Measuring Attitudes to Risk and Personal Values: The Bounded Rationality Approach

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SABE Conference, July 2012, Granada

" If you have *made* a decision that was entirely based on factual information, you have not made a decision; it was made for you by the facts".

Dr. Elliott Jaques

Background and Motivation

- Economic theory presupposes rational expectations
- Individuals incorporate information in coherent and unbiased manner

Nonetheless,

- Empathetic stream of behavioral finance accommodates
  - deviations from rational expectations
  - cognitive issues
  - behavioral biases and emotional factors

Attitude to Risk and Decision making approaches

- Attitude to risk is fundamental facet of individual choice and behavior
- Expected utility approach (Neumann and Morgenstern, 1947)
  - Accommodates different risk attitudes
  - Specification of a utility function and probability distribution
  - Strong assumptions of rationality and that people make optimal choices
- Risk Attitude is a highly abstract constellation of psychological attributes
  - Influenced by past experiences, beliefs, emotions (Loewenstein, 2001)
  - Personality (Weber, 2002)
  - the context and presentation formats (Kahneman & Tversky, 2000) which characterize real environments.

Scope of the Study

- Natural ways to calibrate risk attitudes
- Use the Bounded Rationality (BR) framework or Satisficing approach (Simon, 1982)
  - In an experimental set-up, subjects invest in a portfolio that contains a risk-free but profitable bond and a risky asset
  - Relate aspirations in high and low return states to risk attitudes
  - Calibrate bounded rational risk co-efficient '*R*', measure of riskiness
- Antecedents to risk that drive differences in risk attitudes
  - Do values like security, conformity, achievement, stimulation or more segment investors with different risk preferences?

Insights from Bounded Rationality (BR) or Satisficing approach

- Early work of Herbert Simon, Richard Cyert and James March (1950, 1960)
- Rationality is limited to cognitive ability and structure of environment
- Coined the word 'Satisficing' = satisfy + suffice
  - » Not the very best solution but good enough solution
- Gigerenzer et. al (2001) points out rationality is seen as an adaptive toolbox
  - » Simple Search Rules
  - » Simple Stopping Rules
  - » Simple Decision Rules
- Maximising is complex, leads to simple heuristics
- Reflect on aspirations as a link between goal and choice (Lopes, 1987)

Insights… relevance to investors

- Financial markets are extremely complex uncertain environments
- Plethora of options, different possible outcomes and returns
- Investor is faced with numerous challenges in the decision making process
  - » Cognitive limitations, structure of environment, limited information
  - » Optimising returns is a often difficult
  - » Rarely perceive risky decisions explicitly on the basis of probability judgments (Loewenstein, 2001)
  - » Settles for simple heuristics leads satisficing decisions
- Aspiration adaptation rather than utility maximisation (Guth et al, 2007)

Bounded Rationality and Satisficing Approach

- Rationality is limited to cognitive ability and complexity of the environment
  - Find good enough solutions, Satisfice (Simon, 1982)
  - Rationality is an adaptive toolbox (Gigerenzer, 2001)
- Relevance to investors in a financial decision framework
  - Numerous investment options with different possible outcomes or returns
  - Decision-making is complex
  - Investors reflect on aspirations, a link between goal and choice (Lopes, 1987)
  - An amount one is willing to lose and an amount one aspires to gain
- Use the BR approach to predict portfolio allocation that satisfices aspirations

Riskitude

- The experiment builds upon the study by Fellner, Guth & Maciejovsky, 2005 where bounded rationality is operationalised
- Experiment is coined 'Riskitude'
- Participants are made familiar to the Bounded Rationality / Satisficing approach
- Data collection
  - Purposive sampling
  - Control questions to qualify participation in the experiment
  - Sample of 72 investors, final form is 60 investors
- Classified into risk-averse and risk-seeking categories based on their preference for an assured amount or variable returns or indifferent between both options

Experimental Design

- Portfolio consists of risk-free but profitable bond and a risky asset
- Participants asked to indicate: "How much of your savings (Rs.) would you typically invest in a year?

Characteristics of the investment	Risk-averse	Risk-seeking
R - return offered by the bond	1.10	1.10
H - return offered by the risky asset in high state	1.42	1.36
L - return offered by the risky asset in low state	0.80	0.80
p - probability that the risky asset will attain a high state	0.5	0.5
E - investment amount decided by the investor		
I - amount invested in risky asset		
Constraints of the model	L + H > 2R	L + H < 2R
	0 < L < 1 < R < H	

The Satisficing Approach

The satisficing approach is set to two aspiration levels in the investment task

- A_1 : the minimum amount desired in the low state
- A_2 : the minimum amount desired in the high state
  - Range for $A_1 = E\,L \leq A_1 \leq E\,R$
  - Range for $A_2 = E\,R \leq A_2 \leq E\,H$
  - $A_1 \leq A_2$
  - Participants are guided to enter a valid A_1 and A_2
  - **Riskitude**

