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# Ostrom game theory applied to financial services bonuses and policy improvements



**Aidan Walsh**

EY Tax Partner, EMEIA Financial Services, Ireland; member of the Irish Prime Minister's Banking and Treasury Group



**Malcolm Brady**

Dublin City University



**Piotr Magnuszewski**

Centre for Systems Solutions, Wrocław

International Institute for Applied Systems Analysis, Laxenburg

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### **Abstract**

Elinor Ostrom's work on sustaining common-pool resources (CPRs) has had a profound impact on the management of natural resources. It has had very little impact on the regulation of the financial services industry. The purpose of this article, which focuses in particular on bonus payments, is to argue that this neglect may result in a number of tools available to regulators, industry and the public being underexploited. Coercively-powered, external rule-setting and monitoring authorities appear to have insufficient ability on their own to sustain a natural resource system.

Using a forest sustainability game as a tool (a common technique in natural resource management flexed to include bonus payments) and undertaken in EY's offices in Dublin, we argue that business students and finance professionals seem to behave very similarly to exploiters of natural resources. Given that degrees of self-governance, cooperation between exploiters, self-monitoring and self-sanctioning are considered critical to sustaining natural resources, this paper considers whether the same may be true of financial services. We use this framework to comment on recent work on modeling the effect of bonus caps and bonus deferral on bankers' risk taking.

**SPIEGEL: "Maybe sustainability is just against human nature?"**

**GOODALL: "I don't think so. Even chimps understand the concept. If a troop of chimps enters a fruit tree, they will only pick the fruits that are ripe and leave the others growing. That is sustainability."<sup>1</sup>**

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<sup>1</sup> Interview with Jane Goodall, Spiegel Online. Bethge & Grolle (2015)

## 1. Introduction

Elinor Ostrom (1933–2012) won the 2009 Nobel Memorial prize in Economic Sciences for her work on the governance of sustainable resources, what she called common-pool resources (CPRs). CPRs are those artificial or natural limited resources that are not privately owned and are large enough to make exclusion of potential exploiters difficult, but not impossible, for example, fisheries, irrigation systems, forests, commonages and pasture lands. In her classic text, *Governing the Commons*,<sup>1</sup> she told how she came to study common-pool resources, initially water resources in southern California in the 1950s. She and her colleagues found, completely unexpectedly, that different localities in southern California had self-developed different institutional arrangements to cope with similar problems, but that the different arrangements all worked and continued to work over long periods of time, providing water to local residents, farms and businesses (what she called “appropriators”) in a sustainable way.

Ostrom spent decades expanding these basic insights into studies of thousands of different CPRs, and the strategies and rules adopted by appropriators. She found that appropriators, often without state involvement and without private ownership of the resources, could create rules that allowed for the long-lived sustainability of the CPR. She found examples of resources that were sustained for over a thousand years. *The Tragedy of the Commons*,<sup>2</sup> i.e., the depletion of shared resources through the self-interested actions of participants was not inevitable. It is not too strong to say that her work has transformed our understanding of human cooperation.

Through this work on thousands of sustainable systems, Ostrom and the people that worked with her have discovered certain elements that seem to feature in all successful CPRs and certain elements that seem to result in problems for CPRs. The elements featuring in successful CPRs include cooperation among exploiters, self-governance, self-monitoring and self-sanctioning. Payoff or reward rules are an important element of every CPR.<sup>3</sup>

As yet, this type of thinking has not been widely applied to financial services, despite the prevalent concern about the sustainability of financial systems.

A significant feature of many financial services systems is the widespread use of bonus payments. The purpose of this article is to apply one of the tools that Ostrom developed – a multi-participant, multi-round sustainability game – to discover if the use of bonuses results in unsustainable exploitation of the natural system. Although the insights from such a game may not necessarily apply directly to financial systems, as different specific mechanisms can be at play, we believe that it is still worth considering and using the analogies that such games can produce.

## 2. Background to bankers' bonuses

Bonuses perform a very useful function in the financial services industry. In fact, at one stage, large bonuses were perceived to be essential for a sustainable financial services industry. Philip Augar, an experienced banker, in his history of London's investment banks deplored the shift to fixed salary structures in the 1980s, quoting experienced bankers:<sup>4</sup>

“As a [banking] partnership salaries were kept very low and there was a high-variable element in compensation in form of bonuses and profit share. The mix was about 25% salary and 75% bonus although it varied year to year and that was the beauty of it. In a bad year there was lots of room to manoeuvre on costs. County NatWest reversed the ratio by raising salaries and cutting bonuses. Fixed costs skyrocketed and we were hostage to the downturn in revenues.”

