

# Multi-Criteria Decision Analysis for Investments

Dr. Drew Miller

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Top Level Measures ->

Mid Level Measures ->

Base Level Measures ->

Goal -->

MCDCA for Investments Scorecard

Performance 5				Current Value, Pricing 3			Risks 1				Liquidity 0		Client Fit 1			Wt or Min ↓	
10 year avg 3	Bull Market 1	Bear Market 1	Collapse market 1	P/E ratio 1	expense, fee % 1	Other 0	Principal Loss 1	rel to S&P 500 1	Country/Currency 0	company default, counterparty 0	interest/inflation 1	Other 0	ease, speed, cost of change 1	Risk-return 1	Emotional 1	Social 0	Wt
						list					list						Wt
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Graph	No.	Option Type	Option	Flag														Aggregate Column	
1	1	Stock	SAFM	1	7	7	7	8	8	9		8	7			7	5	4	7.5
1	2	Stock	United Airlines	1	5	7	4	0	7	9		5	6			6	4	7	5.7
1	3	Stock	S&P 500 Index	1	6	8	4	5	7	10		9	5			7	9	6	7.0
1	4	Stock	Managed Mutual Fund	1	5	7	3	4	6	7		7	4			6	7	6	5.6
1	5	Stock	Socially Resp Mutual F	1	5	6	3	4	6	6		7	4			6	7	10	5.4
1	6	Bond	Gov't Bond Index	1	4	4	5	6	7	8		10	10			5	10	8	6.2
1	7	Bond	Corp Bond Index	1	5	6	5	4	7	8		8	7			5	8	6	6.1
1	8	Estate	REIT	1	5.5	5	6	5	9	8		8	7			5	9	7	6.7
1	9	Alternative	Typical Hedge Fund	1	6	5.5	7	2	5	1		2	3			6	2	2	4.3
1	10	Alternative	Shorting Airlines	1	4	3	6	9	5	4		4	2			4	1	4	4.5
1	11	Alternative	Gold	1	4.5	3	8	9	7	6		8	7			7	5	5	6.0
1	12	Alternative	useful, tradable goods	1	3	3	3	10	7	5		9	7			7	10	7	5.4

# Overview

## “Multi-Criteria Decision Analysis for Investments”

1. Why do you need a “decision support system” for choosing investments?
2. Common thinking, investment errors
3. Considering “Black Swan threats” that can disrupt markets, ruin some investments
4. Using a multi-criteria decision support system for selecting investments, managing your investment portfolio

*Note: software I use runs in Excel, email me to request a copy*

My qualifications:

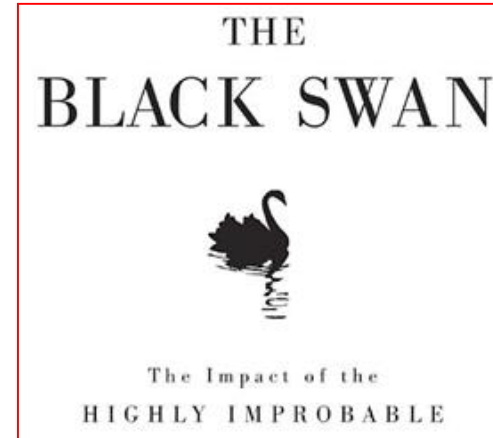
- USAFA graduate, Masters Degree and PhD from Harvard Univ
- 30+ years business experience in operations research, financial analysis, M&A
- Certified Management Accountant, Certified Financial Planner, Certified Mergers and Acquisitions Advisor
- Director of Advanced Analysis Applications, a management consulting, risk assessment, M&A Advisory firm

# Why do you need a “decision support system” for choosing investments?

1. All investments involve trade-offs that you need to carefully consider and weigh
  - Not just return, but return in different types of market conditions
  - Risks (lots of them beyond just stock Beta)
  - Many others: Fees, liquidity, social concerns, etc.
2. No way to keep track of all these tradeoffs in your head—if you don’t have a multi-criteria Decision Support System (DSS) you won’t make good, rational decision
  - And many criteria you cannot or won’t want to convert to a \$ value
3. While you may think you are a rational investor, emotional factors and common thinking errors are unavoidable -- but a careful DSS can help limit
4. If a group of people (or just a spouse) involved in the decision; a system to help show differences and priorities is very valuable
  - Often times you can avoid resolving a difference when the DSS shows the disagreement is irrelevant (does not change the investment choice)

