MegaMillionAnalysis

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October 24, 2018

Mega Millions

Calculate the odds and make a data frame

```
remove(list=ls())

odd.win.jackpot = 1/(70*69*68*67*66/2/3/4/5)*(1/25)
odd.win.1M = 1/(70*69*68*67*66/2/3/4/5)*(24/25)
# 1 / 70C5 *  5C4 *65C1 * (1/25) yellowball
odd.win.10K = (1*2*3*4*5)/(70*69*68*67*66)*(5*65)/25
odd.win.500 = (1*2*3*4*5)/(70*69*68*67*66)*(5*65)*(24/25)
odd.win.200 = (1*2*3*4*5)/(70*69*68*67*66)*(5*4/2*65*64/2)*(1/25)
odd.win.10 =  (1*2*3*4*5)/(70*69*68*67*66)*(5*4/2*65*64/2)*(24/25) +
  (1*2*3*4*5)/(70*69*68*67*66)*(5*4/2*65*64*63/3/2)*(1/25)
odd.win.4 = (1*2*3*4*5)/(70*69*68*67*66)*(5*4/2*65*64*63/3/2)*(24/25)
odd.win.2 = 1/(70*69*68*67*66/65/64/63/62/61*25)

odd.inv = 1/c(odd.win.jackpot,odd.win.1M,odd.win.10K,odd.win.500,
              odd.win.200,odd.win.10,odd.win.4,odd.win.2)

MegaMillion = data.frame(Prize = c(1600000000,1000000,10000,500,200,10,4,2),
                         W.B = c("5+1","5+0","4+1","4+0","3+1","3+0 or 2+1","1+1","0+1"),
                         ODD.fraction = c(odd.win.jackpot,odd.win.1M,odd.win.10K,odd.win.500,
                                          odd.win.200,odd.win.10,odd.win.4,odd.win.2),
                         odd.inverse = odd.inv)

MegaMillion
```

```
##     Prize        W.B ODD.fraction  odd.inverse
## 1 1.6e+09        5+1 3.304962e-09 3.025754e+08
## 2 1.0e+06        5+0 7.931909e-08 1.260731e+07
## 3 1.0e+04        4+1 1.074113e-06 9.310011e+05
## 4 5.0e+02        4+0 2.577870e-05 3.879171e+04
## 5 2.0e+02        3+1 6.874321e-05 1.454689e+04
## 6 1.0e+01 3+0 or 2+1 3.093444e-03 3.232643e+02
## 7 4.0e+00        1+1 3.464658e-02 2.886288e+01
## 8 2.0e+00        0+1 2.729862e-02 3.663190e+01
```

Prize : Is the amount of prizes.

W.B (WhiteBall,YellowBall): Is the requirement you need to meet.

ODD.Fraction : is the probability to meet such requirement.

odd.inverse : 1/ODD.faction which indicate, one out of how many times on average you will get the prizes.

Lump Sums

```
lumpsum.ratio = 1600000000/904900000

# MegaMillion$odd.inverse[1] means all the combination.
# Therefore Total revenue is just the total revenue of buying all possible combination
# Which is the prizes * the number of that prizes you would get
Total.Revenue=sum(MegaMillion$Prize * MegaMillion$ODD.fraction * MegaMillion$odd.inverse[1])

# LumpSum Assumption
Total.LumpSum = Total.Revenue / lumpsum.ratio

Highest.tax.bracket = 0.37
Mass.State.tax = 0.05
Total.tax = Highest.tax.bracket + Mass.State.tax
# Revenue.after.tax tells you the money the MEGA MILLIONS company would pay you
# immediately with lumpsum after tax
Revenue.after.tax = Total.LumpSum * (1-Total.tax)
# Cost, is the amount of money to buy all combination
Cost = MegaMillion$odd.inverse[1] * 2
# Total Profit here is the profit you will get immediately
Total.Profit = Revenue.after.tax - Cost
Total.Profit
```

```
## [1] -46481788
```

If you take the lump sum now then you will loss $46,481,788. Which is very bad.

Annuity Assumption

First we ignore the inflation rate

```
Total.Annuity = Total.Revenue

Highest.tax.bracket = 0.37
Mass.State.tax = 0.05

Total.tax = Highest.tax.bracket + Mass.State.tax
# Annual Revenue tells you the money the MEGA MILLIONS company would pay annually you after tax
Revenue.after.tax = Total.Annuity * (1-Total.tax)
Annual.Revenue = Total.Annuity/30 * (1-Total.tax)
# Cost, is the amount of money to buy all combination
Cost = MegaMillion$odd.inverse[1] * 2
Annual.Cost = Cost/30
# Total Profit here is the profit you will get after 30 years consider there is no inflation
Total.Profit = Revenue.after.tax - Cost
Total.Profit
```

```
## [1] 382660394
```

It makes sense to make money if we ignore the inflation rate.