“Midland were uncomfortable with low salaries and high bonuses so they switched the mix. It moved the risk from the staff to the bank. It was a clear indication that they didn't understand the business.”

However, by the 2000s, the academic focus on game theory<sup>5</sup> and agency problems<sup>6</sup> had flipped that perception.<sup>7</sup> Bonuses were seen as a one-way bet for employees, with the person receiving the bonus getting a percentage of the reward and the

1 Ostrom E. (1990)

2 Hardin (1968)

3 Ostrom E. (2005, 208)

4 Augar (2001, 128)

5 Ostrom E. (2005, 92)

6 Kotlikoff (2010, 129)

7 Jokivuolle, Keppo & Yuan (2015)

institution (or ultimately, the taxpayer) being stuck with the loss. This phenomenon is succinctly captured by the acronym IBGYBG (I'll be gone, you'll be gone [when the loss manifests itself]) as justification for making a financial transaction. More subtly, regulating bonuses is seen as a way of incentivizing individuals within financial institutions to behave sustainably; in other words, to internally motivate them to behave sustainably rather than externally monitoring every transaction – which is considered difficult if not impossible.<sup>8</sup>

It's now taken for granted that bankers' bonuses result inevitably in unsustainable risk taking. The EU Commission amended remuneration rules for bankers in its CRD IV/CRR rules, arguing: "In order to tackle excessive risk taking, the remuneration framework has been further strengthened with regard to the requirements for the relationship between the variable (or bonus) component of remuneration and the fixed component (or salary). For performance from 1 January 2014 onward, the variable component of the total remuneration shall not exceed 100% of the fixed component of the total remuneration of material risk takers. Exceptionally, and under certain conditions, shareholder can increase this maximum ratio to 200%."<sup>9</sup> In the US, under the Dodd-Frank Act, bonuses are to be deferred and can be clawed back in cases of future reversals of profits.

Recent research seems to support the view that bonus caps, despite being a relatively crude one-size-fits-all policy, may be effective in reducing risk-taking by bankers.<sup>10</sup> We comment on this paper further below.

### 3. Some conclusions from Ostrom's work

It is impossible in this short article to do justice to the extent of Ostrom's work, and an article like this has leached out all the uplifting drama that flows from her stories of some of the world's poorest farmers, fishermen and hunters creating and sustaining CPRs from the most unpromising environments and institutional arrangements. But, we can summarize some high-level insights. Ostrom and her colleagues found that successful CPRs had certain common features.<sup>11</sup>

These "design features" were identified as follows:

- ▶ Clearly defined boundaries: Individuals or households who have rights to withdraw resources from the CPR must be clearly defined, as must the boundaries of the CPR itself.
- ▶ Congruence between appropriation and provisions, rules and local conditions: Appropriation rules restricting time, place, technology and quantity of resource units are related to local conditions and to provision rules requiring labor, material and money.
- ▶ Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.
- ▶ Monitoring: Monitors, who actively audit CPR conditions and appropriator behavior, are accountable to the appropriators or are the appropriators.
- ▶ Graduated sanctions: Rules violation as revealed through monitoring is sanctioned, but in a gradual way so that it does not provoke resentment.
- ▶ Conflict-resolution mechanisms: In case of disagreement, fast and effective conflict resolution procedures are established so that only more serious conflicts end up in court.
- ▶ Recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities. As one fisher said: "We've fished here for a long time and we know what's best for our ground. We know what it can take."<sup>12</sup>
- ▶ Nest enterprises (for CPRs that are part of larger systems): Appropriation, provision, monitoring, enforcement, conflict resolution and governance activities are organized in multiple layers of nested enterprises.

These rules are still not well understood and well-meaning governmental intervention has often ended in tragedy even in the most sophisticated countries. For example, Ostrom noted "fisheries in Newfoundland that had been organized to cope with

<sup>12</sup> Ostrom E. (1990, 177)

<sup>8</sup> Goodhart, Hartmann, Llewellyn, Rojas-Suarez & Weisbord (1998, 49)

<sup>9</sup> EU Commission (2013)

<sup>10</sup> Jokivuolle, Keppo & Yuan (2015)

<sup>11</sup> Ostrom E. (1990, 90)

many problems [by the fishers themselves] were destroyed by actions taken by the Canadian national Government."<sup>13</sup> Even where the external rules are well-designed, external coercive rules can "crowd-out" intrinsic motivation for sustainable behavior.<sup>14</sup>