# Many common biases and thinking errors Taleb explains lead to bad forecasts and decisions

- We “tunnel,” focus on too few sources of uncertainty, too limited a list of potential Black Swans to watch out for
- We scorn the abstract in preference for facts, evidence—and you often won’t have concrete evidence of approaching Black Swans
- What we don’t regularly see, we tend to ignore
- Learn by repetition, at the expense of events that have not happened before
- More influenced by emotions, personal events, than statistics
  - death of someone we know from disease X has far more impact than statistics on large # folks dying of X
- React and decide by gut feel, and think we’ve thought it through and made a rational choice when in fact we have not
- Once your mind is set with a certain view of world you tend to only consider instances that appear to show you’re right; helping you feel justified in your views
- “we think that if . . . two variables are causally linked, then a steady input in one variable should *always* yield a result in the other one. Our emotional apparatus is designed for linear causality”
- Tend not to think carefully, not in a disciplined manner; often irrational



# Nassim Taleb's book "Black Swan" explains why we consistently ignore or underestimate risk of foreseeable new forms of disaster

- A Black Swan event is one that is: an outlier, something outside the realm of regular expectations, nothing in the past can convincingly point to its probability as an extreme impact
- Covers our extremely bad habits of thinking about and preparing for very rare/bad events
    - We are by nature programmed to ignore the highly improbable
    - We grossly misapply "normal distribution" statistics, risk management techniques
    - Our schools and organizations teach and use risk management techniques that are grossly inappropriate to deal with "Black Swan" rare events

If you email me; I can send you my "Cliff's Notes" on Black Swan



NEW YORK TIMES BESTSELLER  
THE  
BLACK SWAN

The Impact of the  
HIGHLY IMPROBABLE

"The most prophetic voice of all."  
—GQ

Nassim Nicholas Taleb

# An Antifragile Portfolio is focused not on investments with rapid growth potential—but strong resistance to (or benefit from) disasters



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A hedge fund Taleb advises made a billion dollar profit in one day by anticipating the Aug 15 market drop

MARKETS

## A 'Black Swan' Fund Makes \$1 Billion

As market collapsed, hedge-fund firm Universa Investments gained roughly 20% on Monday



Cash, bonds and gold

Avoid stocks likely to be particularly hard hit in a collapse

Retain equity in companies that may benefit from a disaster:

- food companies that can source local
- ammunition manufacturers that can produce without international trade
- companies that store, stockpile gasoline (and can protect their assets)

More bold: short vulnerable companies and investments: International airlines; carbon credit derivatives; fashion/perfume companies

Use Long-Short hedges in stocks for overall market downside protection

Long in collapse anti-fragile stocks

Short on banks/airlines/frivolous companies

A3 is not recommending any specific investments or techniques.

# My favorite, best investment



Google Finance - Yahoo Finance - MSN Money

Disclaimer

drmillar@advanaapp.com

Advanced  
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# Multi Criteria Decision Analysis valuable for all types of difficult decisions

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Top Level Measures ->

Mid Level Measures ->

Base Level Measures ->

Goal ->

## Risk Assessment and Mitigation Scorecard

Risk Mitigation Impact						Implementation		Costs			Wt or Min
Natural Disaster	Pandemic	Electric System Out	Loss of Law and Order	Nuclear/Radiation	Internet/Cyber	Likelihood of success	Effectiveness Duration	Dollars	Staff Time	Operations Disruption	Wt
1	2	1	3	1	0	1	1	1	1	1	Wt
Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	%	Time scale	\$ scale	Manday scale	OD scale	Wt
10	10	10	10	10	10	10	10	10	10	10	100

No.	Option Type	Option
1	Facility Security	HD Steel doors
2	Facility Security	Extra security staff
3	Facility Security	Staff Guard trng, wprns
4	Supplies	Medical, masks
5	Supplies	Food stockpile
6	Personnel	Training/ Exercise program
7	Personnel	Home Security measures

