IMP (International Match Point) Bidding Strategies in Bridge

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Introduction

When International Matchpoint (IMP) scoring is used in team matches, which is typically the case in Swiss and knockout team matches, the bidding strategies employed should often deviate significantly from the bidding strategies used in pairs games that employ the more familiar matchpoint scoring. This analysis discusses strategies appropriate for IMP scoring and, where useful, explains why strategies appropriate for IMP scoring may differ from those appropriate when matchpoint scoring is used.

My professional experience has been in the world of finance, and I find the risk-return considerations in financial decisions and in bidding strategies in bridge to be based on similar considerations. Before I played in my first IMP-scored game, I sought help regarding appropriate strategies from members of my Louisville club about best bidding practices. The responses I received were consistent (and correct based on statistical analyses I later performed) regarding vulnerable games (**Be aggressive!**), and doubling part scores into game (**Don't!**). In other areas - slam bidding, part-score bidding, doubling game and slam bids, and more - the advice was less consistent, sometimes contradictory, or "Let me think about that!"

My review of articles and websites (see the bibliography at the end of this write-up) reveals a similar state of affairs. There are many sources that address bidding strategies for teams when using IMP scoring, but once you get past the two strategies from the previous paragraph (*Bid aggressively toward vulnerable games! Don't double opponents into game!*), there are often significant contradictions. For instance, one writer advises that "*If game has a 30% chance of making, bid it.*"[2] Other writers suggest bidding game only when there is a 50-50 or better chance of success.[3] Articles and websites sometimes dramatically disagree on grand slam bidding strategies, and the analysis of strategies regarding doubling that I have surveyed, other than the advice to be VERY reluctant to double part scores, is generally incomplete or not covered at all.

These and other ambiguities and contradictions I have observed from my review of the literature on bidding strategies when IMP scoring is used prompt this write-up.

If You Learn One Thing About Bidding When Using IMPs Scoring…

To show how the logic for determining appropriate strategies is formulated, let's start with what is probably the most important strategic situation in IMPs matches, bidding vulnerable games.[4]

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[1]Losey is (perhaps "was" by the time you read this) a professor of finance and avid games player. He is also "CardMan" from Louisville on the Black Jack card counting site Hitorsplit.com.

[2]See **http://www.coolumbridgeclub.com/docs/lesson32.pdf.**

[3] In **http://www.bridgeindia.com/IMP_Strategy_For_Swiss_Teams_by_Steven_Gaynor.pdf**, Gaynor suggests bidding a non-vulnerable game whenever the chances of making game are 50-50 or better.
He mirrors the majority opinion of sources I have surveyed (and is only slightly off target in his conclusions).

[4] Two reasons why strategies for bidding vulnerable games are especially important are that A) They are encountered frequently, and B) Using inferior strategies in bidding vulnerable games can significantly decrease your chances for success at IMPs scoring.

Advice from most sources I've reviewed are correct or at least in the ballpark regarding this situation. But my analysis of bidding strategies for vulnerable games goes into more detail (perhaps more than some readers will care for) in order to explain the logic of the decision whether or not to bid game under more complicated (and I would argue, more realistic) assumptions than are normally made. After the logic for bidding vulnerable games is explained, I "cut to the chase" and provide a table with guidelines for strategies in a variety of bidding/doubling situations. For those who wish to understand how these guidelines were formulated, a rather longish section explaining the logic for each table entry follows the tables. I present the tables first in deference to what I think is good advice from Tony Lipka, who read parts of an earlier draft of this write-up. Tony suspects that the explanations behind the table entries will be of significant interest to only a small number of readers, hence its relegation to a later section of this write-up. **For those of you who wish to cut to the chase and see the summary recommended strategies rather than first considering the logic behind the tables, go to the tables that start on page 6.**

The Logic for When to Bid Those Important Vulnerable Games Under IMP Scoring
Assume that you are **vulnerable** and your best estimate[5] is that you (and your counterparts on the opposing team playing the same hands at the other table) will make 3 NT half the time and will go down one trick half the time with the cards you hold. Assume further that no other game has a reasonable chance of success, and that making slam is unrealistic. In this situation, absent pre-emptive bidding by your opponents, you are faced with only two strategies worth considering: stopping short of game or bidding 3 NT.[6]

In analyzing this situation, let's first assume that the opponents with the same cards at the other table (the "counterparts") choose the bidding strategy we do **not** choose. The analysis that follows will typically be based on the assumption that both sides "play the hands" equally well, hence the difference in scores will solely be a function of the bidding strategy employed. In this case there are two possible scores (one associated with the "superior" strategy, and the second associated with the "inferior" strategy), each of which translates into a particular number of IMPs. This allows us to compare the results from each strategy.

Strategy *SM*[7] When we bid and make game our counterparts stop short of game, our 9 tricks are worth 600 points while their 9 trick are worth only 150 points. As scoring is determined by netting the difference between the two scores, this translates into 600 points – 150 points = 450 points. Using the International Match Point Scale, the 450 point difference in bridge scores equates to +10 IMPs for the side that bid game.

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[5] You may ask how bidders determine estimates of the probability of making game. To quote Zeke Jabbour "…you should quickly calculate the percentages on each hand before you bid a game. How? I'll tell you, I don't know." (From http://www.districtsix.org/Articles/Article%202010-06.aspx). Though explaining the process of estimating probabilities may seem to defy description, don't you suspect that Mr. Jabbour could tick off a long list of factors to consider? Don't we all follow guidelines imparted to us by bridge teachers, articles, and our own experience in making such estimates?

[6] There are other possible (illogical) strategies, including "always bid slam" and "never bid if you could go set." The former reminds me of my stepson's "shoot the moon" strategy at hearts, the latter of the players I see at the blackjack table who won't hit a sixteen because you usually go bust. It is rather easy to show that these "always bidding slam" and "never bidding if you could go set" strategies (and all other strategies) are inferior to the two choices explained herein, given the assumptions.

[7] Strategy **SM** is the "**S**uperior **M**akes" strategy (the superior strategy being to bid game), while Strategy **SS** is the "**S**uperior (goes) **S**et" strategy. Strategy **IM** is the **I**nferior **M**akes strategy and Strategy **IS** is the **I**nferior (goes) **S**et strategy.

Strategy SS) The second possible outcome is that we bid game we go down one (-100 points) while our counterparts (who stopped short of bidding game) make 8 tricks (120) points. Our net score translates into – 100 points – 120 points = – 220 points, which generates 6 IMPs for our opponents.

Thus, given the assumptions, when we bid game and our opponents stop short of game, we expect that on this board we will be either +10 IMPs or our opponents will be +6 IMPs. Given our assumption that there is a 50-50 chance that game will be made, it follows that our opponents are making a mistake if they always stop below 3 NT. They stand to lose 10 IMPs half the time and earn 6 IMPs half the time. If we follow a strategy of bidding only as far as 2 NT in this situation, we will also be making a mistake, as we now will always make exactly the same score that they do when they also bid only 2 NT, and we will score less on average on such hands than will bidders who bid game with these cards.

Expected Value – An Alternative Perspective That Generates the Same Conclusions

One formal way to analyze the advantage of various alternatives is to use the concept of "expected value," which is defined as the average value over a large number of trials (in this case over a large number of "hands played)." If we look at the effects on the expected value of IMPs for either bidding game or stopping short of game under the assumptions above, we find that we expect to make 10 IMPs half the time and lose 6 IMPs half the time. **Mathematically, the expected return is (10 IMPs x .5 + – 6 IMPs x .5) = (5 IMPs – 3 IMPs) = 2 IMPs.** Alternatively, if we follow the strategy of always bidding 2NT in this situation while our opponents bid 3NT, we lose 10 IMPs half the time and make 6 IMPs half the time, and expected return of -2 IMPs. If our goal in bidding is to maximize IMPs for each hand (it normally should be, though we should occasionally deviate from this goal) then we should bid game.[8]

Should we Bid Game if the Probability of Making a Vulnerable Game is 45%?...40%?...35%?

If the probability of making 3NT is 40% and the probability of making only 8 tricks in NT is 60%, then the calculations (see the previous paragraph discussing "expected value") become the following, where changes from the previous calculations are in bold-face type.

