

# Game Theory

*by* Unit Pkd

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**Submission date:** 23-May-2022 04:19PM (UTC+0700)

**Submission ID:** 1842377148

**File name:** Article-10-5.pdf (167.58K)

**Word count:** 6786

**Character count:** 38491

# Game Theory of Regulator, Companies, and Cooperation in Indonesian Financial Technology Industry

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**Abstract.** This article tries to examine possible rational payoffs of cooperative and non-cooperative interaction between the financial regulator and companies in the financial technology industry. To understand the interaction paradox within the financial technology industry, a framework based on Game Theory Prisoners Dilemma Payoff Matrix is used to iterate conditional probabilities that represents the possible decisions given by both the financial regulator and the fintech companies. The possible decisions and consequences of cooperative or non-cooperative decision from each of the player, are encoded into a 2 X 2 matrix to illustrate the conditional probabilities, then analyzed to find the best interaction option. Indonesian financial regulators have not provided clear regulations about the financial technology industry on broad terms inclusive of major types of fintech businesses commonly found in Indonesia. Indonesian financial regulators represented by the Bank Indonesia (Indonesian Central Bank), Ministry of Finance, and Otoritas Jasa Keuangan (Financial Services Regulator), only enacted regulations for certain types of fintech, such as peer-to-peer lending, digital banking, and digital payments. Many other types of fintech have not been regulated or inadequately regulated for business boundaries, liabilities, and obligations toward the consumers. The financial regulators mostly rely on enforcement efforts to fulfill the mandate to promote innovation, protect market integrity, ensure clarity in the market. However, these enforcement actions have potential harms to the mandate if the financial regulators cannot provide clear regulations or ensure enforcement predictability, transparency, and consistency. The best possible rational option for the legal interaction between financial technology companies and financial regulators would be to cooperate. The second-best option would be the company cooperating while the financial regulator does not cooperate. The third option would be both the company and the financial regulator do not cooperate. The least beneficial option would be for the company not to cooperate while the financial regulator cooperates. This article presents a possible contribution to corroborating the conjecture that the best possible rational option for the legal interaction between financial technology companies and financial regulators, would be to cooperate.

**Key words:** Game theory, financial technology, regulator, enforcement, cooperation.

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## 1 Introduction

Consumers, businesses, and organizations are using digital financial services, new market players are offering innovative technologies, and conventional business models are changing to

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stay competitive in the market.

Innovation in business digitalization introduced new business definitions such as digital assets, cryptocurrencies, and crypto-assets (Cumming et al., 2019). Developments in telecommunication and information technology drive this digitalization adoption in various business applications, especially during the Covid-19 pandemic.

New emerging technologies such as Distributed Ledger Technology, blockchain, artificial intelligence, IoT, and tokenization have enabled innovations in financial services (Xu et al., 2019). These new businesses bring both positive and negative impacts to the economy. Ideally, innovations should bring positive impacts. Part of the function of financial regulators is to ensure the innovations could bring positive impacts and prevent the innovations from harming society (Gobble, 2017; Tsindeliani and Egorova, 2020).

Financial technology provides access to financial services for consumers and answers the difficulties due to social distancing necessary to dampen the Covid-19 pandemic. E-commerce, food delivery, vehicle sharing, and digital payment keep the commerce and industry going amid the lockdowns and other human mobility restrictions. Online banking services using identity verification enable consumers to open financial accounts and use financial services without the need to physically come to a branch (Lee, 2020).

Financial technology (fintech) companies emerged as the results of inventions of new financial products, the new access to the markets, and the newly created void unfilled by incumbent financial institutions. Cryptocurrency is one of the fintech innovations, possesses unique attributes of pseudo-currency that have high volatility price, with a high risk of trust abuse from the companies involved in the trading (Liu and Serletis, 2019). Peer-to-Peer lending companies have a very high Non-Performing Loans rate which caused the companies to violate the privacy of their debtors to collect their dues (Wang et al., 2020). These examples show the agency risks related to the lack of clarity in regulations for the relatively new industry.

