

# 2020年度寡占理論 (4)

## Noncooperative and Cooperative Environmental Corporate Social Responsibility

### 今日の講義の構成

- (a) Non-Profit-Maximizing Objectives
- (b) CSR
- (c) CSRと競争構造
- (d) Environmental Corporate Social Responsibility  
as a Collusive Device

# 報告論文情報

## Title

(1) Environmental Corporate Social Responsibility: A Note on the First-Mover Advantage Under Price Competition.

(2) Noncooperative and Cooperative Environmental Corporate Social Responsibility

## Co-author

Kosuke Hirose, Sang-Ho Lee (Professor, Chonnam National University)

## Journal

(1) Economics Bulletin, vol. 37(1), pp. 214-221, 2017

(2) Journal of Institutional and Theoretical Economics, forthcoming

# 元々のタイトルとストーリー

Environmental Corporate Social Responsibility as a Collusive Device

ストーリー:

環境CSRの導入⇒企業の限界費用を上げる

⇒みんなを導入すると均衡価格が上がる

⇒費用が上がっても産業全体の利潤が増える。

～企業団体が主導してECSRを導入する誘因がある

# Plan of the Presentation

- (1) Non-Profit-Maximizing Objectives
- (2) Corporate Social Responsibility (CSR)
- (3) CSR and Endogenous Competition Structure
- (4) Environment Cooperate Social Responsibility and Competition Structure
  - (4-1) Model
  - (4-2) Results and Implications
  - (4-3) Possible Extensions

# Non-Profit-Maximizing Objectives

- (1) Mixed Oligopolies ~ Public enterprises that are concerned with social welfare compete against profit-maximizing private enterprises
- (2) Payoff-Interdependence Approach (Relative Profit Approach) ~ Firms care about their rivals' profits as well as their own profits.
- (3) **Corporate Social Responsibility**

# **Corporate Social Responsibility (CSR)**

# Ghosh and Mitra (2014)

$$U_i = \theta_i W + (1 - \theta_i) \pi_i$$

Firms care about both social welfare and their own profits. → Corporate Social Responsibility (CSR) approach

$\theta_i$ : The weight on CSR in firm  $i$ 's payoff

→ This is the same formulation as the partial privatization approach by Matsumura (1998) in the context of mixed oligopolies mentioned below.

# Public Firm's Objective

Since Merrill and Schneider (1966), the public firm is often assumed to maximize welfare, while the private firm maximizes its own profit in the literature on mixed oligopolies.

Partial Privatization Approach by Matsumura (1998)

$$U_0 = (1-\theta) W + \theta \pi_0$$

joint ownership of public and private sectors.

$\theta$ : the degree of privatization



# Relationship between CSR approach and Mixed oligopolies

Pure private firm case(private duopoly):  $\theta_1 = \theta_2 = 0$

Pure public firm case (mixed duopoly):  $\theta_1 = 1, \theta_2 = 0$

Partial privatization approach:  $\theta_1 \in [0, 1], \theta_2 = 0$

These are special cases of CSR approach.

CSR approach allows all firms are non-profit maximizers.

Cf. Multiple Public Firms, Matsumura and Shimizu (2009), Matsumura and Okumura (2013, 2014), Haraguchi and Matsumura (2016)

# CS Approach

$$U_i = \theta_i CS + (1 - \theta_i) \pi_i$$

Firms care about both consumer surplus and their own profits.

$\theta_i$ : The weight on CSR in firm  $i$ 's payoff

→ This is the same formulation as the partial privatization approach by Matsumura (1998) in the context of mixed oligopolies with foreign private firms.

# Endogenous Competition Structure

## (1) Free Entry Markets

~ The number of firms is determined endogenously

## (2) Bertrand or Cournot

~ Whether price or quantity competition emerges is determined endogenously

## (3) Cournot (Bertrand) or Stackelberg

~ Whether simultaneous-move game or sequential-move game is played is determined endogenously

## **Bertrand, Cournot, Stackelberg**

Each model yields different results and implications.

Which model should we use?

# Endogenous Timing Games

Firms can choose when to produce.

Formulating a model where Cournot outcome and Stackelberg outcome can appear, and investigating whether Cournot or Stackelberg appear in equilibrium.

# Observable Delay Game

Hamilton and Slutsky (1990)

Duopoly

First stage: Two firms choose period 1 or period 2.

Second Stage: After observing the timing, the firm choosing period 1 chooses its action.

Third Stage: After observing the actions taking at the second stage, the firm choosing period 2 chooses its action.

Payoff depends only on its action (not period).

# Equilibrium in Observable Delay Game

## Symmetric Private Duopoly

### Strategic Substitutes

⇒ Both firms choose period 1 (**Cournot**)  
because Leader  $\gg$  Cournot  $\gg$  Follower

### Strategic Complements

⇒ Only firm1 chooses period 1 (**Stackelberg**) or  
Only firm2 chooses period 1 (**Stackelberg**)  
because Leader  $\gg$  Cournot and Follower  $\gg$  Cournot.

# Endogenous Role in Mixed Duopolies

Observable Delay Game

Quantity Competition

Pal (1998)  $\Rightarrow$  Stackelberg

Price Competition

Barcena-Ruiz (2007)  $\Rightarrow$  Bertrand.

# Matsumura and Ogawa (2014)

Observable delay game.

Dixit-type linear demand ( $\delta$  represents the degree of product differentiation)