(10 IMPs x **.4** + – 6 IMPs x **.6**) = (**4** IMPs – **3.6** IMPs) = **.4** IMPs

The average number of IMPs we earn if the odds are 40-60 (rather than 50-50) are a positive .4 IMPs. Hence, we should bid game when we have a 40% chance of making 3 NT and a 60% chance of making only 8 tricks because on average we will come out ahead by 4/10ths of an IMP.

What is the Minimum Probability We Should Accept for Bidding 3 NT?

Using the logic from the two previous paragraphs, we can determine the minimum acceptable probability for bidding 3 NT when vulnerable and we expect to always take either nine or eight tricks. The

[8] Unless you are significantly behind or ahead of the field, your goal should normally be to maximize expected value/return by bidding to the level that generates the most IMPS over the long run. One obvious exception to this rule (and other examples can be constructed) would be when you are leading all teams in the field but your last-round opponents by a wide margin, and leading your opponents in the last round by 12 IMPS with one board left. In this case the ten IMPs that the opponents would gain if they made game with the N/S cards while you bid one trick short of game with the same cards would not jeopardize your lead, but if you judged incorrectly by bidding a game that got doubled and went down three, while your counterparts managed to make their 1 NT bid, this would cost you 890 points, which translates into 13 IMPs lost, thereby causing you to lose the match.

determination can be made by using a bit of algebra[9] (see footnote). But, there is a simpler way to determine the minimum probability that simply considers the two possible IMPs values that occur when the two alternative strategies generate positive scores. We garner 10 IMPs when we bid and make (exactly) game and our counterparts stop short of game. We garner 6 IMPs when game does not make after we bid 2 NT and our opponents bid game and are set one trick. Add these two IMPs values together to get (10 + 6) = 16 and then divide this sum by the IMPs earned when the "don't bid game" strategy works in our favor. This means we divide 6 IMPs by 16 IMPs values to obtain 6/16 = 3/8 = .375. This equals the breakeven probability when considering whether or not to bid game. This method can be used any time there are only two possible outcomes. A more complicated calculation is required when there are multiple possible outcomes (such as he following four potential outcomes: making the bid plus an overtrick, exactly making the bid, going down one, and going down two doubled).

Why the Real Breakeven Probability is Probably Greater Than .375 (Readers who want to cut to the chase may wish to skip the statistical analysis that follows and just read the conclusion to this section.)
If there are only two possible outcomes (Make 9 tricks or make 8 tricks at NT), then .375 is the precise breakeven number to use in deciding whether or not to bid 2 NT or 3 NT. If a more likely set of outcomes including the possibility of an overtrick and going set two tricks (see assumptions below) is as follows, then a new breakeven percentage emerges.

A More Complicated Set of Outcomes When The Probability of Making 3NT or More is 50% and We Bid 3 NT and Our Counterparts Stop at 1 NT

Outcomes When Game Makes and Opponents Bid 1NT	Probability	Our Score	Opponents' Score	Net Score	IMPs	Calculation of Expected IMPs
10 tricks made	10%	630	180	450	10	1 = .1 x 10
9 tricks made	40%	600	150	450	10	4 = .4 x 10
Outcomes When Game is Set and Opponents Bid 1NT	**Probability**	**Our Score**	**Opponents' Score**	**Net Score**	**IMPs**	**Calculation of Expected IMPs**
8 tricks made	40%	-100	120	-220	-6	-2.4
7 tricks made and **we are doubled** while counterparts make 1 NT	10%	-500	+90	-590	-11	-.9

[9] Students of finance, accounting, or economics will recognize the solution as a "break-even" problem. The percentage probability that should cause a bidder to be indifferent between bidding 2 or 3 NT is solved when on average, you will receive the same number of IMPs whichever bid you make. The word equation is:

Expected IMPs from bidding 3 NT = Expected IMPs from bidding 2 NT. The numerical equation is: (10 IMPs x X) = (6 IMPs x [1 – x]), where X = the breakeven percentage that should make us indifferent between bidding 2 NT or 3 NT. Solving this equation for X we get

$10X - 6(1 - X) = 0,$

$10X - 6 + 6X = 0$

$16X - 6 = 0$

$16X = 6.$ Solving for X we get X = 6/16 =3/8, or 37.5%, the breakeven probability in this case.

$X = 6/16 = 3/8 = .375.$

Other things equal, we should be indifferent between bidding 3 or 2 NT when the probability of making exactly 3NT is 3 chances in 8 (.375), and the probability of making exactly 8 tricks in NT is 5/8 = .625. At odds less than .375, DON'T bid 3 NT. At odds greater than .375, DO bid 3 NT. At odds of exactly .375 you might ask yourself whether or not you feel lucky.

Under this more complicated scenario, even though the probability of making game is the same 50% as under the previous simpler scenario, the advantage to bidding game decreases. The expected value in IMPs is now (+1 +4 -2.4 -.9) = +1.7. This compares with the +2 IMPS from the simpler scenario. The advantage to bidding game is less if the assumptions underlying this more complicated scenario are appropriate. See footnote[10] for the calculations that arrive at approximately 40% as the breakeven probability of making game that justifies bidding game under this more complicated scenario.

Conclusion Regarding the Breakeven Probability for Bidding Game Based On A More Complicated Scenario

The assumptions used in the case above are "made up" and are probably slightly more pessimistic than is warranted. The primary purpose of considering the more complicated scenario is to point out that the breakeven probability for bidding 3NT is greater than .375. Under the (slightly pessimistic?) assumptions used in this example the breakeven probability (see the footnote cited above) for bidding 3NT is almost .41. If these numbers are pessimistic then the actual number is somewhere between .375 and .41. Perhaps the nice round fraction of .40 should be used. **This suggests that we should be willing to bid a vulnerable game if we have four chances in ten of making game.**

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[10]Assume there are four possible outcomes. The sum of the probabilities of the four outcomes must add up to 1.0 (100%). Assume a 10% probability of making 10 tricks, a 10% probability of making 7 tricks (and that your opponents have doubled you when you bid game and make only 7 tricks), and an X% probability of exactly making game (9 tricks). The remaining outcome (making 8 tricks), must have a (.8 -X) probability of occurrence to if the probabilities add to 100%. The following analysis represents the calculations in solving for the breakeven probability of bidding game under this scenario.

The word equation for the breakeven condition that suggests whether or not to bid game in this situation is the following: *Expected IMPs when making 10 or 9 tricks = Expected IMPs when making 8 or 7 tricks.* Calculating the expected IMPs under these conditions generates the following numerical relationship:

(Prob of 10 tricks x IMPs from 10 tricks + Prob of 9 tricks x IMPS from 9 tricks) =

(Prob of 7 tricks (set two tricks in a doubled game) x IMPs from 7 tricks + Prob of 8 tricks (when game is set one trick) x IMPs for 8 tricks. The left hand side of the equation above represents the case when game makes exactly or games makes with one overtrick. The right hand side of the equation represents the case when game is set one trick undoubled, or two tricks doubled.

(.1 x 10 IMPs + X x 10 IMPs) = (.1 x 11 IMPs + [.8 – X] x 6 IMPs),

so (1 IMP + 10X IMPs) = (1.1 IMPs + 4.8 IMPs – 6X IMPs),

so (16X = 1.1 -1 +4.8),

so (X = 4.9/16) = .30625. Since X is the probability of making exactly nine tricks when bidding game, and we assume that there is also a .1 chance of making ten tricks (which also makes 10 IMPs), then the breakeven probability of bidding game is .30625 + .1 = .40625. Recall that in this scenario I assume a 10% chance of getting doubled and going down two. The assumed 10% probability of the frequency of being set two tricks while doubled in this situation is overstated (in my opinion, or perhaps it is offset to some degree by the possibility that a doubled game will be made occasionally). If I am correct, the breakeven probability of bidding game is somewhere between the .40625 probability using the calculations above and the .375 probability calculated assuming only two possible outcomes. Perhaps using something in between .40625 and .375 (.4?, or four chances in ten) as an approximate breakeven point is reasonable. If so, the conclusion should be: **BID A VULNERABLE GAME WHEN YOU EXPECT TO MAKE GAME AT LEAST FOUR OUT OF TEN TIMES**.

The Odds are No Different Whether We Consider a NT Game or a Major/Minor Suit Game
The examples to this point assume we are considering whether or not to bid a game in NT. But, because the scores in analyzing major and minor suit games translate into the same number of IMPs, the same advice applies. If the two possibilities are that you will either make game or go down one trick, bid game if vulnerable when you have a 37.5% (or greater) chance of making game. **Under more realistic assumptions that consider the possibility of making an overtrick and going down two tricks (and occasionally being doubled), a more reasonable guideline is to bid game when the probability of making game is 40% (four in ten).**

The Tables
Similar analyses to those presented above for other bidding situations are detailed later in this write-up, and they allow us to generate Tables A-D that follow. Likewise, Tables E-J present the threshold probabilities that justify doubling a contract under various scenarios.