The global financial crisis in 2008 caused by the abuse of trust and legal loopholes by world-class financial institutions, initiated the reform of financial regulation in the United States and many other countries around the world (Magnuson, 2018). The China government did a major shutdown of thousands of P2P lending in China due to the imminent danger of high-rate of Non-Performing Loans and the inability to comply with the regulations, from around 5,000 fintech companies to almost zero at the beginning of the year 2020 (Wang et al., 2020). In both cases, the financial regulators were alarmed by the possible systemic risk posed to the broader economy, which was caused by the reckless decisions from the financial institutions' executives to pursue profit (Adriana and Dhewantoa, 2018). The danger was compounded by the too big to fail mindset among executives. These two cases alone could represent the magnitude of the interactions and consequences, when financial institutions that heavily use technology as part of their offers to the consumers, deliberately abuse the unclear regulations and the absence of proper enforcement.

Fintech products have helped consumers to access various government stimuli in response to the Covid-19 pandemic. Ensuring convenient, safe, and reliable operation of fintech has become more important, as more consumers access financial services online while employees themselves work remotely. Digital technologies will be paramount to reignite, relaunch, and revamp the economy across sectors, including Indonesia. Users of financial services must be protected against risks stemming from increased reliance and agency risks related to financial technology proliferation (Cumming et al., 2019; Khariyana, 2020).

Regulators around the world adopt innovatively, trusted digital solutions for better policy-shaping, information management, and administrative processes to forge truly digitally trans-

formed, user-focused, and data-driven policies and regulations. A stable, innovative, and competitive financial system is necessary to develop the Indonesian economy and to contribute to sustainable growth in other industrial and commercial sectors.

Financial regulators in Indonesia have not provided unambiguous regulations about financial technology, be it inclusive legal definition on digital assets, companies obligation and boundaries, or transparent enforcement actions (Kharisma, 2020). Ideally, regulators should create regulations that promote innovation, protect market integrity, and ensure clarity in the market (Lee, 2020). Indonesian financial regulators and fintech companies could use this article to explore the possible actions and consequences of cooperating or non-cooperating in the regulation compliance matters and identify the best option that maximizes benefits for both sides.

If viewed using the Game Theory approach, the interaction process between regulators and fintech companies in Indonesia can be seen as a game between two parties as players involved to achieve maximum benefits for both the players and public benefits as the ultimate goal of the game (Guseva, 2020). This paper assumes both the fintech companies and financial regulators are driven by logical decisions and would like to achieve maximum benefit. The Prisoners Dilemma game is a very simple game with a 2 X 2 Matrix that can be used to illustrate the interaction of two or more players to achieve maximum benefit. Although it would be unwise to assume that the entire real-world interactions between the players can be oversimplified in a 2 X 2 matrix, game theory has been used to explain the interaction of various business and behavior interactions due to its simplicity (Fader and Hauser, 1988). This paper offers the extension of understanding of how the Prisoners Dilemma game, as a part of Game Theory, can be used to represent the interaction of financial regulators and fintech companies.

## 2 Literature Review

A report from McKinsey defines fintech as financial services delivered via mobile phones, the internet or card (Manyika et al., 2016). Fintech includes a wide range of new financial products, businesses, services, communication, a software application from financial service providers (Gomber et al., 2017). Fintech is a term invented in the 1990s, used to describe technology-enabled innovation in financial services that create new business models, services, applications, processes, or products with significant effects on financial markets and institutions, which might provide new ways of how financial services are provided (EC, 2011). As fintech's broad definition is still evolving and expanding, there is no absolute definition of what kind of financial products and services are considered as fintech. By common understanding, fintech covers products, services, technology, infrastructure, concepts, systems, that enable individuals and companies to have access to a financial service via the internet without the need to physically visit a branch or of the financial service provider (Lee, 2020; Omarova, 2019; Yadav and Brummer, 2019).

Innovation in financial services increases access to finance among individuals, reduces the cost of financial intermediation for financial service providers, and increases aggregate expenditure for governments, which in the end will bring positive effects to the economy (Ozili, 2018). Fintech can improve financial inclusion, expand financial services to previously untouchable by financial sector and provide basic financial access to unbankable individuals (Lee, 2020).

Fintech can provide affordable, convenient, and secure financial services to individuals from developing countries that have fragmented and fragile financial sectors (Hornuf et al., 2016). The accessibility and affordability of financial services around can help billions of poor customers to

move from inefficient and high-cost cash-based transactions to digital financial transactions on secured fintech platforms (Flaming, 2021).

