A practitioner's guide to gain knowledge of investment opportunities, sophisticated principles and proven methods. Basic concept of investment management and instruments are explained with practices.

# Investment 101 for IT

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## Risk/Return Measure in Sharpe Ratio

Sharp ratio was derived in 1966 by William F. Sharpe. It's also known as the Sharpe index, the Sharpe measure, or the reward-to-variability ratio.

$$S(x) = \frac{r_x - R_f}{StdDev(x)}$$

The ratio measure the excess return in an investment asset or trading strategy, typically referred as a deviation risk measure.

### How to Read Result of Sharpe Ratio

- A ratio of 1 or better is considered good;
- 2 or better is very good;
- 3 or better is considered excellent.

### Trial in Excel

| Period | Yearly Returns ($r_x$) | Risk Free Return ($r_f$) | Excess Return or Risk Premium (x) |
|---|---|---|---|
| 1 | 0.255 | 0.02 | 0.235 |
| 2 | 0.184 | 0.02 | 0.164 |
| 3 | 0.473 | 0.02 | 0.453 |
| 4 | -0.041 | 0.02 | -0.061 |
| 5 | 0.0659 | 0.02 | 0.0459 |
| 6 | 0.0347 | 0.02 | 0.0147 |
| 7 | 0.288 | 0.02 | 0.268 |
| 8 | 0.317 | 0.02 | 0.297 |
| 9 | 0.142 | 0.02 | 0.122 |
| 10 | 0.657 | 0.02 | 0.637 |
| 11 | -0.011 | 0.02 | -0.031 |
| 12 | 0.73 | 0.02 | 0.71 |

$x = r_x - r_f$

Average: AVERAGE(E3:E14) = 0.237883333
Standard Deviation (σ): STDEV(E3:E14) = 0.252273145
Sharpe Ratio = Average / Standard Deviation (σ) = 0.942959399

## Trial in VBA

=SharpeRatio(C3:C14,D3:D14)

| D | E |
| --- | --- |
| Sharpe Ratio VBA | 0.942959399 |

1_SharpeRatio_Capital asset pricing model.xlsm - Module1 (Code)

(General) | SharpeRatio

```
Function SharpeRatio(YearlyReturn, RiskFreeReturn) As Double

Dim AverageReturn As Double
Dim StandardDev As Double
Dim RiskPremium() As Double

ReDim ExcessReturn(1 To YearlyReturn.Rows.Count)

For i = 1 To YearlyReturn.Rows.Count
    ExcessReturn(i) = YearlyReturn(i) - RiskFreeReturn(i)
Next i

AverageReturn = Application.WorksheetFunction.Average(ExcessReturn)
StandardDev = Application.WorksheetFunction.StDev(ExcessReturn)
SharpeRatio = AverageReturn / StandardDev
End Function
```

## Case Study

To help evaluate the performance of portfolio as a risk-adjusted measure of return, for example, comparing two managers return:

Manager A is 15% return and Manager B with 12%, it would appear that manager A is a better performer; however, manager A took much larger risks (standard deviation of 8%).

SR for manager B is 1.4, which is better than Manager A (1.25), means manager B is able to generate a higher return on a risk-adjusted basis.

| | A | B |
| --- | --- | --- |
| R | 15% | 12% |
| $R_f$ | 5% | 5% |
| σ | 8% | 5% |
| SR | (15%-5%)/8%=1.25 | (12%-5%)/5%=1.4 |

## Criticisms and Alternative

The denominator of The Sharpe ratio is the standard deviation, which assumes the returns are normally distributed; unfortunately, financial assets tend to deviate from a normal distribution. Therefore the interpretations of the Sharpe ratio could be misleading.

A variation of the Sharpe ratio:

- Treynor ratio: use β (systematic risk) as the risk measure in the denominator.
- Sortino ratio: only factor in downward/negative price volatility on standard deviation.