The central point of all Ostrom's work was the importance of the appropriators having a real role in governing their own CPRs.<sup>15</sup> Sometimes, external parties were needed or were useful, but often they were destructive of institutions that were working or might have worked. For instance, appropriators will make rules that are appropriate for their environment whereas governmental authorities will tend to use one set of operational rules across different environments. As Ostrom et al. (1994, p. 237) noted: "The search for one best rule for solving all CPR problems is doomed to failure." Additionally, the governmental bodies usually recommend quotas for the amount of fish that can be harvested from a CPR in a season. However, in her sample of coastal fisheries, Ostrom found that fishers themselves never used quotas for sustainability purposes, as preordained quotas may take too many fish in lean years and forgo opportunities to take more fish in bumper years.<sup>16</sup>

Communication between appropriators is the first key step in creating a sustainable institutional framework. For example, appropriators in lab-based games "who use the opportunity to communicate to agree a joint investment strategy, who are able to communicate on a repeated basis or can back their agreements with an endogenously adopted sanctioning mechanism, are able to achieve significantly higher levels of net yield from the CPR" even when the individual incentives conflict.<sup>17</sup>

Self-sanctioning by appropriators has been found to be an effective mechanism to support sustainability. "[G]roups that did opt to change their rules and impose a sanctioning system upon themselves were able to achieve the highest average net yield (93%) of all experimental groups."<sup>18</sup> The ability to self-sanction by the group themselves was particularly effective against those "who do not care what others think."<sup>19</sup>

13 Ostrom, Gardner & Walker (1994)

14 Ostrom E. (2005, 95)

15 Deci & Koestner (1999); Frey & Jegen (2001); Ostrom, Gardner, & Walker (1994, 223)

16 Ostrom, Gardner, & Walker (1994, 265)

17 Ostrom, Gardner, & Walker (1994, 103, 149, 171, 195)

18 Ostrom, Gardner, & Walker (1994, 220)

19 Ostrom, Gardner, & Walker (1994, 219)

Rule following, rule monitoring and an attitude fostering reciprocity among appropriators are also effective ways of encouraging sustainability. "Where individuals follow rules and engage in mutual monitoring, reinforcing institutional arrangements and individual strategies bolster one another so as to maintain enduring patterns of consistent, but not perfect, rule-following behavior."<sup>20</sup> But, on the other hand: "It also makes us pessimistic about the likelihood of self-organized improvements [where] many, but not all, individuals are willing to ... extend reciprocity to others, but lack the authority to create their own self-governing institutions."<sup>21</sup>

#### 4. Can CPR thinking be applied to financial services?

While Ostrom's thinking has not been widely applied to financial services, scholars of banking have independently argued that many long-sustained, completely self-regulated financial systems have been created<sup>22</sup>:

► In *Free Banking in Britain*, White (2008) explains how the unique Scottish banking system had evolved in the 17th, 18th and 19th centuries. While liability of shareholders for most of the period was unlimited, the ability to establish a bank and then to issue notes was largely unregulated. There was no central bank in this system, no regulator and no deposit insurance. The system was not foolproof; for example, the Ayr Bank crashed in 1772, bringing down 13 (of the 19) banks in Edinburgh with it (albeit these were the smaller private banks). However, the system still created its own, entirely voluntary, sustainability: the Bank of Scotland and the Royal Bank of Scotland, during that crisis, lent to other banks<sup>23</sup> and even offered to accept the notes of the Ayr Bank. The Scottish banking system was exceptionally innovative: the overdraft in 1728, interest on deposit accounts by 1731 (long before England), branch banking by 1793 and the Union Bank started to publish its annual accounts in 1836. But, competition was also vigorous; profits were squeezed with the spread between deposits and loan interest rates reduced to 1% or below.

20 Ostrom E. (1990, 187)

21 Ostrom, Gardner, & Walker (1994, 328)

22 Walsh (2011)

23 White (2008, 41)

No bank or banks became dominant and attempts to create cartels to increase profits and dividends failed.<sup>24</sup>

► Calomiris (1990) has shown that self-insurance among clubs of US banks in the 19th century was more successful than state-run schemes. Banks in Indiana had a deposit insurance scheme “based on the principles of self-regulation and unlimited mutual liability ... The Indiana insurance system relied on bankers themselves to make and enforce laws and regulations.” All the Indiana banks in this club survived the panics of 1854 and 1857 (over half of nonmember Indiana banks failed).

► Also, interesting here is Beck’s review of the German model of deposit insurance.<sup>25</sup> While there are a number of different deposit protection schemes in Germany, the focus of that paper was the deposit insurance scheme of the German private banks. This was established by the German Bank Association (GBA), a private association, in the 1970s: “privately managed and funded, and stands apart from governmental supervision.” While membership is voluntary, all members of the GBA must be in their scheme or one of the other schemes. Echoing Ostrom, Beck notes: “The almost complete [deposit protection] coverage therefore increases pressure on the member banks to monitor one another.” Beck writes that: “Members may be expelled from the scheme, especially for missing or wrong information ... the common goals and professional ethics create a sense of community. Personal contacts facilitate moral suasion and pressure.” In other words, self-regulation can create a virtuous feedback loop for participants where good behavior is respected and rewarded, and bad behavior noticed and sanctioned (however subtly).