# Matsumura and Ogawa (2014)

Common Results under Price and Quantity Competition

Symmetric objectives

→ Similar results as private duopoly

Symmetric objectives

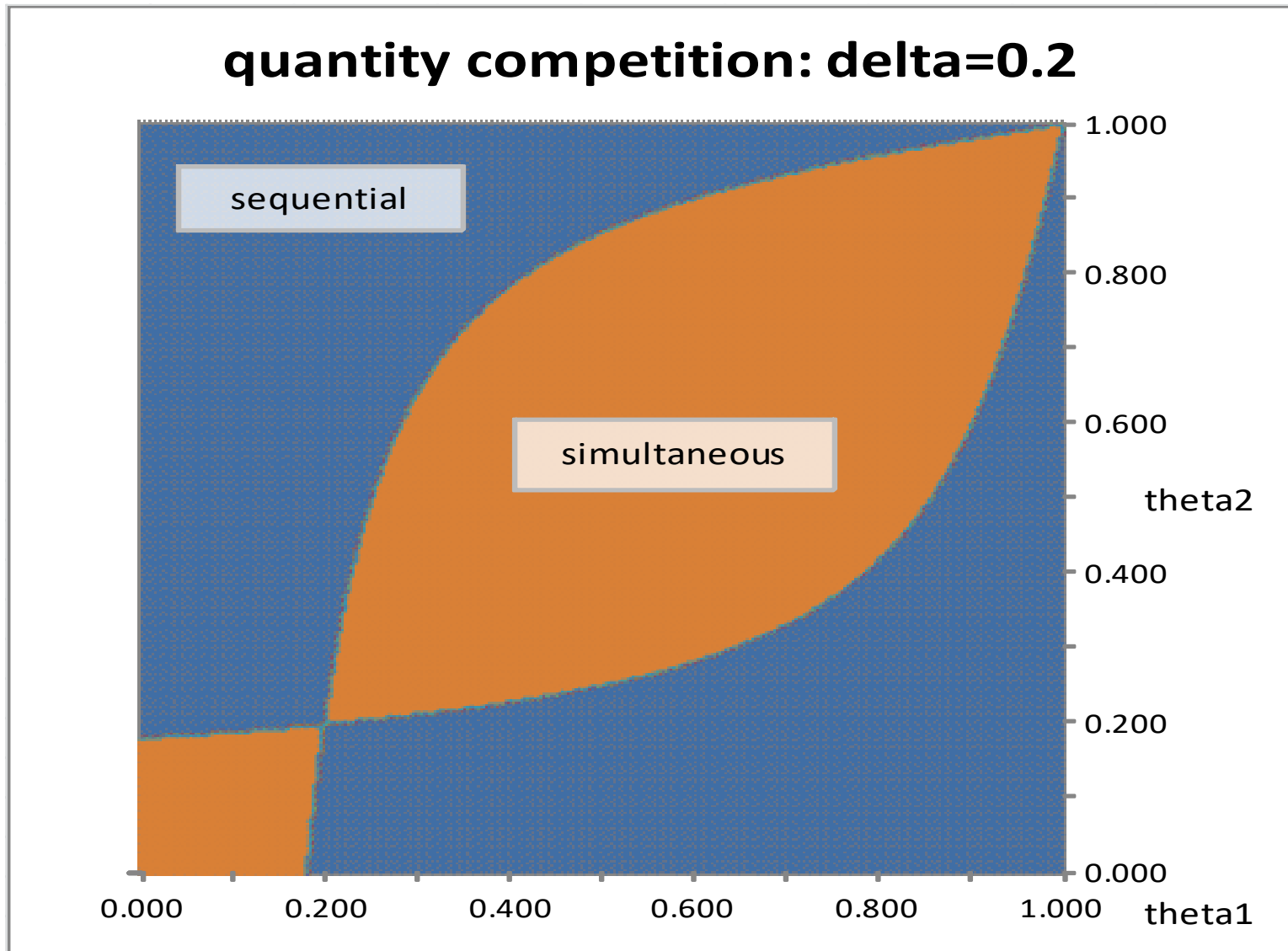
→ Similar results as mixed duopolies

Cost differences

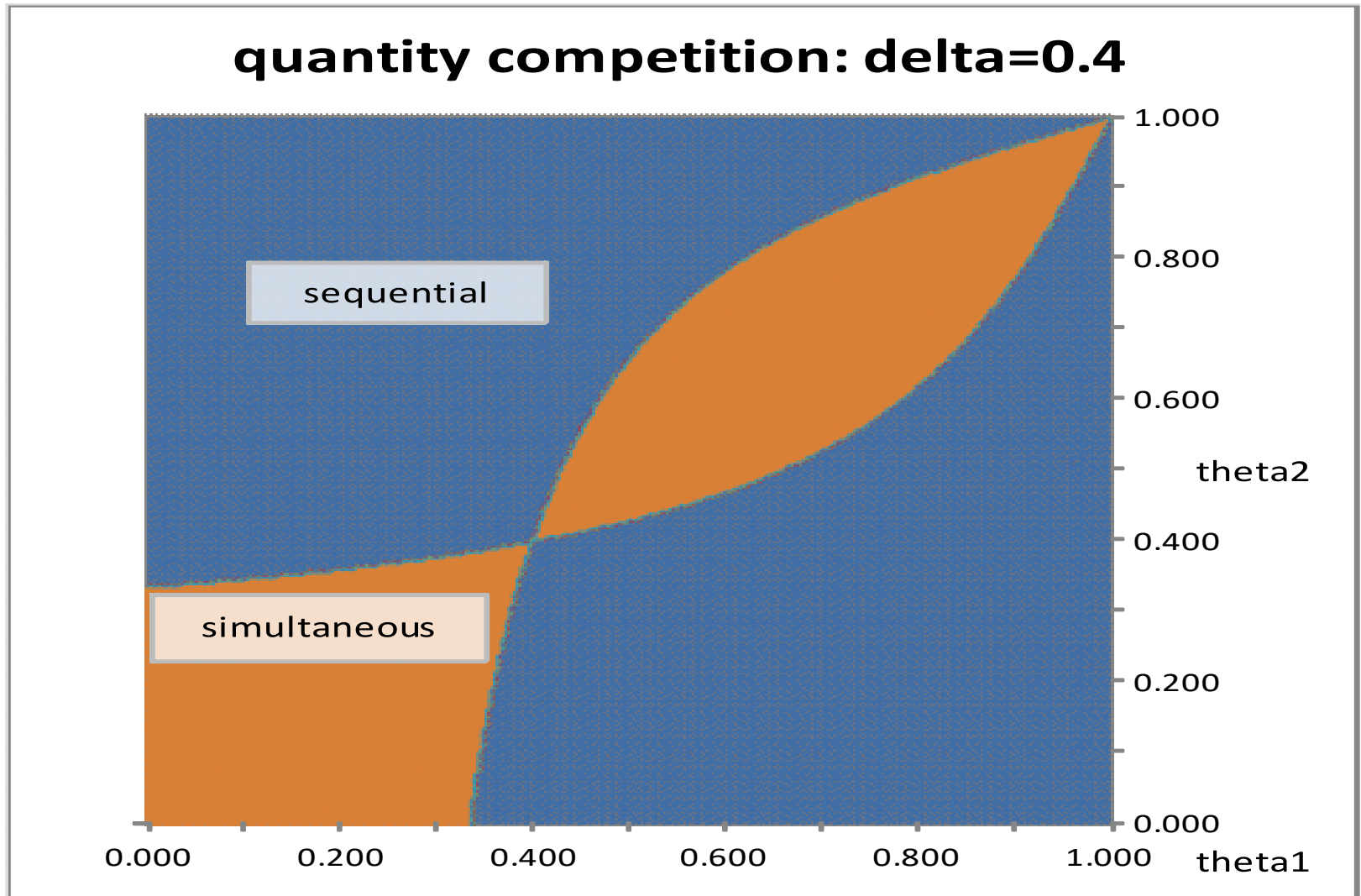
The lower-cost firm more likely be the leader.

Similar to the results in Ono (1978, 1982), van Damme and Hurkens (2004), and Amir and Stepanova (2006) and in contrast to Dastidar and Furth (2005) and Hirata and Matsumura (2011)