Fintech increases the gross domestic product (GDP) by providing access to financial products and services for individuals and companies that can increase GDP levels. The digitalized economy can improve economic stability and simplify financial intermediation by regulators, both for customers and the country (Ozili, 2018).

Consultations held by the European Commission in 2020 showed that: Innovations based on distributed ledger technology (DLT) or artificial intelligence (AI) can improve financial services benefit for consumers and businesses, boosting financial technology will support Europe's economic recovery strategy and broader economic transformation, strengthening European digital financial sector will increase funding of Green Deal and the New Industrial Strategy for Europe (EC, 2011).

Fintech innovation can have long-term positive effects on banking performance, in terms of profitability, scalability, and network performance (Scott et al., 2017). Fintech uses big data analytics and processing to improve customer satisfaction, marketing efficiency, and adaptive strategic management (Hassani et al., 2018).

Fintech benefits governments by providing a platform for consumers to increase expenditures which generates higher tax revenue and a more transparent tax system (Manyika et al., 2016). Fintech benefits financial and monetary system regulators in reducing the circulation of counterfeit money, better access for monetary intervention and control to the market, and a more transparent reporting and monitoring system. For consumers, fintech can provide more personal finance control, quicker financial decision execution, convenient and secure commercial transactions, provide channels for improvement feedbacks aimed at the producers and financial service providers (Union, 2014).

All the conditions and benefits from the emergence of fintech come with problems and concerns about the negative effects of fintech. Among the negative effects are cybercrime, infringement of data privacy, financial fraud, bogus or illegal investment schemes, and the use of fintech services for illegal purposes (Kharisma, 2020).

Financial regulators in countries around the world have not provided clear definitions and scopes of fintech (EC (2011); Gobble (2015, 2017); Gomber et al. (2017); Manyika et al. (2016); Sangwan et al. (2019)). A few publications try to define fintech using the isolated definition and comprehensive definitions (Im et al., 2011). Some definitions cover various aspects of financial services in various countries from various perspectives (Chishti and Barberis, 2016), focusing on banking (Hornuf et al. (2016)), or from multiple financial industry practical perspectives (Insights, 2019).

EC (2011) (EC) through the Directorate-General Financial Stability, Financial Services, and Capital Markets Union (DG-FISMA) created 2020-2024 strategy with six objectives:

1. To facilitate a more integrated, liquid, and open market for cross-border investment and funding for its citizens and businesses.
2. To preserve financial stability, improve supervision and crisis management mechanisms, absorb and diversify risks, fight money laundering, and prevent terrorists financing.
3. To protect the consumers and investors in the European financial market, and to enhance market integrity.
4. To encourage private capital for sustainable investments.
5. To employ digital technology for safe, competitive, and inclusive financial services.

6. To strengthen the EU financial systems sovereignty and competitiveness in an international environment.

The European Union (EU) choose to use ex-ante control established in its financial circuits, on-the-spot checks, and desk-based ex-post checks based risk assessments. By focusing control on risks, it is expected to increase cost-effectiveness to allow a smooth implementation of planned activities and avoid the beneficiaries key operations. The objectives and actions of DG-FISMA are linked to several principles: Coordination and processes, integrity and compliance, data collection and analysis, direct management, indirect management, know-how, and equipment (Room et al., 2020).

Game theory is the study of how people, entities, or companies behave in strategic situations (Straffin Jr, 1993). The strategic here refers to a situation in which a person, when provided with alternatives of action, must consider how others might respond to the action he takes. Strategic thinking is crucial in many business decisions. Because financial technology markets have only a small number of companies and regulators, each of the companies or regulators must act strategically. In the case of compliance to regulation, each company knows that its business continuance depends on both how it acts and how the regulator will act. In making its compliance decision, each fintech company should consider how its decision might affect the response of the regulator (Magnuson, 2018).

Game theory is useful for understanding oligopolies and many other situations in which a small number of players interact with one another (Mankiw, 2020). Game theory helps explain the strategies that fintech companies choose in the face of compliance demand in Indonesia, and the response or pre-emptive response from the regulator.