Flag	Base case row											Aggregate Column
1	5	7	7	9	6	1	10	10	5	9	10	8.2
1	5	7	7	9	6	1	9	4	2	6	10	6.8
1	6	8	8	10	7	1	8	7	8	8	9	8.1
1	6	10	5	7	6	1	9	9	6	9	10	8.0
1	6	9	8	8	6	1	10	8	5	8	10	8.0
1	4	7	6	7	7	3	8	6	7	5	8	6.7
1	3	7	7	7	6	1	7	6	3	3	7	5.9



# Each risk mitigation option is assessed (rated) by all relevant criteria (risks, reduction in harm, cost, etc)

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Mitigation Options to Compare

Top Level Measures ->

Mid Level Measures ->

Base Level Measures ->

Goal -->

## Risk Assessment and Mitigation

Risk Mitigation Impact					
2					
Natural Disaster	Pandemic	Electric System Out	Loss of Law and Order	Nuclear Radiation	
1	2	1	3	1	
Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	
1					
	10	10	10	10	

Implementation	Costs
1	1

Criteria for assessment

Criteria weights (importance)

Option ratings based on a 1 to 10 scale (defined for each criteria)

Graph	No.	Option Type	Option
1	1	Facility Security	HD Steel doors
1	2	Facility Security	Extra security staff
1	3	Facility Security	Staff Guard trng, wpns
1	4	Supplies	Medical, masks

Flag					
1	5	7	7	9	
1	5	7	7	9	
1	6	8	8	10	
1	6	10	5	7	

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# The weighted average aggregate score indicates which option scores best

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Top Level Measures ->

Mid Level Measures ->

Base Level Measures ->

Goal ->

## Risk Assessment and Mitigation Scorecard

Risk Mitigation Impact						Implementation	Costs					Wt or Min
Natural Disaster	Pandemic	Electric System Out	Loss of Law and Order	Nuclear/Radiation	Internet/Cyber	Likelihood of success	Effectiveness Duration	Dollars	Staff Time	Operations Disruption	Wt	
1	2	1	3	1	0	1	1	1	1	1	1	
Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	Improvement Relative To Need scale	%	Time scale	\$ scale	Manday scale	OD scale	Wt	
1	10	10	10	10	10	10	10	10	10	10	100	

Graph	No.	Option Type	Option	Flag	Base case row											Aggregate Column
					1	2	3	4	5	6	7	8	9	10	11	
1	1	Facility Security	HD Steel doors	1	5	7	7	9	6	1	10	10	5	9	10	8.2
1	2	Facility Security	Extra security staff	1	5	7	7	9	6	1	9	4	2	6	10	6.8
1	3	Facility Security	Staff Guard trng, wpns	1	6	8	8	10	7	1	8	7	8	8	9	8.1
1	4	Supplies	Medical, masks	1	6	10	5	7	6	1	9	9	6	9	10	8.0
1	5	Supplies	Food stockpile	1	6	9	8	8	6	1	10	8	5	8	10	8.0
1	6	Personnel	Training/ Exercise program	1	4	7	6	7	7	3	8	6	7	5	8	6.7
1	7	Personnel	Home Security measures	1	3	7	7	7	6	1	7	6	3	3	7	5.9

# Building an Investment Multi-Criteria Decision Analysis scorecard

## Scorecard Template

Label for Scorecard		2nd Label					
MCDA for Investments							
Options (Rows of Scorecard)		Note: First blank row ends list		Measurement Categories (Columns of Scorecard)			
Option No.	Option Type	Option		Top Level Measures	Mid Level Measures	Base Level Measures	
1	Stock	SAFM		Performance	10 year avg		
2	Stock	United Airlines			Bull Market		
3	Stock	S&P 500 Index			Bear Market		
4	Stock	Managed Mutual Fund			Collapse market		
5	Stock	Socially Resp Mutual F		Current Value, Pricing	P/E ratio		
6	Bond	Gov't Bond Index			expense, fee %		
7	Bond	Corp Bond Index			Other	list	
8	Real Estate	REIT		Risks	Principal Loss		
9	Alter- native	Typical Hedge Fund			rel to S&P 500		
10	Alter- native	Shorting Airlines			Country/ Currency		
11	Alter- native	Gold			company default, counter- party		
12	Alter- native	useful, tradable goods			interest/ inflation		
13					Other	list	
14				Liquidity	ease, speed, cost of change		
15				Client Fit	Risk- return		
16					Emotional		
17					Social		

