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OLIGOPOLY PROBLEM IN THE EUROPEAN UNION COMPETITION LAW: GAME THEORY PERSPECTIVE

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SUMMARY

The dissertation aims at finding out how game theory applies to competition law. This undertaking has scientific importance: the connection between these two disparate disciplines is anything but transparent, for game theory is a branch of applied mathematics while competition law is a part of social sciences.

The work is based on the hypothesis that game theory can be useful in the legal analysis if we could find an appropriate legal problem containing a strategic element. One such problem lies at the very heart of the competition law. For economists, it is the phenomenon of "tacit collusion", for lawyers, it is known as "the parallelism problem", "an unproven cartel gap", or most simply "the oligopoly problem".

The oligopoly problem is classical in antitrust law. Many scholars have grappled with it on both sides of the Atlantic, yet it eludes a clear legal solution. Sometimes high prices can be the result of an illegal conspiracy but sometimes it can be simply because firms respond strategically to what other rivals do. How can we tell if firms collude or compete in oligopolies? The language and legal standards of the CJEU on this matter are notoriously ambiguous and not very helpful in delimiting lawful conscious parallelism from proscribed concerted practices.

It would be rash to blame the CJEU alone for the inability to formulate a clear legal standard for differentiating lawful and prohibited modes of oligopoly conduct. The issue is deeper than mere linguistics. Game theory shows that in oligopolies various conduct is rational and consistent with Nash equilibrium (folk theorem). We can take this result in game theory and think about how to reinterpret the law. In this particular example, it turns out that the current legal standard of the CJEU, requiring that concerted practices would be the sole explanation of collusive conduct, is incompatible with what game theory says.

This method of taking a particular result or concept from game theory and reflecting on what legal implications it would have for the competition law is characteristic of this doctoral work and the whole attempt of connecting game theory with law. The adopted perspective is substantially novel and original in legal literature as there are just a few sporadic articles contemplating the approach. More standard

law & economics perspective should be complemented by what can be called the law & game theory view: grounding competition law in game theory. This is the central defended proposition of the dissertation.

Characterization

Oligopoly Problem *Tacit collusion among interdependent competitors reduces welfare and effective competition because colluders manage to foreclose and share markets, limit production and innovation, or increase prices. In comparison with explicit cartels: (i) tacit collusion is much harder to detect and punish; (ii) serious legal difficulty is to separate tacit collusion from conscious parallelism; (iii) the legal scholarship on the oligopoly problem significantly diverges.*

Scientific Problem *To determine and understand game theory's role in the EU competition law, including its legal implications, for solving the oligopoly problem.* This scientific problem was not formulated before. Game theory has not yet penetrated legal scholarship (interdisciplinary gap), leaving open the scientific question of what legal implications could be drawn from it. The theory itself is mathematical and quantitative, so its relevance and feasibility of being applied to law as a social science are not obvious. The pure scientific interest here is mixed with the consideration that the oligopoly problem is real and needs to be practically resolved; thus, this thesis examines the role of game theory primarily in the legal context of the oligopoly problem, which brings us to the purpose of this research.

Research Purpose *To address the scientific problem and construct new legal solutions for the oligopoly problem accordingly.* The focus will be on *ex post* enforcement (Articles 101 and 102 TFEU), concerning actual collusion that causes material harm to consumers and welfare. The reason: *ex post* enforcement faces more grave and elusive legal problems in contrast to merger rules, which are, more or less, functional. In addition, game theory implications for merger rules have been investigated.

Actuality and Significance

The oligopoly problem is global. The OECD in 2015 held an expert discussion on the oligopoly problem, which attracted many written contributions, showing great interest in the subject.[459] Thus, the oligopoly problem is in the focus of antitrust enforcers, yet legal solutions across jurisdictions significantly diverge. The UK antitrust authority, for instance, can use a market investigation tool for identifying antitrust problems in oligopolies with an option to impose behavioral and structural remedies, even in the absence of an actual infringement; this regulatory tool complements standard cartel enforcement. Such an instrument is not available in the EU competition law. Another example is the former legal rule in Korean competition law that required undertakings to report reasons for parallel behavior; this approach was abolished due to high enforcement costs and other reasons.[460]

Industry concentration is increasing. The recent market study concludes that industry concentration in the EU over the past two decades has increased, especially in markets with just four dominating undertakings.[461] This has to do not only with merger regulation but also with *ex post* oligopoly problem – collusion in concentrated markets is, typically, more likely than in less concentrated ones. We can therefore expect some increase in cases, directly related to the oligopoly problem, i.e., where separating conscious parallelism from concerted practices will be the central legal issue. So the topic is both theoretically and practically important.

