GAME THEORY PROJECT

Application of Game Theory to Cartel Collusion and Whistle blowing:
Looking at the case "AT40009 - Maritime Car Carriers"

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Introduction

The European Commission has become increasingly aggressive on competition law within the European Economic Area, creating harsher penalties and better incentives for whistleblowing[1]. This paper looks at a recently resolved case of maritime car carriers who engaged in a cartel between 2006 and 2012 within the EEA and answers the following questions:

- Under which conditions is collusion sustainable?
- Under which conditions is whistleblowing likely?
- What is the optimal choice for cartel members once the whistle is blown?

1. Framework

The particular case explored is the "40009 Maritime Car Carriers", concluded on 21.02.2018. The following five companies were involved:

Mitsui OSK Lines (MOL)
Kawasaki Kisen Kaisha (K Line)
Nippon Yusen Kabushiki Kaisha (NYK)
WWL and EUKOR (WWL)
Compañía Sudamericana de Vapores SA (CSAV)

The European Commission fined four of the companies a total of €395m for colluding.

According to the European Commission, the companies "*coordinated* prices[2]*, allocated customers and exchanged commercially sensitive information about elements of the price, such as charges and surcharges added to prices to offset currency or oil prices fluctuations*"[3] and thereby violated Article 101 of the Treaty on the Functioning of the European Union and Article 53 of the EEA Agreement which prohibits cartels and other restrictive business practices.

This affected around half of the vehicles being imported into the EEA during the period of collusion. MOL, who revealed the existence of the cartel by submitting an immunity application, was exempted from the fine under the Commission's 2006 Leniency Notice[4]

This paper presents three scenarios, which explain the interaction between the companies in different circumstances:

[1,] European Commission (2018b), *Cartel Statistics,* http://ec.europa.eu/competition/cartels/statistics/statistics.pdf
[2] European Commission (2018c), COMMISSION DECISION of 21.2.2018 relating to a proceeding under Article 101 of the Treaty on the Functioning of the European Union and Article 53 of the EEA Agreement (AT.40009 – Maritime Car Carriers), Brussels
http://ec.europa.eu/competition/antitrust/cases/dec_docs/40009/40009_2427_7.pdf?fbclid=IwAR00gPhFhEVIFanGaVI3tEz 68nuKgtZ4bMV7sRMCfRfydD28BDc0ADCqb50 : page 5
[3] European Commission (2018a), Antitrust: Commission fines maritime car carriers and car parts suppliers a total of €546 million in three separate cartel settlements, [Press Release]. Retrieved from http://europa.eu/rapid/press-release_IP-18-962/en.htm
[4] European Commission (2006a), *Competition: Commission adopts revised Leniency Notice to reward companies that report cartels,* [Press Release]. Retrieved from http://europa.eu/rapid/press-release_IP-06-1705_en.htm?locale=en

1. Non-cooperative game before the players agree to collude;
2. Cooperative game where players collude;
3. Whistleblowing game: sequential game to explain other players' actions following whistleblowing.

In order to simplify the game we focus on 3 players, the 3 most relevant companies that took part in the cartel [MOL, NYK, WWL].

Throughout the game, we assume that there is perfect competition between the players when they are not colluding, and thus profit is zero. Players who try to raise prices (try to collude) lose their entire market share if the other players do not collude with them.

2. Game I: Non-cooperative prisoner's dilemma

2.1 Context

Before 2006, no collusion existed between MOL, NYK and WWL. We assume perfect competition.

- Players compete on price (Bertrand competition) when not colluding.
- All three players make independent and simultaneous decisions.

2.2 Payoffs

This game is equivalent to a 3-person prisoner's dilemma. The payoffs are:

M	Monopoly profits = π_m
e(F)	Expected fine, takes into account expected size of fine[5] and probability of being caught
C	Profits under competitive conditions = π_c
fc	Fixed costs of the firm

- If all players collude, they each get monopoly profits minus expected fine: M - e(F)
- If two players try to collude, but the other cheats, the cheating player gets the whole market at a price just under the monopoly price and gets a payoff of 3M.
- If one player tries to collude, and the others cheat. The cheating players share the market in perfectly competitive conditions, and each obtain a payoff of C.

