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THE ECONOMIC MODELLING FOR THE CARTEL DETECTION

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ABSTRACT

Background: The urgency of finding an effective methodology for identifying cartels is due to the need of reducing the negative effects of the cartelization in the country's economy. The use of cartel detection methods will allow solving the problems of preliminary monitoring of commodity markets and trading. Methods: The study allowed the authors solve the problem of applicability of the methods for assessing concentration and correlation models of two types to determine the probability of the cartel presence: determining the correlation between prices of participants in the commodity market; correlations between prices and cost of product market participants. The study made it possible to draw a conclusion about the applicability of these economic methods for cartels detection in commodity markets. Conclusions: Summing up the research results, it should be noted that the use of the economic methods of cartels detection makes it possible to find out cartels on commodity markets. The expediency of using indicators characterizing market concentration and correlation models is confirmed. Noting the complexity of using these methods, it can be stated that the assessment of concentration is more accessible and simple method. Detection of cartels at the auctions is possible with the use of participants' behavioral models that contradict competitive behavior.

INTRODUCTION

The scientific problem of the economic detection of cartels and other anticompetitive agreements is relevant to the processes of reducing the negative impact of the cartelization effects to the economy. As noted in the work of Khamukov, 2006 [1], cartelization leads to a shift in market equilibrium and is characterized by a simultaneous increase in price and a decrease in the volume of supply. In the course of anti-competitive agreements, the competitive relations are replaced by the network structure coordinating group behavior of externally independent economic entities. The essential sign of the presence of a cartel is the uniform and coordinated in time behavior of market entities contrary to the principles of free competition. Such actions include the rejection of transactions, the provision of production facilities and other means of production of a competing company, the rejection of methods of price competition, etc.

Considering the approaches to the economic detection of cartels, it is first necessary to identify the differences in methods for the different types of cartels described in Art. 11 (Federal Law of the Russian Federation "On Protection of Competition", 2006). The probability of the presence of cartels in commodity markets is detected using sectoral concentration estimation methods and two correlation models, the first of which estimates the prices of participants in the commodity market, and the second, reflected in the work Porter & Zona [2], the ratio of their changes prices and costs. As noted in the work Porter & Zona [3], an additional feature of the creation of a cartel is the formation of industry alliances and associations. Examples of the use of these assessment tools according to data on socially significant and priority markets of the Sverdlovsk region are given in the article Kokovikhin et al [4].

In the course of economic detection of the presence of a cartel at auction, indicators characterizing the differences in the behavior of bidders from the competitive model are used. Confirmation of the presence of a cartel is structural changes in the pricing of participants before and after the creation of the cartel, identified by building a price series.

As noted in (Report on the state of competition in the Russian Federation, 2013), a model of cartel formation at auctions for the purpose of dividing lots among bidders is common. This model was used by a group of companies for deliveries for the needs of law enforcement agencies (decision of the Federal Antimonopoly Service of Russia dated 10.05.2012 N AC / 14399 in case No. 1 11 / 143-11), road-building firms (Decision Moscow Office of the Federal Antimonopoly Service of Russia dated 13 February 2012 in case No. 1-00-277 / 77-11) and others.

In foreign literature, two models of cartel detection at auctions are given, the first one is reflected in the work of Baldwin et al. [5]. It uses traditional methods of comparing models, such as logarithmic probability. The second model presented in the work Bajari and Lixin [6] uses the approach of determining the probability of the presence of a cartel during bidding, compares the structural models of "collusion" and "competition" and calculates probability distributions.

It should be noted that the economic detection of cartels at the auction should take into account the practice of attracting pseudo-bidders who do not engage in economic activity and are identified by the absence of indicators of economic activity in external reporting. Attraction of pseudo-participants, as a rule, is accompanied by their subsequent deviation from the bidding procedure due to various reasons: lack of licenses, tolerances of self-regulatory organizations, financial resources, etc.

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Thus, based on the theoretical basis for identifying cartels in commodity markets and trades, it is necessary to solve the scientific problem of determining the applicability of these models for practical use in the economic detection of the presence of cartels. The solution of this task is based on an empirical analysis of the presence of the signs indicated in the theory in cases of identified cartels whose existence has been proven during investigations by the Federal Antimonopoly Service of the Russian Federation.

