, the basic conceptual model of ***SCIbas*** (equation 3, table 1) provides enough flexibility to reflect the importance of both the objective internal characteristics of market competition and the directions of control of external regulators in the form of *reference thresholds* in the structures. The optimization of parameter values in ***SCIbas Model*** led to the selection of ***variant SCIbas(4-1000)***, which contains two *reference thresholds*.

Lower reference threshold $\boldsymbol{b_1=0,001}$ (i.e. 0.01% share in the market) reflects some critical level of company viability as a self-regulating market competition factor.

The antitrust legislation in developed countries regards a 75% share of three market leaders (CR3=75%) as a transition to highly concentrated structures. This common rule permits to define the *upper reference threshold* as $\boldsymbol{b_2 = 0,25}$, reflecting a 25% share in a symmetrical market with four participants (4x25% = 100%) (fig. 1). With an *average degree of competition interaction* (***n=2***) the most natural balancing value ***SCISUMbas=0.5*** corresponds to the transition from "less concentrated" to "more concentrated" structures according to the norms of antimonopoly regulation of the EU, Russia and other countries (the United States until 2010). Actually, it corresponds to a symmetrical market with 10 companies with equal shares of 10%.

The combination of *PhSS concept* and *SCI Model* allows to develop derivative and more objective indicators of market interactions:

1. Competitive Force Index (CFI) as ratio comparing nonlinearly in the SCI format the importance an individual player with the overall concentration in the sectors of supply **(s/S)** or demand **(d/D)**;

2. Market Power Index (MPI) as ratio comparing the importance of an individual supplier with the overall concentration of demand sector **MPI (s /D)** and, in contrast, the importance of an individual consumer with the concentration of the supply sector **MPI(d/S)**;

3. Market Type Structure Index (MTSI), defined as a ratio of concentration levels of supply and demand sectors.

Similar indicators are designed for improving the analysis of "coalition type entities":

4. Coalition Cooperation Coefficient (CCC);

5. Competitive Force Index of a coalition (CFIcoal);

Market Power Index of a coalition (MPIcoal).

The *PhSS-SCI Model* and its new derivative indicators allow to build an comprehensive "**Structures Assessment and Classification System (SACS)**" (table 1).

The profile of the minimizing summing function ***SCISUMbas(simmin)*** in the variant *SCIbas(4-1000)* (equation 6, table 1) is very similar to the profile of the *Harrington Desirability Function (HDF)*, (Harrington, 1965). Moreover, due to horizontal shape of discrete smoothing in the intermediate zones of *minimum PhSS*, the *SCI Model* offers much better possibilities for classification than multi-level regressions based on polinomials models (in which a serious researcher would have to define and justify *ex ante* coefficient values for each element in the model).

While the traditional format of *HDF* has 5 valuation intervals (1÷0,8÷0,63÷0,37÷0,2÷0), we suggest to divide the central interval in two (0,63÷0,5÷0,37) in order to increase them from 5 to 6 (1÷0,8÷0,63÷0,5÷0,37÷0,2÷0). As a result, the most natural central value of ***SCISUMbas=0.5*** creates an overall balance and marks key qualitative transitions:

Table 1. Generalization of "Structures Assessment and Classification System (SACS)" in PhSS-SCI Model