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[5] Refers to the fines imposed by the European commission for firms participating in cartels and other restrictive business practices. Each company involved in a cartel may be fined up to 30% of the yearly sales in the relevant sector for the infringement, multiplied by the number of years of participation in the infringement. Moreover, a part of the fine – the so-called "entry fee" of 15% to 25% of the yearly relevant sales – may be imposed irrespective of the duration of the cartel. Finally, repeat offenders will also be fined more than in the past. (Commission's 2006 Guidelines on fines: http://europa.eu/rapid/press-release_IP-06-857_en.htm?locale=en)

- Consumers will purchase from the least expensive firm and split equally across firms in case of ties. The firm trying to collude (and thus, charging above marginal costs) will make zero sales and thus have a negative payoff equal to their fixed costs[6], when at least one other player does not collude.

$$\text{Where: } 3M > M - e(F) > C = 0 > -fc$$

NYK colludes:

	WWL Colludes	WWL doesn't collude
MOL colludes	M- e(F), M-e(F), M-e(F)	-fc, 3M, -fc
MOL doesn't collude	3M, -fc, -fc	C, C, -fc

NYK not colludes:

	WWL Colludes	WWL doesn't collude
MOL colludes	- fc, -fc, 3M	-fc, C, C
MOL doesn't collude	C, -fc, C	**C, C, C**

2.3 Consequences

Unique Nash equilibrium for all players is therefore not to collude and they will have normal profits with payoff set (C, C, C).

This competitive equilibrium is a unique Bertrand-Nash equilibrium, in which all firms set their price at marginal cost, so $pN = c$ and $\pi_c(pN) = 0$. The total payoff is not maximized since (not collude; not collude; not collude) *is pareto dominated* by (collude; collude; collude). In this sense, the NE is "inefficient for players". For a finite number of games, there is no unilateral profitable deviation from (C, C, C).

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[6] Since we assume that players that price above marginal costs don't make any sales, we assume that they cannot be fined for being in the cartel.

3. Game II: Formation of the cartel

3.1 Context

The European Commission presents evidence that between 2006 and 2012, the companies in the cartel regularly met and discussed strategies for collusion[7]. Factors that increase the probability of cartel formation, such as market concentration, height of barriers to entry the market, homogeneity of products or services and the similarity of cost structures (Stigler, 1964), are all assumed to be high in the car carrier market.

With a grim trigger strategy, we explore under what conditions collusion is sustainable.

Given that no player knows when the collusion will end, assume an infinite repeated game with the same set of matrices as in game 1. We assume that this time the players agree to collude and have payoff set:

(M- e(F), M-e(F), M-e(F))

In grim trigger strategy, if any player cheats in any period, the other players will revert to competitive conditions and stop colluding for all subsequent periods. As long as all players keep colluding, the firms will choose the monopoly price.

Companies have an incentive to deviate from the cartel, since by deviating, in the period of deviation they are able to achieve profits even higher than cartel profits (3M).

3.2 Payoffs

For any given player the payoff for colluding for the infinite game is:

$$[M - e(F)]+ [M - e(F)]\delta + [M - e(F)]\delta^2 + [M - e(F)]\delta^3\ldots$$

When cheating the payoff is:

$$3M + C\delta + C\delta^2 + C\delta^3\ldots$$

Where δ is the discount factor.

The players will collude if the payoff for the infinitely repeated game is higher to collude than to cheat:

$$[M - e(F)] + [M - e(F)]\delta + [M - e(F)]\delta^2 + [M - e(F)]\delta^3\ldots \geq 3M + C\delta + C\delta^2 + C\delta^3\ldots$$

Re-writing geometric progression:

$$\Leftrightarrow \frac{M - e(F)}{1 - \delta} \geq 3M + \frac{C\delta}{(1 - \delta)}$$

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[7] European Commission (2018a)

C equals zero:

$$\Leftrightarrow \frac{M - e(F)}{(1 - \delta)} \geq 3M$$

Multiply both sides by (1-δ):

$$\Leftrightarrow [M - e(F)] \geq 3M(1-\delta)$$

Divide both sides by 3M:

$$\Leftrightarrow \frac{M - e(F)}{3M} \geq 1 - \delta$$

Rearrange:

$$\Leftrightarrow \delta \geq 1 - \frac{M - e(F)}{3M}$$

The players will collude when the discount factor satisfies the above inequality.

3.3 Consequences

In the infinite repetition of this game, if $\delta \geq 1 - \frac{M - e(F)}{3M}$, there is a sub-game perfect equilibrium in which collusion is sustainable. Cooperation therefore holds if δ is large enough.

4. Game III: Sequential - Incentive to whistleblow

4.1 Context

The stability of the cartel depends on certain variables, including the probability of being caught (e) and punishment if caught (F), versus the gain of the illegal agreement ([M-e(F)] - C). In game 2, the conditions are such that the companies' optimal strategy is to collude. During the period of collusion, however, the conditions now change, as exogenous factors make whistleblowing more appealing. The main changes in incentives for whistleblowing are:

1. The Lisbon Treaty (2009)[8]: *The Articles 101 to 109 of the Treaty on the Functioning of the European Union (TFEU)* list new rules regarding competition in the European internal market, prohibiting anti-competitive agreements between undertakings.

