

# Liteature Review

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## 1 Introduction and Literature Review

### 1.1 Motivation

The purpose of this research is to use the repeated game model of collusion to analyze the day-ahead market premium in the energy economics literature. In the literature, large number of goods are traded in a sequential market setup, such as bonds, stock, futures. For a simple economics model, we used to predict that the price will converge in discounted value. However in the empirical observation, there are large inconsistent with this prediction. For example treasury bond market (Coutinho 2013) [1], mutual funds (Zitzewitz 2003) [2] and also electricity markets (Borenstein et al 2008) [3].

### 1.2 Sequential Market

There are three branches of literature talked about sequential market. Three potential explanations are discussed. First is related to behavior of consumers who are not rational or impatient (Coase 1972) [4]. Second is related to risk aversion (McAfee and Vincent 1993) [5] or asymmetric shocks (Bernhardt and Scoones 1994) [6]. But even with those two constrains, if there are arbitrage, then the price must converge, therefore a literature on why there limitations to arbitrage on energy market are discussed (Borenstein et al 2008 [3], Jha and Wolak 2014 [7]).

### 1.3 Collusion

The collusion in energy market is documented in Fabra, Toro (2005) [8] using Spanish electricity market. There are two types of imperfect competition model. The first of it is the Cournot Nash Equilibrium with entry deterrence. The second is cooperative equilibrium in a repeated game.

#### 1.3.1 Cournot Nash Equilibrium with Entry deterrence Models

The basic idea is that if there are limited number of firm, then the symmetric Nash equilibrium is a imperfect competition. Although this imperfect competition will converge to a perfect competition as number of the firm goes to infinite.

However if there are large fixed costs or/and some punishment threats to entry to the market, then it's possible that there are equilibrium that deters potential competitor in the market.

### 1.3.2 Cooperative Equilibrium in a repeated game

In a repeated game set up, the basic idea is that if some player does not accord to the rule of cooperative equilibrium, then there are punishments to deviation, then by Folk theorem, any outcome that are above threats points are attainable. Although the electricity market is imperfectly monitored, but under suitable conditions then there are still Folk theorem holds.

## References

- [1] Paulo Braulio Coutinho. When-issued markets and treasury auctions. 2013.
- [2] Eric Zitzewitz. Who cares about shareholders? arbitrage-proofing mutual funds. *Journal of Law, Economics, and Organization*, 19(2):245–280, 2003.
- [3] Severin Borenstein, James Bushnell, Christopher R Knittel, and Catherine Wolfram. Inefficiencies and market power in financial arbitrage: a study of california's electricity markets. *The Journal of Industrial Economics*, 56(2):347–378, 2008.
- [4] Ronald H Coase. Durability and monopoly. *The Journal of Law and Economics*, 15(1):143–149, 1972.
- [5] R Preston McAfee and Daniel Vincent. The declining price anomaly. *Journal of Economic Theory*, 60(1):191–212, 1993.
- [6] Dan Bernhardt and David Scoones. A note on sequential auctions. *The American economic review*, 84(3):653–657, 1994.
- [7] Akshaya Jha and Frank A Wolak. Testing for market efficiency with transaction costs: An application to financial trading in wholesale electricity markets. Technical report, 2015.
- [8] Natalia Fabra and Juan Toro. Price wars and collusion in the spanish electricity market. *International Journal of Industrial Organization*, 23(3-4):155–181, 2005.