# Results ~ Quantity Competition

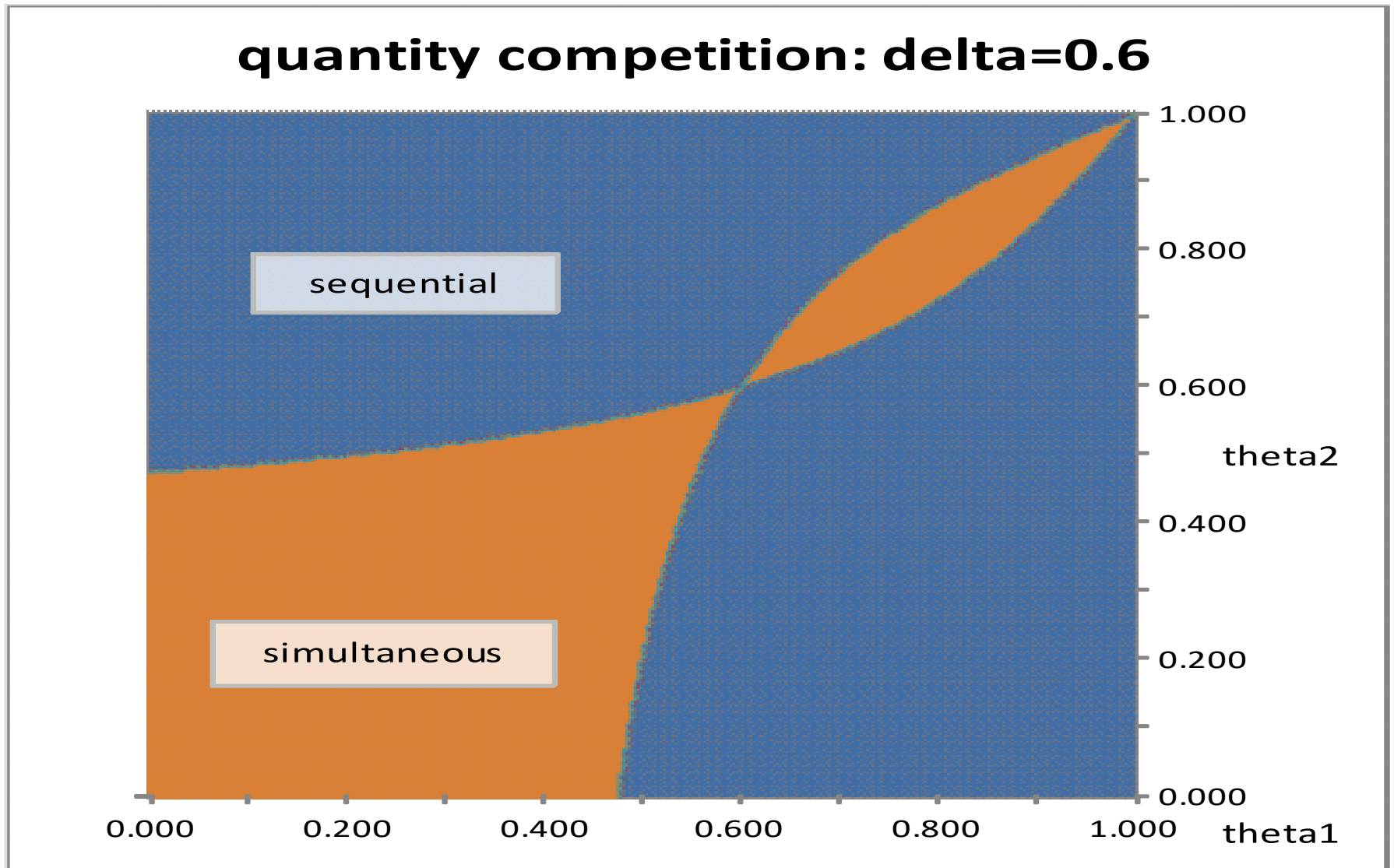


# Results ~ Quantity Competition



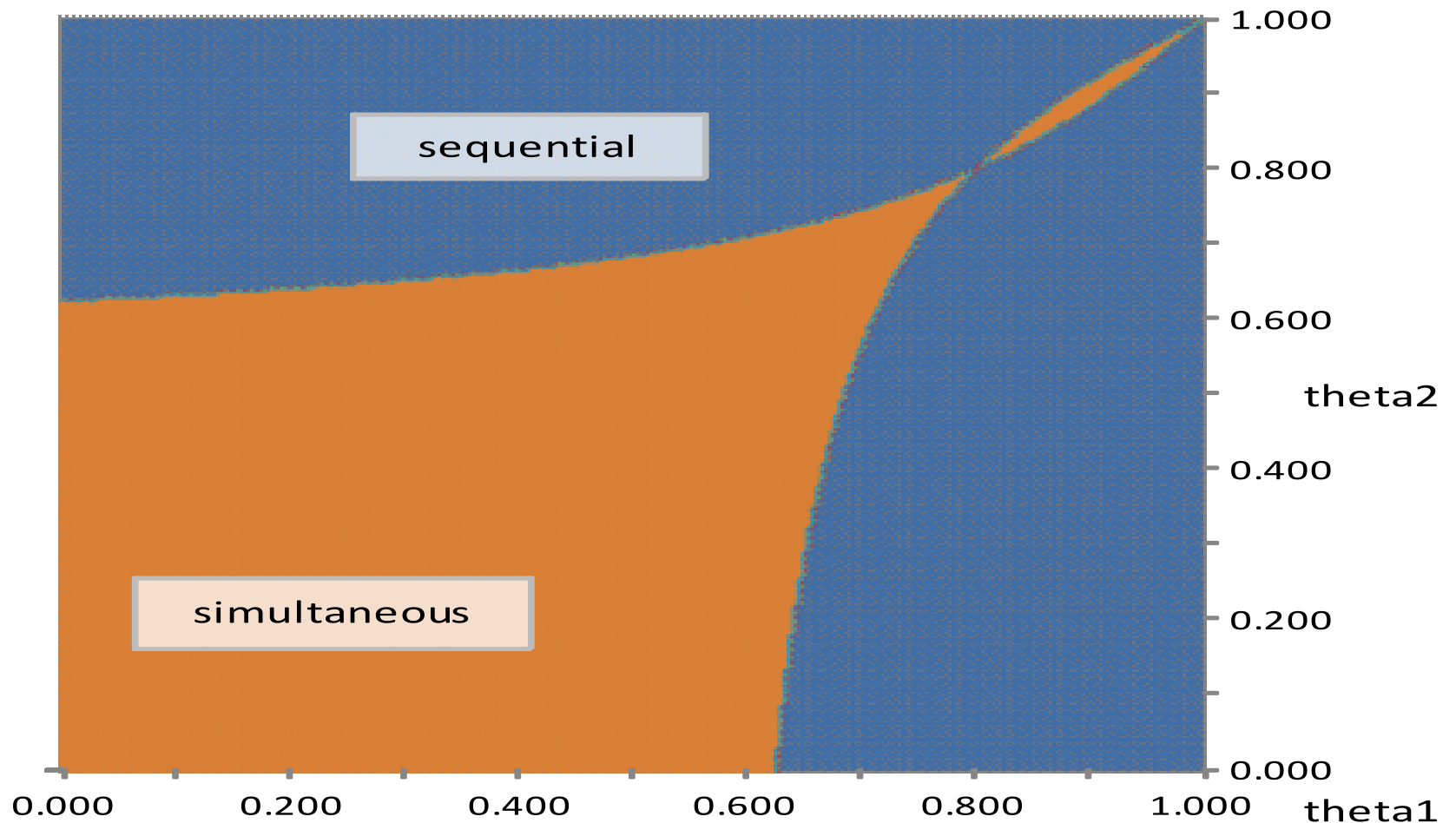
# Results ~ Quantity Competition

quantity competition:  $\delta=0.6$



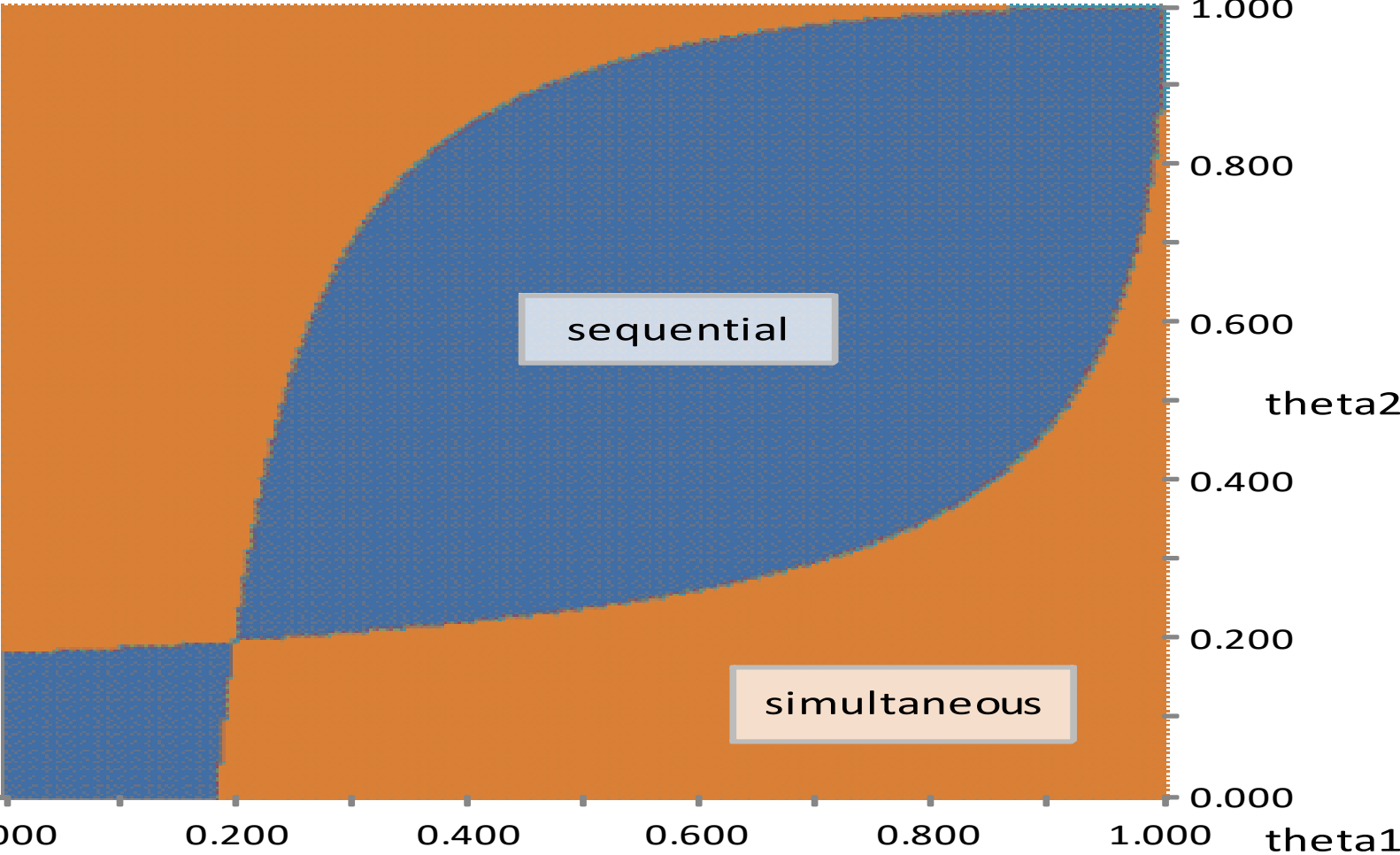
# Results ~ Quantity Competition

quantity competition:  $\delta=0.8$



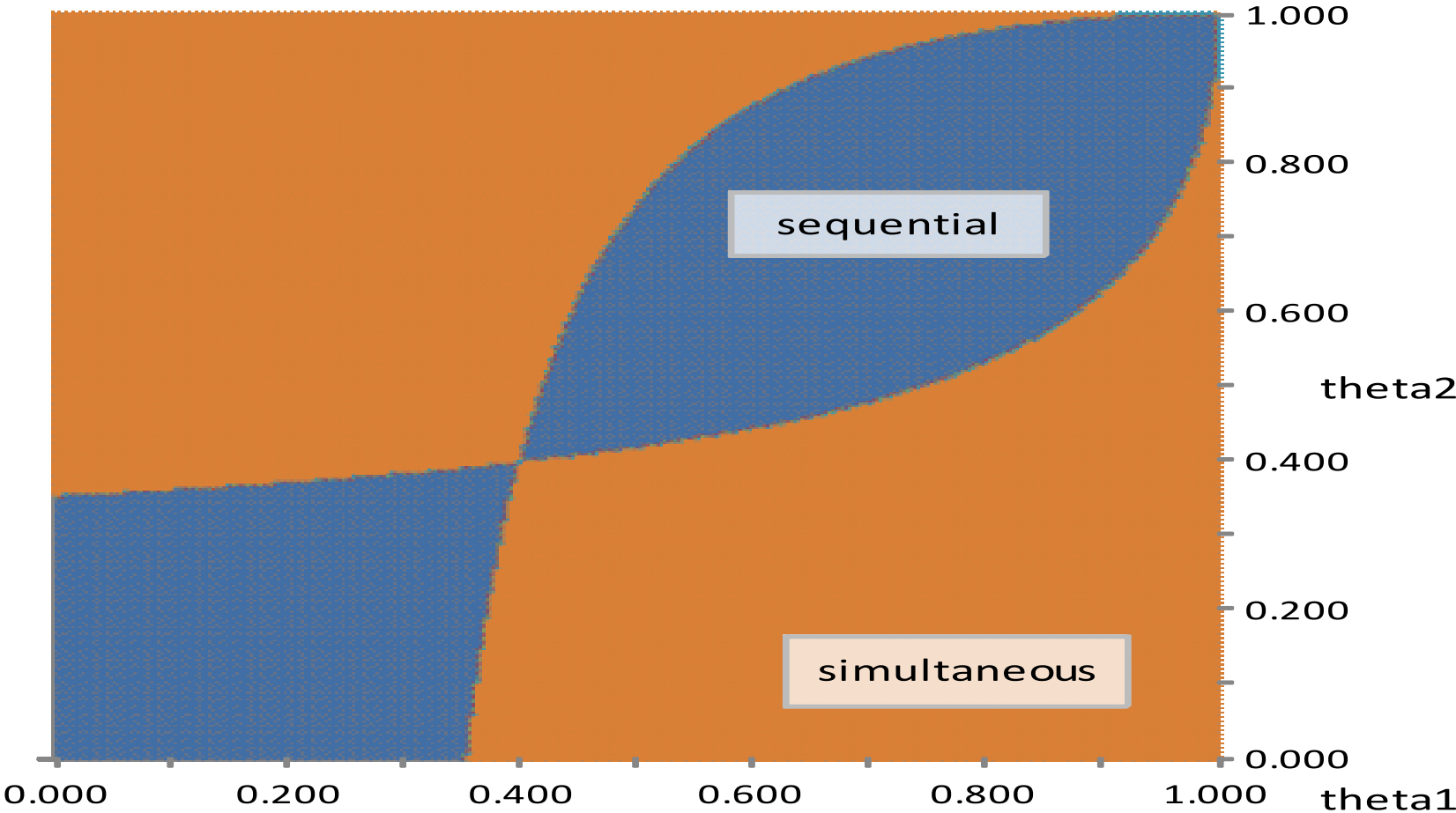
