COMPETITIVENESS IN BRIDGE BIDDING AN HISTORICAL ANALYSIS

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ABSTRACT

In this article we analyse bridge records to study the competitive nature of bridge bidding and how this has changed over time. As dataset we use a collection of 19,000 records of deals played in Bermuda Bowl World Championships competitions from 1955-2013. The input data is in PBN format and is processed in several steps to be able to perform a content-based analysis of the auction and the hands involved. We view this work as a small first step towards a more empirical analysis of bridge bidding. All data and software of this study are publicly available through GitHub.

1. INTRODUCTION

Expert bridge players regularly discuss the fact that bridge bidding has changed over the years, for example that auctions have become much more competitive. This statement is almost certainly true, but there exists little to no empirical evidence to support this claim. The objective of this article is to analyse historical records of expert bridge bidding in order to provide such evidence. An example of a concrete question we would like to answer is: can we show that the frequency of opening a balanced hand with 11-12 HCP has increased? In order to answer such questions we need to analyse for each deal both the hands and the auction. As a consequence we require some limited form of reasoning on top of database querying. In this study we achieve this by manipulating the data in a Prolog database. As input data we use here a set of some 19,000 hand records played during Bermuda Bowl championships in te period 1955-2013.

Taking a wider perspective, we see this study as one possible step towards a more evidence-based approach to the theory of bridge bidding. Through channels such as Bridge Base Online (BBO)[1] more and more hand records become available for analysis. This provides us with data that can be used to analyse the effectiveness of particular bidding agreements. An example would be a comparison of the Multi opening and the natural Weak Two.

In the next section we discuss the overall approach. Section 3 describes the data and the data processing methods. In Section 4 we use the processed data to gather statistical information about four specific research questions related to the competitive nature of bridge bidding. Section 5 discusses the results and limitations of this study. We also reflect on posible future directions.

All data and software of this study can be found in a GitHub repository[2].

2. APPROACH

As input we use hand records encoded in the Portable Bridge Notation version 2.1 (Veugen and Backas, 2007). This plain-text notation is derived from a popular notation for chess (PGN) and adapted to bridge by members of the Internet newsgroup rec.games.bridge. Numerous people have published sets of hand records in PBN format. Another popular format is the LIN (.lin) format used by BBO. Converters between PBN and LIN exist.

[1] http://www.bridgebase.com
[2] https://github.com/guusschreiber/bidstat

Decade/Year	0	1	2	3	4	5	6	7	8	9	Total
50's						448		447		312	1,207
60's			576					256			832
70's				256	192	191		192		192	1,023
80's		192		352				350			894
90's		135				313		1,209			1,657
00's	702	297		1,470		1,968		1,526		3,109	9,247
10's		3,293		1,245							4,538
Total											19,223

Table 1: Hand records used in this study. Rows indicate decades; columns a particular year within a decade. Hand records with incomplete or erroneous hand or auction data have been left out.

Each hand record contains metadata about the event (e.g., time, place, tournament), the table (e.g., player names) and the deal (e.g., vulnerability, hands, auction, play). In this study we focus on data about hands and auction. We process the PBN data in four steps:

1. We first transform the PBN text with an information-preserving Perl parser into a set of Prolog clauses. We opt for Prolog because Prolog-style data manipulation is well suited for the type of reasoning we need to do with the data.
2. In the second step we derive for each deal facts about the hands and the auction, for example that the player in second position has an **unbalanced** hand with a **1-2-4-6** distribution and **8 HCP**, and has made a **jump overcall** at the **3 level**.
3. Subsequently, we create data tables that contain for every deal the year and one or more values for a particular bidding feature, such as whether a player has made a **preemptive bid**.
4. In the final step we process the data tables with statistical software (spreadsheets for simple operations, R for more complex statistical manipulations).

In the next section we discuss the data processing performed in step 2 in more detail.

3. DATA

In this study we analyse 19,223 hand records[3] from 24 Bermuda Bowls over a period of almost 60 years (see Table 1). The number of deals per tournament varies; recent tournaments typically have more records. We selected the Bermuda Bowl as dataset because it is the only tournament for which data is available over a long period of time.