To analyze the economics of cooperation in the fintech industry, the game called the prisoners dilemma can provide insight into why cooperation is difficult but necessary (Ockenfels et al., 2000). People fail to cooperate even when cooperation would make them all better off (von Neumann et al., 1944). The prisoners dilemma provides a general lesson that applies to fintech companies trying to maintain cooperation among their members and toward the financial regulators.

In the game theory, a strategy is called a dominant strategy if it is the best strategy for a player to follow regardless of the strategies pursued by other players (Mankiw, 2020). The players here refer to the companies or the financial regulators. The key point of game theory is to understand the other players consequences, benefits, and losses when a decision is made (Dixit and Nalebuff, 2008). Understanding how a player will play the game allow the players to minimize losses and achieve maximum benefit.

Game theory shows that cooperation plays in strategic situations, and how good strategy must appropriately mix competition and cooperation (Dixit and Nalebuff, 2008). The situations faced by the fintech companies are so diverse that the companies need to know some general principles and adapt them to the strategic games. Fintech companies must develop innovative strategies to survive and find cooperative prospects to grow in the market. Financial regulators must create an environment to support innovation in the market, protect the investors and consumers, and maintain market integrity (Lee, 2020). Good strategic thinking consists of basic principles within the emerging science of strategy, including game theory (Straffin Jr, 1993).

Games in game theory dont always have winners and losers, which means the results dont have to be zero-sum (Holt and Roth, 2004). The games in the business, politics and social interactions can result in a win-win solution, lose-lose outcome, a combination of common interest, or coexistence of some conflicts.

A game involves the inter-dependence of the players decisions. There is two kinds of interactions in game theory: Sequential, where the players make alternating moves, and Simultaneous, where the players act at the same time, irrespective of the other players actions (Dixit and Skeath, 2015). Each player must be aware that there might be other active players in the game, who are similarly aware and might act in the game (Dixit and Nalebuff, 2008).

Each player must pre-emptively understand the rule of the game, all others positions, benefits, and losses, then estimate the outcome (Dixit and Nalebuff, 2008). The action that produces the maximum benefit is an integral part of this overall calculation (Straffin Jr, 1993). When a fintech company or a regulator finds itself playing a strategic game, it must determine whether the interaction in the game is simultaneous or sequential. The compliance game in the fintech industry may have both elements, in which case the players must fit and adjust their strategy according to the context and situation at hand.

In sequential-move, each player should estimate the other players future responses and calculate his own best current move. To anticipate where our initial decisions will ultimately lead, then use this information to calculate our best choice, is called Backward Reasoning (Dixit and Nalebuff, 2008). Strategic situations usually involve decision sequences with several alternatives on each decision (Geckil, 2016). A tree diagram to illustrate the choices in the game can visualize the map toward correct reasoning in such games. Players face strategic uncertainties from other players choices, which is different from the natural aspects of chance. Backward reasoning along a tree diagram can help to analyze and explain games when the players must move sequentially.

In the case of the fintech industry in Indonesia, there are concerns about whether the game theory can predict, estimate, or explain, the result from the interaction among the players? Will the actual outcome emerge as the result of an actual interaction among the players? Currently, there is mixed evidence from behavioral economics and game theory, showing support and refutation of the game theory predictive result.

### 3 Research Methods

This paper use literature-based research on publications about fintech developments, regulations, and applications in Indonesia, China, Europe, and other countries. The framework built in this paper is based on Prisoners Dilemma Game Theory. The rational analysis is based on the assumptions both the financial regulators and fintech companies will take rational decisions to maximize the benefits (Hogarth and Karelaia, 2006).

The fintech companies and financial regulators can be seen as playing a game form during their interaction. Each of them has alternatives of strategies according to its objectives. The chosen strategies will determine the outcome. Ideally, the game assumes that individuals will always announce their true strategies and that the expected result will be produced as the result of the selected strategy (Manyika et al., 2016).

### 4 Results and Discussions

The unclear definitions and scopes resulted in ambiguous or inadequate regulations about financial technology (Guseva, 2020). Indonesian financial regulators face similar difficulties in enacting regulations that have an inclusive legal definition on digital assets, companies obligations, and boundaries, or transparent enforcement actions. Regulators should create regulations

that promote legal innovation, protect market integrity and safety, and ensure sustainability in the market (Lee, 2020).

