Investment options

# Introduction

- Capital amount : $ 5,000,000

- Data – Monthly between Jan 12 - Jul 2016
  - Use the chunk of data between
    - 01.12 to 12.15 for analysis
    - 12.15 to 07.16 to test the model
  - Stocks under analysis VBTLX, VFIAX, APPL

- Options
 - Single highest return
  - Mixed returns

Single security return

- Invest all 5,000,000 in APPL stock

- Final fund value : 5,007, 286

- Final returns = 0.14%

Single security performance
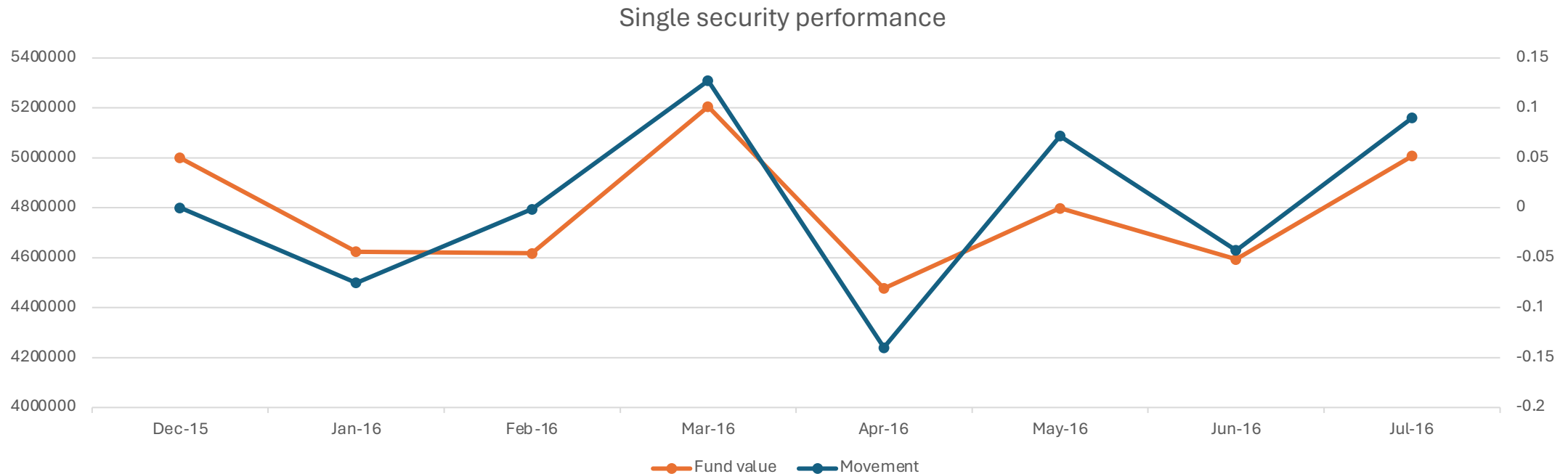
Mixed security options

- Stocks lot to consider : VBTLX, VFIAX

- Goal : Find the right % split of investment among both stocks.

- Method : Modern portfolio theory enables the following
  - Risk-return trade-off and Quantitative approach
  - Diversification and reduced volatility
  - The efficient frontier is a graphical depiction of the best possible investment portfolios.
  - Find better returns for same levels of risk.