Phase-Structure States (PhSS) Model	Limited Space Development Model in the Set Concentration Index (SCI) /Set Hierarchy Index (SHI)	Market Structure Type Index (MSTI) $= 0.5\,[H(s_{iSupply}) / H(s_{iDemand})]$	
		Competitive Force Index (CFI)	
		Individual:	Coalition:
Basic concept model (BCM) **Universal Target Model (UTM)**	$SCIbas(s_i)=\eta(s_i)=\frac{s_i}{1+(\sum_{j=1}^{m}\log_{b_j} s_i)^{\varepsilon}}$ (3) If $m=n=2;\ b_1=0.1\%=0.001;\ b_2=25\%=0.25$ $SCIbas(4-1000)=\frac{s_i}{1+0.1875\,(\ln s_i)^2}$ (3.1)	$CFI(Supply)=\frac{\eta(s_{iSup})}{H(s_{iSup})}$ (9.1)	$CFIcoal(Supply)=\frac{\eta(s_{iIMaxSup})+k[\eta(\sum_i^l s_{iISup})-\eta(s_{iIMaxSup})]}{H(s_{iSupply})}$ (9.3)
Structure Assessment Model (SAM) **Structure Minimal Concentration Model (SMCM)**	$SCISUMbas=Hbas(s_i)=\sum_{i=1}^{N}\eta(s_i)$ (4) $Hbas(4\text{-}1000)(s_i)=\sum_{i=1}^{N}(\frac{s_i}{1+0.1875\,(\ln s_i)^2})$ (4.2) $SCISUMbas(symmin)=H(symmin)$ (6) Discrete definition of symmetric & minimal concentration (hierarchy) of the structure	$CFI(Demand)=\frac{\eta(s_{iDem})}{H(s_{iDem})}$ (9.2)	$CFIcoal(Demand)=\frac{\eta(s_{iIMaxDem})+k[\eta(\sum_i^l s_{iIDem})-\eta(s_{iIMaxDem})]}{H(s_{iDemand})}$ (9.4)
		Market Power Index (MPI)	
Maximal Concentration Model	A. Simulation model (7.1) B. Mathematic model: when $b_o=0.01\%=0.0001;\ n=2$ $SCImax=\eta max(s_i)=\frac{s_i}{1+(\log_{b_o} s_i)^2}$ (7.2)	Individual: $MPI(sup/Dem)=\frac{\eta(s_{iSup})}{H(s_iDem)}$ (10.1)	Coalition: $MPIcoal(sup/Dem)=\frac{\eta(s_{iIMaxSup})+k[\eta(\sum_i^l s_{iISup})-\eta(s_{iIMaxSup})]}{H(s_{iDemand})}$ (10.3)
Average Model **- arithmetic mean** **- geometric mean**	$Harithmeam=(Hbas(symmin)+Hmax)/2$ (8.2) $Hgeomean(math)=\sqrt{Hbas(symmin).Hmax(math)}$ (8.2) $Hgeomeanr(simul)=\sqrt{Hbas(symmin).Hmax(bassimul)}$ (8.3)	$MPI(dem/Sup)=\frac{\eta(s_{iDem})}{H(s_iSup)}$ (10.2)	$MPIcoal(dem/Sup)=\frac{\eta(s_{iIMaxDem})+k[\eta(\sum_i^l s_{iIDem})-\eta(s_{iIMaxDem})]}{H(s_{iSupply})}$ (10.4)

Abbreviations: ***Dem*** *– Demand;* ***Sup*** *– Supply;;* s_i *– Player's Market Share;* ***i*** *– Market Player;* ***N*** *– Players' Number;* $s_{\Sigma i}$ *– Coalition participant's Market Share;* ***k*** *– Coalition Cooperativeness Coefficient*

l *– Coalition Players' Number;* ***il*** *– Coalition Participant* s_{iMax} *– Market Share of Coalition Leader;* ***coal*** *– Coalition;* b_j *– Threshold Market Share;* ***m*** *– Number of \Structure Thresholds;*

n *– level of market interaction between market shares and structures threshold (1≤n≤3; 1 – low interaction; 2 – average interaction; 3 - strong interaction)*

Source:author's concept, design and calculations

- in ***SCISUMbas*** - from *"less concentrated"* to *"more concentrated structures"*;

- in ***CFI*** and ***PMI*** - from *competition* to *domination* type of market interactions;

- in ***MTSI*** - from *"buyer's market"* to *"seller's market".*

The advantages of ***SCI Model*** are proven by testing its several variants with different parameters and comparing them with other existing indicators, i.e. Shannon-Wiener diversification Index (SWI) and Herfindahl-Hirschman concentration Index (HHI). Here an important novelty is the use of integral calculations as a precise and elegant method for generalization and assessment of information contained in continuous basic functions of different index models. The comparative analysis of several *SCI variants* with different *"reference thresholds"* shows that the optimal matching of the *inflection point in SCIbas* with the transition to *majoritarian domination (*>50%*)* and the value *Integral of Structural Information* is attained in the ***variant SCIbas(4-1000)*** (table 2).