Every regulation has two sides of players, the regulator(s) and the regulated(s). Regulations should facilitate safe and transparent financial markets, able to adequately protect consumers and investors interests. and promote market integrity (Guseva, 2020). By mapping the interactions that might happen during the interaction between the Indonesian financial regulators and the Indonesian fintech companies, both the regulators and the companies can predict the types of interactions that could happen, then minimize the adverse effects.

Viewed using the Game Theory approach, the interaction process between regulators and fintech companies in Indonesia, can be seen as a game between two parties as players involved to achieve maximum benefits for both the players and public benefits as the ultimate goal of the game (Dixit and Nalebuff, 2008). The focus of this paper is to find the best approaches to how the financial regulators and fintech companies should interact in the game of cooperation and non-cooperation (Guseva, 2020).

The earliest specific regulation about fintech in Indonesia is from Otoritas Jasa Keuangan (OJK), the Indonesian Financial Services regulator in 2016. Meanwhile, Bank Indonesia, the Indonesian Central Bank, produced a regulation specifically about fintech starting year 2017. The Indonesian Ministry of Communication and Information Technology, in 2018 issued a study on big data, artificial intelligence, blockchain, and financial technology. Currently, there is no higher law created by the House of Representatives or the Indonesian Government specifically to regulate the fintech industry in Indonesia (Kharisma, 2020).

After the regulations were enacted, the interaction among the Indonesian financial regulators (FA) and the fintech companies became a game of complete but imperfect information. The FA and the fintech companies knew the available strategies but did not know in advance what each of them would do. This paper uses the traditional game theory methods of looking at the available strategies for the players, and the equilibrium that will result if each player undertakes a strategy.

The following table summarizes the available strategies and the result when each player uses a strategy:

Table 4.1: Risk Register

		Fintech companys Action	
		Cooperate	Not cooperate
<b>Financial regulators Action (FA)</b>	<b>Cooperate</b>	(+)Firms Business Continuance	(+)Firms Business continuance
		(+)Firms Recognition	(+) companys cost to comply
		(+)FA. Innovation	(-)FA.No Legitimate Innovation
		(-)F. Cost to Comply	(-) FA. No Market Integrity
	<b>Not cooperate</b>	(+)FA. Maximum Market Integrity	(+) FA. Market Integrity
		(-)Firms Unsuccessful Compliance	(-)Firms Business Disruption
		(-) FAs Cost of Enforcement	(-) companys Cost of a Legal battle
		(-) FA. Reduced Innovation	(-) FA. Maximum Cost of Enforcement

In the upper left column, both the financial regulators and fintech companies decided to



cooperate. The company decided to comply with the regulations enacted by the financial regulators. The financial regulators cooperate by assisting the company to comply, simplifying the reporting and assessment processes, showing leniency for the companies that attempt to comply even when it is not fully compliant yet, and resorting to enforcement as the last resort.

The outcome for this part is the company will ensure its business continuance within the jurisdiction of Indonesian regulations, have recognition from the government to legally operate in Indonesia, and can develop new financial technology services legally. However, the company must incur the cost to comply with the regulations. The financial regulators can build trust with the fintech industry, support legal innovation, and incentivize similar fintech company creations.

In the upper right column, the fintech company decided not to cooperate while the financial regulator chose to cooperate. The company decided deliberately not to comply with the regulations enacted by the financial regulators. The financial regulators cooperate by letting a blind eye or not enforcing the regulation.

The outcome for this second strategy is, the company will have its business continuance within the jurisdiction of Indonesian law, despite the company having broken the regulation. The company will not have to pay any cost to comply with the regulations, because the financial regulators chose not to enforce the regulation. The absence or lack of effective enforcement will diminish the incentives for fintech companies to have innovations that are legal and beneficial for the public. Instead, the fintech companies will pursue innovations that benefit the companies, regardless of the benefit for the public and integrity of the financial market.

This second strategy is the dominated strategy in the Game Theory because every company knows that the financial regulator will never choose this strategy for two reasons: the economic damage caused by the illegal activities by the companies, and the diminishing incentives for companies to have innovations within legal boundaries. In this strategy, the financial regulator will fail to fulfill its purpose of existence, to regulate the market and protect the investors. When investors have no adequate protection, they will exit the market and destroy the market's reputation.

In the lower-left column, the fintech company decided to cooperate but the financial regulator decided not to cooperate. The company tried its best to comply, but the financial regulator always chooses enforcement when there is a mistake or flaw in the company's compliance effort.