MATERIALS AND METHODS

To solve the problem of identifying the applicability of the economic methods for cartels detection on commodity markets and trades, research hypothesis complexes have been developed, shown in [Fig. 1, 2].

The first hypothesis of the study involves determining the dependence of the presence of a cartel on the level of market concentration. The first indicator used to test the hypothesis is the Herfindahl -Hirschman index described in work Bajari [7]. As noted work in work of Karelin [8], a decrease in the value of this indicator implies a decrease in concentration, which may indicate a complication of the market structure and a decrease in the positional influence of individual companies, and a corresponding decrease in the probability of cartel formation.

The second direction of testing the hypothesis of the effect of concentration is considered in the article Lymar, [9] and involves the calculation of concentration indices of three and four major market participants.

Within the framework of the second hypothesis, it was suggested that during the formation of a cartel, a change in the correlation dependences of the economic indicators of the cartel participants is observed.

H1: Cartels are formed on high concentration markets	Herfindahl-Hirschman Index $$HHI = \sum_{i=1}^{n} S^2$$ where Si - share of each individual market participant	> 1800 - highly concentrated market; 1000 to 1800 - middle concentrated market; 1000 - low concentrated market; a decrease in the value of the indicator implies a decrease in concentration, which may indicate a complication of the market structure and a decrease in the positional influence of individual companies
	Level of market concentration CR3= C1+C2+C3 CR4= C1+C2+C3+C4	The higher the obtained value and closer to 100, the more monopolized the market
H2: When forming a cartel, there is a change in the correlation dependencies of the economic performance of the cartel members	Evaluation of the prices correlation of participants in the commodity market $$\overline{y}_x = f(x),$$ $\overline{y}_x$ - arithmetic average (conditional average) of all possible values of the price of the i-th market participant, which corresponds to the value X = x of the price of the j-th market participant	Price correlation means that there are prerequisites for the formation of a cartel
	Evaluation of the correlation of prices and costs of participants in the commodity market $$K1 = \frac{\Delta P}{\Delta Q}$$ where ΔP - price change for the period; ΔQ - cost change for the period	The absence of correlation between prices and costs means that there are prerequisites for the formation of a cartel

Fig. 1: Hypotheses of testing economic methods for cartels detection on commodity markets

In the first case, the approach is based on determining the dependence of the prices of "independent" market participants and is considered in work of Michihiro [10]. The hypothesis of independence of participants in the pricing process is confirmed provided that the correlation coefficient for the prices of participants in the commodity market tends to zero. As noted in [8], correlation analysis is performed on the basis of pairwise comparison of prices of companies participating in the same auction.

In the second case, the approach is based on the assumption that the abuse of market power arises when price increases cannot be fully justified by rising costs. Consequently, the correlation coefficient in a competitive market should strive for one, and in the presence of cartel collusion to zero. If the correlation is

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high, the behavior of market participants or bidders is assessed as reasonable; in case of inconsistency between price changes and cost, a cartel is possible.

Next, we present the formulation of a hypothesis to test the economic methods of cartels detection at auction.

H3: Observed differences arise in the behavior of cartel members and independent bidders when a cartel is formed.	Pricing Differences	A sign of cartel presence is a sharp increase or decrease in price
	Behavioral Indicators	Deliberately unfavorable solutions from the economic position of the company

Fig. 2: Hypotheses of testing economic methods for cartels detection at auction
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This method involves comparing the behavior model of cartel members and independent bidders. The essential feature is a discrete change in the functions of pricing firms. It should be noted that econometric evidence of structural changes is not a complete proof of collusion, since it does not distinguish the resulting gaps in behavior during the cartel collusion from other causes. Screening abrupt price changes is to a large extent a method of mass assessment of indicators when searching for cartels, while estimating marginal income implies conducting local research.

The information base of this study includes the data of the decisions that established the facts of violation of Section 2, Part 1, Art. 11 of the Law on the Protection of Competition of the Russian Federation and sampling carried out in the context of cartel participants recognized by these decisions in the databases of the Unified Procurement Information System (http://www.zakupki.gov.ru/epz/main/public/home.html), and also of the System for Professional Analysis of Markets and Companies (SPARK-Interfax (http://www.spark-interfax.ru/).