Now we consider the inflation rate:

We need to calculate the infation rate that would even out the profit to get a rough idea on the profitable state: AN-i = (1- (1/(1+i))^30)/ i Annual.Revenue * AN-i = Sum of Immediate.Revenue

let : Sum of Immediate.Revenue = Cost Annual.Revenue * AN-i - Cost = 0 _____ to find the expected inflation rate that make the cost equal

i.equal gives you the average inflation rate over 30 years that would give you 0 profit. - Higher i indicate more profitable.

```
f <- function (i) 32927036 * ((1- (1/(1+i))^30 )/ i) - 605150700
i.equal =  uniroot(f, lower = 0.00001, upper = 5, tol = 1e-9)$root
i.equal
```

```
## [1] 0.03505866
```

- in this case, as long as the average inflation rate over the next 30 years is below 3.5% this would be profitable.

ASSUMPTION:

- We assume the tax bracket remain the same over the next 30 years, might not likely to be possible.

CASE STUDY:

Lets say, I borrowed the money from the bank and promised to pay them annually. I buy all the possible combination. I won the mega million. Every year, I will take 0.5% from the pay off and use the rest of my money to repay the loan.

```
Annual.Income.After.Pay.Bank=Annual.Revenue *0.005
Annual.Income.After.Pay.Bank
```

```
## [1] 164635.2
```

```
32927036 *0.995
```

```
## [1] 32762401
```

```
f <- function (i) 32927036 *0.995 * ((1- (1/(1+i))^30 )/ i) - 605150700
i.bank =  uniroot(f, lower = 0.00001, upper = 5, tol = 1e-9)$root
i.bank
```

```
## [1] 0.03465894
```

I borrowed 605,150,700 from the bank (NOW). If they agree on the contract that I will pay them 0.995 of the money from the pay off, it would be 32,762,401 annually for 30 years. I will be able to pocket $164,635.2. As conclusion, as long as the inflation rate is less than 3.46% on average. BOTH me and the bank wins.

In this case STUDY there are a flaw, which is the assumption of tax to be the same over the 30 years, which is unlikely to happened. However, we consider the state taxes which could be possibly exclude out in some states. Therefore, this is a safe bet.

Let me show you an example. If we buy the mega millions from Texas, Florida, South Dakota, Wyoming, Washington, New Hampshire, and Tennessee. Then we will only have a total tax of 0.37 instead of 0.42 which is what we assumed. If this is true, even the highest tax bracket sky-rocketed to 0.42 we will still able to make the expeceted amount of money which is $164,635.2 annually over the next 30 years. Therefore, it is a win-win situation for the bank and also ourself.

CASE STUDY2:

If you think that over the 30 years is too slow or risky. We will take the lump sum, with a reasonable ratio. However, to make this profitable, we need to buy the mega millions from either Texas, Florida, South Dakota, Wyoming, Washington, New Hampshire, or Tennessee.

```
lumpsum.ratio = 1600000000/904900000

# MegaMillion$odd.inverse[1] means all the combination.
# Therefore Total revenue is just the total revenue of buying all possible combination
# Which is the prizes * the number of that prizes you would get
Total.Revenue=sum(MegaMillion$Prize * MegaMillion$ODD.fraction * MegaMillion$odd.inverse[1])

# LumpSum Assumption
Total.LumpSum = Total.Revenue / lumpsum.ratio

Highest.tax.bracket = 0.37
State.tax = 0.00
Total.tax = Highest.tax.bracket + State.tax
# Revenue.after.tax tells you the money the MEGA MILLIONS company would pay you
# immediately with lumpsum after tax
Revenue.after.tax = Total.LumpSum * (1-Total.tax)
# Cost, is the amount of money to buy all combination
Cost = MegaMillion$odd.inverse[1] * 2
# Total Profit here is the profit you will get immediately
Total.Profit = Revenue.after.tax - Cost
Total.Profit
```

```
## [1] 1679325
```

As conclusion, you can make an immediate profit of 1,679,325, which is more than 1.5 Million dollar. If you borrowed 605,150,700 from the bank (NOW). Then you can plan to pay them an extra million, 606,150,700 in a couple weeks after the transaction is cleared. You will be able to pocket $679,325, which is making more than half a million in weeks.