From each record the following data is used in this study:

- year in which it was played
- the four hands (list with dealer first)
- vulnerability
- auction, including final contract and declarer

The data is represented in a computation-friendly way. For example, the auction is represented as a list of numbers. Here is one sample auction[4]:

```
[12,13,7,0,0,21,22,31,32,0,0,0]
```

[3]The PBN files contained 19,724 records; 501 records were put aside because no (correct) hand or auction information was available in the record.

[4]Auction on board 1 of the 1955 Bermuda Bowl between USA and Great Britain. NS: Mathe-Rosen; EW: Reese-Shapiro.

Decade	Balanced	Total	% Balanced
50-59	607	1,207	0.50
60-69	290	832	0.35
70-79	531	1,023	0.52
80-89	392	894	0.44
90-99	774	1,657	0.47
00-09	4,418	9,072	0.49
10-13	2,078	4,538	0.46
Total	9,090	19,223	

Table 2: Frequency of the dealer holding a balanced hand (4333, 4432 or 5332).

Each number encodes a bid: 12 stands for 1♢, 13 for 1♡, 21 for 2♣, etc. The numbers 0 and 7 encode a pass and a double, respectively[5].

For each record we derived three types of additional facts:

- hand features that can be established from the 13 cards of one player, e.g. high-card points (HCP), distribution, balanced/semi-balanced/unbalanced, 1/2/3-suited;
- features of a bid independent of the auction, e.g. major/minor, level;
- features of a bid dependent on the auction, e.g. opening, overcall (direct, "live"), jump (single/double/...).

These features form the basis for generating the data tables used for empirical analysis.

4. ANALYSIS

4.1 Preliminaries

As stated, our objective is to analyse whether competitive bidding style has changed over time. Before diving into this we need to consider whether the fact that in earlier days hands were not computer-dealt influences the dataset. We have not studied this feature in every detail, but Table 2 gives some indication. In this table we see the frequency of the dealer holding a balanced hand. The frequencies in the table suggest there is no strong effect of dealing by hand (or at least in the Bermuda Bowl shuffling was done well). In fact, if we aggregate the data in two subsets, "seventies and before" and "eighties and later", we see that both sets have the same frequency (0.47) of balanced hands. Nevertheless, when we formulate concrete research questions we will take care that, whenever possible, this factor is ruled out or minimized.

For this study we selected four concrete questions to get insight into the overall issue of competitiveness:

1. How frequent is a balanced hand with 11-12 HCP opened in first and second position?
2. In cases where the dealer holds a six-card suit with 0-9 HCP, is the hand opened and at what level?
3. How frequent are preemptive bids? Also, what is the relationship between suit length and level in preemptive bids?
4. Whats is the frequency of contested auctions (i.e. auctions in which both sides participate)?

The questions cover by no means the full spectrum of competitiveness, but will hopefully give us some insight into the issue.

[5]The bid codes are chosen in such a way that `code modulo 10` gives a unique denomination (suit 1-4; NT: 5; double: 7; redouble: 8), and `code div 10` gives the level.

Decade	Pass	Opening	Total	% Opened
50-59	105	66	171	0.39
60-69	44	44	88	0.50
70-79	74	80	154	0.52
80-89	47	61	108	0.56
90-99	60	133	193	0.69
00-09	340	803	1143	0.70
10-13	164	354	518	0.68
Total	834	1,541	2,375	

Table 3: Frequency op opening a balanced with 11-12 HCP in first or second position.

