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Classroom Competition Games: Learning Strategy

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A Priori Game Strategy Perspectives

- Cournot strategies yield a first mover advantage for market shares in homogenous competition, whereas Cournot strategies yield center differentiation with some degree of brand substitution in differentiated competition.

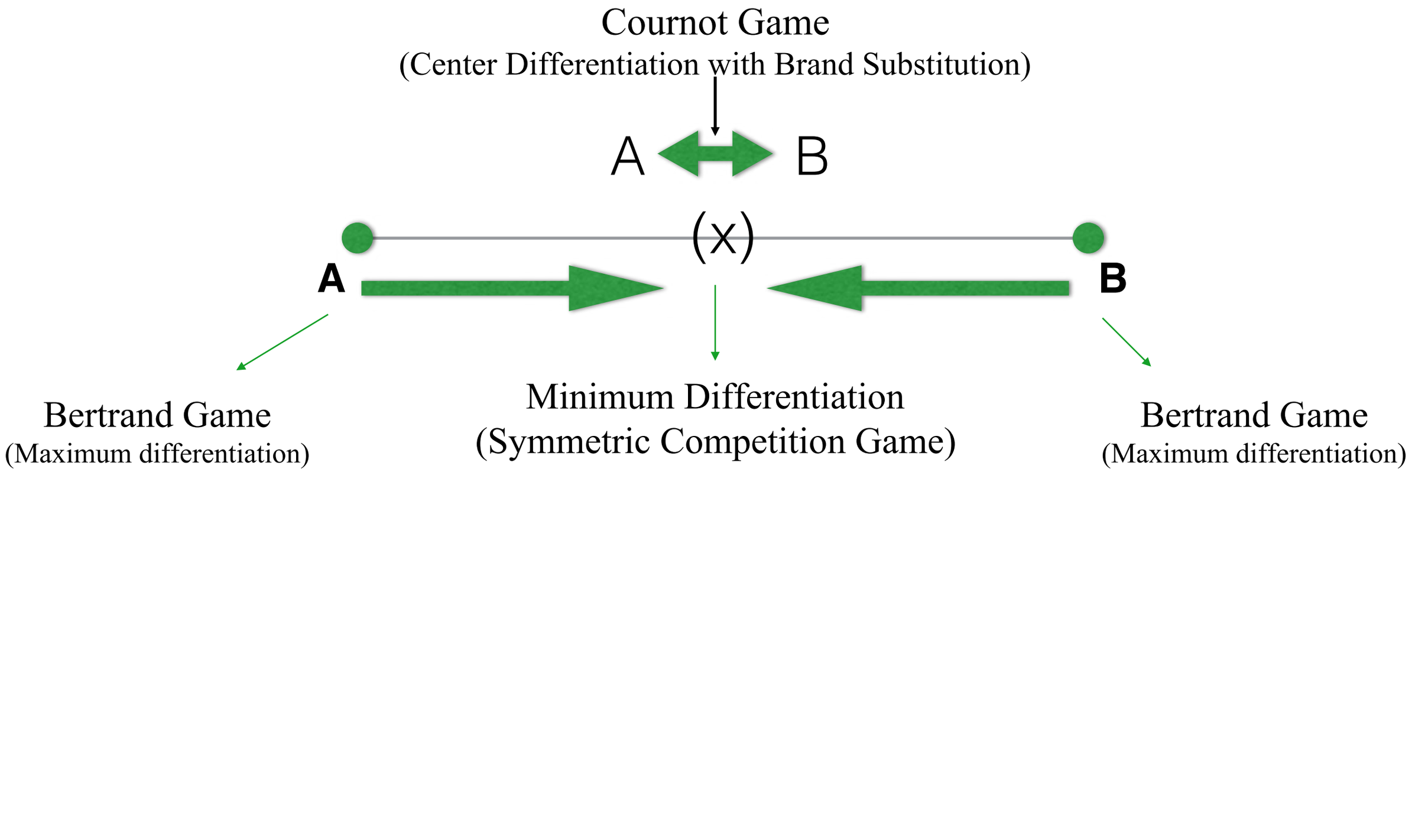
- Bertrand strategies yield a second mover advantage using price undercutting mechanism in homogenous competition, whereas Bertrand strategies yield maximum product differentiation with a price relaxation mechanism in differentiated competition.

- Information strategies yield outcomes which are based on rational expectations, rather than adaptive expectations.

- Imperfect strategies (strategies with trembling hand imperfection) yield outcomes associated with least costly errors.

- Strategies associated with higher risk imply higher expected returns, even if higher returns are not actually realized.