# Results ~ Price Competition

price competition: delta=0.2



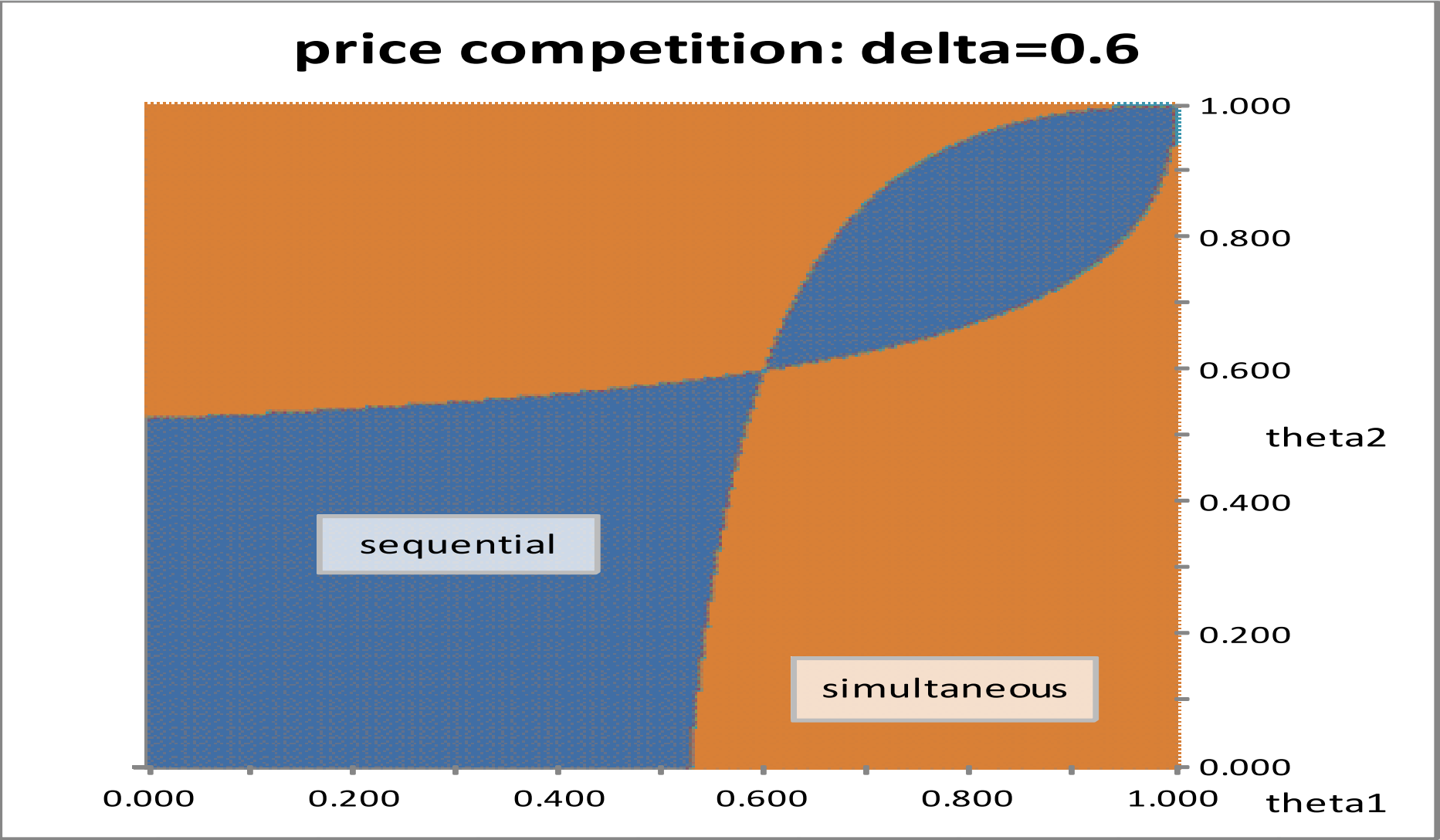
# Results ~ Price Competition

price competition: delta=0.4



# Results ~ Price Competition

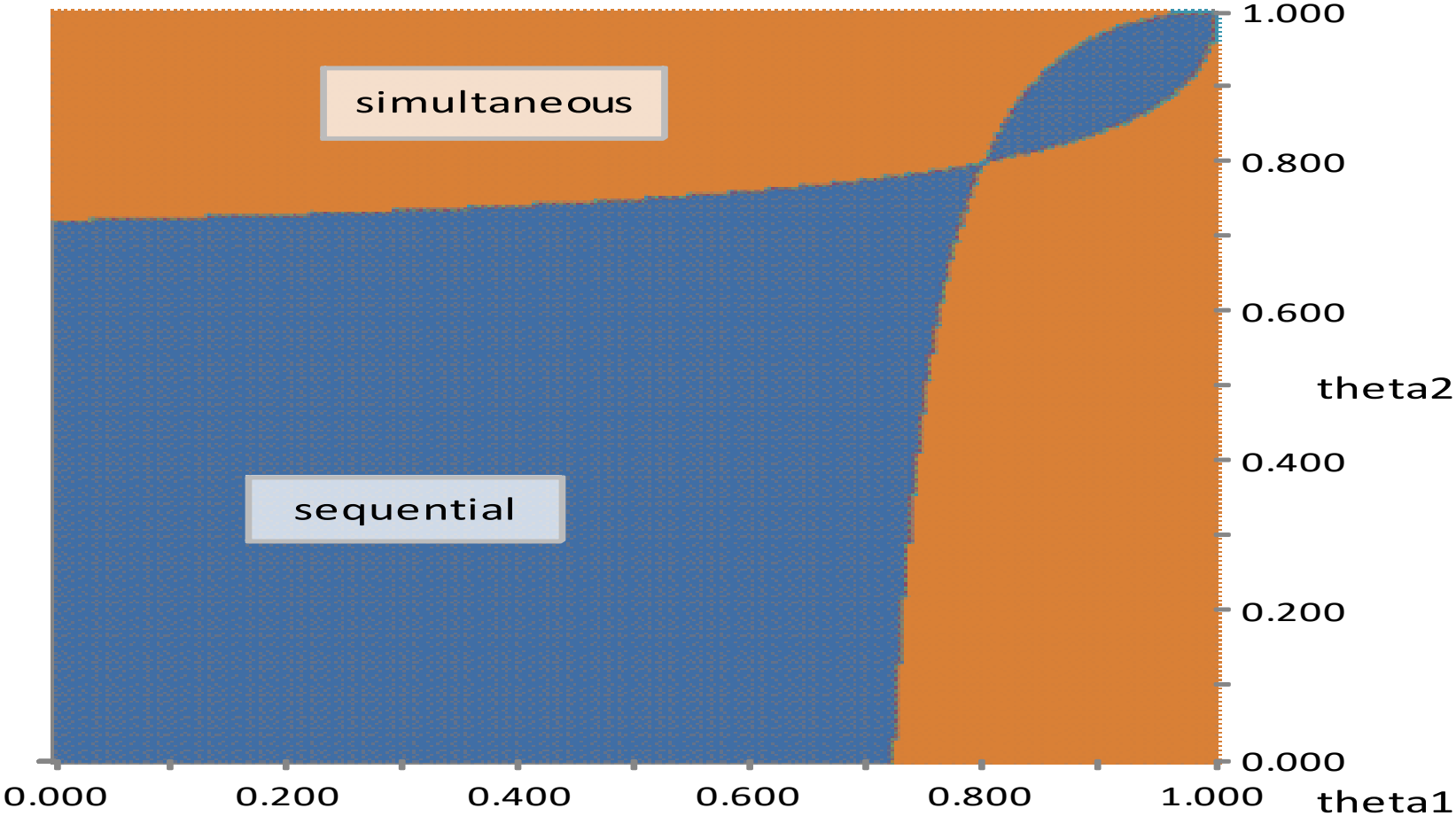
price competition: delta=0.6





# Results ~ Price Competition

price competition: delta=0.8



# Matsumura and Ogawa (2016)

- (1) Incorporating CSR into the price-quantity model formulated by Singh and Vives (1984) and deriving the existing results on private and mixed duopolies as special cases.
- (2) Discussing whether non-profit maximizing objectives or the asymmetry of objectives matter in this context.

# Our Model

$$p_1 = \alpha - \beta q_1 - \beta \delta q_2 \quad p_2 = \alpha - \beta q_2 - \beta \delta q_1 \quad \delta \in (0,1)$$

$\delta$  represents the degree of product differentiation.

