

Article Review

Malueg, David A. and Andrew J. Yates (2010). "Testing Contest Theory: Evidence from Best-of-Three Tennis Matches." *Review of Economics and Statistics*, 92 (3), 689 – 692.

The Article's Research Question

The Malueg and Yates (hereafter, MY) article tests whether the predictions of the strategic model of contests hold in actual best-of- N contests, in their case, best-of-three professional tennis matches

Contest Theory

- Contest theory, as first formulated by Tullock (1980) and Rosen (1986), argues that a contestant's likelihood of winning a contest depends on a combination of ability and effort
- Given their abilities, each contestant selects an effort level to maximize the expected value of the contest's prize net of the cost of the effort level selected
- Contestants adjust their effort levels in predictable ways as the structure and prize of the contest varies
- For example, as each round of a best-of- N contest concludes, contestants weigh the costs and benefits of additional effort and strategically alter these efforts in the subsequent round if net incentives change
- The problem in testing the predictions of contest theory is to disentangle effort from ability. For example, if ability is ignored, incompletely modeled, or simply poorly measured, then incorrect inferences about the role of strategic effort may follow

The Research Question

- MY cleverly finesse this joint ability-effort problem: instead of controlling for ability differences, MY eliminate the problem by using betting odds to identify equally skilled contestants
- Having identified such contestants, MY can then focus on how contestants' efforts vary as incentives change in successive rounds of a best-of- N contest
- MY develop a simple best-of- N contest model with equal ability contestants and derive predictions from this model that they then test using data from best-of-three sets tennis matches between players on the Association of Tennis Professionals (ATP) tour

Prior Literature: Economics

MY briefly examine the economics literature testing best-of- N sports contests for the existence of strategic effects

The evidence from this literature on strategic effects is mixed:

- Two studies looking at individual behavior in best-of- N contests (golf and tennis) find evidence of such effects
- A study of playoff series in professional baseball, basketball and hockey, despite controlling for differing team abilities, finds no evidence of strategic effects

MY attribute these mixed results to issues concerning the proper measurement of contestant abilities, especially in team sports

Prior Literature: Psychology

There is also a considerable literature on psychological momentum (PM) in best-of- N contests

PM most simply put is the idea that ‘success breeds success’

So in the context of best-of- N contests, PM suggests that:

- The winner of the first-round has ‘momentum’ in the second-round and hence, is more likely to win that round (and, in a best-of-3 contest, the contest itself)
- If the contest goes to a third-round, PM switches to the winner of the second round

The results of empirical tests of PM are again mixed:

- There is some evidence that the first-round winner in several sports is more likely to win the second-round – but importantly, ability differences are routinely ignored or incompletely measured
- While some studies have also found PM in third-rounds (the winner of the second-round is more likely to win the third-round)
- Other studies have shown that neither contestant has momentum in the third-round after the first two are split (alternatively put, the second- and third-rounds results are independent)

What contribution is there for MY to address?

By accounting properly for ability differences, which theory – strategic momentum, psychological momentum, or simply independence of results across rounds – best explains round-by-round results in a real world best-of- N contest?

The Strategic Effects Model's Predictions

MY present a formal model of best-of- N contests when both players are of equal ability (often called the symmetry case in the contest literature).

The basic argument of their model is as follows:

- In the first-round, the equal ability players select identical efforts and thus are equally likely to win
- Differences in incentives appear in the second-round: the first-round winner faces a larger 'prize' for winning the second-round (s/he wins the overall contest) than does the first-round loser (who at best, can only restore the balance that prevailed at the start of the contest)
- Differences in incentives produce differences in effort: the first-round winner is likely to exert greater effort than does the first-round loser and as a result, the contest is more likely to end in two rounds than in three
- However, if the first-round loser wins the second-round, incentives to exert effort in the third-round are equalized so that the contestants are equally likely to win the third-round

Two testable predictions emerge from this model:

