M. Tech Practical Training Report

On

Technology based Prevention of Cartelization in APMC

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DECLARATION

I hereby declare that the M. Tech Practical Training Report entitled **UDAY KUMAR VUSIRIKAPALLY** which is being submitted to the **National Institute of Technology Karnataka, Surathkal** in partial fulfillment of the requirements for the award of the Degree of **Master of Technology** in **Computer Science and Engineering** is a *bonafide report of the work carried out by me*. The material contained in this report has not been submitted to any University or Institution for the award of any degree.

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Guide

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Abstract

Firms in an industry compete with each other and practice methodologies that will eventually end them up in a less profitable situation. In such situations competing firms collude with one another on an agreement to form a cartel. This will benefit the members of the cartel to increase their profit collectively. Cartels are considered to be illegal in most of the countries around the world. Agricultural Produce Market Committee (APMC) is a marketing board in India that regulates the farm to retail price of agricultural produce and ensures farmers are safeguarded from exploitation by large retailers. One of the loopholes of APMC system is cartel. This report tries to address the problem of cartel in APMC through technology based solution. The goal is to design an algorithm that takes APMC data as input, analyses the data and detect cartels in APMC. Methodologies should be defined in order to detect cartels and give strong reasons why those methologies will work. Dataset need to be found and the data should be preprocessed. If not possible to find a dataset, a dataset should be constructed following all the regularities in real life situations. Implementation of the defined methodologies should be done and tested on dataset. Implementation of the algorithm should be done and tested on an existing dataset if possible. Results obtained should be shown and conclusions on the objectives achieved to be mentioned.

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Keywords: APMC, Cartel

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Chapter 1

Introduction

Individual organizations which belong to an industry tend to compete with the other organizations in the same industry. Such organizations are known as competitive organizations of that industry. Competitive organizations that produce the same type of product will follow their own strategies to improve their own sales and individual profits of their respective organization. The competition between two competing firms of the same industry will enable the firms to reduce the cost price of the product in order to increase sales and profits than the other competing organizations. The following is a simple example explaining the situations how a cartel will arise.

1.1 Cartel explanation through example

Let us consider a scenario where there are to firms A and B manufacturing the same or similar product. Note that the term organization and term firm are used interchangeably in this paper both having the same meaning. Both the firms A and B initially sell their respective products for the same price say Rs.10. Also assume that both the firms are having more or less the same customer support. Hence both the firms make same profits. Let us consider that firm A attracts the customers by decreasing its product value to Rs.9, hence firm A will make profits because all the customers come to firm A as they are attracted by the low price provided by the firm A. At the same time no customers will go to firm B due to more price of the product compared to the firm A hence firm B will end up in loss. Now firm B will also follow the same strategy by reducing the product value to Rs.8. All the customers will buy the product from firm B and firm A will end up in loss now. This process of competition repeats and

eventually both the firms end up selling their products for very low profits. This type of situations will encourage both the firms to collude to form a cartel. The situation is explained as follows. If firm A and firm B would have had an agreement on the price of the product in the market this situation of both the firms ending up in low profits would have never shown up i.e., if firm A and firm B would have had a secret agreement on selling the product for Rs.10 or more and also agree to share the customer support equally the situation of both the firms ending up in least profits wouldn't have shown up.

In scenarios similar to this competing firms collude on an agreement and form a group. This agreement would help them regulate the product price in the market and collectively improve the profits of both the firms. This formation of a group to regulate the price of the product and dominate the market is called cartelization. Such a group is called a Cartel.

1.2 Cartel definition

A Cartel is a group of independent competitive market participants under the same sphere of business who collude with each other in order to improve their profits and dominate the market. Cartel consists of two or more competitive participants of the same industry. The members of the cartel seek to reduce the competition by controlling the price in agreement to one another. Some of the practices used by the cartel to cut the competition include product output restrictions, price fixing, collusive bidding, market allocation, customer allocation.

1.3 Types of cartels

1. Output restriction cartel : In product output restriction cartels participants of the cartel will agree upon the quantity one should produce. Based upon the product quantity they produce the participants profits are depended.

2. Price fixing cartel : In price fixing cartels the participants of the cartel will collectively decide a price for the product. This product price fixing decision by the cartel will decide the price of the product in the market. Hence making

cartels as a monopoly in the market as they are acting as a key factor in fixing the price of the product.

3. Collusive bidding cartel : Collusive bidding can be taken place in auctions. Participants of the cartel will choose one of the member of the cartel who should win the bid. The chosen member of the cartel will bid for some price which brings him more profit. All the other members of the cartel wantedly bid for a very low price so that the chosen one should be the winner of the auction.

4. Market allocation cartels : In such cartels the members of the cartel will distribute the customers according to geographic area. One cartel member is allowed to sell his goods only in his allocated area.

5. Customer allocation cartels : Customers are equally distributed among the members in the cartel.

Cartels are considered illegal in most parts of the world because they follow anti-competitive practices. Cartels affect consumers by increasing prices in products. It also affects other competing participants by acting as a monopoly and dominating the market.