Exhibit 1: Feasible Region for Aspirations (A_1 and A_2)

Example of a participant willing to invest Rs. 100,000

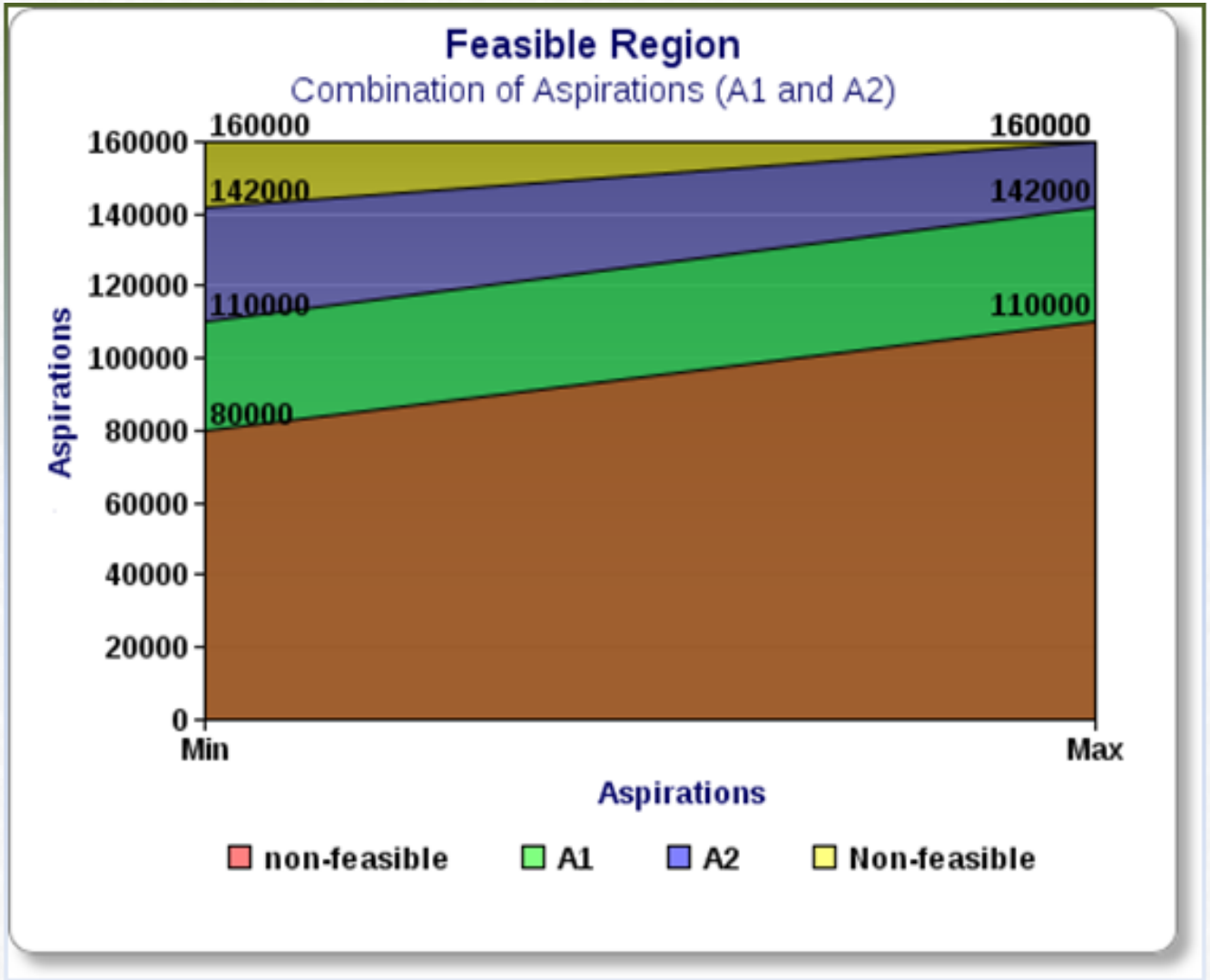
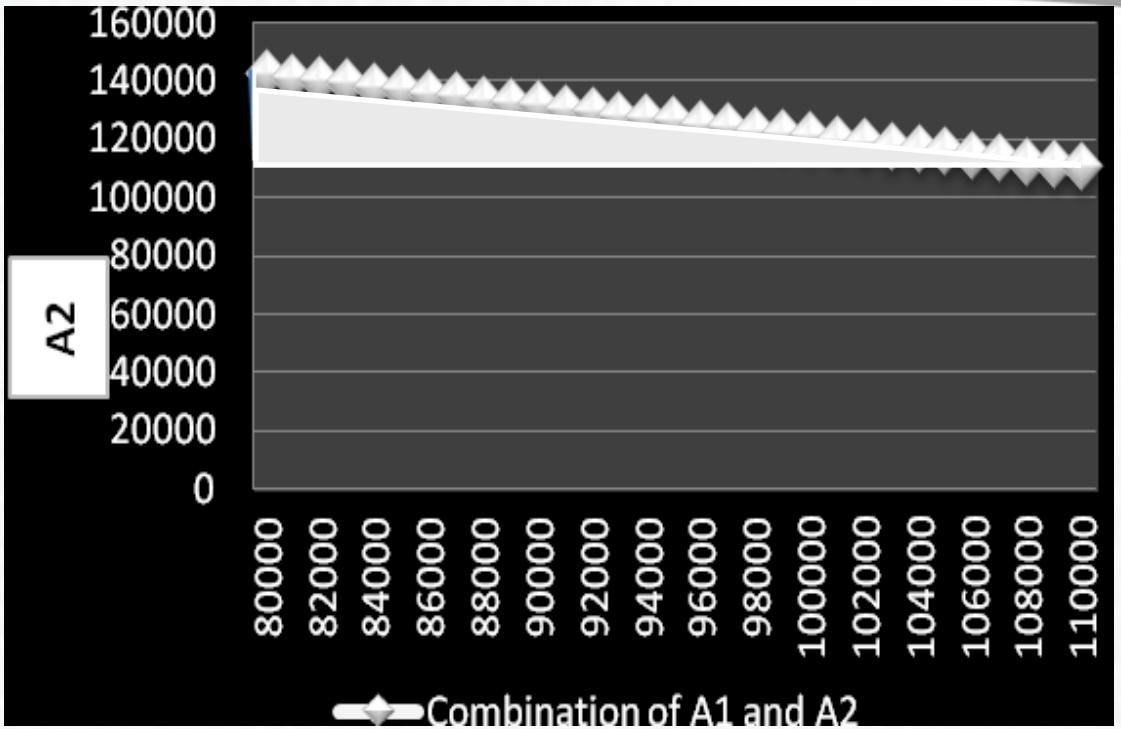