RESULTS

To test the hypotheses of the possibility of using the economic methods for cartels detection on the commodity markets, proven cases of cartel detection were selected: cartel of manufacturers of oil-immersion cable (case No. 1-11.1-37 / 00-22-15), cartel, including salt wholesalers (case No. 1- 00-37 / 00-22-13), cartel, including wholesalers of frozen fish (case No. PK-05/14400).

Further, indicators were calculated for the relevant markets, the year preceding the identification of the cartel was chosen as the time period, the results are shown in [Table 1].

Table 1: The results of applying the economic methods for cartels detection

Economic Detection Indicator	Cartel of manufacturers of oil-immersion cable	Cartel, including salt wholesalers	Cartel, including wholesalers of frozen fish
Herfindahl-Hirschman Index HHI	3 800	4 000	1 200
The level of market concentration of the three largest participants CR3	25	23	4
The level of market concentration of the four largest participants CR4	32	26	5
Evaluation of the correlation of prices of cartel members (the value of the correlation coefficient)	0,7	0,81	0,54
Estimation of price and cost correlation of cartel members (value of correlation coefficient)	0,21	0,3	N/A

The calculations made allow us to draw the following conclusions about the applicability of the economic methods for cartels detection on commodity markets. Indicators characterizing market concentration confirm the hypothesis that participants in concentrated markets tend to form cartels. In all cases, both the Herfindahl-Hirschman index and the concentration ratios of the largest market participants indicate that the product market is highly concentrated. It can be concluded about the possibility of using concentration indicators for the economic detection of cartels on commodity markets.

To test the hypotheses of the possibility of using the economic methods for cartels detection at auction, proven cases of cartel detection were selected: Cartel in the field of construction and installation works (case No. 391), Cartel in the field of road construction (case No. 1-11-21 / 00-22-18) and etc.

During the analysis of the first case, the behavioral indicators given above are observed. The most active bidders gradually reduced the initial (maximum) contract price by 44% from RUB 21 947 434.52 up to RUB 12 290 375,82 thereby reflecting both the sign of a "sharp drop in price" and the sign of a "deliberately unprofitable decision from the point of view of the firm's economy".

At the same time, according to the data presented by the electronic platform to the antimonopoly body, the entrance to the website of the electronic platform during the disputed auction, and all actions to post and change documentation, as well as the filing of applications by these economic entities were carried out from a single IP address.

According to the protocol of summarizing the electronic auction, the second parts of the active participants 'applications were deemed non-compliant with the requirements established by the documentation of the electronic auction, due to the lack of a self-regulating organization for admission to work that affect the safety of capital construction projects, as a result of which the said business entities left the auction without loss of security for bids, and the contract on the results of the auction was concluded with the participant who offered the best price after the first two participants.

Thus, during the preparation and participation in this open auction, the pseudo auction participants having reached an agreement and having the opportunity to exchange information reduced the offers to economically disadvantageous for bona fide auction participants, while deliberately excluding the possibility of positive consideration of the second parts of applications and concluding a contract with them bidding.

DISCUSSION

It should be emphasized that the study confirmed the theoretical conclusions presented in the works of Baldwin et al. [5], Karelin [8], and Lymar [9]. The presence of a cartel, confirmed by evidence, is indeed characterized by indicators of high market concentration, in particular, the Herfindel-Hirschman index. An increase in the value of this criterion indicates an increase in market concentration and an increase in the likelihood of a cartel. The relationship between the high value of the concentration indices of the three and four largest market participants and the high probability of the presence of a cartel was also confirmed.

As a result of testing the second hypothesis, based on the theoretical conclusions of Bajari [6] and Baldwin L, Marshall R, Richard J [5], it was not possible to obtain full agreement. When forming a cartel, a change in the correlation dependencies of economic indicators of cartel participants is not always observed.

CONCLUSION

According to Reports on the state of competition in the Russian Federation 2016-2017, starting in 2014, such a scheme for creating cartels in trades amounts to hundreds of cases. The cartels themselves at the auction began to acquire all the signs inherent in organized criminal groups and criminal communities: structure, stability, distribution of roles.

Summing up the research, it should be noted that the use of economic methods for cartels detection makes it possible to find out cartels on commodity markets. The expediency of using indicators characterizing market concentration and correlation models is confirmed. Noting the complexity of using these methods, it can be stated that the assessment of concentration is more accessible and simple method. Detection of cartels at the auction is possible with the use of participants' behavioral models that contradict competitive behavior.

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