1. Best-of-three contests between equal ability contestants are more likely to end in two rather than three rounds
2. When best-of-three contests between equal ability contestants go to a third-round, both contestants are equally likely to win that round and hence, the contest

Note the contrast between the predictions of the three competing models in this best-of-three contest environment:

- The independent probability model predicts that half of the contests end in two rounds but if the contest goes to a third-round, both players are equally likely to win that final round
- The psychological momentum model predicts that the winner of the first-round is more likely to win the second-round (so more than half of the contests end in two rounds) but if the contest goes to a third-round, the winner of the second-round is more likely to win
- The strategic effects model in the symmetric player case (like the PM model) predicts that more than half the contest end in two rounds but if the contest goes to a third-round, it predicts that both players are equally likely to win (like the independent probability model)

Data

- To test these model predictions, MY use the results of best-of-three sets tennis matches played on the ATP tour in conjunction with the closing betting odds from Bet365, a leading European sports book
- There are between 60 - 70 tournaments on the ATP main tour each year with all but four of these (the Grand Slam tournaments) using a best-of-three sets format. As a result, there are somewhere between 2,500 and 3,000 best-of-three matches per year
- To conduct their empirical tests, MY need a way of controlling for player ability. The only prior paper on testing strategic effects in tennis (Leach, 2005) uses players' relative rankings to control for ability
- Although MY do directly explain or cite prior research on the use of betting odds to forecast tennis match outcomes, a number of studies have shown that these betting odds incorporate much more information on players' current abilities than do rankings and hence, are more accurate predictors of match outcomes than are these rankings
- Betting odds on these contests become available in the middle of 2002. Since the MY paper was submitted for publication in May, 2007, their sample of matches ends at the conclusion of the 2006 ATP season
- Out of the more than 14,000 best-of-three sets matches for the 2002 – 2006 sample period, MY find 351 matches where BET365's closing win odds are equal for both players
- These data are summarized in Table 1 and the model's two predictions are tested in Table 2

Table 1
Tennis Data: Summary of Equal-Odds Matches

The table shows the number of Association of Tennis Professionals (ATP) matches in the 2002-2006 period where Bet365 odds were the same for both players. Close-first-set matches are defined as matches where the first-set score is either 7 - 5 or 7 - 6.

	Full Sample (N = 351)	Close-First-Set Subsample (N = 100)
Number of Matches Ending in Two Sets	226	62
Number of Matches Ending in Three Sets	125	38
Number of Third Sets Won by Second Set Winner	63	22

Table 2
Hypothesis Tests to Discriminate among Competing Models

The table shows the proportion of Association of Tennis Professionals (ATP) matches ending in two sets and the proportion of third-set matches won by the winner of the second-set. The Z-statistics test the null hypothesis that these proportions equal 0.5 (p -values for the two-tailed test of these hypotheses are shown in parentheses).

	Full Sample	Close-First-Set Subsample
Probability Match Ends in Two Sets	0.644	0.620
Z-Statistic	5.396	2.400
(p -value)	(0.000)	(0.016)
Probability Win Set Three Given Won Set Two	0.504	0.579
Z-Statistic	0.089	0.973
(p -value)	(0.929)	(0.331)

Summary of Results & Conclusion

Second Set Results

- 64.4 percent of the 351 matches end in two rather than three sets (a Z-statistic of 5.396 and associated p -value of 0.000)
- That is, the null hypothesis that matches between equal ability players are equally likely to end in two sets as in three sets is rejected - significantly more than one-half of the contests between equal ability players are two-set matches
- This result is consistent with the strategic effects and psychological momentum models but not the independent probability model

Third Set Results

- There are 125 three set matches: 63 of these (50.4 percent) are won by the winner of the second set (a Z-statistic of .089 and associated p -value of 0.929)
- That is, the null hypothesis that player's probability of winning the third-set is 0.5 is not rejected
- This result is consistent with the strategic effects and independent probability models but not the psychological momentum model.