Marginal cost is constant. Firm  $i$ 's marginal cost is  $m_i$

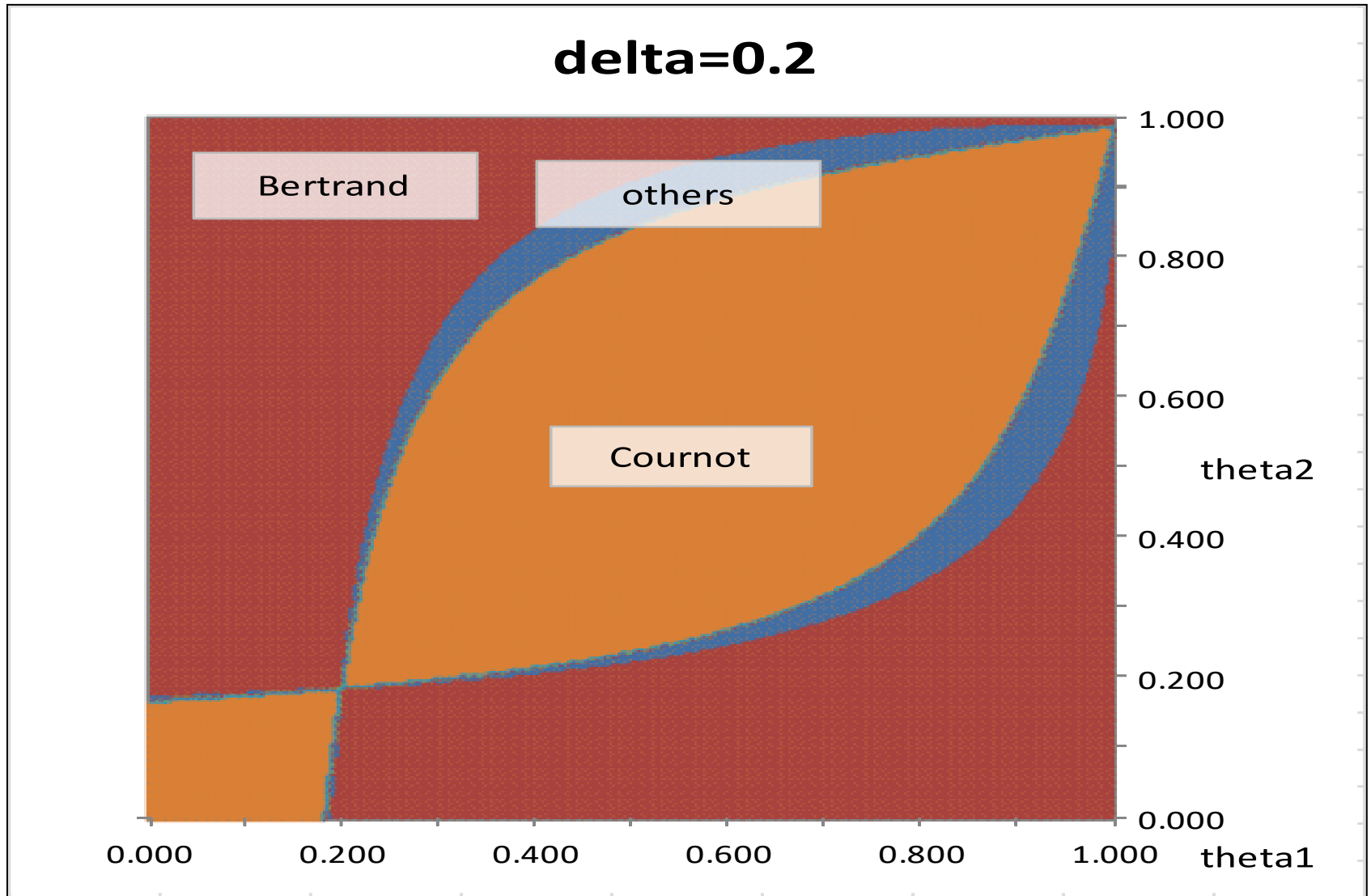
$$\text{Payoff: } U_i = \theta_i W + (1 - \theta_i) \pi_i$$

In the first stage, each firm chooses price contract or quantity contract.

In the second stage, after observing the rival's choice of the previous stage, each firm chooses price or quantity, according to the first stage choice.

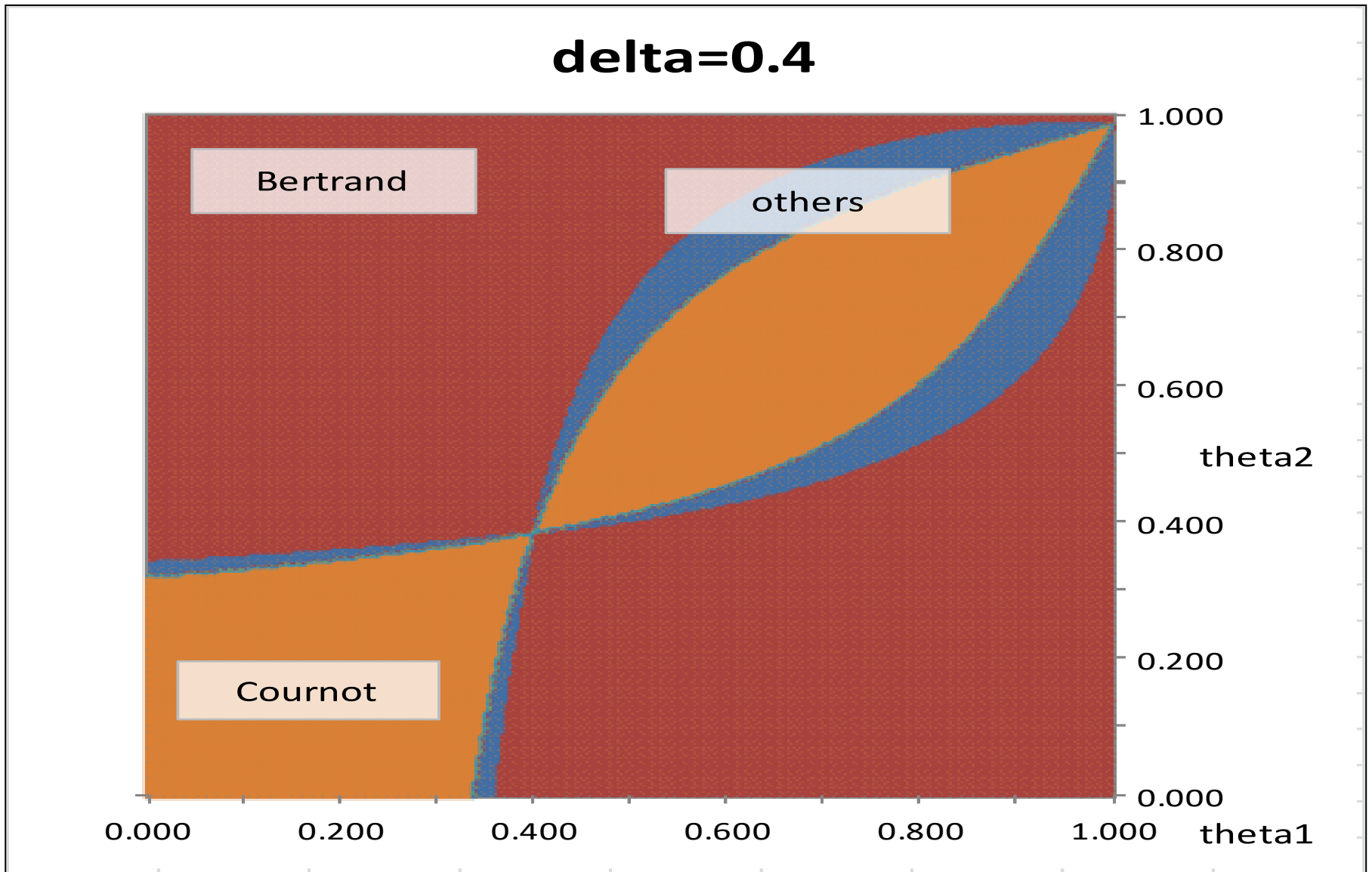
We assume that four fixed contract games, p-p (Bertrand), q-q (Cournot), p-q, and q-p games, have interior solutions.