The oligopoly problem gained significant scholarly attention. It has been long recognized by legal scholars. Filippelli, comparing the US and the EU regimes, concludes that there is a convergence in the use of merger regulations (where structural analysis is based on game theory and behavioral economics), but at *ex post* level of enforcement, there is a gap.[462] Motta and Hawk consider that both Articles 101 and 102 are

[459] "... the session, originally conceived as a hearing on oligopoly, received a surprisingly large number of written contributions ... a sign of great interest in this challenging area of competition law." OECD, *Competition Enforcement*, §1.
[460] OECD, *Competition Enforcement*, §19–22.
[461] Koltay and Lorincz, "Industry Concentration and Competition Policy."
[462] Filippelli, *Collective Dominance and Collusion*, 284.

inadequate to address it.[463] Kaplow importantly points out that the extensive use of game-theoretic analysis by economists had very little impact on antitrust law and legal analysis of agreements.[464]

The emergence of artificial intelligence. The use of artificial intelligence in markets raises some new aspects of the oligopoly problem. The OECD warns that algorithms can widen the scope of the oligopoly problem because tacit collusion can be achieved and sustained in more markets.[465] Heinemann and Gebicka, for instance, argue that computer systems may alter traditional forms of exchange of information between firms; however, it does not eliminate the "meeting of the minds" criterion (which is necessary for an inference of a cartel), because undertakings have to consciously adopt computer systems in the first place; therefore, cartels formed by computer systems should amount to a rebuttable presumption of liability.[466] We will argue later that the "intent" or "meeting of the minds" criteria are not helpful and should be abandoned. From the game theory perspective, an underlying reason for collusion *is not intent* to collude, but rather the objective factor of profit maximization, which is the same to both colluding and non-colluding undertakings.

Structure and Objectives

The basic structure of this thesis is two-fold. The first half uses a legal analysis of the oligopoly problem. The second half draws more on game theory implications. The logic is that legal aspects of the oligopoly problem must be clarified before drawing game theory implications. The other governing principle is implicit in the proposed structure of the oligopoly problem, reflecting the life stages of collusion: proceeding from the risk of collusion (*ex ante*) to difficulties in enforcing actual collusion (*ex post*) when a substantive legal norm should be selected, to even more specific issues: (i) how to differentiate legal and illegal

[463] Hawk and Motta, "Oligopolies and Collective Dominance."

[464] "...the past decades of game-theoretic work by industrial organization economists has had little penetration in the analysis of competition law and virtually no application to the analysis of the agreement requirement." Kaplow, *Competition Policy and Price Fixing*, 185 n. 18.

[465] OECD, *Algorithms and Collusion*, 7.

[466] Heinemann and Gebicka, "Can Computers Form Cartels?," 440–441.

conduct in oligopolies, (ii) the notion of strategic leniency, (iii) to the final stage of what fines to impose.

Chapter 1 To introduce game theory to a legal audience. The independence principle, frequently invoked by the CJEU, is misleading. Oligopolists are *interdependent*, therefore, obliging them to act purely independently is a stretch. In game theory, independence corresponds to having a dominant strategy, the one when undertakings could safely disregard what other rivals do. We develop four propositions that clarify various degrees of autonomy under Articles 101 and 102.

Chapters 2–4 To clarify the most pressing legal aspects of the oligopoly problem. The leading objective is to resolve the ongoing academic debate of whether Article 101 or 102 could address the problem better. This implies the investigation of concerted practices and abuse of collective dominance. In these chapters, the thesis discusses theories of collusion, the system of available legal instruments, *ex ante* and *ex post* stages of cartel enforcement; legal defenses; in a separate chapter, the full evolution and exposition of the doctrine of concerted practices are provided. The thesis converges on the view that this concept is the most suitable for the oligopoly problem; we reject the abuse of the collective dominance approach as misleading. To improve the doctrine of concerted practices, the thesis proposes a specified interpretation of conscious parallelism, which is akin to the distinction between simultaneous and sequential games. To tackle the overuse of "by object" category under Article 101, we propose the new *sliding criterion* for differentiating when to use by object and when by effect qualifications, depending on the temporal factor; for long-lasting cartels – by effect, for short-duration – by object. Here ordinary legal analysis predominates; we use game theory insights whenever appropriate.