The result of this third strategy will cause the financial regulator to have a significant increase in the cost of enforcement, and the other fintech companies will be reluctant to create new financial services or experiment with new financial innovations. However, this strategy will create maximum market integrity because there will be zero tolerance for incompliance. The cost enforcement might include the form of class suit action by the fintech company against the financial regulator.

For the last strategy in the lower-right column, both the fintech company and the financial regulator decided not to cooperate (Maskin, 1999). The company will resist or evade regulations as best as it could, and the financial regulator will always pursue the course of enforcement on every possible violation.

The result of this fourth strategy is the company will experience business disruption as soon as the financial regulator begins to enforce the regulation. The company will have a legal battle against the financial regulator on every possible violation. The financial regulator will suffer a maximum cost of enforcement. The other fintech companies will not be able to innovate anything, in the fear of rigid enforcement from a zero-tolerance policy by the financial regulator. However, this strategy will have market integrity as the main benefit.

The four strategy payoffs can be ranked from the highest to the lowest as follow: first, both the fintech company and financial regulator cooperate - as the dominant strategy; second, the fintech company cooperates and the financial regulator does not cooperate; third, both the fintech company and financial regulator do not cooperate; fourth, the company does not cooperate and the financial regulator cooperate as the dominated strategy. This ranking assumes that action by either the Fintech Company or financial regulator will result in a reaction by the other. This also means the optimal strategy is for both the company and the financial regulator to cooperate until one of them does not cooperate.

The fintech companies should anticipate if the financial regulator will choose not to cooperate. In this case, the fintech company should choose to cooperate to minimize the possible legal battle cost. When the fintech company decided to cooperate, maybe the financial regulator will decide to change its policy to cooperate. This result may be the Nash Equilibrium in this game.

The Nash Equilibrium is used to predict peoples behavior in a game, identify the situations in which there is tension, and possible interactions among the players (Nash, 1951). The result in this paper can be used to predict the behaviors of financial regulators and fintech companies in Indonesia, the situations that might arise due to the actions taken by both players, and the kind of interactions that might happen during the interaction.

The financial regulator could end the game for the fintech company that deliberately does not cooperate, which means the specific game will not be repeated for that particular fintech company. The lesson from this ended game will benefit the whole industry to understand the strategies and outcomes preferred by the financial regulator.

Based on this framework, Indonesian financial regulators should offer good faith to assist fintech companies to comply and to reward the fintech companys effort to comply by showing lenience. The Indonesian fintech company should also try at its best to be fully compliant with the regulation while innovating within legal boundaries.

Despite the clear outcome of the game, this paper has limitations that offer several opportunities for future research. Some directions could be particularly fruitful to extend the current work:

What will happen if one of the players decides not to use rational decisions, for example, due to public pressure? Which strategies are best in this situation? In November 2015, the Indonesian government forbade one of the Indonesian biggest fintech companies to stop its operation after being pressured by the conventional transport company consortiums. However, due to the public pressure from the fintech users and the drivers who numbered far above the affected conventional transport workers, the government revoked the ban in December 2015. Will the size, social impact, and other unforeseen benefits from fintech companies affect the decision to cooperate / not cooperate with the financial regulators? What other factors might influence the strategic decision of each player?

In the non-cooperative games with compact strategy sets and continuous payoff functions, will there be a Pareto optimal Nash Equilibria in mixed strategy? In other words, when one of the players decided to change from cooperating to non-cooperate, followed by the non-cooperate by the other player in the next continuous games, will there be a point where the outcome would be maximized for each player that makes the game finally stopped because there is a no more possible way to increase a players outcome? Is there be a point where both financial regulator and fintech company decided not to cooperate, but at one point reach the maximized result for each of them, then both decided to cooperate to maximize the outcome?

Fintech companies often grow in countries where conventional financial industries are relatively not strong compared to the developed countries [Das et al. \(2019\)](#); [Hornuf et al. \(2016\)](#),

and the developing countries often have a high rate of corruption in law enforcement. What are the best strategies in countries where corruption and cronyism are rampant? If a country has a high rate of corruption or other deviation from good and clean government, what are the components in the payoff matrix? Should the players pursue rational strategies as expected in the Game Theory, or should the players resort to the nonrational strategy as long as it benefits the fintech companies?

