Less Is More with Forward Trading: Experimental Evidence

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Camp Resources XIX

Motivation

- Hedging is standard argument for existence of forward markets
- Is there a strategic impact of forward markets on market power?
- Two competing theories:
  1. forward trading increases competition (pro-competitive hypothesis): existence of forward stage poses prisoner's dilemma (Allaz and Vila, JET '93)
  2. forward trading softens competition (collusive hypothesis): defecting is never more profitable and sanctioning path is more costly (Liski and Montero, JET '06)

- Empirical studies on market power in electricity markets: Borenstein et al. EJ '99, Wolfram AER '99, Borenstein et al. AER '02, Borenstein et al. JIE '08

Experimental Design

- 3 treatments: duopoly (C2), two-stage duopoly (FS2), triopoly (C3)
- 144 subjects in 7 sessions (64 supergames)
- Use standard experimental technique to mimic infinitely repeated setting in the lab
- Demand is automated, producers have zero production cost
- Sellers choose sales quantity from a limited, discrete choice set that reflects five pure strategies
    - forward stage options: zero or two-stage game Cournot forward quantity (both support collusive equilibria)
    - spot stage options: zero, collusive, (subgame) Cournot, defecting, punishing quantity

Two-Stage Game: Timing of Events
Symmetric Duopoly with Single Forward Market

- Stage 1 (*Forward Contracting*):
  1. sellers simultaneously submit forward stage quantity bids $f_j, j = 1, 2$
  2. sellers observe forward market outcome

- Stage 2 (*Spot Market*): sellers compete over residual demand $(q - f)$
  1. sellers simultaneously submit spot stage quantity bids $s_j, j = 1, 2$
  2. sellers observe spot market outcome

- Demand is stage-indifferent and has perfect foresight
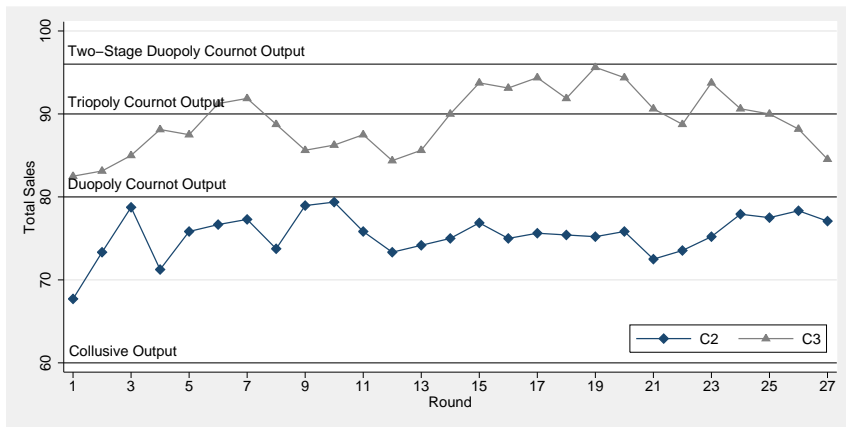 - forward-spot price parity

Experimental Results

Figure: Average Total Sales per Round by Treatment

Experimental Results

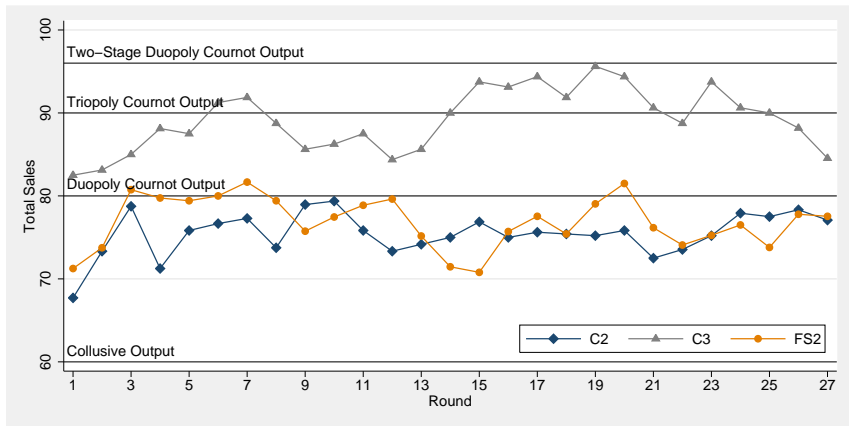A forward market does not increase market efficiency in infinitely repeated duopolies.

Figure: Average Total Sales per Round by Treatment

Experimental Results Cont.

In forward-spot duopolies, sellers are less likely to choose the defective strategy if they sold in the forward stage.

Table: Effect of Forward Stage Decisions on Chosen Spot Stage Strategy

	Zero		Cournot		Defect		Punish	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Constant	-3.00***		-0.33		-0.56		-3.20***	
	(0.55)		(0.46)		(0.44)		(0.60)	
Self Sell Forward	0.75	1.62%	0.02	3.21%	-1.40**	-15.70%	1.37**	7.46%
	(0.76)	(1.37%)	(0.57)	(10.13%)	(0.57)	(4.56%)	(0.67)	(3.57%)
Competitor Sells Forward	0.62	0.90%	-0.15	-9.35%	0.53	4.87%	1.97***	10.29%
	(0.70)	(1.12%)	(0.54)	(9.50%)	(0.52)	(3.83%)	(0.56)	(2.63%)
Self x Competitor	0.52	0.68%	0.56	14.04%	0.11	-0.79%	-1.75**	-5.98%
	(0.93)	(1.57%)	(0.81)	(15.27%)	(0.82)	(5.77%)	(0.86)	(1.70%)
Round	-6.82E-02**	-0.11%	-7.16E-03	0.03%	-3.05E-02	-0.28%	-1.34E-02	-0.02%
	(2.76E-02)	(0.04%)	(1.59E-02)	(0.33%)	(1.99E-02)	(0.19%)	(2.98E-02)	(0.12%)

Log-Likelihood $= -1,555.16$; Wald $\chi^2 = 193.13$; $N = 1,296$ (24 supergames)

Note: Control group is no forward sales. Base strategy is collude. Standard errors in paranthesis. Coefficient estimates for different strategies are shown across columns.

Findings

Result
In infinitely repeated duopolies, forward contracts do not act as additional competitors.

- We find evidence that forward contracts can facilitate collusion.

Result
Forward contracts soften competition in infinitely repeated duopoly markets.

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