Chapter 5 To determine the legal implications of game theory for Article 101. The leading objective is to find solutions for distinguishing between legal and illegal oligopoly conduct; between conscious parallelism and concerted practices. This difficulty can be alleviated by integrating game theory ideas into legal doctrine. The thesis here formulates five novel solutions incorporating folk theorem, Nash equilibrium, and focal points. Modern antitrust law, if it takes game theory seriously and is to grapple with algorithmic collusion, should abandon subjective

intent-based enforcement; intent matters, but only as a mitigating or aggravating circumstance in fine calculations; not as a constitutive element of Article 101 infringement. This chapter shows the potency of the game theory perspective and its facilitating role.

After dealing with the substantive, we turn to the procedural aspects. Specifically, the oligopoly problem includes leniency and cartel fines as the subtopics because (1) oligopoly collusion must be, obviously, detected before any substantive norm can be applied; in fact, we detect most cartels by leniency; (2) imposing sufficiently deterring fines is no less important to discourage oligopoly collusion. The thesis ventures to explore if game theory has implications for these subtopics, and it has.

Chapter 6 To determine the legal implications of game theory for leniency rules. The first objective here is to describe the notion of strategic leniency, which originates from the game theory perspective: and repeated prisoner's dilemma in particular. The chapter discusses three distinct ways to exploit leniency. The notion of strategic leniency is sound theoretically, but do firms actually use it strategically? Addressing this question is the second objective. For that purpose, we examine 42 EU cartels, caught by the EC during the period 2010 – 2018, and find some support but the evidence seems inconclusive. The EC positions leniency as a major success; is it? The same data shows that the 2002 leniency reform had no tangible disruptive effect on pre-reform cartels, suggesting that leniency is not that effective, and it can especially fail in uncovering tacit collusion, which is central to the oligopoly problem. The risk of strategic use of leniency is overlooked, current rules contain no mechanism to prevent abuses.

Chapter 7 To determine the legal implications of game theory for the imposition of cartel fines. The leading objective is to investigate whether Shapley value would be useful in calculating cartel fines. This chapter differs from the others in that it deals with *cooperative* game theory. Sometimes cartels employ third parties – cartel intermediaries or facilitators – who themselves did not operate in a relevant market. It is difficult to invoke their liability and, specifically, to calculate fines since they generate no relevant sales. The inquiry into this problem is the second objective. In examining the method, we discover the "spill-over" effect: marginal contributions to a global cartel overcharge are equal for

both undertakings in duopoly cartels, thus they should receive an equal basic amount of fine irrespective of asymmetries in market share, cartel sales, and so on. The spill-over effect holds generally, given market shares (power) positively correlate with cartel overcharges.

Methodology

This dissertation combines qualitative and quantitative methods. By using document analysis, the research data has been collected: scientific literature, jurisprudence, including the EU, the US, and some national cases, the EC's cartel decisions, the EU legislation, and other supplementary sources such as OECD reports.

(1) *The systematic analysis* helped to define the system of legal instruments for the oligopoly problem. With this method, the dissertation also spotted some inconsistencies: for instance, in the legal treatment of conscious parallelism *ex ante* and *ex post*; also that an abuse of collective dominance solution for the oligopoly problem would obscure the fundamental distinction between Articles 101 and 102.

(2) *The analytical method* facilitated decomposing the oligopoly problem into smaller legal questions; was useful in clarifying conceptual distinctions between cartel agreements, concerted practices, and conscious parallelism; was employed in the analysis of jurisprudence, doctrinal proposals, and legislation in order to arrive at underlying judicial rules, assumptions, and propositions. By getting to the elements of particular concepts, it was possible then to construct new propositions and definitions.

(3) *Historical and comparative methods.* The dissertation examined the legal origins of the oligopoly problem. Basic theories of oligopoly collusion – Harvard and Chicago schools – had been explained; the formative Turner-Posner debate was considered. The analysis of the CJEU's jurisprudence, spanning more than 50 years, showed how the doctrine of concerted practices has evolved.

