Is there an evolutionary stable strategy for world peace?

Background

In this project, the focus will be on the peace and war game which is a two-player game, based on prisoner's dilemma. Each player has to decide between two actions in this game, either maintain peace and produce or attack the other player and steal the production. All players are self-interested and their ultimate goal is to maximize their profit by taking rational decisions in that direction. Their utility can be calculated using an initial payoff matrix, shown in Table 1. If every player keeps attacking, shortly thereafter there will be no production left and every player faces the danger of extintion. On the contrary, if every player chooses peace then the option of war becomes more appealing and more profitable.

Research/project question and aim

When looking at the project there are few research questions that makes the *Peace and War game* interesting to research and simulate. The questions proposed are both theoretical and practical for simulation. The first research question is *Which strategy acquire wealth most rapidly*? Is it the player who makes peace and is focusing on producing that earns the most wealth or is it the player who is aggressive and attacks the producing nations? The simulation is both going to show players that play with aggression (war) and cooperation (peace). The idea is to answer the question which strategy is going to maximize the player's payoff. Important game theory question is *where is the Nash equilibrium*, one of the goals of the project is to located the Nash Equilibrium in the game. The goal is to find the Evolutionary stable strategy in the game to analyse if there could be an Evolutionary stable strategy with World peace in the game.

Methods

This project will be evaluated by simulation, focusing on a two player approach. The simulation environment will be setup in a Python program, where each player will have his own strategy which will be evaluated against each other according to the initial payoff matrix shown in Table 1. In future expansions, the outcomes of the game will be affected by the history of the players choices in form of accumulated utilities. The payoff matrix and probabilities of winning each round will depend on these accumulated utilities as well as a certain uncertainty. The outcome of the game will be evaluated by analysing the stability of different strategies and their accumulated utilities. Examples of such analysis can be found in Appendix 1.

Limitation/scope

The initial limitations of the game is that we will only have two players. The scope of our project will adapt to modelling availability and already existing theories. We are in this stage of the project considering the following potential expansions of the decision rules of the game: the cost of waging war might increase with current wealth; the reward of winning a war might increase with opponents wealth; the probability of winning might be a function of relative wealth of the aggressor; the players might be allowed more options than *peace*, and *war*, i.e. *rearmament*, and *defend*; and the initial conditions might vary. I.e. one player might at round 0 be wealthier than the other player.

1 Appendix

		Player 2	
		Peace	War
Player 1	Peace	(1,1)	(-4,4)
	War	(4,-4)	(2,2)

Table 1: Payoff matrix for prisoner's dilemma game implemented as an iterated peace and war game.

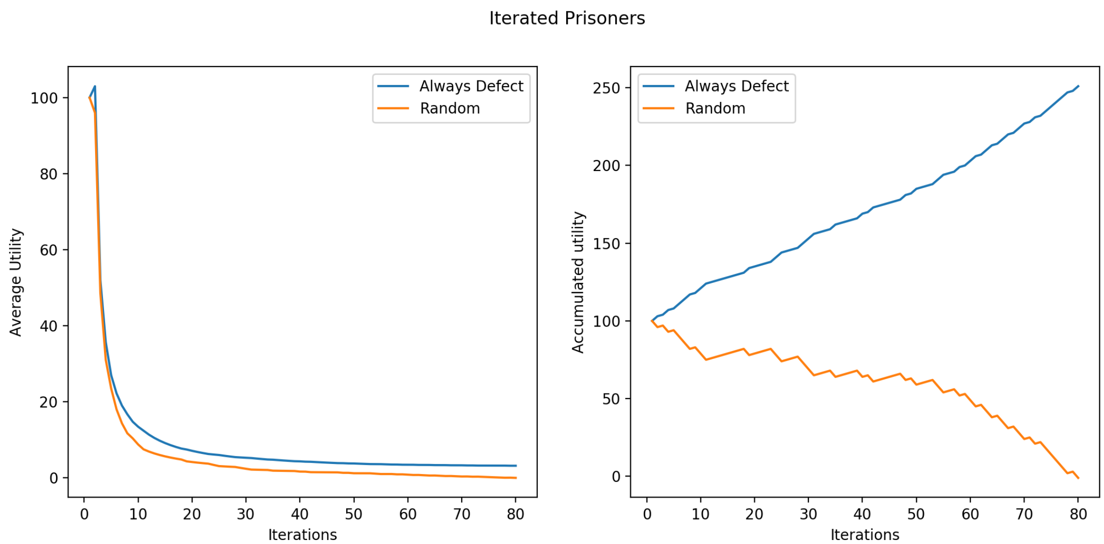

Figure 1: The Figure shows the average and accumulated utilities of the iterated prisoner's dilemma implemented as a peace war game, with payoff values as presented in Table 1 and initial utility of 100. The simulation is made over 100 iterations, but the Random individual goes extinct after 80 iterations (its utility goes below 0), thus terminating the simulation. One can see that the average utility of the Always Defect strategy converges a bit below four, and the Random strategy converges slightly above zero.