Tables A-D below list threshold minimum probabilities for success (success being defined as making the bid in question) that justify bidding the specified contract (game, small slam, or grand slam). For instance, under normal playing conditions, if you estimate that there is a 40% or better chance of making a vulnerable game, you should bid game, even though you expect to be set 60% of the time in such cases (See Table A).[11]

Bidding Guideline Tables when using IMPS (by R L Losey)

Table A

Minimum Threshold Probabilities for Success that Justify Bidding Game

Contract	***Threshold Probability***
Non-vulnerable Game	48%
Vulnerable Game	40%[12]

Table B

Minimum Threshold Probabilities for Success that Justify Bidding a *Small Slam*

Contract	**Threshold Probability**
Major or NT (whether vulnerable or not)	53%
Minor (whether vulnerable or not)	50%

Table C

Minimum Threshold Probabilities that Justify Bidding a *Grand Slam* against Aggressive Bidders

Contract	**Threshold Probability**
Any Strain (whether vulnerable or not)	60%

[11] The threshold probabilities in these tables are most appropriate as guidelines on the first hand of an early match in either Swiss of Knockouts. A team playing the last hand of a match with a lead over all other teams that can only lose if it goes set several tricks should logically bid more conservatively than suggested by the tables. Similarly, a team intent on winning that is significantly behind going into the last hand(s) of the match should bid more aggressively than the guidelines suggest.

[12] As previously discussed, many other analyses place 37.5% in this cell rather than the 40% I post. 37.5% is correct if the only two possibilities are that game is made or game goes down one trick. When a more realistic scenario that allows for a wider range of possibilities (including being doubled and set more than one trick) is considered, the logical minimum threshold probability for bidding game is higher.

Table D

Minimum Threshold Probabilities that Justify Bidding a *Grand Slam* against Conservative bidders

Contract	Threshold Probability
Major or NT (whether vulnerable or not)	90%

Doubling Guideline Tables

Tables E-H below list threshold minimum acceptable probabilities for success (success being defined as setting the bid that is doubled). Readers must keep in mind that the act of doubling gives the opponents information that increases the chances they will find a way to limit their losses either by bidding again or by the play of the hand. The probability thresholds shown are AFTER consideration of the adjustments (in contract played or play of the hand) made by the opponents as a result of the double. For instance, if your opponents would always go down if they played the contract you doubled, but you are 100% sure that doubling will result in the opponents running to a superior contract, then the probability of success for your double is 0%.

Table E

Minimum Threshold Probabilities of a Set that Justify a Penalty Double at the One Level

Contract	Threshold Probability
Non-vulnerable at one level	50% Minor, 50-71% Major, 60-71% NT*
Vulnerable at one level	33% Minor, 33-60% Major, 43-60% NT

***The threshold probability for doubling minor suit contracts has only one value rather than a range of values because one of a minor cannot be redoubled into game. The minimum threshold for doubling 1 NT is higher because making 1 NT doubled generates more IMPs than one of a suit doubled.

Table F

Minimum Threshold Probabilities of a Set that Justify Doubling into *Game*

Contract	Threshold Probability
Major or NT (whether vulnerable or not)	80%
Minor (whether vulnerable or not)	79%

Table G

Minimum Threshold Probabilities that Justify Doubling a *Game Bid*

Contract	Threshold Probability
Minor or NT when **NOT** vulnerable	67%
Major when **NOT** vulnerable	71%
Minor or NT when **vulnerable**	57%
Major when **vulnerable**	63%

Table H

Minimum Threshold Probabilities that Justify Doubling a *Small Slam*

Contract	Threshold Probability
Major or NT when **NOT** vulnerable	72%
Minor when **NOT** vulnerable	68%
Major or NT when **Vulnerable**	67%
Minor when **Vulnerable**	62.5%

Table I
Minimum Threshold Probabilities that Justify Doubling a Non-Vulnerable *Grand Slam*

Contract	Threshold Probability
Minor Suit	71%
Major Suit	75%
No Trump	78%

Table J
Minimum Threshold Probabilities that Justify Doubling a Vulnerable *Grand Slam*

Contract	Threshold Probability
Minor Suit	62.5%
Major Suit	67%
No Trump	70%

Lead-Directing Doubles Represent a Special Case
The threshold probabilities for doubling a slam using a lead-directing double are much lower than the probabilities reported in Tables I and J above. We should use a lead directing double if there is approximately a 5% chance of a set if we know that a slam will make in the absence of a lead-directing double and our partners have not bid the slam, 30% when our partners have bid the slam. Thus the probabilities of success that justify **lead-directing doubles** are much lower than the percentages from the tables above. Not surprisingly, they assume that lead-directing doubles increase the chances of a set more often than they result in the opponents running to a superior contract.

More on the Mathematical Underpinnings of Teams Bidding Strategies

In the following sections I provide the logic that supports each case for which probabilities are given in the tables above (though not for the vulnerable game case that has already been explained).

Bidding Game when Not Vulnerable

Assume that you're **not vulnerable** and calculate that your cards will make game half the time and go down half the time and you're trying to decide whether to raise your partner to game. Should you bid game? (The example considers bidding 2 NT vs. 3 NT, though the IMP calculations are also the same when considering three of a major vs. game in a major, or four of a minor vs. game in a minor.)

Assume that you bid game (but your counterparts at the other table do not) when the odds of making are 50-50. Over a series of such deals you'll end up as follows:

A. When you score 9 tricks (400 points) your opponents score 150. 250 points = 6 IMPS for your team.
B. When you score 8 tricks (-50 points) your opponents score 120. -170 points = 5 IMPS for the opponents.

As previously discussed, one way to calculate the breakeven probability for bidding game is to divide the 5 IMPs received under scenario B above by the total (11) IMPs from A and B to obtain the breakeven probability. In this case the ratio of 5/11 = .4545 = 45.45%. Making allowance for the more realistic case in which we might make an overtrick or go down two doubled, this percentage should probably be increased to approximately .48. Thus a good rule of thumb when not vulnerable is to **Bid Game Anytime There is Almost a 50% Chance of Making Game.**

Bidding a Nonvulnerable Small Slam – NT and the Major Suits

The conversion of small slam scores to IMPs results in no difference in IMPs whether we consider NT or major suit slams. If you and your counterparts will be making 12 tricks when you bid slam and they stop in game, you net (either 990 – 490 or 980 – 480) = 500 points, which translate into 11 IMPS. When you bid game and make 11 tricks while your opponents go set 1 trick at a slam you will net (460 or 450) + 50 = 500 or 510 points, also worth 11 IMPS. Given these parameters, then the guideline should be to bid a small slam anytime your chances are 11/22 = .5 = 50%. In practice we should use a slightly higher cutoff to account for the possibility that we will occasionally go down two (or perhaps even more) tricks while being doubled. As is the case when bidding games, this consideration suggests that we should increase the threshold percentage by 2-3% so that **we should bid a nonvulnerable small slam when there is at least a 52-53% probability of making the small slam**.