Competition Game Outcomes



GAME PLAY

- Each game is played in *N* repeated rounds (usually N=4).
- Within each round of each game, each firm must decide whether to stay in the market or to exit, with possibility of exit gain (asset liquidation in some games), followed by integer decisions on pricing; production quantity; with inventory carry-over to the next round(s); and possibility of discounts/promotions (max. at 50% of the price).
- Timing, asymmetric information, signaling, and negotiation are extensions to the core game. For example, some games have production timed before pricing, while others have price decisions before production.
- There exists *L* brand loyal customers, who are determined at a varying percentage of market demand. This percentage is increasing for non-exit firms as rounds are played for each game.
- Some games are played based on sealed bid auctions, in which case the price and exit decisions are the only determining strategy factors.
- Demand is 60 units (market), with a reservation price of $10/unit. Firm demand is $D=L + (60 – nL)$ where *n* is the number of firms (student groups).
- If the firm stays in the market, it incurs a fixed cost *F* of $300 per round, and a variable (marginal) cost of α = $2/unit depending on quantity choice, and the firm chooses an integer price at which to sell.
- Brand loyal customers have WTP up to the reservation price.
- The firm charging the lowest price gain the neutral customers (or split the market in case of a tie) only if there are enough inventories to sell, based on current and prior production *Q* decisions: $Inv(t) = Inv\ (t\text{-}1) + Qp\ (t) – Qs\ (t)$ with *p*=produced, *s*=sold.
- The winner is the firm still operating in the market having the highest cumulative profits or lowest cumulative losses at the end of each multi-round game.
- The winning firm gains a prize of $500 at the last round of each game, equivalent to a present worth valuation of operational sustainability and goodwill.

Competition Platforms

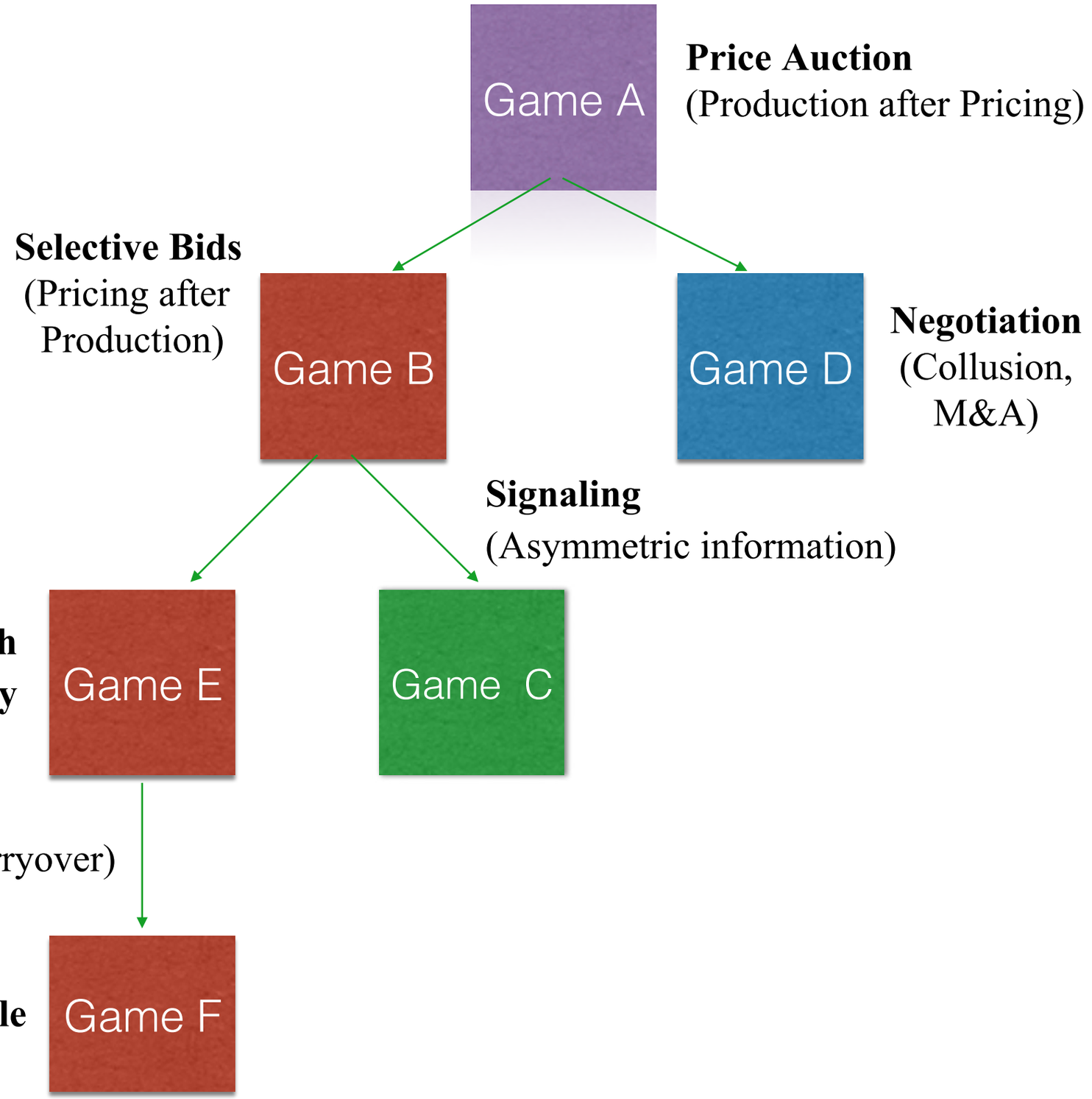
The market simulation games are based on different competition platforms based on competing firms (student groups), multi-choice variables (strategy decisions), and different sequences of competition (stages of each game).