# Results



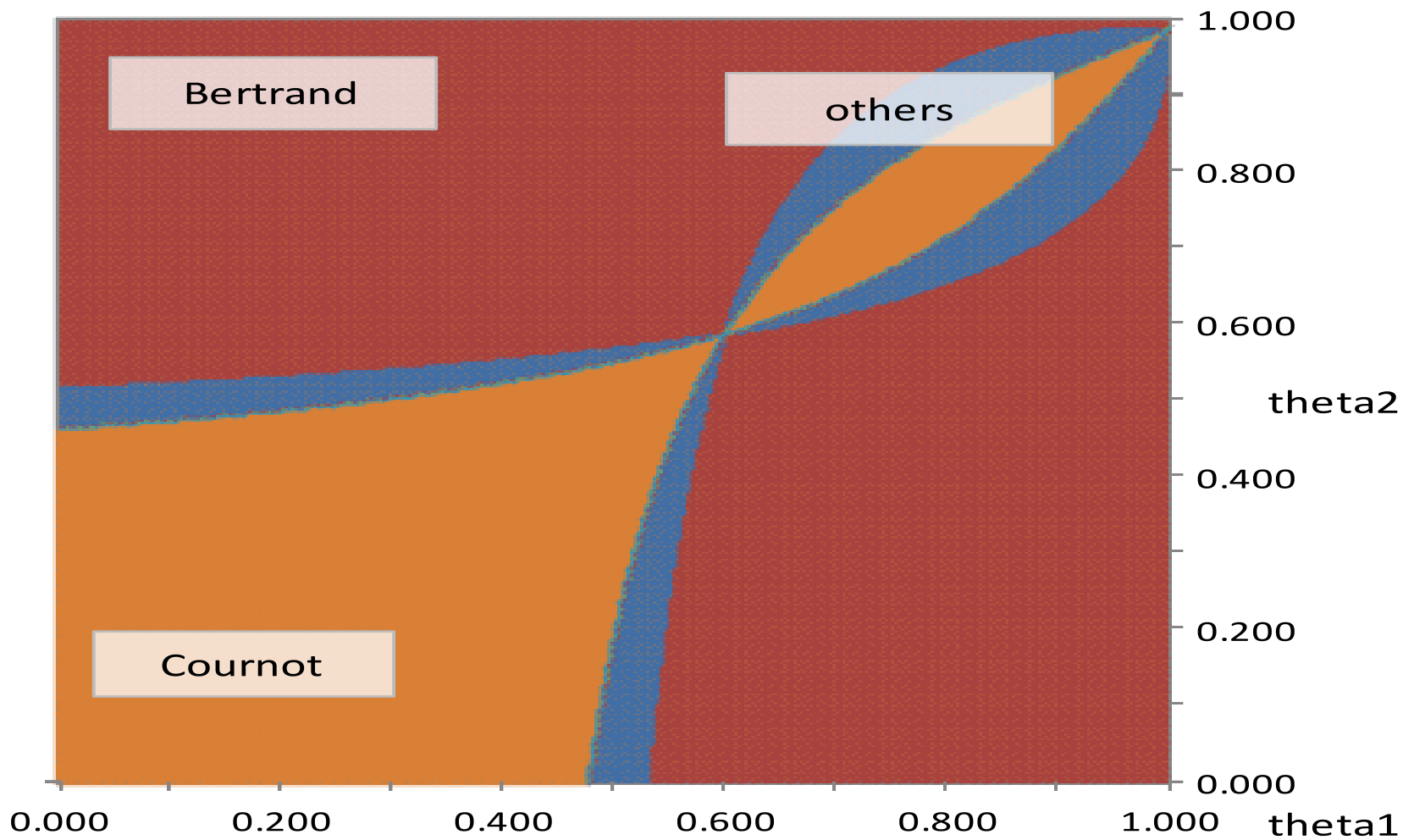
# Results

$\delta=0.4$



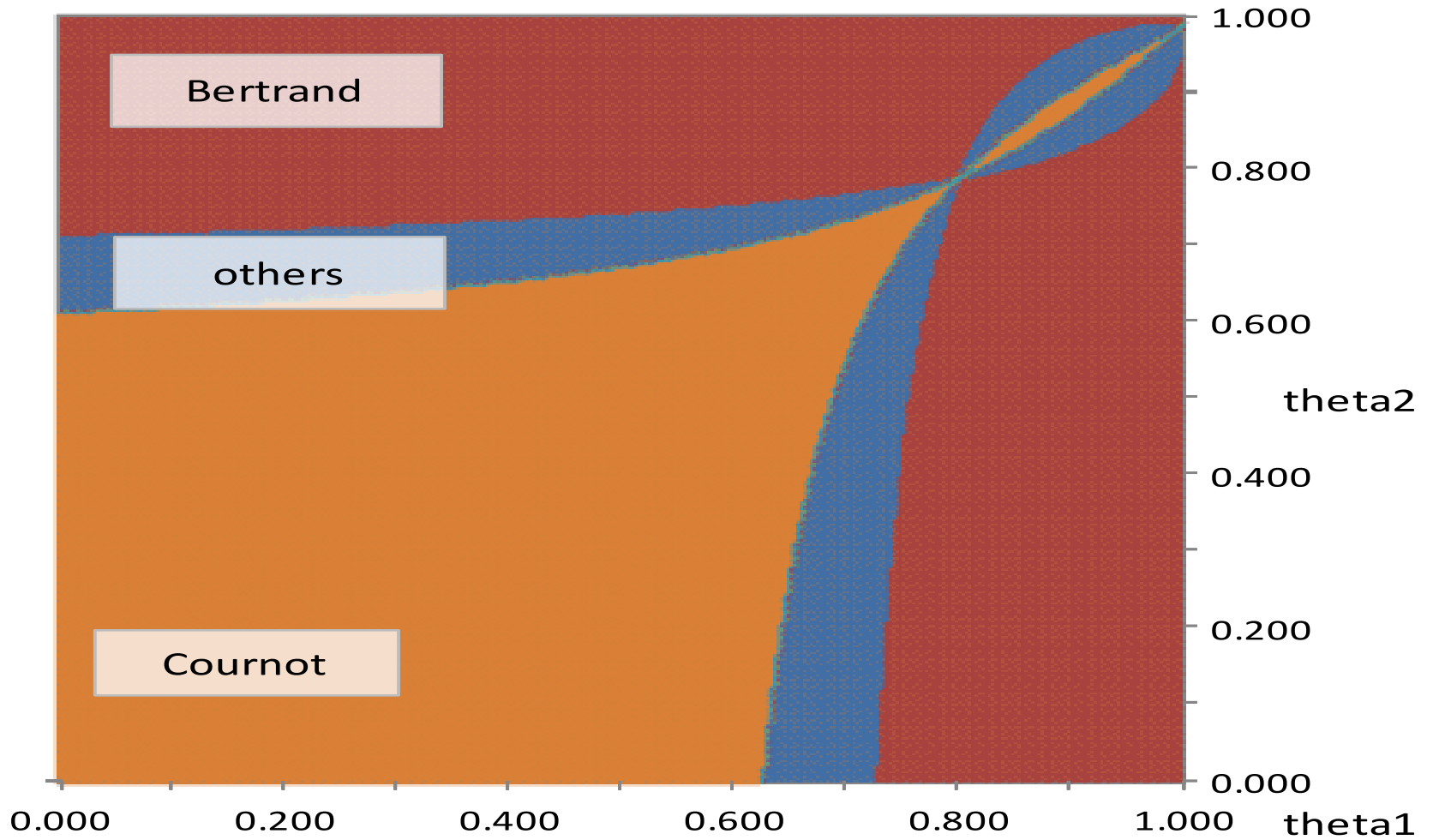
# Results

$\delta=0.6$



# Results

$\delta=0.8$



# Future Works

## Corporate Social Responsibility

Consumer welfare, environment, child labor free,...-  
concerning objectives must be more important than  
welfare-concerning objectives in the context of CSR.

We are going to try these problems.

My first and second works for this direction ~ ECSR ~

Today's talk

(all are joint works with Kosuke Hirose and Sang-Ho Lee)



# Environmental Corporate Social Responsibility as a Collusive Device

- Motivation: Why does firms adopt ECSR despite its high cost. The simplest answer is it is profitable. But why does it increase its profit?
- Some (but not all) empirical works have suggested that the financial performance of those firms believed to be highly concerned with ECSR is better.