- Graph below is returns trend – from Jan 2012 - Dec 2015

- Initial impression – VFIAX has higher swings and more volatile
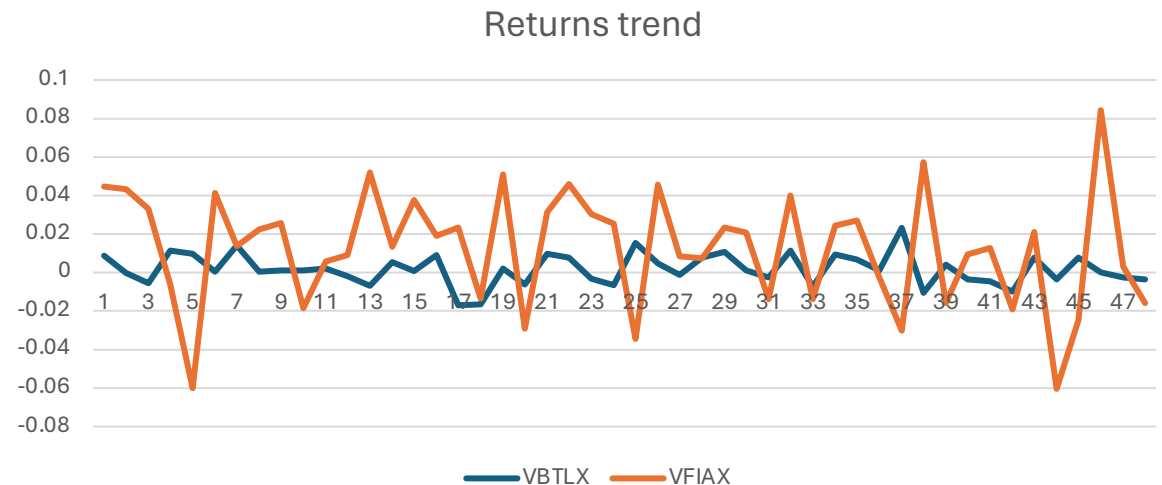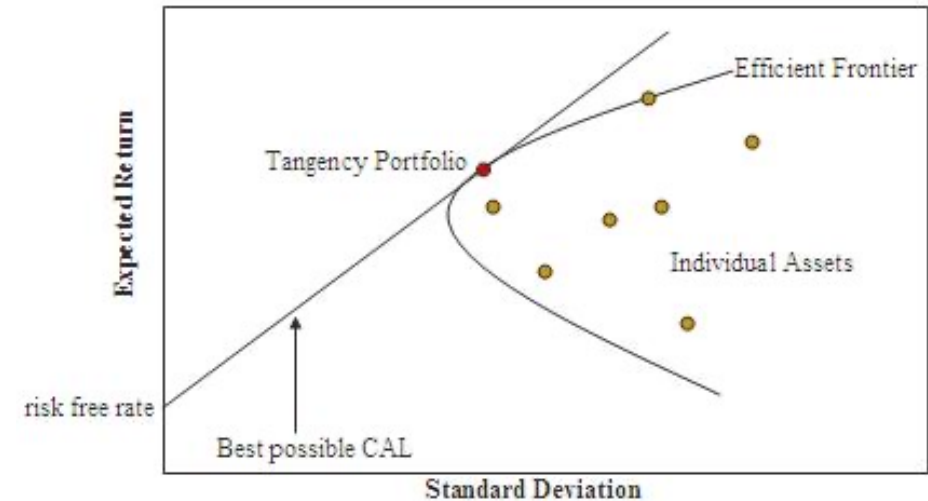
Calculations for mixed portfolio

- Solve for w1 and w2 weights to optimize sharpe ratio.

- Sharpe ratio = $\dfrac{E(r) - Rf}{\sigma_p}$ (for this method we assume Risk free returns is 0.)

  - $E(r) = W1 * E(R1) + W2 * E(R2)$
  - $\sigma_p = W_1^2 * \sigma_1^2 + W_2^2 * \sigma_2^2 + 2 * W_1 * W_2 * COV_{1,2}$

- Use excel solver to optimize sharpie ratio by adjusting W1 and W2

- Optimized weights after solver :
  - 67.85 % and 32.15%
  - Investment split : $3,392,500, $1,607,500

- Calculate the mixed return based on the ratio for validation data

- The following is the returns list.

Combined returns weighted			Month	Mixed
			Dec-15	5000000
-0.006210772	-0.62108	-0.0062	Jan-16	4968946
0.004095519	0.409552	0.41	Feb-16	4989297
0.028245835	2.824583	2.82	Mar-16	5130223
0.0039	0.39	0.39	Apr-16	5150231
0.005891274	0.589127	0.59	May-16	5180573
0.013998113	1.399811	1.4	Jun-16	5253091
0.01624269	1.624269	1.62	Jul-16	5338415

	0.68	0.32
	VBTLX	VBTLX
VBTLX	6.43533E-05	-1.7E-05
VFIAX	-1.7424E-05	0.000897
	2.58212E-05	8.89E-05
Annual returns (ER)	2%	15%
Risk free	0	
mean	0.06163939	
SD	0.010710471	
sharpee	5.755058902	
	5000000	
0.68	3392500	
0.32	1607500	

Comparison chart

Mixed vs single security portfolio

- Mixed security portfolio is
  - less volatile over a period of time.
  - Outperforms the single security returns at end of comparison period.

Portfolio performance

	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16
Mixed	5000000	4968946.139	4989296.551	5130223.398	5150231.269	5180572.693	5253090.934	5338415.259
Single	5000000	4623788.534	4617835.097	5205272.877	4476945.318	4798268.789	4593575.826	5007286.007