1.4 Agricultural Produce Market Committee

APMC stands for Agricultural Produce Market Committee. It is a marketing board established by state government in India to ensure farmers are safeguarded from exploitation by large retailers, as well as ensuring the farm to retail price spread does not reach excessively high levels. Before establishing APMC farmers used to sell their farm produce to their money lenders. Money lenders used to buy the farm produce at a price of their choice. Due to this, farmers were in perpetual debt to the money lenders. To overcome this problem government of India has established APMC or Mandi. APMC is also called as Mandi. Mandi is a market area where farmers can bring in their produce and sell them in the market. A farmer can go to any Mandi in India and sell his/her produce in the Mandi. The stake holders of the APMC are farmers, traders, commission agents, laborers, Local bodies and government agencies. Farmers are the producers of the agriculture products. Traders need to take license

from the government to take participate in the auctions which will take place in the mandi. Commission agents are the middle men between the farmers and the traders. Labourers are assigned by the mandi for various tasks. Local bodies is nothing but the mandi association. Government agencies is the state government who operate the mandis.

1.5 Workflow in APMC

Farmers bring their produce into the mandi and consult to a commission agent. Commission agents are assigned by the local body (mandi). Commission agent is responsible for cleaning, sorting and displaying the farmers produce. Then the produce is open for Auction starting from the Minimum support price (MSP) provided by the Mandi. Licensed traders put in their bids to buy the farmer's produce. Highest bidder wins the Auction and gets the produce. Produce is bagged and loaded into outbound logistics. The trader who bought the produce has to pay 6 percent tax on the bid he/she has kept. This amount is paid to the commission agent. Commission agent cuts 1 percent as tax for cleaning, sorting and storage from the winner's bid and the rest amount is given to the farmer. This is how the normal process flow works in mandi.

1.6 Cartel in APMC

Some of the traders collude with one another to form a cartel and fix their price on bid. They participate in auction with very low and fixed bids. Due to this the farmer may not get a fair price for his produce. Also, people in the cartel act as a monopoly and they buy the produce only if the price is very low. Hence, they act as a monopoly in the mandi.

Chapter 2

Related work

Even though cartels are present in many industries solid solutions through technology and standard rules to identify cartels in collusive bidding are not defined. This problem is raised due to lack of data. Labelled data defining cartels is not available since cartels won't reveal that they are cartels. Even though some members of the cartel reveal that they are cartels, there is very less chance we find all the cartels in the industry. So dataset is a major concern in this area of research. To detect cartels through data analysis one needs to have trader's behavioral data, bidding data. Even though this data is recorded by the agencies who are conducting the auctions, they are not revealed to the outside world. Organization for Economic Cooperation and Development (OECD) is an inter-governmental organization to stimulate economic progress and world trade. Even OECD says not to reveal the bidding data because this data may be used by the competing organizations to form cartels and data may be misused by the existing cartels.

OECD [2013] is the document that compromises proceedings of a roundtable by OECD on cartel Investigation and the use of screens to detect cartels. The document consists of discussion and the contributions of 25 countries towards the detection of cartel using screens. OECD [2013] majorly classifies detection of cartels into two types namely pro-active and reactive methods.

Bence Toth and istvan janos toth. [2015] provides a toolkit for detecting collusive bidding in public procurement.. The paper discusses about various approaches in detecting collusion, robust elementary indicators and analytical tools for adapting them to local contexts. The paper delivers a conceptual definition and theoretical discussion for each indicator as well as a complex empirical assessment using data on

over 75,000 contract awards in Hungary.

Pesendorfer [2000] has done a study on bidding for school milk contracts in florida and texas. Pesendorfer [2000] observed two types of cartels: one cartel divides the market among members and the other cartel uses side payments to compensate members for refraining from bidding.

Porter and Zona [1993] examines cartels in state highway construction contracts and says that detection of collusion is possible because of limited participation in the collusive scheme. They also say that collusion did not take the form of a bid rotation scheme. Instead, several ring members bid on most jobs. One was a serious bidder, and the others submitted phony higher bids.

Morselli and Ouellet [2018] focuses on collusion bidding patterns in Quebec's construction industry. Used Jaccard index to detect similarities in firm's interactions.

Conley and Decarolis [2016] present statistical tests to detect coordinated entry and bidding choices. The tests perform well in a validation dataset where a court case makes coordination observable. They used the tests to detect coordination in a larger dataset where it is suspected, but not known.

Wachs and Kertesz [2019] tries to detect cartels using a network-based approach. The author allocates one node to each trader who is participating in the auctions. If two traders are participating in an auction then the weight of the edge between the two traders is increased. This increment is done because if two traders are from a cartel there is very less chance of participating in the same auction. So, if two traders are participating in the same auction then we can sense that they may not be belonging to a cartel. Then we identify the groups of traders who bid for the same type of products using an overlapping community detection algorithm. Then calculate the topological features defined by the author. They are coherence and exclusivity. Coherence is the ratio of geometric mean to arithmetic mean of the weight of the edges in a group. Exclusivity is the ratio of strength within the group to the total strength of nodes in the group (including edges leaving the group). As features of groups of firms, coherence captures the consistency and intensity of interactions among firms in the group, while exclusivity quantifies the extent to which group interactions happen in isolation from the rest of the firms in the broader market. The author says that the collusion is more likely to emerge among high coherence and exclusivity groups

because they offer the ideal conditions for firms to learn to cooperate and trust one another. With this method they worked on a dataset of school milk contracts with a known cartel, a dataset of virtually all contracts awarded in the Republic of Georgia over several years, and in a simulation model of contracting markets with spatial correlations.

