

Analysis of Profitability of Major World Lotteries

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Advisor Report

Lotteries tend to pay out only a small fraction of its revenues to the players. Usually, the fraction that is paid out is about 50%. However, the lotteries place a significant portion of the payout into the jackpot, the highest prize. As the probability of hitting the jackpot tends to be astronomically small (in the order of one in hundreds of millions), this prize is typically rolled out to the next drawing, thus creating situations when the jackpot can itself become so large that it may be in principle profitable in expectation to buy a lottery ticket.

There are 4 major world lotteries, namely Mega Millions and Powerball in the USA and Euro Millions and Euro Jackpot in Europe. The difference of the US and European lotteries is several fold:

- US lotteries impose no jackpot cap in contrast to the European lotteries,
- US lotteries have fixed dollar winnings for higher prizes, European lotteries allocate a fixed percentage of revenues for higher prizes and distribute them equally among the winners,
- US lotteries quote annuity value of the jackpot, while the winner usually takes the corresponding cash value that is substantially smaller,
- USA taxes the winnings in contrast to most European countries.

The thesis studies two situations: buying a random ticket and buying all tickets (a syndicate ticket). The expected win is different in these two situations since buying all tickets guarantees winning the jackpot (or the corresponding share). The author computes the required value of the jackpot size as a function of tickets filed so that the expected winning agrees with the ticket price for all the studied lotteries. The more tickets are filed, the more likely we have jackpot sharing with other jackpot winners. The syndicate ticket requires lower value of the jackpot in comparison to the random ticket.

The problem is that a higher jackpot will attract a higher number of tickets. Thus the author runs a regression analysis of this dependence and compares it with the profitability region of the corresponding lotteries. As it turns out, currently a ticket is expected to be profitable only in Mega Millions lottery for a syndicate when the cash value of the jackpot exceeds 200M dollars. Historically, there were several instances of profitable draws in Euro Millions lottery, but the recent change of rules that increased the number of combinations and reduced probability of winning the jackpot makes the lottery unprofitable in all realistic situations.

In conclusion, this is a nice work on an interesting topic that has not been deeply studied. I recommend to accept it as a bachelor thesis as an above average work.

One question remains: the graph on page 14 does not seem to fully correspond with the largest jackpots listed on page 15, they are missing in the plot.

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