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[8]European Union (2007), Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, signed at Lisbon, 13 December 2007. http://ec.europa.eu/competition/information/treaty.html

2. In 2008 the European Commission introduced a new settlement procedure for cartels to facilitate the cartel members acknowledging having taken part in anticompetitive behavior. [9]

3. Finally, there is an increase of fines and number of cartels being identified especially during 2007-2009. We assume that firms calculate the amount they will be fined if caught, will be comparable to others.[10]

Under the Commission's Leniency Notice, the first company that whistleblows receives full immunity, thus fully avoiding a fine [11]. All other companies who cooperate with the Commission can expect reductions of their fines of up to 50%, depending on the timing and extent of cooperation. [12]

Hence, in game III players have the option of whistleblowing.

4.2 Payoffs:

Let the following letters denote the different levels of punishment for the infringement:

	NF	No fine
	RF	Reduced Fine (r*F, where r is the discount ratio that the Commission applies for cooperation)
	F	Full Fine
B		Benefit from colluding = Cartel payoff M-e(F) - Competitive payoff C = [π_m - e(F)] - π_C
	B_{MOL}	Benefit from colluding for MOL
	B_{OTH}	Benefit from colluding for all other firms

- The first player revealing the cartel, the whistleblower, will receive a full exemption from the fine, NF
- All players cooperating with the Commission after the first whistleblower, will receive a reduced fine RF
- Every player who keeps colluding after the first whistleblower, will be fined the full amount F.
- If all players keep colluding, their payoff will be the continued monopoly profits minus expected fine, M-e(F).

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[9] European Commission (2008), Antitrust: Commission introduces settlement procedure for cartels, [Press Release]. Retrieved from http://europa.eu/rapid/press-release_IP-08-1056_en.htm?locale=en

[10] European Commission (2018b)

[11] European Commission (2006a)

[12] European Commission (2006c), Commission Notice on Immunity from fines and reduction of fines in cartel cases, Official Journal of the European Union https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52006XC1208(04)&from=EN

For whistleblowing to be the dominant strategy for any one player, it must hold true that: B < RF

$$\Leftrightarrow [\pi_m - e(F)] - \pi_C < r * F$$
(since $\pi_C = 0$, we can get rid of it)
$$\Leftrightarrow [\pi_m - e(F)] < r * F$$

This will be satisfied if the probability of getting caught e is sufficiently large compared to the discount ratio r for cooperation. Since we assume r to be similar for all players and F to be dependent on the firms' sales (thus, to hurt each player similarly), the decision to whistleblow depends on e, which is subjective to each player.

Since MOL decided to whistleblow and the other players did not, it must hold that:

$$F < B_{MOL} < RF < NF < B_{OTH}$$

In this case, confessing is the dominant strategy for MOL and will thus always be played.

We assume MOL was the only player aware that their payoff for staying in the cartel was lower than paying the reduced fine, because if this information was available to all players, they would all whistleblow simultaneously.

To understand how the other players would move once the cartel is uncovered, we use backward induction. After MOL revealed the cartel, the two other companies could choose between continuing collusion or collaborating with the European Commission. Consequently, we face a sequential game where NYK and WWL have to choose their strategy depending on the first move of MOL. Their payoffs depend on the first player's strategy.

SPNE = {(Whistleblow, Cooperate, Cooperate)}*
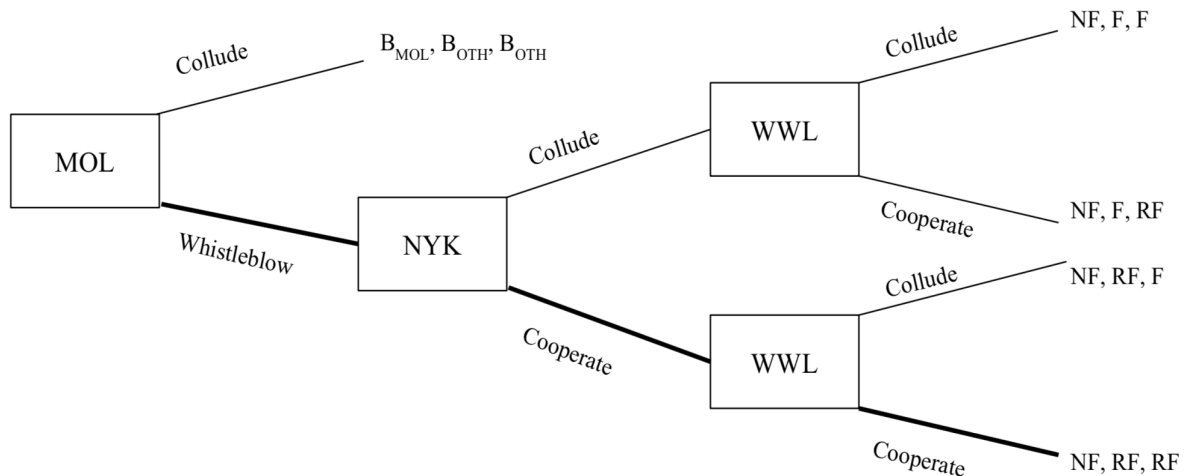
4.3 Consequences