Decade	Pass		1 level		2 level		3 level		4 level		Total
	#	%	#	%	#	%	#	%	#	%	
50-59	89	0.86	2	0.02	10	0.10	3	0.03	0	0.00	104
60-69	57	0.84	2	0.03	5	0.07	4	0.06	0	0.00	68
70-79	69	0.86	0	0.00	8	0.10	3	0.04	0	0.00	80
80-89	32	0.64	6	0.12	8	0.16	4	0.08	0	0.00	50
90-99	76	0.69	4	0.04	19	0.17	11	0.10	0	0.00	110
00-09	452	0.62	35	0.05	196	0.27	37	0.05	4	0.01	724
10-13	194	0.58	14	0.04	87	0.26	37	0.11	4	0.01	336
Total	969		63		333		99		8		1,472

Table 4: Absolute and relative frequencies of dealer actions with a 6-card suit and less than 10 HCP. Data is aggregated per decade.

4.2 Opening a balanced hand with 11-12 HCP

We start off by tackling a topic which is accepted as common wisdom: nowadays balanced hands with 11 or 12 HCP are opened much more frequent in first and second hand. Table 3 shows the results. About 12.5% (2427) of the records fit the profile. Note that we only consider the second hand if the first hand does not fit the "11-12 balanced" profile; otherwise the action of the first hand would biase the outcome. The frequencies are aggregated per decade.

The percentages in the table suggest that a major change in style took place in the nineties, when the frequency of opening 11-12 balanced hands went up from "about half" to "about two-third". After the nineties no major change appears to have taken place. The results also suggest that there was a marked increase in frequency in the sixties.

4.3 Opening a hand with a 6-card and 0-9 HCP

For the second question we select hand records in which the dealer has some 6-card and less than 10 HCP. The reason we only look at the dealer position is because in other positions the variation of the previous bids could easily biase the results (or better: we lacked the time and energy to consider all the consequences of such a situation). If the hand was opened we record the level at which it was opened, which ranged from 1-4.

Table 4 lists the results, again aggregated per decade. About 7.5% (1472) of the records match the profile. Since the eighties there is a marked increase in the frequency with which these hands are opened. Unfortunately, the number of deals for the eighties is very low. On manual inspection most hands that were opened at the 1-level turn out to be non-standard cases from the 1987 Bermuda Bowl. It is therefore more useful to look at the openings at the higher levels.

Figure 1 shows the cumulative frequencies for opening these hands at the 2/3/4-level. Unlike the 11-12 balanced hands the frequency appears to keep rising after the initial increase. Also, the frequency with which such a hand is opened at the 3-level is increasing. If we check the data for the non-vulnerable situation[6] this trend is even more prominent. For example, in 2013 14 of these hands were opened at the 3-level, whereas only 6 at the 2-level.

[6]These data are not included in the paper; see the results/bb directory in the GitHub repository

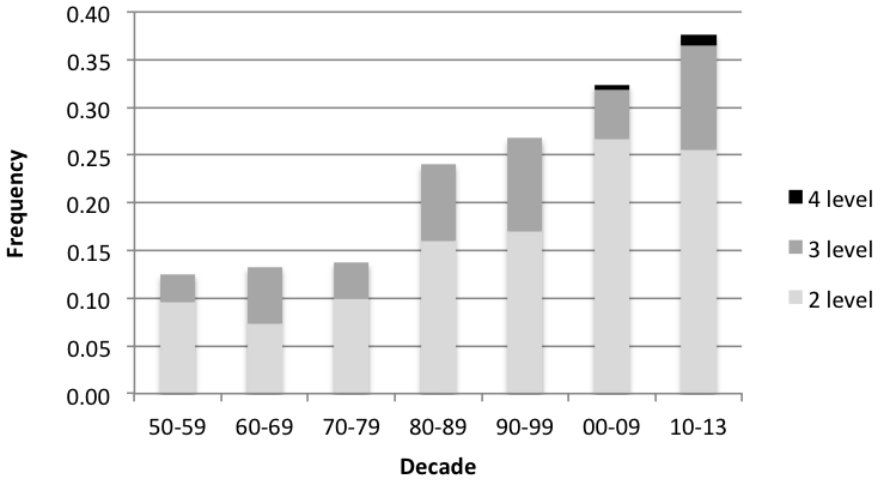

Figure 1: Cumulative frequencies of for a 2/3/4-level opening with a 6 card and less than 10 HCP. Data is aggregated per decade.

