CS 4710 Project

Jingtao Scott Hong
jh4ctf@virginia.edu

Da Justin Lin
dl2de@virginia.edu

Yanwen Phillis Wang
yw9cj@viriginia.edu

Yufei Sky Zhou
yz5zys@viriginia.edu

October 7, 2021

1 Motivation and Statement of the Problem

With the development of technology and the wide application of artificial intelligence, more and more price-setting processes are delegated to algorithms. People might set rules for algorithms about how to react to market changes and adjust prices accordingly to achieve certain goals (e.g., profit maximization). People could also design artificial intelligence algorithms that interact with the market and complete price-setting processes independently. Indeed, the use of algorithms reduces the chance of human errors, enables timely adjustments in response to market changes, and thus improves efficiency. Yet, some simulation experiments have shown that the use of pricing algorithms would lead to collusive equilibrium prices. We would like to first replicate their results and then extend them to a broader context where market assumptions become more complex. Questions we are interested in studying include:

- What are the effects of artificial intelligence pricing algorithms on equilibrium prices?
- When there are multiple agents choosing prices sequentially and have prior knowledge of the market, will the result be different?

2 Proposed Approaches

In the case of small number of competing companies (2 companies in the minimal case), we will be implementing algorithm that is more fit for small sample such as Min-Max to check what the equilibrium outcome is.

In the case of larger number of competing companies which will be more realistic (more than 2 companies in the industry), because of the complexity of the industrial price competition, we are planning to use a reinforcement learning algorithm such as multi-agent Q-learning to learn about firms' strategies and study whether algorithms learn to collude automatically.

3 Our team

Our team consists of four members (three BACS Major and one Econ and Math Major):Jingtao Hong, Da Lin, Yanweng Wang, and Yufei Zhou.

4 Prior Literature

Calvano, Emilio, et al. "Artificial intelligence, algorithmic pricing, and collusion." American Economic Review 110.10 (2020): 3267-97.

Klein, Timo. "Autonomous algorithmic collusion: Q-learning under sequential pricing." Amsterdam Law School Research Paper 2018-15 (2019): 2018-05.