(4) *Descriptive statistics.* The hypothesis that leniency can be abused was partially verified by examining cartel data, comprising of all 42 cartels investigated by the EC during the years 2010 – 2018, so that

the sample coincided with the population. Using descriptive statistics, we then checked how frequently leniency was applied to concerted practices and what percentage of cases was consistent with the hypothesis. Overall, game theory can generate testable hypotheses for the EU competition law.

(5) *Modeling method.* By modeling hypothetical strategic situations, the dissertation explained Nash equilibrium, backward induction, dominance, folk theorem, focal points, Shapley value, prisoner's dilemma, grim trigger, stick and carrot strategies, and other concepts in game theory. It helped to clarify game theory principles, from which game theory's relevance and implications for legal problems had been considered. The mathematical formalism was basic, so it should not be complicated for the reader without a background in game theory to follow.

Logical analysis: induction, deduction, synthesis, and generalization methods were used for drawing inferences and conclusions. The dissertation frequently employed case law analysis as is common in works on the EU competition law. The methodology of this thesis can be described as *exploratory research.*[467] It explored how game theory can be applied in the EU competition law, which is not obvious.

Conclusions

This thesis began with the fundamental hypothesis that game theory can mitigate the oligopoly problem in the EU competition law. Can we confirm it or should we reject it? Judging from the *propositions*, *recommendations*, and *conclusions* throughout this thesis, it must be confirmed. After combining game theory with legal analysis, the thesis concludes with the main takeaways.

Systematic Problem The thesis uncovered a contradiction concerning the oligopoly problem *ex ante* and *ex post*: the risk of tacit collusion is treated more strictly than actual tacit collusion. Presently, mergers are not allowed if they cause a risk of conscious parallelism (*ex ante*), meanwhile conscious parallelism is permitted under Article 101

[467] Jupp, *Social Research Methods*, 110–111.

(*ex post*). To eliminate this inconsistency, it should be specified that mergers, posing risk for *concerted practices*, should not be allowed.

Priority of Article 101 The *ex post* oligopoly problem should be solved by applying the doctrine of concerted practices under Article 101. The concurrent – an abuse of collective dominance – solution is conceptually flawed; it was shown by arguments that it would erode the distinction between Articles 101 and 102, imply that a cartel is an abuse of dominance, subsuming the whole Article 101 under 102, violating the principle *lex specialis derogat legi generali*, to name the salient one.

Facilitative Role It was demonstrated, how axioms, ideas, and concepts in game theory, including Nash equilibrium, Shapley value, focal points, grim trigger, stick and carrot, folk theorem, self-enforcement, best-response, dominance, credibility, and punishment facilitate legal analysis. The game theory perspective is distinct from the economic and is unduly overlooked in legal research of competition law.

* * *

Some results from the game theory perspective contain both legal conclusions and recommendations, thus it is more natural and appropriate to state them together.

Folk Theorem (a) The theorem rationalizes the lawfulness of conscious parallelism. It should be checked if seemingly collusive conduct could have been self-sustaining without targeted punishments or exchanges of information; if yes, it is unlikely that firms colluded and *vice versa*; (b) The legal dictum: "*... parallel conduct cannot be regarded as furnishing proof of concertation unless concertation constitutes the only plausible explanation for such conduct ...*"[468] is incompatible with the theorem, implying multiple equilibria that range from competitive to collusive; it is, therefore, wrong to suppose that concertation can ever constitute "the only plausible" explanation of oligopoly conduct. The rule should be modified retaining that parallel conduct is not proof of concertation.

[468] The CJEU, *Wood Pulp*, §71.

Grim Trigger (a) Cartel fines create an extra layer of punishment besides lost profits when cartels collapse and firms revert back to competitive equilibrium. This is why leniency could deter deviations *ipso facto* – i.e., it may reinforce collusion *ex ante*; (b) It can be predicted, using the grim trigger strategy, that a cartel deviator would be the same undertaking to submit for leniency (maverick). The reason: by "cheating" on a cartel and combining it with leniency, the deviator not only gets high deviation profits but also protects itself from the extra layer of punishment - antitrust fines - thus, it obtains a relative strategic advantage insofar as other rivals get fined. The thesis verified the prediction by analysis of 42 cartels, caught by the EC during the years 2010 – 2018. In 20/37 of the relevant cases, the pattern "deviate + submit for leniency" was observed, supporting the prediction. Since in 17/37 of the cases the pattern was not observed, strong conclusions would be unwarranted. The whole exercise can be replicated and extended by including a larger case sample to obtain firmer results. Overall, this demonstrates how game theory can help in formulating testable legal hypotheses for antitrust law.