Decade	Preempt	Total	% Preempt	L (mean)
50-59	74	1,207	0.06	3.82
60-69	38	832	0.05	3.87
70-79	52	1,023	0.05	3.79
80-89	69	894	0.08	3.61
90-99	143	1,657	0.09	3.71
00-09	955	9,072	0.11	3.82
10-13	533	4,538	0.12	3.50
Total	1,864	19,223		

Table 5: Frequency of preempts, aggregated per decade. The last column lists the mean of the length of the longest suit minus the level at which the preempt is made (the L value).

4.4 Preempts

Our third question is related to the previous one, but is more generally aimed at the frequency and nature of preempts. Giving a precise definition of the notion of preempt is not trivial. In this study we consider a bid to be a preempt if it satisfies the following conditions: (1) it is a jump bid in a suit; (2) the bid is either an opening or an overcall[7]; (3) the bidder has less than 10 HCP; (4) the bid is made in the first round of bidding. This definition might be overly restrictive (for example, a weak jump bid after an original pass is not considered a preempt), but at least we know with high certainty that it is indeed a preemptive bid.

We also want to get information about the relationship between suit length and the level at which the preempt is made. To this end we compute for each preempt the L value, which we define as the length of the longest suit minus the level at which the bid is made. Thus, a low value of L indicates an aggressive preempt.

Table 5 shows the results for the Bermuda Bowl data set. The frequency of preempts appears to have increased constantly since the eighties. Over the course of six decades the frequency has roughly speaking doubled. It should be pointed out that this query might be biased somewhat due to the manual dealing of hands in older tournaments. However, the increase is much larger than could be explained by this bias (if there is such a bias at all, see Table 2),

It is difficult to draw conclusions from the mean L values. Given the earlier results we would expect a decrease, but in particular the data from the period 2000-2009 do not support this. We see a decrease in recent years, but more data is needed to verify that this is not an accidental result. We should also point out that the L value overestimates two-suited hands. For now we can only state that the length/level property of preempts needs to be studied in more depth in a follow-up study.

[7]Overcalls can be "direct" (2^{nd} position, after an opening) or "live" (4^{th} position, after an opening and a response)

4.5 Contested auction

Finally, we look at the frequency of contested auctions, i.e., auctions in which both sides participate. Defining what precisely a contested auction is requires some care. We like to exclude doubles of final contracts after some rounds of bidding. We decided to take only the first two rounds of bidding into account and consider it contested if both sides make some non-pass bid. This definition has some minor flaws; for example, it will count a lead-directing double of Stayman as a contested auction. Deals which are passed all round are considered "non applicable" (51 deals in this dataset).

Decade	Contested	Total	% Contested
50-59	561	1,194	0.47
60-69	363	831	0.44
70-79	523	1,016	0.51
80-89	490	887	0.55
90-99	825	1,650	0.50
00-09	4,783	9,063	0.53
10-13	2,240	4,531	0.49
Total	9,785	19,172	

Table 6: Frequency of contested auctions, aggregated per decade. Passed hands (51 in total) are left out.

Table 6 shows the results. We expected to see a marked increase, but this is not a completely obvious result if we look at the aggregated frequencies in the table. Given the fact that the number of hand records per tournament has a relatively high variation we decided to do an additional analysis, using a more stratified method. We partition the complete dataset into subsets of 200 records, ordered by year. For each subset we compute the average year and % of contested auctions.