Looking at the graph, the first player, MOL, has to choose between continuing colluding, and whistleblowing. NYK and WWL are the second and the third players, whose strategies between continuing collusion, or collaborating with the European Commission, depend on MOL's first move. Using backward induction yields the sub-game perfect Nash equilibrium SPNE= {(Confess, Cooperate, Cooperate)}, corresponding to a payoff of RF for both NYK and WWL, and NF for the whistleblower. As discussed previously, MOL has a higher incentive to whistleblow compared with staying in the cartel, obtaining no fine (NF). After having observed MOL's move, NYK and WWL's best response is to cooperate with the authorities not to continue collusion. Due to their cooperation with the Commission, NYK and WWL obtain a reduced fine and payoff of (RF)[13].

The deciding factor is MOL's dominant strategy of confessing, which results in a best response of all other players to cooperate with the Commission. This matches what happened during the unfolding of the cartel: after MOL whistleblew, the Commission granted MOL conditional immunity from fines on 14 August 2012, all other firms involved in the cartel cooperated when presented with this information.[14]

5. Criticism

There are different criticisms that we identify in our paper and that could lead to different outcomes of the presented games.

Firstly, the paper does not take into account the "aggravating circumstances" that would set higher fines according to the *Guidelines on the method of setting fines imposed pursuant to Article 23(2)(a) of Regulation No 1/2003[15].*These include corporations that repeat similar infringements in the past. In such cases, fine can increase by up to 100%. Other *"aggravating circumstances"* include *"refusal to cooperate"* or *"obstructing investigations".*

Secondly, the paper does not consider the negative consequences of whistleblowing such as loss of trust by the other cartel members risking the opportunity of future collusion. This would negatively influence the payoff for whistleblowing in the 3rd game.

Thirdly, there is no evidence explaining why MOL had a greater incentive to whilstleblow than the other players.

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[13] European Commission (2006b), Competition: Commission revises Guidelines for setting fines in antitrust cases, [Press Release]. Retrieved from http://europa.eu/rapid/press-release_IP-06-857_en.htm?locale=en
[14] European Commission (2018c), COMMISSION DECISION of 21.2.2018 relating to a proceeding under Article 101 of the Treaty on the Functioning of the European Union and Article 53 of the EEA Agreement (AT.40009 – Maritime Car Carriers), Brussels
http://ec.europa.eu/competition/antitrust/cases/dec_docs/40009/40009_2427_7.pdf?fbclid=IwAR00gPhFhEVIFanGaVI3tEz 68nuKgtZ4bMV7sRMCfRfydD28BDc0ADCqb50 : page 8-9.
[15] European Commission (2006d): Guidelines on the method of setting fines imposed pursuant to Article 23(2)(a) of Regulation No 1/2003 (2006/C 210/02) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52006XC0901(01)&from=EN

Fourthly, the cartel could have been ended without whistleblowing. The paper does not consider this option as an alternative strategy. Lastly, the paper explains the behaviour of the cartel members with a Grim Trigger Strategy in Game Number II. There are alternatives such as Tit for Tat.

6. Conclusion

After looking at the different stages of cartel described at Maritime Car Carriers case, the paper reaches several conclusions. Firstly, before 2006 the paper finds a Unique sub-optimal Nash equilibrium "not to collude" for each player, which is *pareto dominated* by "collude" for all players. Secondly, the paper outlines the necessary conditions for sustainable collusion. In this case, cooperation holds if δ is large enough. Hence we find a sub game perfect equilibrium with sustainable collusion for an infinitely repeated game. Collusion leads to higher profits than non-collusion since players price at monopoly prices. In the last scenario, the option to whistleblow is included. The paper shows that one of the cartel members is more likely to whistleblow when the benefit from colluding is smaller than the expected reduced fine. Assuming that MOL was the better-informed player about this condition, the sequential game shows that once MOL whistleblew, the best response for the other players was to cooperate.

From a social welfare perspective, it would be better if the companies would never enter a cartel since total welfare including for consumers is higher when price is equal to marginal cost. Furthermore, the creation of cartels eliminates competition and, when there is no competition, there is no need to innovate, which again is detrimental for welfare

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