► Edward Stringham, in his recent impressive work, *Private Governance*, has emphasized the continuity over time of such self-regulation: “Without the ability to rely on external courts, brokers transformed coffee houses into private clubs that created and enforced rules ... The private club known as Jonathan’s Coffee House eventually became the London Stock Exchange, which adopted as its motto ‘My word is my bond’... In modern times, PayPal and eBay and other payment processors and clearing houses also created order in markets and facilitate exchange ... From the world’s first stock markets in

the seventeenth century ... to millions of credit card transactions governed by private rules today ... privately produced rules are more common, effective and promising than most of us believed.”<sup>26</sup>

And, even in the current environment, some regulators have seen the importance of self-governed behavior and of non-legislative, even tacit, factors. For example, the Dutch National Bank explicitly supervises culture and behavior in their financial institutions. This has become an influential model. Their insight is that: “DNB acts on the premise that all institutions are responsible for their own business operations and the accompanying behavior and culture.”<sup>27</sup> However, they do not seem to recognize that each individual also has some responsibility toward the sustainability of the system.

## 5. Using games

Understanding and analyzing complex policy issues is often hampered by the high cost of gathering data about how various members of society actually think and decide about these issues. Similarly, scientists and policymakers must often invest years to gain enough experience to be able to manage systems without risking them. Role-playing games have been successfully used as a way to simulate how people address complex resource decisions, such as sharing water for irrigation in Africa,<sup>28</sup> farming and subsidies in North America<sup>29</sup> and land use change around national parks in Poland.<sup>30</sup> They can address complex concepts, such as the water-food-energy nexus<sup>31</sup> or ecosystem services,<sup>32</sup> in an understandable and comprehensive way. Role-playing games are highly flexible and leave room for the demonstration of individual initiative and imagination,<sup>33</sup> which is an advantage in games involving policymaking. They are already used to test social responses and inspire social policy in relation to challenges like oil or water shortages.<sup>34</sup>

Games have increasingly become a standard experimental method in economics research.

26 Stringham (2015, 3, 4)

27 De Nederlandsche Bank (2015)

28 Barreteau, Bousquet, & Attonaty (2001)

29 Taff (1998)

30 Krolkowska et al. (2007)

31 Mochizuki et al. (2017)

32 Costanza et al. (2014)

33 Ladousse (1987); Stefanska et al. (2011)

24 White (2008, 22-34)

25 Beck (2002)

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Most of the existing experiments on CPR governance follow the methodology of experimental economics. Those experiments have been conducted both in the lab<sup>35</sup> and in the field,<sup>36</sup> and have established the use of games as a research method.

Although the method is not ideal because people may behave differently in game settings than in real world settings, it can provide an additional source of insight supplementing the current debate about the reform of financial markets institutions. While games can appear to be completely artificial, it seems that they are not totally divorced from how people behave in real life, as Bowles and Gintis point out: "Of course, experimental results in the laboratory would not be very interesting if they did not reflect real-life behavior. There is some evidence that they do or, to put it behaviorally, the experimental results have external validity."<sup>37</sup>

Although games and simulations have already been used as a tool for policy improvement,<sup>38</sup> such applications are still rare and have never been considered, as far as we are aware, for financial markets.<sup>39</sup> Their potential has been established to enhance a deeper analysis of the root causes of existing problems and to support policy formulation that could lead to governance innovations.

## 6. Experiments using simulation games

With the use of gaming, the largely ideological question of the regulation of financial markets and its potential consequences on market participants, their actions and overall equilibrium could become more empirical. Games and simulations could help to uncover the potential unintended consequences of proposed policies and regulations. Therefore, the authors of this paper undertook to organize a game using a dynamic "forest game" - an expanded version of the standard CPR games used for lab and field experiments.

### 6.1 Description of simulation game

Forest@Risk is a simulation game played by teams of players. Teams may view themselves as being in cooperation or in competition with other teams. The game centers on a forest, which acts as a resource for the community as a whole,

35 Ostrom, Gardner, & Walker (1994); Janssen, Holahan, & Ostrom (2010)

36 Cardenas (2003); Rustagi, Engel, & Kosfeld (2010)

37 Bowles & Gintis (2011, 39)

38 Duke & Geurts (2004)

39 Walsh, Magnuszewski, & Slodka-Turner (2012)

providing timber on the one hand and acting as a buffer against flooding on the other.