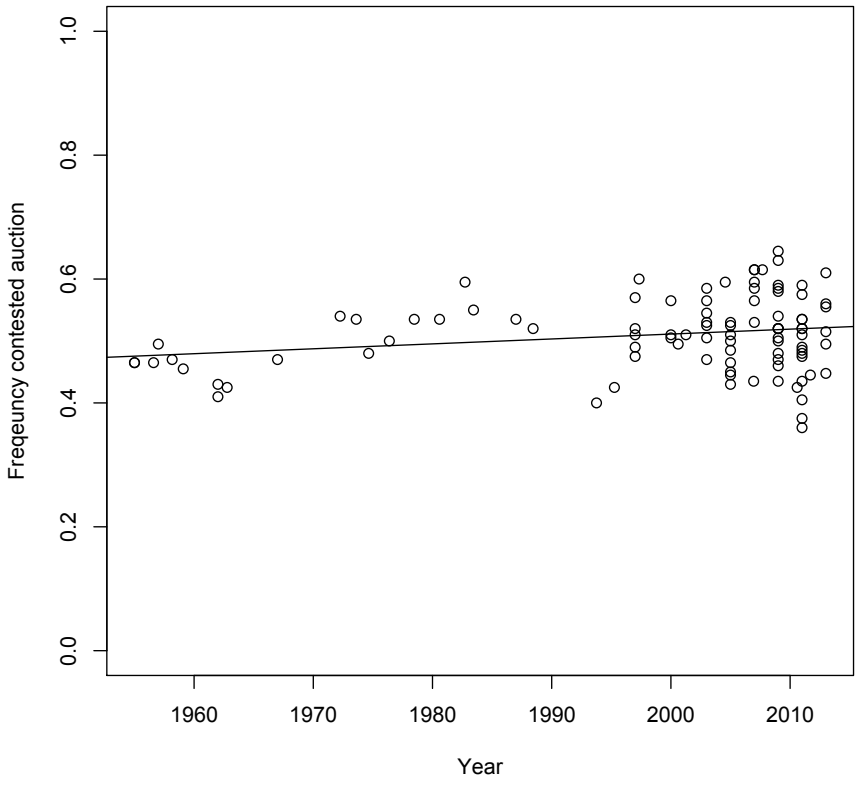

Figure 2: Scatterplot and regression line of the relation between year (X-axis) and frequency of a contested auction (Y-axis). Each circle stands for a set of 200 hand records. P-value of the linear model: 0.0324

Figure 2 shows the results of this second analysis in the form of a scatterplot with a regression line. Each circle represents one subset of 200 records. The linear model represented by the regression line shows a small increase of contested auctions over time. The model has p-value of 0.324, which suggests that the model falls within the 95% confidence interval. We conclude that the expected increase over time is not inconsistent with the data, but that the increase rate is not as large as one might have thought (from 47.5% to 52% in the period 1955-2013 according to the estimated model).

5. DISCUSSION

The results of this study basically confirm our intuitions. Some nuances are interesting though. The style of opening light balanced hands has not really changed since the nineties, whereas preemptive styles still seem to keep evolving. Also, we probably underestimate how competitive the auctions of our predecessors were.

From our perspective the main point of the paper is that *this type of study can be done* . In this analysis we have only used a fraction of the hand records available online. Services like BBO produce more data every week. We should take advantage of these data to work on a more evidence-based approach to the theory of bridge bidding. Let's put our bidding conventions to the test. To do this we would need to take into account the result of the board (information not used in this study). The author intends to study the effectiveness of the Multi 2♢ in a follow-up study. In general, we would like to make a plea for a community effort to share software and data in order to make large-scale empirical analysis possible.

This study has a number of limitations. Firstly, a significant number of hand records contains errors. We have tried to detect these records automatically, but it is almost certain that we missed out on some. This may have influenced the results, although it is unlikely it will have had a large effect. Secondly, due to the uneven distribution of hands over the time periods in the study the result have to be interpreted with some care, in particular those about subsets of hand records. Thirdly, the size of the Bermuda Bowl has grown over time, with more and more teams participating. This may have lowered the average level of expertise of the players involved and thus biased the results of this study.

Note for reviewers: this paper does not have a related work section. This is of course highly unusual; unfortunately the aiuthor is unaware of related work in the bridge area. The author would be extremely grateful for pointers.

Acknowledgements This study would not have been possible without the work of a dedicated group of enthousiasts, who have started collecting hand records and making these publicly available. In particular, the author gratefully acknowledges the support of Richard van Haaastrecht who provided through his website[8] the data for this study.

6. REFERENCES

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[8] http://www.bridgetoernooi.com/