Bidding a Nonvulnerable Small slam – Minor Suits

The conversion of minor suit small slam scores yields slightly different results relative to NT or major suit slam bids. If you and your counterparts will be making 12 tricks when you bid slam and they stop in game, you net (920 – 420) = 500 points (the nonvulnerable small slam bonus), which translate into 11 IMPS. When you bid and make 11 tricks while your opponents go set 1 trick at a slam you will net (400) + 50 = 450 points, which are worth 10 IMPS. Given these parameters, the guideline should be to bid a NV minor-suit small slam anytime your chances are 10/21 = .476 = 47.6%. However, we should use a slightly higher cutoff to account for the possibility that we will occasionally go down two (or perhaps even more) tricks while being doubled. **Thus a reasonable estimate of the threshold level for bidding a nonvulnerable small slam is 50%.**

Bidding a Vulnerable Small Slam – NT and Major Suits

If you and your counterparts will be making 12 tricks when you bid slam and they stop in game, your team will earn 750 additional points (the small slam bonus when vulnerable), which translate into 13 IMPS. When you bid game and make 11 tricks while your opponents go set 1 trick at a small slam you will net (660 or 650) + 100 = 760 or 750 points, worth 13 IMPS. Given these parameters, then the guideline should be to bid a vulnerable small slam anytime your chances are 13/26 = .50= 50%. As in the nonvulnerable case, the possibility that the bid will be set multiple tricks doubled suggests using a higher cutoff. This consideration suggests that bidders should increase the threshold percentage by approximately 2-3% so that **a vulnerable small slam should be bid when there is a 52-53% probability of making the small slam.**

Bidding a Vulnerable Small Slam in the Minor Suits

The advantage when the small slam makes is (again) the slam bonus of 750, worth 13 IMPs. However, when only 11 tricks are made in a minor suit the calculations are different from a NT or major-suit game. When you bid game and make 11 tricks while your opponents go set 1 trick when bidding a vulnerable minor-suit small slam you will net (600 + 100 = 700 points, worth 12 IMPS. Given these parameters, then the guideline should be to bid a vulnerable minor-suite small slam anytime your chances are 12/25 = .48= 48%. As in the nonvulnerable case, the possibility that the bid will be set multiple (two or more) tricks doubled suggests using a higher cutoff. Thus we should increase the threshold percentage by approximately 2-3% so that **the vulnerable small slam should be bid when there is a 50-51% probability of making a vulnerable minor-suit small slam**.

Bidding the Grand When Not Vulnerable: NT and the Majors

If you and your counterparts will be making 13 tricks when you bid a nonvulnerable grand slam and the counterparts stop in a small slam, you will gain 500 more points (earning the grand slam nonvulnerable bonus of 1000 while your opponents earn the small slam bonus of 500). Both teams will earn the same game/tricks score. 500 points translates into 11 IMPS. When you bid the grand and go down one while your opponents bid and make the small slam they will gain 50 points for the set plus either 990 or 980 points. In either case this translates into 14 IMPs. Given these parameters, then the guideline for bidding the nonvulnerable grand in NT or a major suit should be that you should bid the grand any time your chances are as good as 14/25 = 56%.

But, two factors argue for using a higher cutoff than suggested by the pure mathematical calculations . One is the likelihood that, as previously discussed, the bidder will occasionally go down two (or perhaps even more) tricks while being doubled. If this were the only factor to consider, we should increase the threshold percentage by approximately 2-3% so that we should bid a grand slam when there is at least a 58-59% probability of making the grand slam.

However, there is a second very important consideration that should cause bidders to consider modifying this guideline. If the counterparts are likely to stop at game this should cause us to significantly raise the threshold probability required for bidding a grand slam. The calculations for this rather complicated state of affairs are presented after the following section.

Bidding the Minor Suit Grand When Not Vulnerable

If you and your counterparts will be making 13 tricks when you bid a grand slam in a minor suit and they stop in a small slam, you will gain 500 more points (the difference between the grand slam and the small slam bonus). This difference is worth 11 IMPS. When you bid the grand and go down one while your opponents bid and make the small slam they will gain 50 + 920 = 970 points. This is worth 14 IMPs. Because the difference in the IMPs for the two strategies are the same for whatever strain in which the grand is bid when not vulnerable, the strategies for any type of nonvulnerable grand slam are the same.

Bidding the Grand When Vulnerable: NT and Major Suits

If you and your counterparts will be making 13 tricks when you bid a **vulnerable** grand slam and the counterparts stop in a small slam, you will gain 750 more points (earning the grand slam vulnerable bonus of 1500 while your opponents earn the small slam bonus of 750. Both teams will earn the same game score and bonus. 750 points translates into 13IMPS.

When you bid the grand and go down one while your opponents bid and make the small slam they will net 100 points for the set plus either 1240 or 1230 points. In either case this translates into 16 IMPs. Given these parameters, then the guideline for bidding the nonvulnerable grand in NT or a major suit should be that you should bid the grand any time your chances are as good as 16/29 = 55.17%. As previously discussed, two factors suggest using a higher cutoff. One is the likelihood that, the bidder will occasionally go down two (or perhaps even more) tricks while being doubled. If this were the only factor to consider, the logical threshold percentage should be approximately 2-3% higher, so that we should bid a vulnerable grand slam only when there is at least a 57-58% probability of making the bid.

The second consideration that affects desirability of bidding the vulnerable grand is discussed below.

The "Second Factor" That Should Be Considered Before Bidding the Grand: What if Our (Timid) Counterparts Will Stop at Game and 12 Tricks is the Minimum that Will be Made: The Nonvulnerable Case?

In this case when we make the grand we will score 1000 points more than the opponents, garnering 14 IMPs. When we are set one trick after bidding the grand they will make twelve tricks and receive the game score. Their score will be +50 (for our being set 1 trick) + 480 (major suit) or 490 (NT) = a net plus to our opponents of 530 or 540 points, both of which are worth11 IMPs. Bidding and making the grand relative to going set one trick generates either +14 IMPs or -11 IMPs . Thus, if our choices are to either bid the grand or bid game we should bid the grand anytime that we have an 11/25 = 44% chance of making the grand. But, **please ignore this percentage**. It is irrelevant because we have a third choice (bid a small rather than a grand slam) that is a preferred strategy.

Why Should We Consider Bidding Only as Far as the Small Slam Even Though the Grand is Likely to Make and We Always Make at Least 12 Tricks? **(Again Assume We Are Not Vulnerable)**
When we bid the small slam and our counterparts only bid game we do not ever go set and always best out opponents' scores by the small slam bonus. 500 points translates into 11 IMPs, which we will net 100% of the time since our opponents only bid game. The upshot is that if our opponents will not bid even a small slam when the small slam is a sure thing, then this should decrease our willingness to bid past the sure small slam for the iffy grand. The calculations are as follows.

Bidding the Small Slam makes 11 IMPs 100% of the time
Bidding the Grand makes 14 IMPs X% of the time (when the grand makes)
Bidding the Grand loses 11 IMPs (1 – X)% of the time (when 12 tricks are made)

The breakeven probability that the grand will make is the percentage rate that we expect will give us the same long-run average number of IMPs whether we bid the grand or bid only the small slam. Said another way, it only makes sense to bid the grand if we will average making IMPs equal to the "sure thing 11 IMPs" that the small slam bid makes under these circumstances (remember that this section assumes that the counterparts always bid game and do not ever bid slam). So we have Equation GSNV, which defines the threshold probability for bidding the nonvulnerable grand when we know our opponents will only bid game. In words the formula is:

The "Sure-Thing" IMPs Score for Making a NV Small Slam = The Average Score for Bidding a Grand.

The left side of the equation equals 100% (probability of making the small slam or more) x IMPs score for a small slam.
The right side of the equation is the weighted average of IMPs that equals the left side of the equation when we bid a slam at the breakeven point (threshold level that makes it equally advantageous on average to bid or not bid the grand).

11 IMPs (The "Sure-Thing" Score for Making a Small Slam= (X x 14 IMPs +[1 - X] x -11 IMPs), or
$11 = 14X – 11 +11X$, or
$25X = 22$, or
$X = 22/25 = 88\%$

Conclusion: **If your counterparts will only bid game** when you bid a nonvulnerable grand, you should bid the grand only if there is an 88% chance the grand will make.
If we factor in the likelihood that we will occasionally get doubled and go down multiple tricks, we should increase the required probability to over 90%.

What About the Vulnerable Grand Case?

If we are vulnerable, making the grand yields a margin over our opponents of 1500 points, worth **17 IMPS**, while going set one trick generates 780 or 790 points for our opponents, worth **13 IMPs**. When we bid the small slam and they only bid game we do not ever go set and always best out opponents scores by the small slam bonus of 750. This translates to **13 IMPs.** We solve Equation GSV to determine the threshold probability.

13 IMPs = (X x 17 IMPs +[1 - X] x -13 IMPs), or   Equation GSV

13 = 17X -13 + 13X, or

30X = 26, or

X = 26/30 = 86.67%. The minimum vulnerable grand slam threshold suggesting that we bid the grand rather than the small slam under these assumptions is only a bit more than 1% lower than the 88% threshold when not vulnerable.

Should We Use the 60% Threshold Assuming Our Counterparts Will Bid a Slam or the 90% Threshold Assuming They Will Only Bid Game?