Table 1. Inflection point and valuating information in the SCI, HHI and SWI models

Indicators/Models	SCIbas						HHIbas	SWIbas
Model's Variant	(2-1000) b_1=0,5 b_2=0,001	(3-1000) b_1=0,367* b_2=0,001	**(4-1000)** b_1=0,25 b_2=0,001	(5-1000) b_1=0,2 b_2=0,001	(6-1000) b_1=0,166 b_2=0,001	(10-1000) b_1=0,1 b_2=0,001	Single Variant	Single Variant
Integral of Structural Information $\int_0^1 \cdots$	0,4226	0,4496	**0,4664**	0,4723	0,4798	0,4826	0,33..	0,25
Parameters: Market share *(s)*	Inflection point						No inflection, minimum, maximum	Maximum 0,367* 0,367
Basic function *f(s)*	0,62 0,54	0,55 0,49	**0,5 0,47**	0,48 0,44	0,47 0,435	0,45 0,43		

Source: author's concept and calculations (in MapI and Matlab)

The *Integral of Structural Information* $\int_0^1 \mathbf{SCIbas\ (4\text{-}1000)} = \mathbf{0{,}4664}$ is 41% higher than $\int_0^1 \mathbf{HHIbas} = \mathbf{33}$ and 86% higher than $\int_0^1 \boldsymbol{SWIbas} = \mathbf{0.25}$. More detailed analysis proves, that *structural information* in the ***SCIbas*** has a more plausible and balanced distribution within the intervals 0÷0.5÷1. Variant *SCIbas(4-1000)* provides a "gold section" in the *SCI Model* - it can be used for a large number of real economy sectors (incl. energy, transport, machine building, tourism, etc.).

Moreover, compared with other models the range of modeling flexibility for applied studies purposes in the new *PhSS-SCI approach* is without analog and depends on mostly on researchers' abilities, targets and areas of studies. For applied research in some specific economy sectors (banking, insurance, telecommunications, etc.), as well as for some social and political systems, we should keep the *SCIbas(4-1000)* as an universal *reference model* and further develop the model and analysis according to sector's characteristics and regulative framework.

4. Adjusting competition notions and improving classification of market structures

The overall balance and flexibility of *PhSS-SCI Model* allow to adjust several theoretical terms and to develop a new classification system for market structures, comprising 5 main stages: *1) Monopoly; 2) Oligopoly; 3) Polipoly 4) Multipoly; 5) Hyperpoly*. A more detailed categorization improves the studying of all type of market structures. It is particularly helpful for less concentrated, but more dynamic markets, which have so far failed to attract the attention of economic theory and regulation policy. Classification based on the *SCI Model* allows