Stick and Carrot Antitrust agencies should screen markets for pricing patterns consistent with the stick and carrot strategy. However, to corroborate the inference of collusion, this strategy must be accompanied by *targeted* punishment(s). When undertakings need to renegotiate collusion, e.g., due to market disruptions, it prompts a valuable opportunity for finding cartel evidence. Relatedly, a learning effect, caused by temporary punishment phases (price wars), partially explains why collusion, especially in mature industries, may go undetected for many years or eventually be sustained without cartel agreements and concerted practices.

Self-enforcement From the game theory perspective, conscious parallelism is self-enforcing rational conduct sustainable by reversals from CNE to NNE and *vice versa* (Article 101); whereas, predatory pricing does not only violates Article 102, but, in the oligopoly context, might indicate the punishment phase, which should prompt antitrust authorities to look closer into the market for potential collusion. Predatory pricing should not only be thought of as a strategy to deter potential entry but also checked for if it is not the punishment strategy within an oligopoly. Consequently, a predator would receive fines under Ar-

ticle 102, while non-predators, given there was a cartel, under Article 101. Contrary to the dismissed scholarship proposals – to solve the oligopoly problem through a concept of abuse of collective dominance – the view advanced here does not require, in the thesis's view erroneous, the application of an abuse of collective dominance to the oligopoly problem.

Focal Points The idea of focal points appeared in a merger case related to collective dominance once, but it did not play any significant or direct legal role at *ex post* cartel enforcement because there is no case law operationalizing the idea yet. The thesis proposed the legal definition of focal points, which should stand beside conscious parallelism in delimiting legal and illegal conduct (see recommendations).

Shapley Value The cooperative game theory contains useful ideas for antitrust law. Specifically, Shapley value could function as the new method for attributing legal liability and calculating cartel fines. It obtains the general result in duopoly cartels: for both undertakings, the basic amount of fine should be equal regardless of their asymmetries in market share, sales, costs, and other parameters. The thesis uncovered *the spill-over effect*, which manifests itself in that a smaller undertaking has greater importance to collusion than it might seem, challenging the current understanding of "economic importance", which depend on the value and volume of cartel sales. The spill-over effect emerges because the smaller firm's marginal contribution to a total cartel overcharge might be relatively great even if it sells less than the other undertaking(s): in a duopoly, for example, a firm holding 30% of market share obtains not only its own cartel profits, but *enables* the other, holding 70% of market share, to obtains its, substantively larger, cartel profits. This effect holds beyond duopolies if market shares (market power) positively correlate with cartel overcharges, which antitrust economics seems to suggest. The method does not interfere with the possibility of individualizing cartel fines after the basic amount is determined. Calculating fines based on Shapley values could deter some collusion because smaller undertakings would risk more if they enter collusion. The key insight is that cartels are coalitions and cartel fines – Shapley value allocations.

Recommendations

To adopt the sliding criterion (3.7). Inferences of collusion can be presently made without taking notice of *a temporal dimension*. This leads to a perverse situation when cartels, which allegedly lasted for many years, can be inferred solely on "by object" category without showing actual harm. The proposed sliding criterion integrates the temporal factor in that multi-year cartels should be proven by using "by effect" qualification because it is reasonable to assume that at least some cartel harm could be shown to exist. If an antitrust authority cannot show that, it is reasonably dubious that a cartel really existed or caused any harm. If adopted, the sliding criterion would limit the overuse of "by object" qualification, which is at odds with the "more economic" antitrust view. By contrast, if an alleged cartel lasted just briefly, then it is justified to use "by object" qualification because cartel harm could be less apparent. There must be a continuum in this criterion and an exact judgment on whether to use "by object" or "by effect" category should depend on a case-by-case basis. This recommendation is for the CJEU.