This is the sort of question that John Nash, the father of game theory (whom Russell Crowe played in "A Beautiful Mind") dealt with on a regular basis. Perhaps Dr. Nash could give you a definitive answer (more likely a set of answers based on differing assumptions). I can only give you the following guidelines.

1) If your best guess is that there is a 90% or better chance of making the grand, then bid it.

2) If there is less than a 60% chance of making the grand, always bid only a small slam.

When the chances are between 60% and 90% that the grand will make, require that your threshold probability of making the grand be closer to 60% than 90% **if**

A) You are playing against aggressive bidders.

B) You are playing against players that are less likely to make mistakes than your team.

C) Your score is such that making the grand will help you more than going set and scoring badly will hurt you.

Require that the probability of making the grand be closer to 90% when

D) You are playing against timid bidders.

E) You are playing against players that are more likely to make mistakes than your team.

F) Your score is such that going set would hurt you more than making a grand would help you. If you are ahead by enough that making a small slam when they make a grand will mean you will come in first in your bracket, perhaps you should require a 100% probability of making the grand before you bid it.

On Doubling

It would be nice when we make a penalty double if we could make a **"Martha and the Vandellas Nowhere to Run, Nowhere to Hide" double** which does not allow the opponents to bid again. Why do I bring up Martha and the V's? I do love Motown music, but more importantly, I need to make the point that the act of doubling conveys information that can alter the odds that your opponents will make their bid. The team that is doubled may use the information conveyed by the double to find a way to limit their losses either by bidding again or by the play of the hand.

There is no general rule to determine how much effect that doubling will have in altering the chances a contract will be played differently or played at all. What this means is that the calculations reported in this write-up can only be viewed as estimates that apply only if doubling conveys no information. Bidders considering making a double must not only consider the estimates of threshold probabilities for the success of the double, but must also try to estimate how much the threshold probabilities will change because the double is made. For instance, if you are sure that your double will result in the opponents finding a way to turn a sure set into a made bid, then that double should be made 0% of the time.

Doubling One-level Bids

For the following reasons, this section of this write-up is probably the least important. Very few players these days make outright penalty doubles at the one level. Occasionally though, a take-out double at the one level is left in when partner has a stack of trumps. But, if you want to see the numbers explaining the logic for the threshold probabilities for one level penalty doubles, read on. Let's start with four assumptions:

1) We double **one of a minor** but our counterparts at the other table do **not** double.
2) No further bidding transpires after the double.
3) The bidder will either make the bid exactly or go down one.
4) The bidder is **not vulnerable**.

If one of a minor has been doubled, then the scores will be

When making one→ +140 rather than +80, so a net of +60, which is worth 2 IMPs
When down one → -100 rather than -50, so a net of -50, also worth 2 IMPs

Based on these calculations alone, the double is a 50-50 proposition that should be made when there is greater than a 50% chance of a set.

We arrive at the same conclusion if we allow the possibility of a redouble, when the following scores occur.

When making one→ +230 rather than +80, so a net of +150, which is worth 4 IMPs
When down one → -200 rather than -50, so a net of -150, also worth 4 IMPs

If we consider a double of **one of a major**, the scores are as follows.
If one of a major has been doubled, then the scores will be

When making one→ +160 rather than +80, so a net of +80, which is worth 2 IMPs
When down one → -100 rather than -50, so a net of -50, also worth 2 IMPs

The IMPs results are the same for the major as for the minor if we ignore the possibility of redoubling.
But **when a redouble occurs the possible scores for doubling a major become**:

When making one→ +520 rather than +80, so a net of +440, which is worth **10** IMPs
When down one → -200 rather than -50, so a net of -150, worth 4 IMPs

If the double is sure to be redoubled then the potential doubler should double only if there is a 10/14 (71%) chance of a set. From the perspective of the team bidding one-of-a-major that is doubled, that team should redouble any time there is less than a 71% chance that they will be set. Said another way, the one-of-a-major bidder should redouble if there is greater than a 29% (100%-71%) chance that the bid will be made.

I leave to the interested reader to work through the calculations for **1 NT doubled**. You will find that the important factor is that the doubling of 1 NT results in a net of 3 IMPS when doubled and made rather than the 2 IMPs that are earned for one-of-a major doubled and made. Thus a double of 1 NT should require a higher threshold probability of a successful set.

Doubling one of a minor or major when the bidder is vulnerable, the analysis is as follows:

If **one of a minor has been doubled**, then the scores will be

When making one→ +140 rather than +80, so a net of +60, which is worth 2 IMPs
When down one → -200 rather than -50, so a net of -150 that is worth 4 IMPs

Based on these calculations alone, the **double of one of a minor is a 1 in 3 proposition that should be made anytime there is greater than one chance in three of a set.**

We arrive at the same conclusion if we allow the possibility of a redouble, when the following scores occur.

When making one→ +230 rather than +80, so a net of +150, which is worth 4 IMPs
When down one → -400 rather than -50, so a net of -350, also 8 IMPs

If we consider a **double of one of a major**, the scores are as follows:

When making one→ +160 rather than +80, so a net of +80, which is worth 2 IMPs
When down one → -200 rather than -50, so a net of -150 that is worth 4 IMPs
This suggests that we should double if there is at least a 1 in 3 chance or a set.

The IMPs results are the same for the major as for the minor if we ignore the possibility of redoubling, but **when a redouble is made the possible scores become**:

When making one→ +720 rather than +80, so a net of +640, which is worth 12 IMPs
When down one → -400 rather than -50, so a net of -350, worth 8 IMPs

These calculations result in a threshold probability for doubling that is 10/18 = 56%. If you know that the double will be redoubled, require at least a 60% chance of achieving a set when doubling a one-of-a-major bid.

Considering the two cases (a redouble does or does not occur) the calculations above suggest that a double should be made when the threshold probabilities are somewhere between 33% and 56% that the double will be successful. Given that a potentially successful double will often be taken out and a potentially unsuccessful double will often be redoubled, it would seem that a threshold closer to 56% than 33% is appropriate when determining whether or not to double one of a major at the one level.

If we consider **doubles of 1 NT**, the scores are as follows:

When making one→ +180 rather than +90, so a net of +90, which is worth **3** IMPs
When down one → -200 rather than -50, so a net of -150 that is worth 4 IMPs
This suggests that, when we are sure that our double will not be redoubled, we should double 1 NT if there is at least a 3 in 7 (43%) chance or a set.

But **when a redouble occurs the possible scores become**:

When making one→ +760 rather than +90, so a net of +670, which is worth 12 IMPs
When down one → -400 rather than -50, so a net of -350, worth 8 IMPs

These scores are the same as for one of a major redoubled and thus suggest that if you know that the double will be redoubled, require at least a 60% chance of achieving a set when doubling a 1 NT bid.

Doubling Into Game

The excellent pamphlet by Carol and Tommy Sanders[13] includes a statement that summarizes most authors' attitudes about doubling into game when playing IMPs. Contemplating doubling 3D in a competitive auction, the Sanders say "…***it would be unthinkable***…" The logic of this statement is based on a cost/benefit analysis. Consider first this scenario where there are two possible outcomes:

The bid will be made, and

The bid will be set one trick.

If our counterparts do not double then the scoring will be as follows:

When the opponents are not vulnerable, we double a 2H or 2S bid into game and our opponents do not, and they make the doubled bid, our opponents garner 470 points and we receive 110. The 360 net is worth 8 IMPs. When 2H or 2S is set our opponents are -100 and we are -50 for a net of +50 (worth 2 IMPs). Thus the opponents stand to gain 8 IMPs if we are wrong, and we stand to gain 2 IMPs if we are right.
Under these assumptions it makes sense to double only if the probability that the double will be successful is more than 8 out of 10 (80%).

When doubling a vulnerable opponent into game the odds are virtually the same. When the opponents make the doubled bid, they garner 670 points and we receive 110. The 560 net is worth 11 IMPs. When the bid goes down one our opponents are -200 and we are -100 for a net of +100 (worth 3 IMPs). Under these assumptions it makes sense to double only if the probability that the double will be successful is more than 11 out of 14 (79%). However, as discussed in the introduction to this section, doubling can change the odds that the contract will be made. The Sanders are correct: we should double into game only on rare occasions.[14]

Doubling a Non-Vulnerable Game

Assume that you estimate that the cards are such that both teams are either going to make the game they have bid or go set one trick. Assuming that your opponents do not double, when you double five of a minor or 3NT and they make a game they'll receive an extra 100 for the doubled trick score + 50 for the insult = +150 for a non-doubled NT or minor-suit game. For a major-suit game that makes ten tricks the additional points will be +170. The additional 150 points (550 – 400 at NT or a minor-suit game), or 170 points (590 – 420 for a major-suite game), are worth four and five IMPs respectively. When there is a one-trick set for both teams, the doubler receives an extra 50 points, which is worth 2 IMPS.

