

Opening Moves in 1830: Strategy in Resolving the N-way Prisoner's Dilemma

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Abstract

By aggregating hundreds of games played of 1830: Railways and Robber Barons we analyze opening bids strategy of private companies, and compare this to heuristics held by prominent players.

1 Introduction

The game 1830: Railways and Robber Barons ("1830") is a strategy board game[1] which is entirely deterministic aside from initial player order. It has spawned an entire genre of "18XX" games, and has been the inspiration for the computer game Railroad Tycoon. 1830 is the most popular variant[2] by games played and popularity rank.

The first action of all players is to bid for private company assets of asymmetric value. The system for bidding entails a deterministic auction mechanic which can be directly analyzed. Objective guidance in these opening moves may reduce barriers for new players to enjoy the game.

2 Background

Players act as investors in train companies at the onset of the rail revolution in the eastern United States on a deterministic and asymmetric playing field. Players alternate between a round of buying and selling stock in rail stock companies, and then rounds where each stock company operates as dictated solely by its president: the majority shareholder who shares in its dividends and bankruptcy. These companies operate by placing rail on hex tiles onto an asymmetric hex map to connect stations, buying a scarce supply of trains, and then running these trains between stations to generate a profit which can be issued as a dividend to their shareholders so that they may invest in further companies. These themes are common among most variants in the 18XX genre, however generally have a different locale and map arrangement, unique list of historically accurately companies, and alternate set of rules regarding the structure of ownership of companies of varying degrees of complexity. The game ends when one player goes bankrupt or the bank runs out of money, and the winner is the player with the highest net worth.

Prior to these rounds, however, players go through a single opening round of bidding on minor private companies. Private companies represent small early railroads with nominally diminishing profits, and retain right-of-way land use claims for specific areas of the map, and are often sold to stock companies for advantage during middle game. These private companies ("Privates") are auctioned in a unique manner, and as this is deterministic, it becomes straightforward to analyze their bids as opening moves for patterns and heuristics.

Each player takes a buy-bid-turn until all private companies are sold. In this turn a player may (1) pass, (2) pay face value for the lowest face value private that has no bid, or (3) bid for any other private. Bids in this way must be at least \$5 higher than the next highest bid, and money is committed to that bid until it is sold, and is refunded if won by another player. If the private with the lowest face value has a bid on it, the buy-bid-turn sequence halts. Starting with the lowest player's bid and increasing, all

players with a bid on that private can either increase their bid to at least \$5 higher than the next highest bid or pass. When all players pass, the highest bidder wins the private.

3 Private Companies

1830 starts with six private companies of progressively increasing value. They each have their own unique abilities, however can also be sold to a stock company for up to twice their minimum bid which is a common strategy used as a way to loot the treasury by a company's president. For example, if a player owns CA, and is the president of PRR owns a majority of 60% of the stock but an opponent owns 40%, and PRR has \$500 in treasury, in operating round of PRR the president may sell CA to PRR for \$320, and then use that money to start another company which their opponent has no stake in.

Private Company	Abbr	Min. Bid	Revenue
Schuylkill Valley	SV	20	5
Champlain & St. Lawrence	CS	40	10
Delaware & Hudson	DH	70	15
Mohawk & Hudson	MH	110	20
Camden & Amboy	CA	160	25
Baltimore & Ohio	BO	220	30

3.1 Schuylkill Valley

SV cannot be bid up due to the structure of the bidding rules. Any player who wants it may purchase it for \$20, and doing so triggers auctions on any further companies.

If all players pass in turn and this private is not sold, this specific private's price decreases by \$5. This is rare, and occurred once[3] in the entire data set, and is responsible for its average sale price to be very slightly under \$20.

3.2 Champlain & St. Lawrence

Blocks construction in a non-critical area of the map, and has nominal value in looting treasury.

3.3 Delaware & Hudson

If sold to a stock company, allows the option of the stock company to relocate to a specific hex on the map.

3.4 Mohawk & Hudson

This company can be exchanged by the player for a share in the NYC stock company, which closes this company. This flexibility gives it a lot of value.

3.5 Camden & Amboy

The winner of this company is awarded a 10% share of the PRR stock company. This private is retained, which gives it more value than MH, as it can still be sold to loot a treasury.

3.6 Baltimore & Ohio

The winner of this company is made president of B&O, and made president of it. Current meta-game sees this company as having sub-optimal placement, making this private is less than desirable.

4 Traditional Wisdom

Mannien[4] has suggested the following values for each private, and notes that it is important to reserve a necessary \$402 to float a stock company, but this is less important when a share is granted from MH, CA, or BO.

Private	Value
SV	20
CS	45-50
DH	85-95
MH	135-155
CA	205-230
BO	220-230

Kantner[5] has suggested the following values for each private, and advises that selling a private to a stock company to loot its treasury is a primary winning strategy.

Private	3 players	4 players	5 players	6 players
SV	20	20	20	20
CS	45-50	40-45	40-45	40-45
DH	80-90	75-85	75-80	70-75
MH	115-135	115-135	115-130	110-120
CA	210-240	199-220	185-205	170-190
BO	220	220	220	220

5 Data Collection

Objective data collection of 1830 match results has historically been mired with anecdotal hunches and biologically trained mental models, however a modern implementation of the game has been created at <https://18xx.games>[6], and we have aggregated data from 135 4-player completed games. These distributions represent empirical results, among a wide range of strategy and play style.

6 Results

6.1 Empirical Winning Bids

Private	Average	Std. Dev	Median
SV	19.96	0.43	20
CS	46.66	5.31	45
DH	80.023	8.27	75
MH	122.87	12.44	120
CA	189.27	24.18	185
BO	222.14	3.07	220

These bids represent open play of 4 player games.

6.2 Distribution of Winning Bids

$\Delta Min.Bid$	SV	CS	DH	MH	CA	BO
-5	1					
0	134	28	9	6	46	88
+40		97	103	99	57	45
+45		27	54	57	30	6
+50		12	18	19	10	1
+55		11	13	13	9	
+60		1	6	4	17	
+65			7	5	32	
+70			1	9	13	
+75			2	6	13	
+80			1	4	11	
+85			1	2	13	
+90				2	8	
+95				1	9	
+100					3	
+105				1	4	
+110					3	
+115					4	
+120					2	
+125						
+130						
+135					1	
+140						
+145					1	
+150						
+155						
+160						
+165						
+170						
+175						
+180						
+185						
+190						
+195						
+200					1	

Bids have been bucketed into \$+5 increments for clarity.

7 Conclusion

Online league tournament play of 1830 has only recently begun, which should increase the data available in a few months. The authors hope to quantify player skill and correlate advanced play to bidding strategy and uncover new meta strategy. Additional findings from will be made available at <https://18xx.tools>.

References

- [1] Francis Tresham. *1830: Railways and Robber Barons*. Avalon Hill, 1986.
- [2] Boardgamegeek. <https://boardgamegeek.com/boardgamefamily/19/series-18xx/linkeditems/boardgamefamily?pageid=1sort=rank>. [Online; accessed 2021-03-26].
- [3] <https://18xx.games/game/31929>.
- [4] Crist-Jan Mannien. 1830 strategy guide. <http://www.18xx.net/1830/1830c.htm>, 1997. [Version 1.3; Online; accessed 2021-03-26].
- [5] Henning Kanter. 1830 advanced strategies and common mistakes. https://www.tckroleplaying.com/bg/1830/1830_adv_strategies_and_common_mistakes_by_Henning_Kanter, 03 – 26].
- [6] Toby Mau. <https://18xx.games>.