# Two Stories of ECSR

(1) emission cap commitment

→ voluntary restriction of total emission

(2) emission intensity commitment

→ voluntary restriction of emission per output

# Environmental Corporate Social Responsibility as a Collusive Device

- Motivation: Why does firms adopt ECSR despite its high cost. The simplest answer is it is profitable. But why does it increase its profit?
- Some (but not all) empirical works have suggested that the financial performance of those firms believed to be highly concerned with ECSR is better.

# The Model ~ Quantity Competition

General Demand, General Cost, Symmetric Duopoly,  
Homogeneous Product Market.

Strategic Substitutes.

# The Model

$\pi_i = Pq_i - C(q_i) - K(x_i) \quad \sim \quad x_i$  is emission abatement  
 $P' < 0, C' > 0, C'' \geq 0, K(0) = K'(0) = 0, K' > 0, K'' > 0$

Emission =  $g(q_i) - x_i$   
 $g' > 0, g'' \geq 0$

Emission cap commitment  $\sim g(q_i) - x_i \leq T_i$

$T^B \sim$  business as usual emission

$\Rightarrow$  If  $T_i \leq T^B$ , emission commitment is not effective.

We call firm  $i$  adopt ECSR when the commitment is in fact effective in equilibrium.

# Time Line

- (1)  $T_i$  is determined. (Either individual firm or industry association)
- (2) The two firms face quantity competition.
- (3) Each firm chooses  $x_i$ .

The second and the third stage are interchangeable.  
(Analysis is different but the results are same)

# Individual Choice of ECER

Suppose that each firm  $i$  chooses  $T_i$  independently.  
Then no firm adopts ECSR. (Proposition 1)

Adopting ECSR increases the abatement costs (direct cost). It increases the marginal cost  $\Rightarrow$  an increase in the rival's output (indirect cost)

Both reduces the profit.  $\Rightarrow$  No firm adopts ECSR.

2019年度の寡占理論第7講(Multi-stage strategic commitment games)の戦略的代替のケースのstrategic cost-reducing investmentの話を出すとすぐに理解できる。

# Collective Choice of ECER

Suppose that the industry association chooses  $T_1 = T_2 = T$  to maximize the joint profit.

Then it adopts ECSR. (Proposition 2)

Adopting ECSR increases the abatement costs  
(direct cost)

It decreases the total output (indirect gain)

When  $T$  is close to  $T^*$ , a decrease in  $T$  always increases the joint profit (indirect gain dominates direct cost)  $\Rightarrow$  The industry association adopts ECSR.



# Discussion

- (1) Collective choice of output by industry associations is apparently against antitrust legislation. However, collective choice of ECSR is not.
- (2) Many Japanese associations, such as the Japan Association of Corporate Executives, Japan Business Federation, Japan Iron and Steel Federation, and Federation of Electric Power Companies of Japan, emphasize ECSR in their reports and on their websites, and encourage---and often force---member firms to adopt ECSR. This is also true in European countries.

# Welfare implication

ECER adopted by the industry association can be welfare reducing because it is harmful for consumer welfare and can be welfare-improving because it reduces emission.

# The Model ~ Price Competition

General Demand, General Cost, Symmetric Duopoly,  
Differentiated Product Market.  
Strategic Complements.

# The Model

$$\pi_i = P_i q_i - C(q_i) - K(x_i) \quad \sim \quad x_i \text{ is emission abatement}$$
$$\partial P_i / \partial q_i < 0, \quad \partial P_i / \partial q_j > 0, \quad C' > 0, \quad C'' \geq 0, \quad K(0) = K'(0) = 0, \quad K' > 0$$
$$K'' \geq 0$$

$$\text{Emission} = g(q_i) - x_i$$
$$g' > 0, \quad g'' \geq 0$$

$$\text{Emission cap commitment} \sim g(q_i) - x_i \leq T_i$$

$T^B$  ~ business as usual emission

$\Rightarrow$  If  $T_i \leq T^B$ , emission commitment is not effective.

We call firm  $i$  adopts ECSR when the commitment is in fact effective in equilibrium.

# Time Line

- (1)  $T_i$  is determined. (Either individual firm or industry association)
- (2) The two firms face price competition.
- (3) Each firm chooses  $x_i$ .

# Individual Choice of ECER

Suppose that each firm  $i$  chooses  $T_i$  independently.  
Then both firms adopt ECSR. (Proposition 3)

Adopting ECSR increases the abatement costs (direct cost). It increases the marginal cost  $\Rightarrow$  an increase in the rival's price (indirect cost).

When  $T$  is close to  $T^B$ , a decrease in  $T_i$  always increases firm  $i$ 's profit (indirect gain dominates direct cost)  $\Rightarrow$  Each firm voluntarily adopts ECSR.

2019年度の寡占理論第7講の戦略的補完ケースの話  
を思い出すと理解できる。

# Collective Choice of ECER

Suppose that the industry association chooses  $T_1 = T_2 = T$  to maximize the joint profit.

Then it adopts ECSR and  $T$  is smaller than that of the individual choice case. (Proposition 4)

The industry association has a stronger incentive to adopt ECSR.

# Emission Standard

$$\pi_i = Pq_i - C(q_i) - K(x_i) \quad \sim \quad x_i \text{ is emission abatement}$$
$$P' < 0, C' > 0, C'' \geq 0, K(0) = K'(0) = 0, K' > 0, K'' > 0$$

$$\text{Emission} = q_i - x_i$$

$$\text{Emission standard commitment} \sim (q_i - x_i) / q_i \leq t_i$$

$t^B$  ~ business as usual emission

$\Rightarrow$  If  $t_i \leq t^B$ , commitment is not effective.

We call firm  $i$  adopts ECSR when the commitment is in fact effective in equilibrium.



# Individual Choice of ECER

Suppose that each firm  $i$  chooses  $t_i$  independently.  
Then no firm adopts ECSR. (Proposition 5)

Adopting ECSR increases the abatement costs  
(direct cost)

It increases the marginal cost  $\Rightarrow$  an increase in the  
rival's output (indirect cost)

Both reduces the profit.

$\Rightarrow$  No firm adopts ECSR.

# Collective Choice of ECER

Suppose that the industry association chooses  $t_1 = t_2 = T$  to maximize the joint profit.

Then it may not adopt ECSR.

In the emission standard case, the cap of total emission is proportional to the output level

Upper bound of total emission is  $q_i t_i$ .

Therefore, the output-restricting effect is very weak  
 $\Rightarrow$  direct cost may dominate the indirect gain even when the industry association chooses ECSR.

This type of ECER less likely harms consumer welfare.

# Discussion

Usually, emission standard commitment is considered to be less efficient and effective than emission cap commitment because firms have smaller incentives for reduce its production. Therefore, many environment researchers and policy makers dislike this commitment or regulation. However, emission standard less likely harms consumer welfare and can be more efficient form the viewpoint of social welfare.

**Strategic Commitment through  
Adopting Environmental  
Corporate Social Responsibility  
Policies and First-Mover  
Advantage under Price Competition**

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## Title

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# Stackelberg

What happens if firms choose price sequentially?  
⇒ In the emission cap commitment case,  
only the follower adopts ECSR voluntarily.

# Second-Mover Advantage under Price Competition

In the literature of Industrial Organization, it is known that the first-mover (second-mover) has an advantage if strategies are strategic substitutes (complements). Thus, naturally the second-mover advantage appears under price competition.

# First-Mover Advantage under Price Competition

In our context, only the follower commits to higher price via ECSR, and it increases the profit and price of the leader and the latter increases the profit of the follower. ~ this may be interesting for IO researchers.  
→ **First-Mover Advantage under Price Competition**



**Thank you very much for your kind  
attention!!**

**非常感謝**