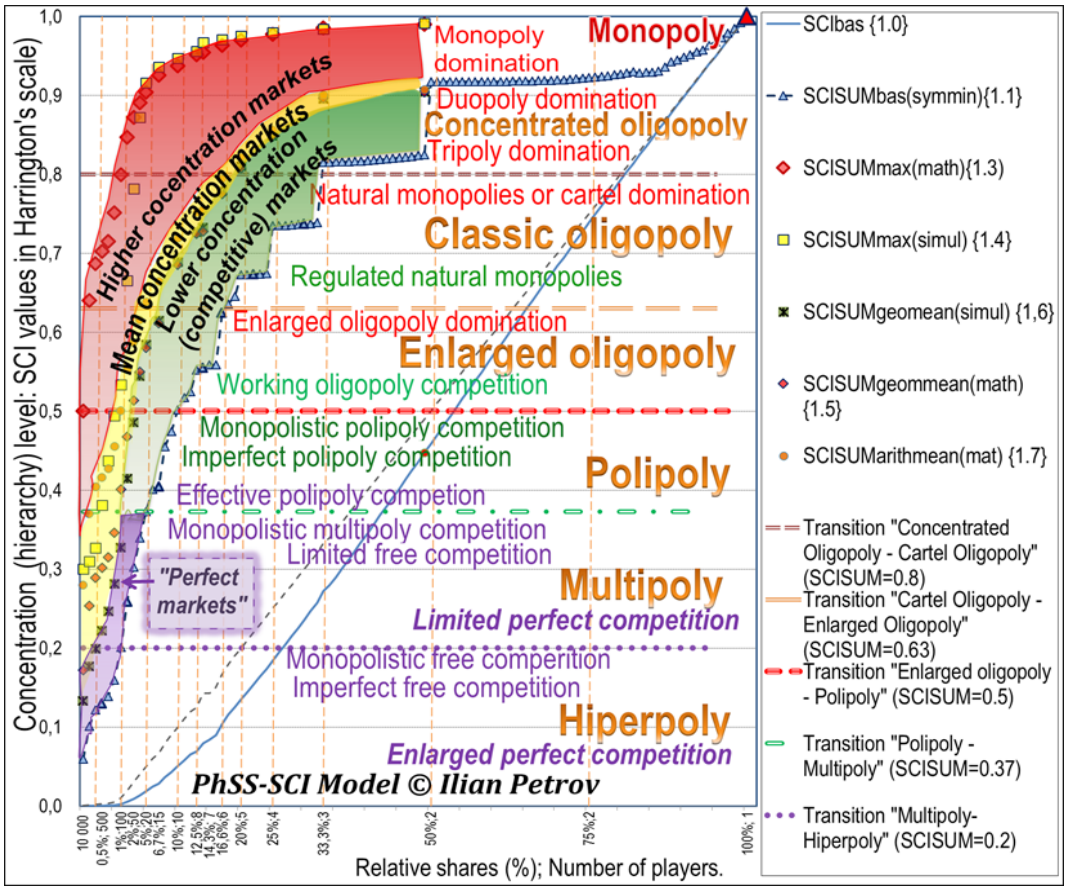

Fig.1. Classification of Market Structures and Competition in the PhSS-SCI Model
Source: author's concept and design

to put real content and meaningful figures in some very relative terms like "large" and "very large" number of market participants.

Further, the oligopoly space of "more concentrated" structures (***SCISUMbas = 0,5÷1***) is divided into 3 sub-stages: *concentrated oligopoly (partial monopoly), cartel oligopoly and enlarged oligopoly.* "Less concentrated" structures (***SCISUMbas =0÷0,5)*** are also divided into 3 stages: *polipoly, multipoly and hyperpoly*. The *PhSS-SCI Model* does not assign a separate stage to the notion of "perfect competition". Still, a refined analysis regards the *multipoly-hyperpoly* stages as "free markets" and their least concentrated states as "limited perfect competition" and "enlarged perfect competition" (fig. 1).

Designing a balanced valuation scale and redundant classification system is a very challenging task, which is impossible to approach with models of other indicators (*HHI, SWI*, etc.), even with sophisticated secondary manipulation of data derived from their simplistic basic functions.

From this point of view the concept the *SCI Model* may be considered as a targeted reassessment and development of "information theory". The aim is not to produce abstract information, similar to classical Shannon-Renyi entropy approach (Shannon, 1948), (Rényi, 1961),

but a much more objective and balanced ***structural information*** about ***hierarchy interactions*** in different economic, social and political structures. For many years this area of system and structural analysis remained insufficiently developed in Eastern and major Western economic schools. Despite the fact that *hierarchy (i.e., order, predictability, etc.)* would be more accessible for description and understanding than *entropy (i.e., disorder, unpredictability, chaos, etc.)*.

5. Mechanical measurement of concentration versus system analysis of hierarchy and synergy

For assessing market structures economic theory now employs the term *concentration*, which became the official term in antitrust law. However, *concentration* is associated with the mechanical approach of measuring mixtures in continuous states in physics and chemistry and when transferred to economics creates some confusion. Taking into account complicated and discrete character of economic systems, in our opinion it is more appropriate to investigate them from point of view "many-body hierarchy" rather than "concentration of a mechanical mixture". For that reason our new index is initially defined as *Set Concentration Index*, although it should be seen as a measure of hierarchy and referred to as *Set Hierarchy Index (SHI)*. In any case, taking into account the tradition of changing paradigms in economic theory and the inertia in market regulation and legislation, it may take some time to revert the way of thinking about market structures.