To abandon the fault doctrine (5.3). The legal elements implying fault, especially intent: "meeting of the minds", "mental consensus", "knowingly substitutes for the risk of competition", and similar notions describing collusion are incompatible with the game theory perspective, given the principal cause of collusion is rationality: firms will collude on condition that expected profits exceed expected losses. The jurisprudence on whether a subjective mental element is a *conditio sine qua non* for proving collusion is itself contradictory. Article 101 enforcement should not be based on fault not only because it is artificial to attribute human qualities to corporations, is difficult to determine, or that pricing algorithms would minimize human interactions in collusion, but also because the fault is replaceable by an objective and well-defined notion of Nash equilibrium. This recommendation is for the CJEU.

To delimit cartel agreements from concerted practices (5.3.2). It would be prudent for the CJEU to choose either to continue the doctrine that the distinction between cartel agreements and concerted practices is, for practical purposes, unimportant but then ground both concepts on the mental consensus requirement to avoid inconsistencies;

alternatively, to develop them as fundamentally distinct – one requiring intent or mental consensus, and the other not. And in the latter case, to redefine concerted practices by eliminating the qualification of "knowingly". This recommendation is the milder version of the previous one as it suggests the elimination of mental element at least from concerted practices.

To adopt the delimiting criterion (5.4.4): *If Nash equilibrium could be justified without direct or indirect contact between undertakings, taking into consideration: (i) market transparency, (ii) market concentration, and (iii) legal and economic context, concerted practices under Article 101 cannot be constituted.* Jointly with the proposed self-enforcement, targeted punishment, and focal point tests that fall within "legal and economic context" analysis, the criterion facilitates separating legal and illegal oligopoly conduct. This recommendation is for the CJEU.

To adopt the doctrine of focal points (5.4.6): *Focal points are any clues that allow incumbent firms – industry professionals – to achieve coordination (tacit collusion) that reduces or eliminates effective competition between them without the need to resort to concerted practices and/or cartel agreements within a particular legal and economic context.* This doctrine is distinct from that of conscious parallelism; it is not about strategic interactions – rather, it relates to any contextual hints for coordination, which are independent of incumbents and solve an equilibrium selection problem. This recommendation is for the CJEU.

To adopt the rebuttable presumption (5.4.7): *Given an antitrust authority shows CNE but has no evidence of illegal contact between undertakings, it must be presumed that undertakings engaged in concerted practices, unless they can rebut this presumption by showing, with a sufficient degree of probability, that CNE is due to conscious parallelism or focal points for coordination in that particular market.* This recommendation is for the CJEU.

To adopt the doctrine of failed attempts at colluding (5.1, 5.4.4, 5.4.5). Whenever attempts at colluding do not succeed, welfare is not being harmed. Treating them equally as realized cartels is unjustified – thus, it would be prudent to recognize a milder form of infringement. Specifically, under this doctrine should fall *exchanges of information*

that do not lead to harmful conduct, also *tacit acceptance of collusion* when it is not implemented. The doctrine would bring conceptual clarity and better discriminate between important – realized cartels – with the less important – failed ones. It would imply lowering the burden of proof and fine cap for such infringements (e.g., 5%, instead of 10%).[469] It could potentially minimize enforcement costs, better aligning the enforcement with the economic view that aptly criticizes *by object* qualification without proof of tangible harm as too stringent. This recommendation is for the CJEU because it enjoys unlimited jurisdiction to impose cartel fines. The legislative route for lowering the absolute fine cap is also possible, but this would imply amending Regulation 1/2003, therefore, developing the doctrine in jurisprudence would be easier.

To adopt the Shapley value method (7). Besides specifying cartel fines to incumbents, this method is suitable for calculating cartel fines to facilitators. The CJEU clarified that facilitators bear legal liability even if they are not actual or potential competitors – did not sell products associated with collusion. However, the salient difficulty is to calculate cartel fines as their "economic importance" cannot be determined by the usual method – assessing proceeds from cartel sales. The Shapley value method provides a missing methodology by showing that facilitators' marginal contributions to a total cartel overcharge are always positive, thus their Shapley values would be also positive, leading to a calculable cartel fine. This recommendation is primarily for the EC, which can establish the method in its Guidelines on Fines, and for the CJEU, which, as said, enjoys unlimited jurisdiction.