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[13] *Swiss Team Tactics by Carol and Tommy Sanders*. Devyn Press 1981, Louisville, KY

[14] A second alternative set of assumptions further illustrates the wisdom of the admonition against doubling into game. Assume that there is a 50% chance that 3 D will make exactly three or will go down exactly **three tricks (yes**, this is a big set, but bear with me) then one of two scoring scenarios will prevail if 3D not doubled is played at the other table.

A) Half the time they will make 3D doubled and score 470 points while we will make 110 points. The difference of 360 points is worth 8 IMPs to them.
B) Half the time they will be set three tricks and will be negative 500 while we will be negative 150. The difference of 350 IMPs will be worth 8 IMPs to us.
In this scenario, the double breaks even over the long run. The takeaway from this exercise is that if the opponents have a 50% chance of making game, we have to average setting them by **more than three tricks** for the double to be a winning proposition.

When NT and minor-suit games are bid when game will either be made or there will be a one-trick set, the difference in the scores when comparing a game that is made versus a one-trick set leads to the conclusion that that you should double nonvulnerable 3NT and minor-suit games when you have a 4/6 = 67% probability of setting the opponents. You should double major-suit games when you have a 5/7 = 71% chance of setting the opponents.

Doubling a Vulnerable Game Bid

Again assume that game will either be made by both teams or be set by one trick. If you double and they don't and they make a game they'll receive the same bonus (either 150 or 170 points) as detailed in the previous section. Thus there will be a gain of either four or five IMPs when a doubled game is made.. When there is a one-trick set your opponents are -200 points to your -100. The 100 point advantage is worth +3 IMPS to you.

These numbers suggest that you should double when you have a 4/7 = 57% chance of setting a vulnerable NT or minor-suit game bid. They suggest that you should double when you have a 5/8 = 62.5% chance of setting a vulnerable major-suit game bid.

How do these figures relate to the threshold probabilities that have previously calculated that indicate when we should be bidding game? Earlier in this article it was suggested that you and your opponents should normally be bidding vulnerable games that have at least a 40% chance of making (thus a 60% chance of going set). The calculations from the previous section suggest that, if we can identify those marginal NT or minor-suit Vulnerable games bid by the opponents that both we and our opponents would agree have between a 40% and a 43% chance of making, these should be doubled.[15]

Do the Threshold Probabilities for Doubling Change Appreciably Under More Complicated Assumptions?

Assume now that when game makes or goes set that we assume four possible outcomes (rather than the two assumed previously). The four possible outcomes (using vulnerable NT or minor-suit game outcomes) when we double but our opponents do not double are

A) Bidders make game plus an overtrick, which is worth + 170-180 points and + 5 IMPs.

B) Bidders make game exactly, which is worth + 150 points and + 4 IMPs.

Assume that outcomes A and B are equally likely.

C) Bidders go down one trick., which costs 100 points and 3 IMPs.

D) Bidders go down two tricks, which costs 300 points (500 points doubled and vulnerable rather than 200 points not doubled but vulnerable) = 7 IMPs.

Assume that outcomes C and D are equally likely (but do not necessarily have the same probability as outcomes A and B).

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[15]If all parties at the table have equal abilities to estimate the probabilities that a game will make under all conditions (including whether or offense or defense), then vulnerable games that have less than a 43% of making will always be doubled unless there are strategic reasons not to double. Thus the high incidence of their being doubled should decrease the advantage of bidding 40% games, and a new, slightly higher probability threshold for bidding vulnerable games than the 40% threshold estimated in this article will prevail. More practically though, since it is very difficult to discern the difference between a "50% game" that should **not** be doubled and a "40% game" that should be doubled, the likelihood that 40% games will be doubled is little different from 50% or 55% games and the optimal threshold for bidding marginal games is affected only to a minor degree.

Combining the combination of A and B (gain to bidders under two "game made" scenarios) to the combination of C and D (down one or down two), the average of A and B is 4.5 IMPs, while the average of C and D is 5 IMPs. If this is a more realistic set of outcomes than the assumption that game is either exactly made or the bidder goes down one trick, then the threshold probability for doubling changes from 4/7 = 57% to 5/9.5 = 52.65%. This is a small but perhaps significant change. When the possible outcomes vary even more, say ranging from two overtricks to being set three tricks, the threshold for doubling drops below 50%.

Doubling Slams

The analysis as to when it makes sense to double slams is complicated by the "lead-directing double" (LDD) that many partnerships play against slams (and NT games). Let's defer consideration of the LDD until after we deal with the generic double I'll call the "Partner,-I-think-we-can-set-this-slam-if-you-choose-**any-reasonable-lead-**double." This "**any-reasonable-lead**" (**ARL**) double[16] involves the same logic used previously in discussing the doubling of games, though the threshold probability for a set when making an ARL double needs to be higher against slams because the opponents' gain in IMPs when they make a doubled slam is higher than their gain in IMPs when they make a doubled game.

As an example, consider the **double of a NV small slam** when either 11 or 12 tricks are possible at NT (or a major suit – the math is the same). If slam is made by both our team and theirs, and we double but the opponents do not, the opponents net an extra 240 or 230 points (6 tricks worth 190 or 180 points plus 50 "for the insult") rather than a push. Both 240 and 230 points convert to 6 IMPS.

When there is a one-trick set for both teams, our double generates 100 points rather than 50, thus a 50 point swing for our team, which is worth 2 IMPS. The asymmetrical distribution of the potential gain (2 IMPs) vs. the potential loss (6 IMPs) from doubling a NV small slam suggests that, under these circumstances, one should double a NV NT or major-suit slam only when there is a 6 in 8 = a 75% probability of setting the small slam.

The calculations for a minor suit game show the same 2 IMP gain from the double when the double results in a one-trick set, but a 5 IMP gain for the opponents for making the doubled game. This suggests a 5/7 = 71% threshold for doubling minor-suit small slams.
The possibility that the double of a slam will result in a multiple-trick set alters the potential benefits of doubling by perhaps 2-4 percentage points[17] in favor of doubling, in which case the probability threshold that makes sense for doubling drops to about a 72% probability that the double will result in a set for NT and major-suit games, and a 68% probability for minor-suit games. If you're willing to split the difference you could say that you should require at least a 70% success rate when employing the ARL double of a NV small slam bid.

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[16] The "ARL" terminology is this author's. Feel free to suggest another name that would be more useful and/or descriptive. For purposes of this analysis the important thing is to differentiate between a generic, or "general principles" double and a "lead-directing" double that calls for a particular lead. Some partnerships may have agreements that the only kind of double of a slam they will make is a lead-directing double, hence an ARL double would not be possible only if disguised as a LDD. If a partnership uses only LDD doubles then the analysis of ARL doubles may be irrelevant for such partnerships.

[17] This is an estimate. More precise calculations on this await an expanded edition of this paper or someone else's work.

For the double of a **vulnerable small slam** in a major suit or NT, the same IMPs advantage (a gain of 6 IMPs) as calculated above accrues to the opponents when the opponents make the doubled contract, but when they go down, the doublers get an extra 100 points (worth 3 IMPs) rather than an extra 50 points. So, the threshold probability become 6/9 = 67%. In a minor suit the threshold probability is 5/8 = 62.5%.

When a NV grand slam in NT or a major suit **is doubled** and the outcomes are either that the bid will be made or the bid will be set one trick, the scoring if our counterparts do not double will be as follows:

When the grand slam makes our opponents will garner an extra 190 points (minor suit), 260 points (major suit), or 270 points (NT). These increases translate into 5, 6, or 7 IMPs respectively. When the slam is set one trick the 50 point differential is worth 2 IMPs. The threshold probabilities for doubling minor, major, and NT NV grand slam bids convert into 71%, 75%, and 78% respectively.

Under the same assumptions, **doubling of a vulnerable grand slam** will result in threshold probabilities suggesting the following:
Minor suit vulnerable grand slam contracts should be doubled when there is a 62.5% chance of a set.
Major suit vulnerable grand slam contracts should be doubled when there is a 67% chance of a set.
Vulnerable grand slam contracts in NT should be doubled when there is a 70% chance of a set.