# Solver Function for Optimal Portfolio

## General case

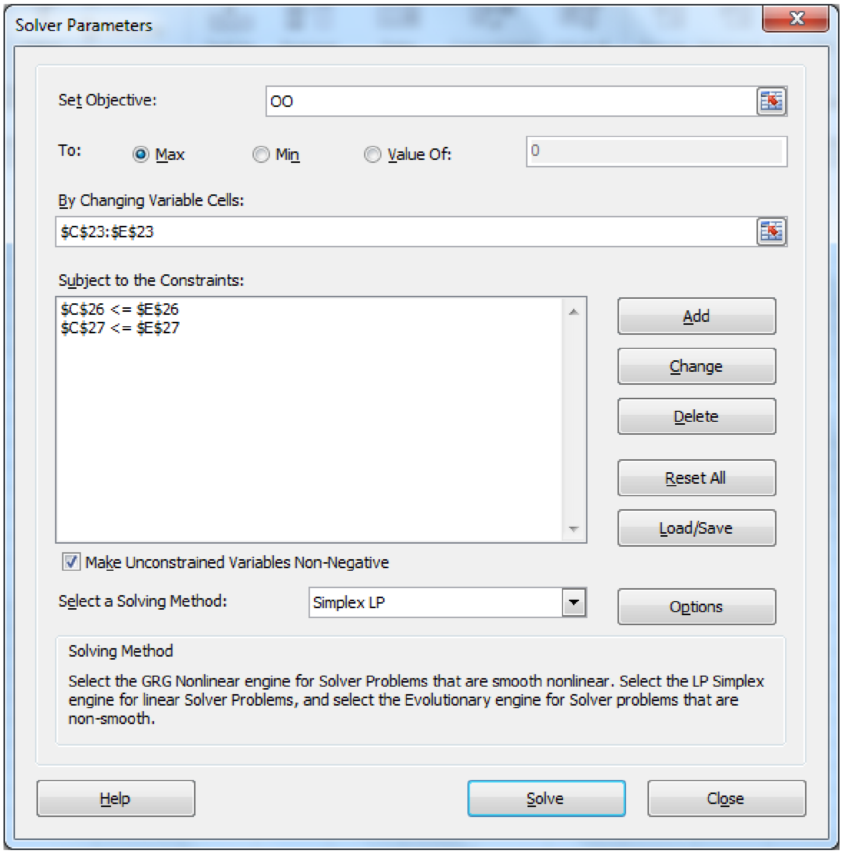
| | | | | | |
|---|---|---|---|---|---|
| Trial Solution | | | | | |
| | Mountain Bicycles | Mopeds | Tricycles | | |
| Unit Profit | 100 | 300 | 50 | | |
| | | | | | |
| Capital | 300 | 1200 | 120 | | |
| Storage | 0.5 | 1 | 0.5 | | |
| | | | | | |
| Order Size | 20 | 40 | 100 | | |
| | | | | | |
| Exit criteria | ResourcesUsed | | ResourcesAvailable | | Total Profit |
| Capital | 66000 | ≤ | 93000 | ⇨ | 19000 |
| Storage | 100 | ≤ | 101 | | |

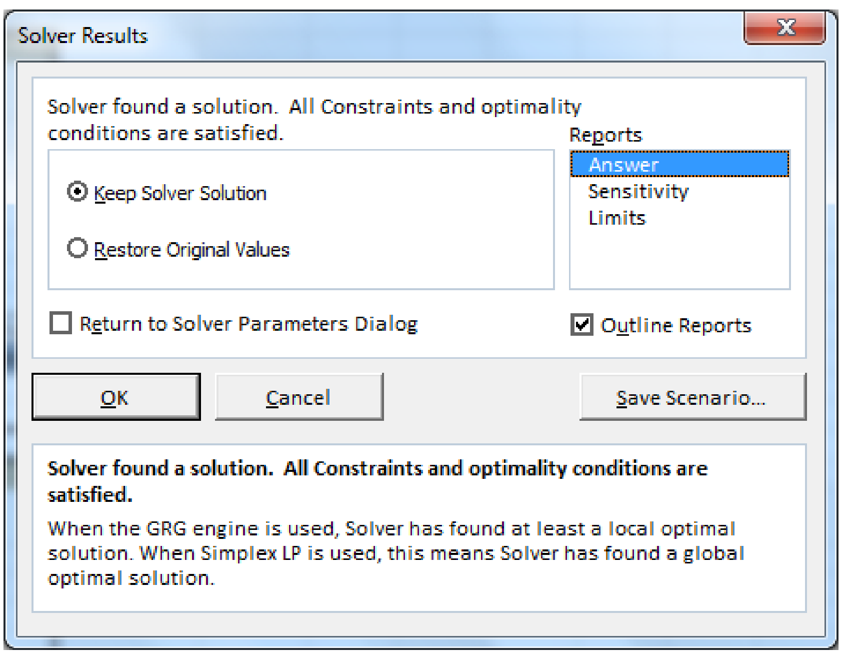
Sum of capital = SUMPRODUCT(C6:E6,OrderSize) = 66000 <= 93000