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- Views
- ColorRankResults
- UnColorRankResults
- HideNullOptions
- UnHideNullOptions
- ShadeMaxEffect
- UnshadeMaxEffect
- HideHighRiskOptions
- UnhideHighRiskOptions

Option	2nd Label	Top Level Measures	Mid Level Measures	Base Level Measures	Cost Type
SAFM		Performance	10 year avg		
United Airlines			Bull Market		
S&P 500 Index			Bear Market		
Managed Mutual Fund			Collapse market		
Socially Resp Mutual F		Current Value, Price	P/E ratio		
Gov't Bond Index			expense, fee %		
Corp Bond Index			Other	list	
REIT		Risks	Principal Loss		
Typical Hedge Fund			rel to S&P 500		
Shorting Airlines			Country/ Currency		
Gold			company default, counter-party		
useful, tradable goods			interest/ inflation		
			Other	list	
		Liquidity	ease, speed, cost of change		
		Client Fit	Risk- return		
			Emotional		
			Social		

Note: First blank row ends list

Measurement Categories (Columns of Scorecard)

Cost Categories (Cost columns)

Note: In measurement hierarchy first subordinate measure be in same row of template superior. There can be superior without subordinates, but



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Top Level Measures ->

Mid Level Measures ->

Base Level Measures ->

Goal -->

### MCDAs for Investments Scorecard

Performance				Current Value, Pricing			Risks				Liquidity		Client Fit			Wt or Min	
5				3								0	1			Wt	
10 year avg	Bull Market	Bear Market	Collapse market	P/E ratio	expense, fee %	Other	Principal Loss	rel to S&P 500	Country/Currency	company default, counterparty	interest/inflation	Other	ease, speed, cost of change	Risk-return	Emotional	Social	Wt
3	1	1	1	1	1	0	1	1	0	0	1	0	1	1	1	0	Wt
						list					list						Wt
																	10

Graph	No.	Option Type	Option	Flag														Aggregate Column			
1	1	Stock	SAFM	1	7	7	7	8	8	9	8	7			8			7	5	4	7.5
1	2	Stock	United Airlines	1	5	7	4	0	7	9	5	6			7			6	4	7	5.7
1	3	Stock	S&P 500 Index	1	6	8	4	5	7	10	9	5			7			7	9	6	7.0
1	4	Stock	Managed Mutual Fund	1	5	7	3	4	6	7	7	4			7			6	7	6	5.6
1	5	Stock	Socially Resp Mutual F	1	5	6	3	4	6	6	7	4			8			6	7	10	5.4
1	6	Bond	Gov't Bond Index	1	4	4	5	6	7	8	10	10			7			5	10	8	6.2
1	7	Bond	Corp Bond Index	1	5	6	5	4	7	8	8	7			7			5	8	6	6.1
1	8	Real Estate	REIT	1	5.5	5	6	5	9	8	8	7			7			5	9	7	6.7
1	9	Alternative	Typical Hedge Fund	1	6	5.5	7	2	5	1	2	3			5			6	2	2	4.3
1	10	Alternative	Shorting Airlines	1	4	3	6	9	5	4	4	2			5			4	1	4	4.5
1	11	Alternative	Gold	1	4.5	3	8	9	7	6	8	7			5			7	5	5	6.0
1	12	Alternative	useful, tradable goods	1	3	3	3	10	7	5	9	7			5			7	10	7	5.4

# Switch to Excel

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[drmiller@advanaapp.com](mailto:drmiller@advanaapp.com)





# QUESTIONS ?

Warren Buffett:

“The CEO should regard his position #1 as the Chief Risk Officer. Now you have a lot of other functions too, but you should wake up every morning and think about ‘is this place built to take everything’?”



If you email me; I can send you my “Cliff’s Notes” on Black Swan

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