GAME A: Auction Game
GAME B: Selective Bids Game
GAME C: Signaling Game
GAME D: Negotiation Game
GAME E: Retail Game
GAME F: Business Cycle Game

See *Table of Variables* in next slide for the Game Platforms.

Table of Variables

GAMES	**Pricing**	**Exit**	**Fixed Cost**	**Brand Loyalty**	**Quantity**	**Asymmetry (Signals)**	**Negotiation (M&A)**	**Variable Costs**	**Inventory Carry-Over**	***Loss Limit***	***Minimum Profit Requirement***
	$1 to $10	*Stay-Exit OR Stay-Exit-Gain*	*$300 per round (relaxed in amortized investment platform)*	*L (subset of 60), increasing with each round*	*D=60 OR D=L+(60-nL) n= no. of firms*	*Based on Prior Rounds*	*Varies*	*$2/unit V=2Q*	*Inv(t)= Inv(t-1) + Qp-Qs*	*Max. Value*	*Min. Value*
A Auction	*	*	*					*		YES	NO
B Selective Bids	*	*	*					*		YES	NO
C Signaling	*	*	*			*		*		YES	NO
D Negotiation	*	*	*				*	*		YES	NO
E Retail	*	*		*	*			*		NO	YES
F Business Cycle	*	*		*	*			*	*	NO	YES


Game A
Price Auction
(Production after Pricing)
Selective Bids
(Pricing after Production)
Game B
Game D
Negotiation
(Collusion, M&A)
Signaling
(Asymmetric information)
Retail with Brand Loyalty
Game E
Game C
(Inventory carryover)
Business Cycle
Game F

MAIN FINDINGS

Main Findings (1):
Bertrand vs. Cournot Strategies

① Equilibrium converges faster in Bertrand competition in comparison to Cournot.

② Cournot advantage is not always first-mover advantage. Actually, Cournot's advantage is persistently delayed to the second or third stage, and this delay is further ignited by brand loyalty and inventory carry-overs.

③Inventory carry-over effect is able to "switch" the traditional Bertrand price advantage towards Cournot-based advantage with time.

④Bertrand competition converges towards $P=MC=\alpha$ (price equals marginal cost) only under homogenous market games (no brand loyalty).

Note: (1) and (4) basically conform to economic theory, whereas (2) and (3) contrast with theory.

Main Findings (2): Information, Expectations, & Trembling-Hand Errors

① **Adaptive expectations are more persistent than rational expectations.**

② **Existence of trembling-hand imperfection towards more costly errors, rather than least costly errors, is persistently found in the market games.**

③ **Asymmetric information changes the order of play. For example the order of strategic thinking is (1,3,2) even when the sequence of play is (1,2,3).**

④ **Lower profits are persistently associated with higher uncertainty. In almost all games played, the finding of "higher risk implies lower returns" is persistent. This finding contrasts with "higher risk implies higher expected returns" hypothesis.**

⑤ **The ability to predict market information is more important than availability of current market information (in asymmetric information games).**

Note: (3) and (5) basically conform to economic theory, whereas (1), (2) and (4) contrast with theory.

Main Findings (3):
Utility and Behavior

① **Behavioral patterns most commonly observed are based on (1) regret theory, and (2) dynamic time inconsistency, followed by (3) winner's curse.**

② **Fixed costs are not sunk, and are perceived as marginal costs or quasi-fixed costs, even under the strategic decision of "Stay/Exit". The reasoning behind this behavior point towards an ego utility component for all the players, combined with a disutility component for past cumulative costs, if such costs are not rewarded.**

③ **Learning by doing effects are proven evident in all repeated games.**

④ **An adequate time lag with sub-optimal response to a change in opponent strategy is more beneficial than the optimal strategy itself. This finding is robust with no discounting.**

Note: (1) and (3) basically conform to economic theory, whereas (2) and (5) contrast with theory.

CONCLUSION

Learning strategy through classroom competition games has entailed a series of interesting findings, of which some conform and some contrast with theory on both neoclassical and behavioral schools of thought, as per the main findings in our paper.

However, beyond this paper, it is fundamentally important to mention that there is no single objective that encompasses all dimensions of market outcomes. Accordingly, single objective optimization models of utility and profit, such as in Bertrand or Cournot models of competition and their contemporary counterparts, are an incomplete picture of the nature of real-life competition.

We need to teach our students economic methods based on multi-objective techniques of optimization, and not just the incomplete reasoning of single objective functions and their outcomes.

Thank You