Lead-Directing Doubles
The Sanders[18] and the "IMPs Tactics" article[19] quote odds of "22 to 1" in arguing in favor of the use of lead-directing doubles (LDDs). If they are right (and they are right under the restrictive assumptions they presume) then lead-directing doubles must differ significantly in some important aspect from the ARL double as defined above. This becomes all the more obvious when we consider that the preceding paragraph calculates that doubles of a slam contract should be made only when there is at least a 68% likelihood that the contract will be set. This amounts to odds of approximately 1 to 2, odds that are very much "shorter" than the 22 to 1 odds discussed by the Sanders. It is thus very important to make the assumptions regarding situations involving LDDs very clear. As detailed later, there are three critical assumptions made by the Sanders that allow them to arrive at 22 to 1 odds, two of which are rather unusual.

Before we explain the logic behind the 22 to 1 odds quoted by the Sanders, let's first consider a simple example that employs more normal assumptions.

Assume that our opponents have bid 6 NT and partner must choose a lead. You have doubleton AK of spades sitting behind the opponent who opened the bidding with a 1 spade bid. You are sure that:

A) Your partner will lead anything but spades unless you double, and slam will be made by the opponents.
B) If you double, your partner will lead spades and you will set the slam one trick. This assumption represents a crucial difference between ARL and LDD doubles. Making an ARL double has been

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[18] Swiss Team Tactics by Carol and Tommy Sanders. Devyn Press 1981, Louisville, KY.

[19] http://users.ox.ac.uk/~ball0888/bridge/imps.doc. Sanders and the "IMPs Tactics" article at this website cite odds of 22-1 in favor of making lead-directing doubles. (I suspect that the "IMPs Tactics" article has derived the 22-1 odds from a read of the Sanders article, as the "IMPs Tactics" provides no calculations, and I can find no other reference to 22-1 odds elsewhere.) As discussed in this article, my analysis suggests that these odds are correct only under a narrowly defined set of assumptions.

assumed to not increase the likelihood that a contract will be set. In contrast, a LDD double is assumed to increase the odds that the contract will be set. [20]
C) The opponents will NOT double your partners and your partners will make the slam.

The lead-directing double in this case (assume NV) results in the following scoring scenario.

We set the opponents while our partners make the slam and our team nets 100 + 990 = 1090 points. Had we not doubled, this deal would have been a push with both teams making the small slam. Thus a successful double in this case is worth a swing of 1090 points = 14 IMPs.

What does it cost us if my partner thought I was asking for a non-spade lead instead of a spade lead? In this case the opponents make 990 plus an extra 240 because you doubled. Our undoubled partners at the other table make "only" 990, so the difference is the 240 points bonus for making six NT, which is worth 6 IMPs. The conclusion in this case is that we should use the lead-directing double under these conditions when it increases the chances that partner will lead spades (thereby setting the contract) to at least 6/20 = 30%.[21] But, a 30% probability represents just over 3 to 1 odds, still very much different from the 22 to 1 odds cited by the Sanders

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S**o where do the Sanders come up with their "22 to 1" odds in favor of lead-directing doubles?**
The Sanders make the following assumptions that mean that the 22 to 1 odds will apply.
1) As in the case above, they assume that the LDD changes the likelihood that the slam will be set.
2) Our team uses, while the counterparts do not use, lead-directing doubles, and
3) Our opponents bid a small slam while our partners stop at game. (In the example from the previous section, this third assumption was **not** made.)

It is reasonable to frame the question that the Sanders are asking as, "If I am sure that my partners do not bid slam when my opponents do bid slam, what threshold probability should I refer to in deciding whether or not to make a lead-directing double against a NV small slam bid?

Given their assumptions, there are two possible outcomes when the small slam is doubled (assume 3 NT is bid by our team and 6 NT is bid by their team):

Outcome 1) The double results in setting the small slam by one trick while our partners make game.
Outcome 2) The double results in the opponents scoring an additional 230 points when they make a doubled slam (while we make game). Points associated with each of these possible outcomes are calculated below.

IMPs calculations for Outcome 1) When the slam is set by one trick we make 490 (or perhaps 460) points for making game + 100 points for setting them. 590 and 560 points both convert to 11 IMPs in our favor.

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[20] In some cases an ARL double will provide information to the bidders that will alter their play of the cards and decrease the likelihood of a set. This possibility should of course be factored into the decision-making process.
[21] The crucial difference in this use of lead-directing double as compared to the ARL double is the assumption that our opponents do NOT employ the lead-directing double.

IMPs calculations for Outcome 2) When the slam makes we make 490 points, but they make 990 + 240 = 1230 points. The net margin to them is 740 points, which is worth 12 IMPs in their favor.

So How Do We Evaluate the LDD Based on The Sanders Assumptions?
If the double results in a set, we make +11 IMPs (See IMPs calculations above).
If the double is unsuccessful (the small slam contract is made) the opponents make 1230 points (+12 IMPs for them = -12 IMPs for us. The difference between +11 IMPs and -12 IMPs represents a potential swing of 23 IMPs.

What are the results when the contract is not doubled?

If we don't double our assumption is that they make the slam while our team bid game and thus they net 990 – 490 = 500 points = 11 IMPs (which is -11 IMPs for us). This is the default result that is assumed to always occur if we do not double. The double can potentially result in a swing of 22 IMPs (from -11 IMPs to +11 IMPs for us) if the double results in a set. The potential cost is the 1 extra IMP the opponents will garner if the doubled slam is made. The 22 to 1 odds the Sanders cite represent the potential gain of 22 IMPs versus a potential loss of 1 IMP.

An alternative way to arrive at the same conclusion is to use "breakeven analysis."
If we do double there is a chance (X%) that the opponents go down. The rest of the time (1 – X)%, the opponents will make the doubled contract. Thus they will make either
990 + 240 when they make the slam (This occurs [1 – X]% of the time), which after subtracting the 490 points we make will result in a net 740 points for them (worth 12 IMPs). Or, they will go down X% of the time, in which case we will make 430 or 460 + 100 = 530 or 560 (worth 11 IMPs).

Without the LDD we have assumed a 100% chance that the opponents make the slam (while our team bid and made game) and thus in this default case the opponents score a net equal to the slam bonus of 500, so 11 IMPs. Our expected score if we do not double is -11 IMPs.

When doubled there is (1 - X)% chance that the opponents still make the slam and thus score additional points of 240,. In addition they score the slam bonus of 500. 500 plus 240 = 740 points (worth + 12 IMPs to them, -12 IMPs to us). There is (X) chance that they go down, in which case we score 460 or 490 + 100 = 560 or 590 (both worth 11 IMPs).

Perhaps it is useful to spell out the alternatives again before making the calculations that define the circumstances in which a double should be made: If we do not double the opponents are assumed to make the small slam while we make the same number of tricks after only having bid game. We can view this as the "default" situation (in which we score -11 IMPs). When the LDD is made, this will mean that there is no longer any chance that we lose exactly 11 IMPs. We will score -12 IMPs when the slam makes, but we will score +11 IMPs when the slam is set. The value of X that will cause us to make the same average score over the long run whether we double or do not double in situations like this is defined as a "breakeven point," and is determined by the following equation.