To recognize strategic leniency (6). It should be recognized that leniency can be strategically exploited in at least three distinct ways: (1) used to punish cartel deviations; (2) used as a cartel exit strategy; (3) used to report false infringements, hoping that rivals will be fined. The EC's Leniency Notice (2006) contains no rules for preventing abuses and, therefore, should be revised by allowing to impose fines on leniency abusers. This recommendation is supported by an observation

[469] The absolute level of fine cap is a matter for a separate discussion, but the principle of ensuring deterrence should be taken into consideration.

from *Lithuanian Internal Combustion Engine* case,[470] where the court explicitly refused to check the purposes behind the leniency submission because the law does not require it (a legal gap), although sometimes it would be a sensible thing to do, especially when a market is highly concentrated; as well as by the survey of leading antitrust practitioners in the US, who reported that strategic leniency is a reality.[471] This recommendation is for the EC, which is responsible for handling leniency submissions. The EC should amend Leniency Notice by establishing that purposefully misleading leniency submissions constitute an abuse of law. By applying the legal analogy, procedural fines up to 1% of the total turnover in the preceding business year should be applied under Article 23(1)(a) of Regulation 1/2003.

To adopt leniency for Article 102 (2.3). The central open debate for *ex post* solution to the oligopoly problem revolves around picking between concerted practices and an abuse of collective dominance solutions. The thesis has argued that concerted practices is the most suitable substantive norm for the task. Nevertheless, if the opposite view is maintained, one improvement in the System can be suggested: it should be ensured that there is a counterpart of leniency for Article 102 so that several undertakings would have an incentive to self-report an infringement. This conditional recommendation is for the EC.

To recognize that law can create focal points for collusion (5.4.6). *Car emission* cartel (2021) illustrated how regulation can, unintendedly, create focal points for collusion.[472] At least in Lithuanian, national competition law expressly obliges the legislation draft-makers to perform an impact assessment on competition.[473] Lithuanian competition authority frequently complains that this obligation is performed negligently or completely ignored, due to expertise and budget constraints. The observation that legislation can create focal points for collusion suggests that this obligation should be taken more seriously.

[470] The Supreme Administrative Court of Lithuania, *Envija, Manfula vs Competition Council, Case No eA-169-822/2017*, April 18, 2017.

[471] D. Daniel Sokol, "Cartels, Corporate Compliance, and What Practitioners Really Think about Enforcement," *Antitrust Law Journal* 78 (2012): 212, http://scholarship.law.ufl.edu/facultypub/298.

[472] The European Commission, *Car emissions, Case AT.40178*, July 8, 2021.

[473] Competition Law of the Republic of Lithuania, Article 4^1.

The point is general and applicable to any jurisdiction, thus the recommendation is for all legislators.

To empower the EC (5.4.2). Given parallel conduct leads to a harmful equilibrium, when (1) there is no evidence of illicit contact between undertakings and (2) it cannot be explained by conscious parallelism, it would be prudent to empower the EC with a right of imposing, at least behavioral, remedies in such cases (*ad hoc*), in the absence of Article 101 infringement. This would help to address a specific competition problem, circumventing the EC taking on a general regulatory role and making it a better solution than the recently proposed *New Market Tool* (2020). This recommendation is primarily for the EU legislators. Because it implies a far-reaching change in antitrust law, it warrants a separate academic discussion and legislative initiative by the EC for gathering opinions from all interested parties.

To empower the EC (5.4.5). Game theory differentiates between credible information and "cheap talk": rational players should take seriously only credible information and disregard cheap talk as a bluff. The legal distinction between unilateral signaling versus reciprocal exchanges here plays no role; what matters is the credibility of information itself, not the form of its delivery. Thus, grounding competition law in game theory, the escape of unilateral signaling from the ambit of Article 101 is unwarranted. This leads to two recommendations: (1) the EC should, ideally, design and include the "credibility test" in assessing alleged collusion, which is missing from the EC Guidelines,[474] and (2) unilateral signaling should be accessible to legal scrutiny under the suggested doctrine of failed attempts at colluding. This recommendation is both for the EC, which decides whether to proceed with antitrust allegations and for the CJEU, forming the legal doctrine.