During the game, players can spend their "action points" (an equivalent to money, time and effort) on cutting trees or planting them - the effects on the state of the forest are immediately visible for all players. When all decisions have been made, the simulation rolls on to the end of the period and presents the outcome to the teams: their income and potential flood damage that also depends on the forest state.

The game exposes participants to the concept of the tragedy of the commons and to the difficult job of preventing excessive exploitation of common resources by self-interested entities in the absence of strong rules. It also exposes players to the difficulties that arise in self-regulation and in the introduction of external governance policies and sanctions.

### 6.2 Technical specifications

The simulation game - *Forest@Risk* - has been developed by the Centre for Systems Solutions based in Wroclaw, Poland. It is a web-based multi-player game, but can also be run in workshop format. Each role (forest user) can be represented by an individual player or a team of few players. They make their decisions using a web application with all decisions recorded in a central repository located on a server. The game engine on the server then rolls forward the impact of all decisions as well as simulating regeneration of the forest and natural destructive phenomena like flooding (also influenced by the numbers of trees and other factors). This provides the starting position for the subsequent round. Teams then continue to make rounds of decisions until the end of the game.

The simulation event took place in the Dublin offices of EY during one evening in April 2015. Fifteen teams took part, with each team comprising 4 members: a total of 60 people. Most of the teams comprised students from an MSc in Management program from a local university,<sup>40</sup> partners and employees of EY Dublin, and one team of experienced bankers. Two of the authors acted as independent facilitators for the duration of the game.

40 MBA-type students are typical recruits for financial institutions. Michel & Wortham (2009, 109)

The game took two and a half hours in total to play. Ten rounds of decisions were made, each round taking approximately 10 minutes. Two “town hall”-type meetings of approximately 20 minutes each were also held during the course of the game.

### 6.3 Bonus rounds

To simulate something akin to a bankers’ bonus, two rounds provided for a monetary reward (these were the only monetary rewards in the game). In rounds 2 and 6, a prize of €50 was offered to the team that made the “most profit” in that round.

### 6.4 Town hall meetings

The teams were encouraged to communicate with each other during two town hall meetings, with one representative from each team at the meeting. These meetings took place immediately after the two “bonus” rounds. The town halls were mostly devoted to discussing policy changes. They also provided an opportunity for teams to make sense of what was happening and see who was “making trouble.” During the first meeting, the teams collectively decided to change policy to a hierarchically driven quota system (forest harvest limit) - for every one tree cut, a team had to plant one tree.

However, this did not achieve the desired result as the forest condition was already too poor for the restriction to have an effect. In the second meeting, they voted in an egalitarian policy (income sharing) with the intention of disincentivizing the free riders, as any extra logging benefits would be shared with everyone. The group representatives worked out a fairly detailed four point plan and voted democratically on each point. They agreed on income redistribution and a plant-and-yield policy, with no harvest, to allow time for the forest to regenerate. They also sought a change in the rules of the game - a typical bargaining action. These decisions resulted in some improvement as the forest started to regrow, but slowly.

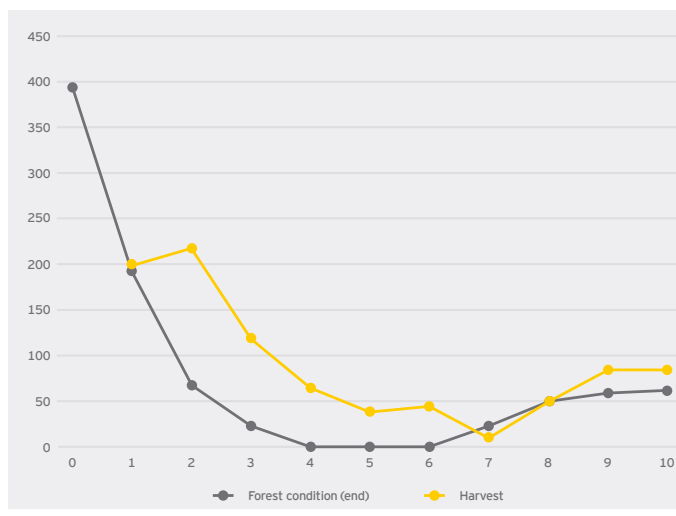


Figure 1



## 7. Results of rounds where bonuses were offered

In some ways, the outcome from the offered monetary prize, the €50 bonus, was predictable: nearly all the trees were cut down. However, a more detailed analysis gives a more nuanced result. The first team performance bonus was allocated in round 2. A number of teams appeared to change their policy in this round. Of the 15 teams, six significantly increased the number of trees that they cut down. Four teams reduced the number of trees that they cut and five teams made little change to their policy. However, in total, the number of trees cut increased by 10% and the number of trees planted reduced by 36%. It would appear that the introduction of a performance-based bonus increased the level of exploitation of the resource, leading the teams collectively down the road to a later tragedy of the commons: denuding of the forest, no timber to sell and ever more disastrous flooding.