The breakeven value for X is when it has a value such that our score will average the same whether we double or not. As we always make -11 IMPs when we do not double, and we average making
-12 IMPs x (1 – X) + 11 IMPs x X when we double, the breakeven value of X occurs when

$$-11 \text{ IMPs} = -12 \text{ IMPs} \times (1 - X) + 11 \text{ IMPs} \times X, \text{ so}$$
$$-11 = -12 + 12X + 11X$$
$$1 = 23X, \text{ thus } X = 1/23 = .0435 = 4.35\%.$$

The conclusion we should draw from this is that, under the restrictive assumptions the Sanders use, using a LDD will give the doubler the same average number of IMPs as not doubling when there is a 4.35% chance that the small slam will be set. Hence, if we wish to maximize our average IMPs scores, we should use the LDD any time there is greater than a 4.35% chance that we will set the small slam contract. Note that 4.35% = 1 in 23, which is also defined as 22:1 odds. **Hence, the Sanders are correct that the odds strongly favor using a LDD under the restrictive assumptions they make.**

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Conclusions Regarding Doubling NV Small Slams

The calculations above suggest the following threshold probabilities that should be equalled or exceeded in order to maximize our average expected IMPs when doubling a NV small slam (in NT or a major suit),

Type of Double with Related Assumptions	Threshold Probability: Double When There Is At Least A
ARL Double	72% chance of set
LDD when 1) LDD increases chance of set from zero	30% chance of set
LDD when 1) LDD increases chance of set from zero, and 2) Partners only bid game	4.35% chance of set (1 in 23, or 22 to 1)

Playing for Overtricks vs. Utilizing Safety Plays

When considering whether to play for an overtrick vs. "playing safe," players should often pursue dramatically different strategies in IMPs play relative to pairs play. Consider the following:

You are declarer having bid a vulnerable NT game and have the AKQ432 of diamonds in the dummy and the 765 of diamonds in your hand. There is no way to get back to the dummy if you play the top three diamonds from the dummy and find that an opponent has all four missing diamonds. If you play for the diamonds to run and they do, you will make ten tricks. If you play a low diamond from both your hand and the dummy when breaking the suit, then run the diamonds you will make exactly the nine tricks needed for game. However, if you try to run the diamonds without executing the safety play and one opponent has all four diamonds, you will be cut off from dummy and will go set one trick. You have no reason to believe that the four diamonds in your opponents' hands will not follow the usual distribution of cards, hence the following probabilities:

50% of the time the outstanding cards will be split 3-1, 40% of the time 2-2, and 10% of the time 4-0. Thus, if you play for the diamonds to run, you find that they do run 9 times out of ten.

Should you play for diamonds to run?

In a pairs game, other things equal, you should play for diamonds to run since your score will be higher nine times out of ten. If all other pairs play for diamonds to run and you don't, you will have a zero board 90% of the time.

In IMPs it is a different story. Assume that your opponents playing the same hand at the other table execute the safety play of playing a low diamond from each hand when breaking the diamonds. They will make exactly nine tricks, generating a score of 600. Consider what will happen under the two alternative lines of play available to you.

A. You play for diamonds to run: This strategy will generate a 630 score 90% of the time. Your IMPs score will be worth one IMP more than that of your opponents' 600 score 90% of the time. 10% of the time you will go set and your score will be -100, which, when combined with your opponents' + 600, will generate a +700 score for them, resulting in an IMPs score of +12 for your opponents. From your point of view, the strategy of playing for diamonds to run generates the following average return over the long run.

Probability x IMPs when Run Succeeds + Probability x IMPs when Run Fails = average long run result.

.9 x +1 + .1 x -12 = +.9 - 1.2 = -.3.

Other Scenarios and Other Distributions

There is a multiplicity of possible scenarios that could be analyzed when considering whether or not to utilize safety plays. The advantages of "playing safe" rather than seeking overtricks increase when playing slams, and are relatively less advantageous when playing part scores. A reasonable case can be made that taking out insurance (via safety plays) is not warranted against potential 6-0 and 5-0 adverse distributions when declarer and dummy's combined holding is either 7 or 8 in a suit. Taking out insurance against these extreme distributions is logical because the 6-0 and 5-0 distributions occur so infrequently that the extra IMP from an overtrick gained by not utilizing a safety play occurs so often that, over the long run, the many one-point IMP gains offset the rare case when the safety play allows the contract to be made. True though this may be, one has to ask how adversely team morale is affected by the rare set and accompanying loss of double digit IMPs when you explain during the scoring huddle that you could have made game, but played for an overtrick and went down.

Harold Feldheim devotes 35 pages to the logic behind, and the execution of safety plays in his excellent book[22] contrasting pairs and IMPs scoring. This book is very helpful for those who want to play best strategies in teams play.

Conclusion

I salute anyone who has read this very tedious analysis through to the conclusion. It is quite possible that I have made significant errors in this write-up, and I have little doubt that the analysis and write-up can be

[22] See Harold Feldheim's book in the list of references.

improved. If you have suggestions please e-mail me at RLLosey@gmail.com and I will endeavor to incorporate improvements into a future revision. Thanks to Tony Lipka and Brian Ross for reading parts of an earlier draft of this piece. Of course all errors and omissions are attributable to yours truly.

References I have used follow this paragraph.
Bob Losey, Fall 2014

References (with My Comments)

http://www.bridgeindia.com/IMP_Strategy_For_Swiss_Teams_by_Steven_Gaynor.pdf (1 page)
This is short and generally on the mark, but I question his statement that…" *If you bid three vulnerable games that your opponents do not bid and you make only one of them, you break even*." He's close, but in fact you need to make at least three out of eight (according to most good sources), but more likely four out of ten based on my analyses, to break even. If you make one of three vulnerable games against opponents with similar abilities, you will be likely to be trailing them if they are slightly more conservative bidders than you.

Swiss Team Tactics by Carol and Tommy Sanders. Devyn Press 1981, Louisville, KY. This is a very solid nine-page discussion of strategy. Doubling strategies and the discussion of lead-directing bids, though on the right track, need more discussion and analysis.

http://www.vcbridge.org/Writings/Bridge%20Team%20Scoring%20and%20Strategy.pdf. "Win-Loss Scoring and Victory Point Scoring" by Bob Gruber (Four pages with some math – nothing on doubling slams)

ACBL Encyclopedia of Bridge, 7th Edition, Ch. 16 (Tactics at Matchpoints vs. IMPs). This is a useful discussion that presents some basic math. I question some of the logic under "General Tactics" on p. 424 re matchpoints. If the author is arguing that bidders should take risks to play in NT and major suits, I couldn't agree more, but against players of your own caliber or better I'd argue that making the recommended "bad" bids is likely to lower your expected score in matchpoint games, hence inadvisable.

http://www.math.cornell.edu/~belk/impmp.htm. This one-pager is useful if you only have two or three minutes to review strategy.

http://richmondbridge.net/PDF/handouts/ImpStrategy.pdf "IMP Strategy" by Lorne Russell. This is a useful short guide. Players wanting significant detail will want more.

http://www.coolumbridgeclub.com/docs/lesson32.pdf. This two-pager has a good short list of do's and don'ts with the exception of the following quote. **"***If game has a 30% chance of making, bid it."*
What (s)he should have said was that you should bid vulnerable games if there is approximately a 40% chance of making them.

http://users.ox.ac.uk/~ball0888/bridge/imps.doc. This is a nice summary with no calculations. It uses the same 22-1 odds for lead-directing doubles that the Sanders does. These odds are correct under one limiting assumption, but can be wrong under others.

Knock Out Teams Strategy for the Intermediate Player by Marty Nathan.
http://www.mabcbridge.org/mabc350/377_KOteamStrategy.htm This presents a very nice discussion followed

by the most comprehensive set of tables on probabilities I have seen. The discussion of probabilities is always predicated on the proposition that there are only two possible outcomes when bidding – make the bid or go down one. This view gets you close enough to best strategy for game bidding, but less so for slam bidding, especially grand slam bidding. Nathan also does not cover doubling in detail, and does not cover the lead-directing double at all.

http://www.districtsix.org/Articles/2004-08.html. This article provides quotes from many experts regarding **Swiss Team Strategies** when recovering from a bad start**.**

http://www.doublesqueeze.com/2008/12/imp-strategy.html. This source makes some good points in a short discussion along with one extremely bad suggestion: "*…if you think you have at least a 35% chance of making the slam, it's usually worth it to go for it." My analysis suggests that small slams should be bid only if you have at least a 50-50 chance of success. Grand slams require a higher threshold probability of success, 60% against aggressive bidders, and approximately 90% against conservative bidders.*

Winning Swiss Team Tactics" by Harold Feldheim. Lorold Associates: Branford, Conn. Revised for the fourth printing in1993. 272 pages. This is the most comprehensive book I have found on strategies for playing when IMPs scoring is used. It appears to be targeted toward the intermediate player, though Feldheim's very readable style will appeal to advanced beginners as well. This well-written book covers a variety of topics of import when IMPs scoring is used, with chapters on Swiss vs. KOs, non-competitive auctions, competitive auctions, pre-emptive and tactical bidding, play of the hand, and strategy. The 35-page section on safety plays provides some superb material. The book chooses to spend little time on strategies about when (and when not) to double. It seems to me that a section on doubling would be a useful addition to what is already an excellent book.

http://www.bridgehands.com/V/Victory_Points.htm. This website provides an IMP scoring table and conversion of IMPS to Victory Points in tabular form.