They plotted the distribution of groups in coherence-exclusivity space and with the help of their group detection algorithm they identified cartels for each year. They observed that groups in network that has been developed from the data exhibit high coherence and exclusivity than the model the network they simulated providing random bids.

Chapter 3

Solution

Farmers bring their agricultural produce to the APMC for selling them through auctions. There will be auctions held separately for different products. Traders will participate in the auction by placing their individual bids. The highest bidder in the auction is considered to be won and the product in the auction will be given to that bidder. Traders form a cartel well before the auction takes place. They fix the value of the bid and agree upon a winner. All the other members of the cartel either doesn't participate in the cartel or bids for a very small amount compared to the chosen winner. Our Aim is to detect such cartels in APMC by giving a technology based solution.

Wachs and Kertesz [2019] can be considered as base paper and try to improvise the network based approach in detecting cartels. Alternatively new methodologies to detect cartels can be introduced. These methodologies should be chosen in such a way, so they can be implementable through computer algorithms. Such an algorithm that incorporates the cartel detecting methodologies is to be written. The algorithm should be turned into code and it should be implementable. APMC data need to be studied and proper inputs need to be chosen to give them to the algorithm. This algorithm takes the APMC data, analyses the data and detects the cartel.

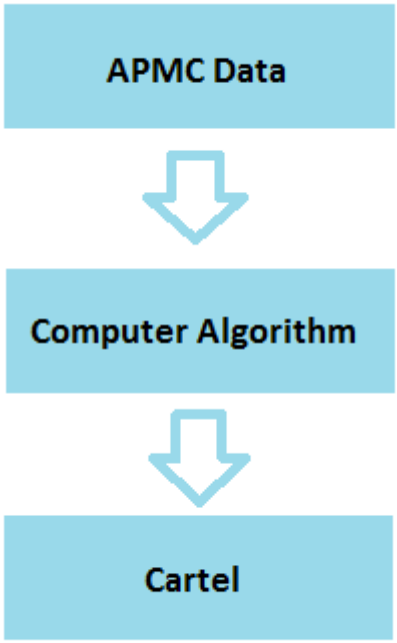

Figure 3.1: Solution

Chapter 4

Applications

Cartels are found in many industries from very small businesses like a bakery cartel in a town and in very large businesses like Organization of the Petroleum Exporting Countries (OPEC) cartel. APMC is one of those organizations which suffers from cartels. Providing solution to detect cartels has many applications. Some of them are listed below.

1. As cartels are present in APMCs, the farmers will not get a competitive price for their produce in the APMC auction. Since the bid rigging takes place and all the traders in the cartel have an agreement to not compete in the auction and buy the farmer's produce for a very low price, the produce will not be sold out for a more profitable value for the farmer. The difference between the sold auction bid of the product in existence of a cartel and the sold auction bid in absence of a cartel is considerably large and effects the farmer's profit in a bad way. So providing a technological solution to detect cartels in order to eradicate them from the APMC system will enable farmers to get competitive bids for their produce in APMC auctions.

2. Cartels act as a monopoly in the industry. Some of the strong competitors in the industry will collude to form cartel. As these strong participants of the industry form a cartel who produce majority quantity of the product, the cartel members dominate their industry in fixing the values of the product and suppressing other competitors. Non cartel participants are forced to sell the product for a price decided by the cartel participants. The same is applicable in APMC. Traders in the cartel choose one among them to be winning the next auction and decide to

participate in the auction with a small bid. All other cartel members does not participate in the auction. Even though other cartel participants participate in the auction they will bid for a very small value compared to the bid value of the chosen winner among the cartel members. The non cartel traders are forced to place small bids since the cartel members will not put large bids because there is no competition. If majority of the traders collude in a cartel then there will be no competition in the bidding and there will be only one bid that is the chosen cartel member. Also non cartel members are bribed not to participate in the auctions. So the cartel acts as a monopoly in the APMC, decides the product value in APMC and it will not allow other traders to survive in the APMC. So having a cartel detecting solution helps in healthy competition in the APMC.

Chapter 5

Conclusions and Future Work

A thorough study is made on APMC. Studied why APMC are required and who regulates the APMC. Studied the workflow in APMC. Studied what is a cartel. Studied various types of cartels in the market. Studied cartel in APMC. Studied various reference papers related to the problem statement.

Methodologies need to be defined for detecting cartels. Write an algorithm using those methodologies. Implement the algorithm and test it. Test the algorithm and caluculate the efficiency of the algorithm. Provide reasons why the algorithm works. Debug the code. Develop a demo web application to simulate the work done.

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