The second bonus was awarded in round six. The level of tree-cutting, while much less than in round two, as the forest had been greatly depleted by this stage in the game, increased 27% and the amount of planting reduced by 14%. It is evident from figure 1 that the two spikes in the level of harvesting occurred in the two rounds in which bonuses were offered; the increase in harvesting that occurred in rounds 8, 9 and 10 mirrored an increase in the forest resources. This again implies that the introduction of the performance bonus led to an increase in the exploitation of resources (see figure 2). Note that policy changes may be due to the introduction of the bonus, but could also be due to other forces, for example, a team's dissatisfaction with its results from previous rounds.

The participants individually completed questionnaires during the game. There were 37 questions in the main questionnaire, but only a small number were directly relevant to the bonus issue. Two separate sheets were circulated after each bonus round. These questions were as follows:

- ▶ Compared with previous rounds, the possibility of €50 made no difference to the way that we made decisions. (This was probed after both rounds in which money was offered.)

- ▶ Question: The team that won the prize went up in my estimation. (This was only asked after the second bonus round.)

Participants rated each question from 1 to 7 rating, where 1 was “strongly agree” and 7 was “strongly disagree.”

	Strongly agree/ agree/ slightly agree	Neutral	Strongly disagree/ midly disagree
First round bonus question:  Compared with previous rounds, the possibility of €50 made no difference to the way that we made decisions.	21  (i.e. made no difference)	1	33  (i.e. made a difference)
Second round bonus question:  Compared with previous rounds, the possibility of €50 made no difference to the way that we made decisions.	31  (i.e. made no difference)	4	23  (i.e. made a difference)
The team that won the prize went up in my estimation.	17  (i.e. went up in estimation)	12	28  (i.e. did not go up in estimation)

**Table 1**

In addition, in both bonus rounds, participants were asked why the bonus made a difference. We can see the shift toward the bonus having a smaller impact on the second round when we look at the explanations that people gave when they answered the question.

It is no longer a surprise that people do not act in a narrow, self-interested way and, even when there are only virtual trees at stake, people had different motivations in making their decisions. They made different decisions - some of which gave rise to sustainable solutions and some of which did not.

First or second bonus	Rating	Comment
Round 1	7	We decided against a long-term strategy
Round 1	7	We aimed to earn the highest income to gain the €50
Round 1	7	It's real money ... I assume regeneration is factored in
Round 1	7	We wanted beer money
Round 1	3	The team become more money focused
Round 1	6	The lads became more ruthless
Round 1	7	It pushed me more to make the money as it is real and could be spent in real life not over a computer
Round 1	7	We blindly harvested ...
Round 1	7	Incentives drive work ethic and productivity
Round 1	5	We wanted the money (a number of participants made similar comments)
Round 1	5	Team cared more about income points than making sustainable decisions
Round 1	7	More greedy
Round 1	7	More focused to make more money and not thinking about sustainability
Round 1	2	There was an emphasis within the group and the room in general toward profit as opposed to sustainability, possibly sacrificing overall chance of success for immediate financial gain

Table 2

### 8. Application of the game results to Ostrom's insights

In many ways, both sides of the banking sustainability debate can take comfort from the results. On the one hand, nearly all of the trees were cut down and the environment was unsustainably degraded. It would take the forest many years to recover. This seems to show that individuals will destroy a CPR unless an external party has some power to modify the individuals' natural behavior. It also shows the power of incentives and that badly designed incentives can result in adverse outcomes for all.

However, on the other hand, some of the participants showed themselves capable of resisting the temptation of a short-term reward and looked to a longer-term sustainable future. We can also see that the individuals communicated and tried to self-create a cooperative, sustainable system using rules that they created, and were evolving, to monitor and self-sanction each other. In the end, the number of trees was growing and participants were creating a more sustainable system. As the survey results and group discussions showed, the individuals were grappling with the social problem of how to control themselves and each other to create such a sustainable system. However, they were only in the process of doing this when the game ended.

Both interpretations are entirely consistent with Elinor Ostrom's work. Creating a sustainable system is a complex task and not every sustainable resource is actually sustained. However, Ostrom's work makes us focus on the heterogeneity of the participants and the heterogeneity of their reactions to the same risks and rewards. We can see that different teams behaved in different ways, and that some were capable of producing sustainable behavior. This is an important point that we will now discuss.