Robustness Check

- It is possible that players with equal betting odds have unobserved ability differences
- To eliminate (or at least diminish) this possibility, MY examine a 100 match subsample where the first-set scores are 'close' (defined as the set score being either 7 – 5, or 7 – 6)
- The results of the second- and third-set tests continue to hold for this subsample

Conclusions

- Although MY cannot measure player effort, their results suggest that equal ability players exert effort and thereby, produce outcomes that are consistent with the economic theory of contests
- The winner of the first set exerts more effort in the second set than does the loser and this effort differential results in more second-set (and match) wins for that player
- If the match goes to three sets, players exert equal efforts with the result that either player is equally likely to win the third set

Points to Note & Remember

1. The Article's Structure

The MY article is in the 'Notes' section of the *Review of Economics and Statistics* so the normal structure of a full length empirical economics/finance article is somewhat abbreviated

There are four sections to the MY paper: an introduction (which morphs into a literature review); a model plus hypotheses to be tested section; a results section which includes one robustness check; and a conclusion.

It is worthwhile considering what each section of a normal academic article in economics/finance (even in this abbreviated form) attempts to do.

Introduction

An introduction asks and answers, in a simple, non-technical manner, the following questions:

- What is the article's research question?
- What answers does the article find?

Frequently, the last paragraph of the introduction outlines how the rest of the paper is organized

Literature Review

A literature review (even if combined into an introduction as here) also has two essential ingredients:

- What do we already know?
- What 'contribution' will the article make to our knowledge?

Model Section

In a typical empirical article, this section:

- Develops a (formal or informal) model – usually based (wholly or in part) on the prior literature
- States the testable hypotheses resulting from this model

The Article's Structure continued

Data and Initial Results

This section's structure can vary considerably. Nevertheless, it usually contains:

- A clear description of the data used, definitions of variables, etc.
- A table of summary statistics (perhaps even a diagram or two)
- Table(s) of initial results accompanied by a careful explanation of what each table shows

Extensions and Robustness Checks

Either as a result of measurement and/or specification issues in the basic model or as a result of unexpected/unusual initial results, many papers have a section where:

- Tests are conducted on whether or not a different measurement of one or more variables or a respecification of the basic model changes the results (robustness checks)
- A brief exploration of issues raised by the initial results is undertaken

Discussion and Conclusion

At a minimum, this section

- Restates the research question – what this paper set out to do
- Restates the main results – what this paper finds

This section frequently also contains:

- A discussion of how the paper's results agree / conflict with the prior literature
- Provides suggestions about possible extensions of the paper

2. The Power of Simplicity

Simple Model

MY reduce the complexity of the typical contest model arising from the joint ability-effort problem by eliminating differences in contestant abilities

This simplicity allows MY to focus solely variations in strategic effort - how efforts may vary across successive rounds of a best-of- N contest as incentives change

Simple Testable Hypotheses

From this simple model, MY derive two testable hypotheses for best-of-three contests between contestants of equal ability:

- that the first-round winner is more likely to win the second-round than is the loser
- that if the contest goes to a third-round, both contestants have an equal chance of winning this round (and hence, the contest)

Simple Statistical Tests

The MY hypotheses are tested using the simplest of statistical tests – a Z-test of sample proportions

By sequentially testing the two hypotheses, the researcher can test the second- and third-set results against the predictions of the psychological momentum and independent probability models

- Rejection of the first hypothesis is compatible with the strategic effects and psychological momentum models but is inconsistent with the predictions of the independent probability model
- Failure to reject the second hypothesis is compatible with the strategic effects and independent probability models but inconsistent with the psychological momentum model

Only the strategic effect model survives both tests!

Such simplicity is extremely powerful!

3. Possible Extensions

There are several ways the MY paper could be extended. Here are two examples:

- **Allow for Differences in Ability**

If the researcher allowed ability to vary between the contestants, how quickly would MY's second- and third-set results start to change?