Furthermore, it is well known that the main obstacles in studying coalitions are linked to the problems of assessing the cooperativeness (synergy) of their activities. Game theory is quite technical in providing equilibrium analysis from point of view of benefits in cooperative interactions and a helpful method to define policy and test scenarios. However, it is a well-developed mathematical method and a resource-consuming exercise that could yield limited results when analyzing the real-time dynamic structural changes, the controversial combination of competition and cooperation, or dramatic price volatility.

In an attempt to overcome such limitations, we suggest that an additional indicator in the *SACS* is introduced – the ***Coalition Cooperativeness Coefficient (CCC)***. At this stage it is defined by expert evaluation based on limited set of criteria about coalition's activity and its background. Its evaluation concept defines two major zones divided by the natural central value ***CCC=0,5*** as a transitional boundary between less cooperative interactions ("cluster" or "coalition within itself") and more cooperative interactions ("cartel" or "coalition for itself"), (table 3).

The concept of ***CCC*** is flexible and may be applied to different economic, social and political sectors, where there is a formal or informal cooperation among groups. In our opinion, valuation criteria should cover a limited number (5 to 10) of key aspects. In an earlier study of the oil and sectors, the author of this paper (Petrov, 2015) focused on just 6 criteria – technical and economic advantages, comprehensiveness of common policy, imperativeness of decisions, influence on the volume of supply, demand and pricing mechanisms, and other criteria. That pilot implementation of *CCC* was based on an individual expert evaluation with equal shares for all criteria forming average and static values for a whole period (table 4).

On the supply side due to a higher cooperativeness *(CCC=0.75)* the Organization of Oil Exporting Countries (OPEC) can be classified as very influential *"quasi cartel"*. At this stage the cooperativeness of the Forum of Gas Exporting Countries (FGEC) is much lower in the transition zone between *"super cluster"* and *"mini cartel" (CCC=0.5)*.

On the demand side the major industrially-developed western countries have been for many years also the major importers of hydrocarbons. Their common economic

Table 3. Assessment and classification of structure, competition interactions and coalitions

SCISUM value	Structure concentration	Structure Stage	Character of Competitive force and Market power	Value of CCC and Coalition Status		MTSI
1	Maximum	Monopoly	Monopoly and Oligopoly Domination	Super cartel (CCC>0,8)	Coalition for itself	Seller's Market Structure *MTSI>0,5*
0,8-1	Very high	Concentrated oligopoly				
0,63-0,8	High	Classic oligopoly	Cartel domination	Quasi cartel 0,63<CCC<0,8		
0,5-0,63	Higher than average	Larger oligopoly	Larger oligopoly domination	Mini cartel 0,5<CCC<0,63		
0,5	**Zone of central qualitative transition boundary of structure concentration (hierarchy), "domination-competition", "cluster-cartel" coalition interaction and types of structures**					
0,37-0,5	Lower than average	Polipoly	Working competition	Super cluster 0,37<CCC<0,5	Coalition within itself	Buyer's market Structure *MTSI<0,5*
0,2-0,37	Low	Multipoly	Free competition	Quasi cluster 0,2<CCC<0,37		
0-0,2	Very Low	Hyperpoly	Perfect competition	Mini cluster 0<CCC<0,2		
***Abbreviations*: SCI** – Set concentration Index, **CCC**– coalition cooperativeness coalition ; **MTSI** – Market Type Structure Index						

Source: Developed by author

policy is coordinated within the Organization of Economic of Cooperation and Development (OECD), while in the energy sector their policy is developed and regulated by the International Energy Agency (IEA). Traditionally since the 1970s the activities of OECD/IEA have been more focused and better institutionalized in the world oil sector. It is our view that, as a result, the current cooperativeness of OECD is still higher in the oil sector *(CCC=0,4)* than in the gas sector *(CCC=0,3).*

Further improvement of the model will propose a more realistic view in terms of dynamics and the weight of the different criteria. A valuation procedure with participation of several experts should also be on the agenda.