In the real world of the Indonesian fintech industry where people within the companies and regulators are experienced at playing the games they are involved in, the players have accumulated much more learning and play generally good strategies either by calculation or by trained instinct.

For real-life complex games within the fintech industry, strategically aware players can use computers or consultants to do the calculations. It is necessary to analyze the starting points of such games and for predicting their outcomes (Dixit and Skeath, 2015). This first pass at the analysis can be later modified in the particular context of compliance, to recognize that players may make mistakes and that some games may become too complex to be solved unaided directly with the existing rules of the game. Therefore, the rules when necessary should be adjusted to meet the accommodated goals of the maximum and sustainable benefits for the consumers.

People may bring many considerations and preferences into their choices besides their rewards. Game theorists should include in their analysis of games the players concerns for fairness or altruism, as stated by Dixit and Nalebuff (2008), Behavioral game theory extends rationality rather than abandoning it.

Front research in game theory includes in the players objectives their concerns for equity, altruism, second-round concern to reward or punish others whose behavior reflects or violates these precepts, backward reasoning, interpretation and manipulating information, cooperation and coordination, auction, bidding, contest, and bargaining, among other concerns.

## 5 Conclusions

Financial Technology companies in Indonesia operate in an uncertain legal environment due to the lack of functional definition and regulation enforcements by financial regulators. Indonesian financial regulators also face difficulties to define functional definitions because financial regulators in other countries have a similar condition. Fintech as in the current popular understanding, started to gain popularity in early 2000 in the US, early 2010 in China, and mid-2015 in Indonesia. The nature of fintech as an ever-innovative industry created an ever-growing definition and scope of fintech.

The regulation enforcement in Indonesia also faces hurdles as the financial regulators are not omniscient and omnipresent in every circumstance every time. Financial regulators have limited resources and have other tasks than enforcement to do. A financial company who decided not to cooperate, or use a fake cooperation strategy, could expect the probability of the financial regulator failing to notice the companies deliberate violation.

The framework in this paper shows the rational alternatives available for companies and Regulators if both want to continue doing sustainable business in Indonesia. Although the best rational strategy is for both the financial company and fintech company to cooperate, as soon as one of them decides to defect from the cooperate strategy, then the optimum result will differ.

The financial regulator has to understand that enforcement actions may backfire and produce a negative uncontrollable outcome if FA cannot clarify legal definitions while providing

enforcement predictability, transparency, and consistency. The financial regulator must use enforcement as the last resort to achieve its objective to promote innovation, protect market integrity, and ensure an optimal level of clarity in the market (Yadav and Brummer, 2019).

The worst outcome is when the fintech companies in large numbers are not willing to cooperate with FA, which will bring harm to investors, which will hamper the legitimate innovation, then will destroy market integrity.

A primary weakness of this game, was the use of hypothetical actions, benefits, and disadvantages, although other researches have shown that hypothetical actions, benefits, and disadvantages can represent oversimplified the real-world condition in the Game Theory (Dixit and Skeath, 2015). Considering the various conditions of each Indonesian fintech company, and its unique interactions with the financial regulators, it would not be feasible nor possible for every interaction to be represented in this game.

An additional weakness of the present analyses was the assumption that there was no backdoor cooperation between the agents within the players, which is quite common to happen in a new industry in the developing countries that has no clear definition and regulation for that new industry. The backdoor access is sometimes necessary, even for governments from developed countries, to seek solutions for unforeseen problems that have not been regulated yet.

Regardless of the weaknesses, this paper confirms and extend the findings of Brummer and Yadav (2018); Magnuson (2018), who call for wide-ranging reconceptualization of financial regulation, especially for the financial technology industry. This reconceptualization must come in the form of effective cooperation between the fintech companies and the financial regulators of a country. As the fintech industry is still fragmented with many smaller and decentralized players, the risk of not cooperating of any player or bad governance system, could result in higher risks of adverse economic shocks.

A stark warning has been issued by Ostrom (1990), that **The dilemma never fully disappears, even in the best operating systems. No amount of monitoring or sanctioning reduces the temptation to zero. Instead of thinking of overcoming or conquering tragedies of the commons, effective governance systems cope better than others.**

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