First or second bonus	Rating	Comment
Round 2	3	Not too much concern about the money. (Close variations of this in three other forms)
Round 2	7	We are in a minus situation, so it is difficult to achieve our target
Round 2	6	It is not a good idea to (be) selfish even in business, so we have to harvest as well as plant
Round 2	1	Preplanned strategy (x 3)
Round 2	7	We were harvesting anyway
Round 2	6	We wanted to win it
Round 2	7	Profit max
Round 2	1	We teamed up with the Rowans (team): we plant and they harvest; we share outcome (similar responses in three other sheets)
Round 2	7	(Rowan team member) We really wanted to win it
Round 2	7	The game is what it is - we are doing our best
Round 2	6	It made us work harder
Round 2	5	More determined to strategically gain more points
Round 2	5	Tried harder
Round 2	2	We still did the same like last time: just harvest trees and try to make most money
Round 2	7	It made us want to work harder to make money, we didn't care about the rules
Round 2	7	Not motivated by money, but for the greater good
Round 2	6	New goals and lessons learned from last €50 bonus round
Round 2	1	Our goal didn't revolve around profitability
Round 2	1	A new direction was taken
Round 2	1	Save the forest
Round 2	1	Because we have a policy of sustainability foremost and making some points
Round 2	1	Because we stuck with the rules and our goal, which we set to balance harvesting and planting
Round 2	4	It did (affect decision) the round before, but it doesn't work in the long-term perspective
Round 2	7	Strategy abandoned
Round 2	7	Real vs. virtual
Round 2	3	No more resource to be used
Round 2	3	There was nothing left to harvest (plus two similar responses)
Round 2	1	We learned that we cannot deviate from a long-term strategy for short-term gain
Round 2	4	I am already greedy
Round 2	4	Not much as previous one, as everyone knew the rule and stuck to their strategy
Round 2	1	Because everyone stole the trees anyway, so we lost hope of winning
Round 2	7	We are losing, wouldn't make a difference
Round 2	6	More inclined to harvest

Table 3

## 9. Application of Ostrom's work to the issue of bonuses

As we have seen, Ostrom and her colleagues found that successful CPRs had certain common features. How well does the financial services system measure up (taking a small number of Ostrom's features and focusing on bonuses)?

- ▶ Clearly defined boundaries: Financial services is now a global system, one that has shifted quite quickly from very local, especially in-country, systems and there are many new players at the edges of the system (for example, shadow banking and FinTech). Therefore, we would expect to see a system that has been and remains under sustainability stress.
- ▶ Congruence between appropriation and provisions rules and local conditions: Instead, there is a quest for global rules and consistency among larger areas (for example, top-down bonus rules that apply right across all the different banking cultures in the EU)
- ▶ Collective-choice arrangements: Does the financial services industry itself still have the power to influence the rules under which it must operate? For example, in relation to bonuses where even participants in the industry who thought that the previous bonus culture had acted as a perverse incentive were not in favor of the top-down rigid solutions from the EU.<sup>41</sup>
- ▶ Recognition of rights to organize: A poignant feature of the game was the rudimentary attempt by individuals to self-create rules to preserve the forest. As Ostrom would have expected, the individuals were willing to extend reciprocity to each other and to curtail their own behavior. This may be the critical missing feature of the current financial system: the extent to which financial institutions are willing and able come together to discuss and argue out common behaviors that are essential for a sustainable financial system. It is possibly even illegal for industry participants to come together to agree local market-specific bonus rules. This ability to self-govern has been a feature of financial systems in the past, but is now largely gone. This is, potentially, the real tragedy of the commons: "individuals are willing to extend reciprocity to others but lack the authority to create their own self-governing institutions."<sup>42</sup>

41 BBA (2015)

42 Ostrom, Gardner, & Walker (1994, 328)

For examples of such reciprocal private governance in the most modern and sophisticated financial markets, see Stringham (2015, p.165ff) and Tett (2010).

Ostrom's work adds an extra dimension to the debate. To demonstrate this, we can consider a recent Bank of Finland discussion paper on bankers' bonuses. In this detailed and impressive paper, the authors modeled the behavior of bankers' risk-taking as it was affected by bonuses. They concluded: "We calibrate the model to US banking data and show that lengthening the standard one-year bonus payment interval has no material impact, whereas capping the bonus at the level of the base salary substantially reduces the bankers risk-taking. Our results suggest that the EU's bonus cap reduces risk taking, whereas bonus clawbacks as prescribed in the Dodd-Frank Act appear to be ineffective."<sup>43</sup> This seems like reasonably definitive support for the one-size-fits-all, prescriptive, externally enforced EU bonus cap. However, Ostrom's work would provide an additional insight - in the paper, the authors model bankers' behavior as homogeneous, that all bankers are "risk neutral,"<sup>44</sup> and that their reaction to risk and to the bonuses was also homogeneous. However, as Ostrom shows individuals are not homogeneous. This heterogeneity is not just in their risk appetite, but, even where their risk appetite may be the same, in the reaction to that risk and their reaction to the potential reward. Our game can be seen as a very limited illustration of that point.