Defended Propositions

(1) The economic analysis of law should be complemented by a cognate (yet distinct) game theory perspective, which facilitates solving competi-

[474] The European Commission, *Guidelines on the Applicability of Article 101 of the Treaty on the Functioning of the European Union to Horizontal Co-operation Agreements (2011/c 11/01)*, January 14, 2011.

tion law problems in multiple ways: *explanatory* — explaining the cause of collusion (rationality), why it is difficult to separate legal and illegal tacit collusion (multiple equilibria), why conscious parallelism must be permitted (folk theorem, self-enforcement); *constructive* — helping to formulate new legal solutions for delimiting concerted practices from conscious parallelism (Nash equilibrium, focal points); *purifying* — suggesting what legal notions are improperly used or redundant in legal doctrine (independence, intent); *predictive* — generating testable legal hypotheses (strategic leniency); *methodological* — supplying a new method for calculating cartel fines (Shapley value).

(2) The oligopoly problem should be addressed by applying concerted practices, but the underlying legal doctrine, in the present form, is unfit for this task and therefore must be substantively modified in accordance with the game theory considerations, suggested in this thesis, which includes abandoning fault-based enforcement, introducing the Sliding criterion, adopting the new doctrine of "failed attempts at colluding" and new criteria for differentiating lawful/unlawful tacit collusion, recognizing that leniency can be abused, modernizing cartel fine calculations by the Shapley value method, to name the salient ones.

Scientific Novelty, Originality, Significance

(1) The scientific merit of this dissertation consists of a fresh attempt at deriving legal implications from game theory and the original construction of new legal solutions for the oligopoly problem in the EU competition law. To my knowledge, there are no legal works of book or dissertation size that would have systematically explored non-cooperative and cooperative game theory in the EU competition law, *a fortiori* for the oligopoly problem. The thesis proposes its own structure of the oligopoly problem on which future legal research could be modeled.

(2) The interdisciplinary game theory perspective of this work is fruitful in new propositions, recommendations, and legal solutions, including (i) grounding conscious parallelism in the distinction between simultaneous and sequential games; (ii) constructing five novel legal solutions by integrating game theory ideas – folk theorem, Nash equilibrium, focal points – for delimiting legal and illegal oligopoly conduct; (iii) exploration and empirical verification of strategic leniency; (iv) introducing the Shapley

value method for calculating cartel fines, to name a few. The latter is markedly new in legal domain because the *cooperative game theory* is overlooked even by legal scholars who apply game theory.

(3) The "literature review" section has confirmed that existing legal literature, employing game theory, is extremely sparse, the research direction undeveloped, and most works are sporadic articles on one or another aspect of the oligopoly problem, and even these primarily discuss the US antitrust law. This dissertation, therefore, contributes to the interdisciplinary sophistication in the EU competition law. Specifically in Lithuania, the oligopoly problem has not been investigated *a fortiori* applying game theory, except for my own early efforts.[475]

The game theory ideas used throughout should be familiar to antitrust economists, but, to be clear, this thesis is not a work in game theory or economics; it does not claim game theory or economic contributions; the potential merits of this thesis are restricted to the legal domain and audience for which the work is intended.

[475] Martynas Jablonskis, "Game Theory and Collusion: Oligopoly Problem in the European Union Competition Law" (master's thesis, Mykolas Romeris University and Savoie Mont Blanc University, 2015).

Publication of the Results of the Dissertation

(1) Martynas Jablonskis, "Concerted Practices: Concept and Evolution," International Comparative Jurisprudence 8 (2022): 13, https://doi.org/10.13165/j.icj.2022.06.002 (Chapter 4).

(2) Martynas Jablonskis, "Strategic Leniency: Insights From Game Theory And Empirical Evidence," *Vilnius University Open Series*, no. 6 (December 2020), https://doi.org/10.15388/OS.LAW.2020.7 (Chapter 6).

Presentation of the Results of the Dissertation

(3) Martynas Jablonskis, "Collusion in Oligopolies: Can Game Theory Help to Improve Cartel Laws?," *Diss:kurs 2020*, University of Basel (November 2020).

(4) Martynas Jablonskis, "Strategic Leniency: Insights from Game Theory and Empirical Evidence," *The Future Decade of the EU Law: 8th International Conference of PhD Students and Young Researchers*, Vilnius University (May 2020).

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Education:

Since 2018	PhD studies (law), University of Basel, Switzerland
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2013 – 2015	Master of Law, Université Savoie Mont Blanc, France (mention très bien avec les félicitations du jury)
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