Suppose a researcher could:

- Demonstrate that betting odds, when converted into favorite win probabilities, are accurate predictors of the favorites' observed match win proportions
- Develop a standard contest success function (CSF) that examines how win likelihoods change as both effort varies with changing incentives over the course of a best-of-3 contest and as contestant abilities diverge

So armed, the researcher could then test second- and third-set results against expected match win probabilities contingent upon who (the favorite or underdog) won the prior set

- **Team Contests**

Many contests involve teams rather than individuals. Do the MY results hold in team contests? MY note that the economics literature finds that strategic effects appear to hold for contests involving individuals but do not appear to hold in team contests

So there is an open question here: do the team results stem from ability mismeasurement or from within-team incentives that are incompatible with incentive differences between teams?

Doubles matches (where there are two players on each side) are team contests. An obvious extension is to apply the MY methodology to a equal-odds doubles matches

4. Style and Other Organizational Issues

- **Journal Style**

Each academic journal has its own style: how sections are organized and labeled, how tables are presented, how references are written, and so on

Pick a particular journal style – I would recommend using the style of a leading journal such as the *Journal of Political Economy*, the *Southern Economic Journal*, or the *Journal of Finance* – and use it for the rest of Research Methods I and II

- **A Logical Sequence of Arguments**

An academic paper is a sequence of logical arguments

Once you have a clear idea of how you wish to organize the sections of your paper, focus on the sequencing of paragraphs within each section

Once you have the paragraph sequence, focus on the sequencing of the argument within each paragraph

Avoid both long, complicated paragraphs and sentences. Rather than make several points within a single sentence, just try to make one point

Reread each sentence to make sure it makes sense and is not ambiguous: rewrite it if not

Avoid colloquialisms, jargon, and contractions - you are writing a formal academic paper

While your paper is a formal academic exercise, avoid being wordy, obtuse, or trying to hide behind impenetrable, dense language. Clarity, simplicity, and conciseness are important!

Have someone else read your paper before you turn it in

- **Picky but Important Points**

Number your pages

Pick a verb tense – the easiest is to use the present tense – and use it throughout the paper

Tables must be numbered and given titles. Check your chosen style journal on how notes to tables are employed. When you turn in any written work with tables, put each table on a separate page and position these tables after your references

Within the text of your paper, refer to each table by its number (Table 1 provides summary statistics for all variables....)

If you have diagrams, treat them like tables – number, label, and provide notes for each diagram, put each diagram on a separate page, and position these after your tables

Within the text of your paper, refer to each diagram by its number (Diagram 1 shows the unconditional relationship between the dependent variable and)

Provide full references for all articles, book chapters, books, etc., cited in the paper (again using your chosen style journal). Do not include references to any work that is not cited in the paper

Place your references after the main text of the paper and before the tables and diagrams.

Check on how references (to articles, book chapters, etc.) are embedded within the text of articles in your chosen style journal and do the same in your papers

Use the spellchecker in Word (or whatever else you are using to write your paper). Misspellings anywhere in the paper, but especially in your title, do not create a good impression. Do the same for any presentations

We will send out detailed guidelines on the above points!

References

Malueg, David A. and Andrew J. Yates (2010). "Testing Contest Theory: Evidence from Bets-of-Three Tennis Matches." *Review of Economics and Statistics*, 92 (3), 689 – 692.

Leach, Andrew (2005). "Game, set, and match: identifying incentive response in a tournament." HEC Montreal, unpublished working paper.

Rosen, Sherwin (1986). "Prizes and Incentives in Elimination Tournaments." *American Economic Review*, 76 (3), 701-715.

Tullock, Gordon (1980). "Efficient Rent Seeking." In James Buchanan, Robert Tollison, and Gordon Tullock (Eds), Toward a Theory of the Rent-Seeking Society (College Station: Texas A&M University Press).