This has been borne out in real life with, for example, Gillian Tett noting that even in the most recent financial crises that some bankers were not swayed by large bonuses and were concerned about the sustainability of the system. On the other hand, in the modern regulated environment they had no ability, incentive or mechanism, no institutional framework, to act on these concerns; no ability to usefully monitor or to sanction. One noted plaintively: "it wasn't our job to stop other banks being so stupid."<sup>45</sup> But, implicit in that statement is the fact that the individual did not act stupidly, the bank he or she worked for did not act stupidly. Both forewent bonuses and profits in the short-term, making the bank more robust and sustainable in the long run. We can also see it in the game where 28 (49%) of the questionnaire respondents disagreed with the statement:

"the team that won the (€50) prize went up in my estimation."

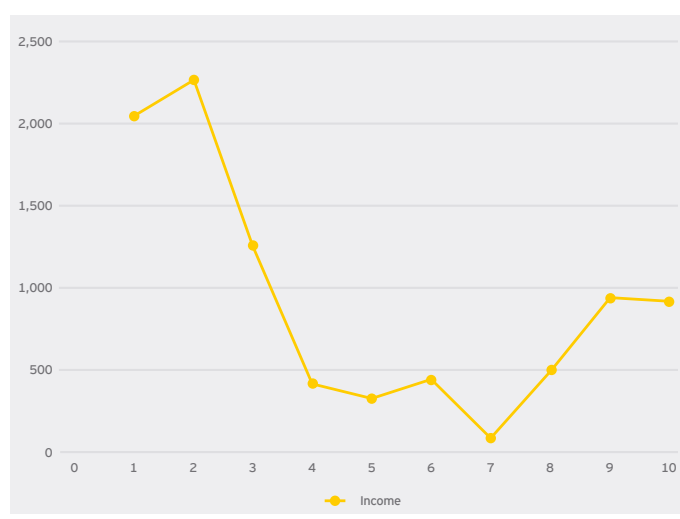


Figure 2

## 10. Conclusion

This was a limited study, which lacked many important design features of larger studies (for example, control groups, multiple runs of the games, diversity of participants and so on). While the results are consistent with the types of results that Ostrom and her colleagues, collaborators and followers have seen over countless such games, much further work will need to be done. Our research can be considered to be a pilot for further study, which will continue.

It is not yet robust, but it may be capable of producing richer insights than purely formal modeling. Our primary conclusion is methodological. We have sought to demonstrate that games may be a useful tool for industry participants, regulators and the public to learn about possible consequences of rules, to test different rules and to teach the benefits of new or different rules. To date, as far as we are aware, tools like this have not been used in the financial services industry in this way.

<sup>43</sup> Jokivuolle, Keppo, & Yuan (2015)

<sup>44</sup> Jokivuolle, Keppo, & Yuan (2015, 10)

<sup>45</sup> Tett (2010, 249)

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Elinor Ostrom and her husband, the political philosopher Vincent Ostrom, argued for polycentric solutions to problems<sup>46</sup> - layered, different, overlapping, even competitive - and for polycentric ways of investigating and testing these problems. This pilot should be seen in that spirit.

Work on the sustainability of the financial services industry is decades behind work on the sustainability of CPRs. The financial services industry can be compared with the fishing industry at the time of this statement of the Canadian Government (1976): "in an open-access, free-for-all fishery, competing fishermen try to catch all the fish available to them, regardless of the consequences. Unless they are checked, the usual consequence is the collapse of the fishery: that is, resource extinction in the commercial sense, repeating in the fishery context *the Tragedy of the Commons*."<sup>47</sup> Ostrom spent her entire career unpicking this misapprehension, although it is still widely held.

Is relying exclusively on external coercive rules optimal? Stringham has pointed out: "responsible people realize they must constrain their own choices. Yet, of all areas of governance, individual self-governance is the least studied and recognized."<sup>48</sup>

We are caught, ironically, in an unsustainable dynamic, if we see the regulators of the financial services industry as "wise and ecologically aware altruists" and the participants in the industry as "myopic, self-interested and ecologically unaware hedonists."<sup>49</sup>

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46 Ostrom E. (2005, 280)

47 Ostrom E., *Governing the Commons* (1990, 242)

48 Stringham (2015, 145, 147)

49 Ostrom E. (1990, 218)

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