Lecture 11: The Design of Trading Platforms (Alos-Ferrer et al. 2010)

1. Introduction

Lecture 10: selection between exogenously given market institutions

now: emergence of new institutions

2 possibilities for the emergence of new institutions

Emergence of new trading platforms as unintended consequence of traders' behavior - market institutions as customs (lecture 12)

Deliberate introduction of new trading platforms by market designers

Market designers, who demand trading fees

Market designers take into account that traders learn which platform to use

Will deliberate design of market institutions plus competition between them lead to the introduction of market clearing institutions?

Related Literature on Two-sided Markets

Amstrong (2002), Caillaud and Jullien (2002), Rochet and Tirole (2003), Gabszewicz and Wauthy (2004), Rochet and Tirole (2004) etc.

Different research question

2. The Model

2.1. Design of market platforms

one homogenous good

two designers of trading platforms

choose simultaneously platform characteristics

revenue fees $f \in F$; F finite

bias $\beta \in B$; B finite; $1 \in B$

$\pi_{D,i} = f_i p_i Q_i$

set N_i of buyers, M_i of sellers choose platform i

$\Longrightarrow$ market clearing gross price $p_i^*(N_i, M_i, f_i)$

realized gross price $p_i(N_i, M_i, \beta_i, f_i) = \beta_i p_i^*(N_i, M_i, f_i)$

for $\beta_i \neq 1$: traders at long market side equally rationed

2.2. The Traders

After design of platforms, set of buyers, N, and of sellers, M, have to choose simultaneously a trading platform.

sellers: firms with identical *CRS*-technology with marginal costs c $\Longrightarrow$ supply correspondence

buyers: firms or consumers, buyer n endowed with continuous and monotone demand function $d_n(p)$. ${d^{-1}}_n(0) > c$.

2.3. Trading outcome at platform i

Inactive platform with N_i or $M_i = \varnothing$: no trade possible

Active platform: $N_i,\ M_i \neq \varnothing$

$$p_i(N_i, M_i, \beta_i, f_i) = \frac{\beta_i c}{1 - f_i}$$

$$q_{n,i}(N_i, M_i, \beta_i, f_i) = \begin{cases} d_n\left(\frac{\beta_i c}{1-f_i}\right) & \text{if } \beta_i \geq 1 \\ 0 & \text{else} \end{cases}$$

$$q_{m,i}(N_i, M_i, \beta_i, f_i) = \begin{cases} \frac{1}{|M_i|}\sum_{N_i} d_n\left(\frac{\beta_i c}{1-f_i}\right) & \text{if } \beta_i \geq 1 \\ 0 & \text{else} \end{cases}$$

2.4. Evaluation of the trading outcomes

sellers' profits

$$\pi_{m,i}(N_i, M_i, \beta_i, f_i) = \begin{cases} \frac{(\beta_i - 1)c}{|M_i|} \sum_{n \in N_i} d_n \left(\frac{\beta_i c}{1 - f_i} \right) & \text{if } \beta_i \geq 1,\ N_i, M_i \neq \varnothing \\ 0 & \text{else} \end{cases}$$

buyers payoffs

$\beta_i \geq 1$: buyers not rationed $\implies$ payoffs decrease in the price

$\beta_i < 1$: buyers cannot trade, worst possible outcome

$\implies$ one possible payoff function (among many)

$$\pi_{n,i}(N_i, M_i, \beta_i, f_i) = \begin{cases} \frac{1}{p_i} = \frac{1 - f_i}{\beta_i c} & \text{if } \beta_i \geq 1,\ N_i, M_i \neq \varnothing \\ 0 & \text{else} \end{cases}$$

3. The traders' platform choice

For given fees and biases of platforms: Full coordination of traders on any of the two platforms is a Nash-equilibrium

Learning

At the end of a period t, traders observe outcomes (prices, quantities, rationing) of all platforms active at t.

Random switching opportunity with same properties as in model of lecture 10

If a trader can switch platform, he changes platform whenever the outcome of other platform in the last period was better for traders of his market side

$\Longrightarrow$ states are given by a distribution of traders over platforms.

with probability ϵ experimentation, in which case platform chosen according to a prob. distribution with full support over platforms

$\Longrightarrow$ unique invariant distribution $\mu(\epsilon)$ over the states with full support

limit invariant distribution $\mu^* = \lim_{\epsilon \to 0} \mu(\epsilon)$

ER_i : long run expected average revenues generated on platform i.

$$ER_i = \sum_{\omega \in \Omega} \mu^*(\omega) p_i[N_i(\omega), M_i(\omega), \beta_i, f_i] Q_i[N_i(\omega), M_i(\omega), \beta_i, f_i]$$

Theorem: If $\beta_i > 1$ and $\beta_j = 1$, then it holds for any f_i, $f_j \in F$:
i) $\mu^*(\omega) = 1$, iff $N_i(\omega) = N$ and $M_i(\omega) = M$
ii) $ER_i = \frac{\beta_i c}{1-f_i} \sum_{n \in N} d_n \left(\frac{\beta_i c}{1-f_i} \right)$; $ER_j = 0$

If one platform is market-clearing, and the other is favorable for sellers, in the long run traders will fully coordinate on the biased platform.

4. The Platform Design

Profit of designer of platform i

$$\pi_{D,i} = f_i ER_i$$

4.1. Monopolistic designer

No competition between platforms, traders have to choose monopolistic platform.

Benchmark to assess impact of platform competition

Result: Monopolistic designer chooses unbiased $\beta = 1$

4.2. Competition between rational market designer

Simultaneous choice of platform characteristics (β_i, f_i) and (β_j, f_j).

Since F and B are finite: Nash - equilibrium exists, at least in in mixed strategies.

Theorem: For any Nash equilibrium of the market designers' game, $\beta_i^* > 1$ for (β_i^*, f_i^*) that is in the support of the equilibrium strategy of designer i.

"Competition forces the market designers to introduce non-market clearing platforms."

4.3. Robustness checks of the result

4.3.1. Competition between boundedly rational market designers

Designers are not rational, but learn the same way as traders

Theorem: The support of the limit invariant distribution of the co-learning process of designers and traders consists only of states where at least one platform i with $\beta_i > 1$ exists, and where all traders coordinate on such a non-market clearing platform.

4.3.2. Decreasing returns to scale

With decreasing resturns to scale production technology, limit invariant distribution of traders choice depends on exact specification of demand, of supply, of the random switching opportunity process, and of the experimentation process.

Specific example with decreasing returns to scale, where in equilibrium platforms with $\beta_i > 1$ are chosen.

5. Conclusions

If traders have to learn which platform to use, platform competition leads to the introduction of non-market clearing institutions.

Possible extensions

other learning models, e.g. best reply learning: particularly plausible for two players game of designers

multi-homing allowed