Sum of storage = SUMPRODUCT(C7:E7,OrderSize) = 100 <= 101

Exit at Total Profit = SUMPRODUCT(UnitProfit,OrderSize) = 19000

## Optimal case



OO =SUMPRODUCT(C18:E18,C23:E23)

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 15 | | | | | | | |
| 16 | | Solver Model | | | | | |
| 17 | | | Mountain Bicycles | Mopeds | Tricycles | | |
| 18 | | Unit Profit | 100 | 300 | 50 | | |
| 19 | | | | | | | |
| 20 | | Capital | 300 | 1200 | 120 | | |
| 21 | | Storage | 0.5 | 1 | 0.5 | | |
| 22 | | | | | | | |
| 23 | | Order Size | 94 | 54 | 0 | | |
| 24 | | | | | | | |
| 25 | | Exit criteria | ResourcesUsed | | ResourcesAvailable | | Total Profit |
| 26 | | | 93000 | ≤ | 93000 | | 25600 |
| 27 | | | 101 | ≤ | 101 | | |
| 28 | | | | | | | |

**Microsoft Excel 14.0 Answer Report**
**Worksheet: [2_Analysis_Shannon Index_Std graph.xlsx]Solver**
**Report Created: 2017/7/9 9:59:54**
**Result: Solver found a solution. All Constraints and optimality conditions are satisfied.**
**Solver Engine**
Engine: Simplex LP
Solution Time: 0 Seconds.
Iterations: 2 Subproblems: 0
**Solver Options**
Max Time Unlimited, Iterations Unlimited, Precision 0.000001
Max Subproblems Unlimited, Max Integer Sols Unlimited, Integer Tolerance 1%, Assume NonNegative

Objective Cell (Max)

| Cell | Name | Original Valu | Final Value |
|---|---|---|---|
| $G$2 | OO | 19000 | 25600 |

Variable Cells

| Cell | Name | Original Valu | Final Value | Integer |
|---|---|---|---|---|
| $C$23:$E$23 | | | | |
| $C$2 | Order Size Mountain Bicycles | 20 | 94 | Contin |
| $D$2 | Order Size Mopeds | 40 | 54 | Contin |
| $E$2 | Order Size Tricycle | 100 | 0 | Contin |

Constraints

| Cell | Name | Cell Value | Formula | Status | Slack |
|---|---|---|---|---|---|
| $C$2 | Resources Used | 93000 | $C$26<=$E$ | Binding | 0 |
| $C$2 | Resources Used | 101 | $C$27<=$E$ | Binding | 0 |

## Shannon Diversity index

Also known as the Shannon index; it's invented by Claude Shannon to quantify the uncertainty of information contents (entropy).

$$H' = -\sum_{i=1}^{n}\left[\left(\frac{n_i}{N}\right)\ln\left(\frac{n_i}{N}\right)\right]$$

### How to read

The higher result means more diverse community, in terms of ecological literature.

E3 fx =(C3/C$8)*LN(C3/C$8)

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | **Assets** | **Count the weight of each category** | **Shannon Index Variable Name** | **Shannon Index Calculation** |
| 3 | | stock options | 7 | =n1 | -0.347 |
| 4 | | T-bills | 7 | =n2 | -0.347 |
| 5 | | mutual bonds | 7 | =n3 | -0.347 |
| 6 | | commodities | 7 | =n4 | -0.347 |
| 7 | | | | | |
| 8 | | sum: | 28 | **=N** | **1.386** |

Sum = -1*SUM(E3:E6) = 1.386

# HELOC Payment Options

HELOC: Home Equity Loan of Credit.

## Fix term

$$Monthly\ Payment = \left[rate + \frac{rate}{[[1+rate]^{month}]-1}\right] \times \text{principal}$$

| Fix Term | | | |
|---|---|---|---|
| | Loan Amount | 150000 | |
| | Loan Term | 30 | years |
| | Interest Rate (APR/Annual Percentage Rate) | 8 | % |
| | | | =(0.08/12+(0.08/12)/(((1+(0.08/12))^360)-1) * 150000 |
| | | | **1100.65** |

## Fix payment

$$N = \frac{-\log(1-\frac{iA}{P})}{\log(1+i)}$$

| Fix Payment | | | |
|---|---|---|---|
| | Loan Amount | 200000 | A |
| | Monthly Pay | 1264.14 | P |
| | Interest Rate(APR) | 6.5 | i (6.5/1200) |
| | | | =(-LOG(1-(6.5/1200*200000/1264.14)))/(LOG(1+6.5/1200))/12 |
| | | | **30.00** |

# Discounted Cash Flow (DCF) Model