Table 1. Minimum general administrative requirements for applicants for civil servant positions

Criteria of coalition cooperativeness	OPEC	FGEC	OECD/oil	OECD/gas
Techno-economic advantages in the value chain (volume of own reserves, flexibility of costs, production and export capacity)	0,9	0,8	0,15	0,35
Comprehensiveness of common policy	0,4	0,3	0,5	0,5
Imperativeness of decision and rules (i.e. production and export quotas, volume of strategic reserves)	0,75	0,4	0,5	0,1
Influence on the volume of supply or demand	0,8	0,6	0,5	0,35
Influence on pricing	0,75	0,4	0,4	0,25
Accessibility to sources of supply and customers' markets	0,9	0,5	0,35	0,25
Average assessment of CCC	**0,75**	**0,5**	**0,4**	**0,3**

Source: Public Administration Institute, 2004

Taking into consideration the complexity of the problems and the need to review past periods, the evaluation should be made with the participation of experts and organizations with different interests and views.

Conclusions

The key methodological aspects of our innovative approach to market structures analysis are:

- The evolution of economic structures is examined through the logical and original concept of *Phase-Structure States (PhSS)*;
- The concentration (hierarchy) of structures is analyzed with our new and more plausible indicator –*Set Concentration Index (SCI),* which is equivalent for *Set Hierarchy Index (SHI)*;
- The *PhSS-SCI Model* permits to develop a set of logically linked indictors for profound system analysis of competition forces, market power, coalition effects and market typology;
- The theoretical advantages of new indicators are supported by logical and reliable mathematic models.

As a result, the author proposes not a partial or elaborated view on some methodology aspects, but a comprehensive and balanced system for the assessment and classification of market and social structures, which can facilitate transparent data treatment, flexible modeling, profound system analysis and plausible forecasting in applied studies of many sectors, i.e. energy, finance, etc.

The next paper will discuss the practical implementation of the new concepts and models in the oil and gas sectors with a detailed analysis of reserves, production, consumption, foreign trade flows. Special attention will be paid to diversification of world, regional and national energy balances.

References

Dimitrov, M., Andreff, W. and Csaba, L. (eds.), 1999. (1999). Economies in Transition and the Variety of Capitalisms: Features, Changes, Convergence. Sofia: Gorex Press.

Greenberg, R., Rubinshtein, A., 2013. Individuum & Gosudarstvo: economic dilemma. Moscow: Ves Mir.

Harrington, E., 1965. The disirability function. Industrial Quality Control, Volume 21, pp. 494-498.

Herfindahl, O. C., 1950. Concentration in the U.S. Steel Industry. Washington: Columbia University.

Hirschman, A. O., 1945. National power and the structure of foreign trade. Berkeley: University of Califofrnia Press.

Kolesov, V., Lukyanenko, D., 2013. Globalnoe economicheskoe razvitie: tendenzii, assimetrii, regulirovanie. Kiev: Kiev National Economic University.

Krugman, P., 2008. Microeconomics. 2nd ed. s.l.:Worth Publishers.

Livshitz, V., 2013. Systemnyi analiz ryinochnogo reformirovania nestatzionarnoi ekonomiki Rosss: 1992-2013. Moscow: LENAND.

Petrov, I. I., 2015. Evolyutziya structur mirovih i evropeiskih energeticheskih rynkov i perspektivi razvitiya gazotransportnih setei v Yugo-Vostchnoi Evrope s uchastiem Bolgarii i Rossii (PhD Dissertation in Economics). Moscow: Gubkin Russian University for Oil and Gas.

Rényi, A., 1961. "On measures of information and entropy". Proceedings of the fourth Berkeley Symposium on Mathematics, Statistics and Probability 1960.P. 547–561.. Berkeley, Cal., University of California Press.

Shannon, C. . E., 1948. A Mathematical Theory of Communication. *Bell System Technical Journal*, Volume 27 (3), p. 379–423.

Statev, S., 2007. Financial Development and Economic Growth in Bulgaria. Sofia, University of National and World Economy.

Stiglitz, J., 2010. Freefall: free markets and the sinking of the global economy. London: Penguin.

Tirole, J., 1988. The Theory of Industrial Organization. Cambridge, MA: MIT Press.

Tirole, J., 2002. . Financial Crises, Liquidity and the International Monetary System. Princeton: Princeton University Press.