Exhibit 2: Combination of Aspirations (A_1 and A_2)



- Bounds of the lottery keep decreasing when subjects exhibit greater risk-aversion in A_1.
- Hence A_2 for a given A_1 is:

$$A_2 = \left(\frac{(ER - A_1)}{(R - L)} \times H\right) + \left(E - \frac{(ER - A_1)}{(R - L)} \times R\right) \qquad (1)$$

Solution set 'I'

The valid aspirations in A_1 and A_2 suggest a solution set of investment in risky asset I such that:

$$\frac{(A_2 - ER)}{(H - R)} \leq I \leq \frac{(ER - A_1)}{(R - L)} \qquad (2)$$

$$I_1 = \frac{(A_2 - ER)}{(H - R)} \qquad (3)$$ - Investment in risky asset if good state occurs

$$I_2 = \frac{(ER - A_1)}{(R - L)} \qquad (4)$$ - Investment in risky asset if bad state occurs

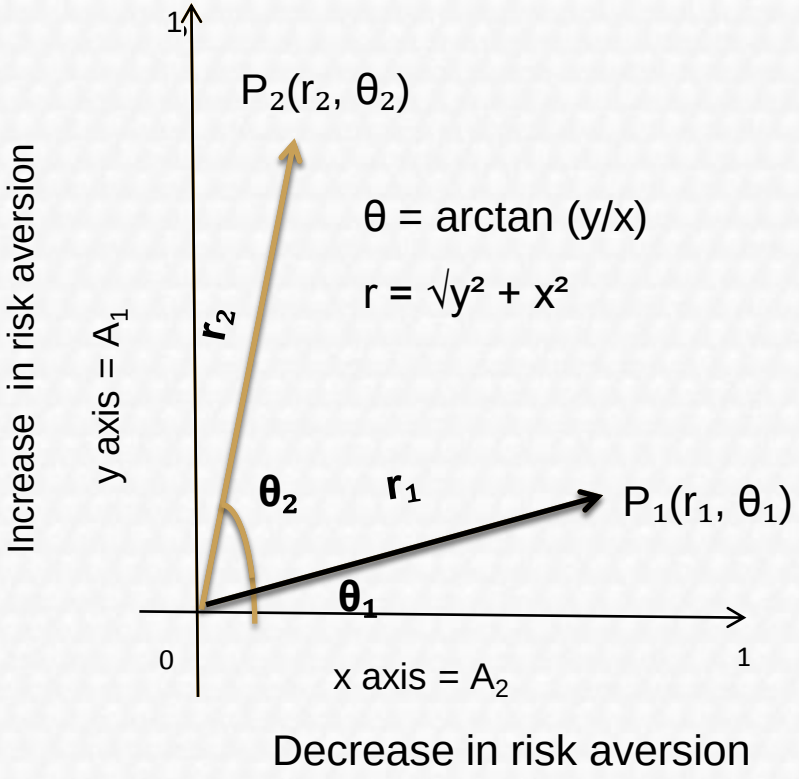
subject to constraints such that $I_2 \geq I_1$

- Participant is guided to invest a specific amount *I* in the risky asset that satisfices his stated aspirations in A_1 and A_2

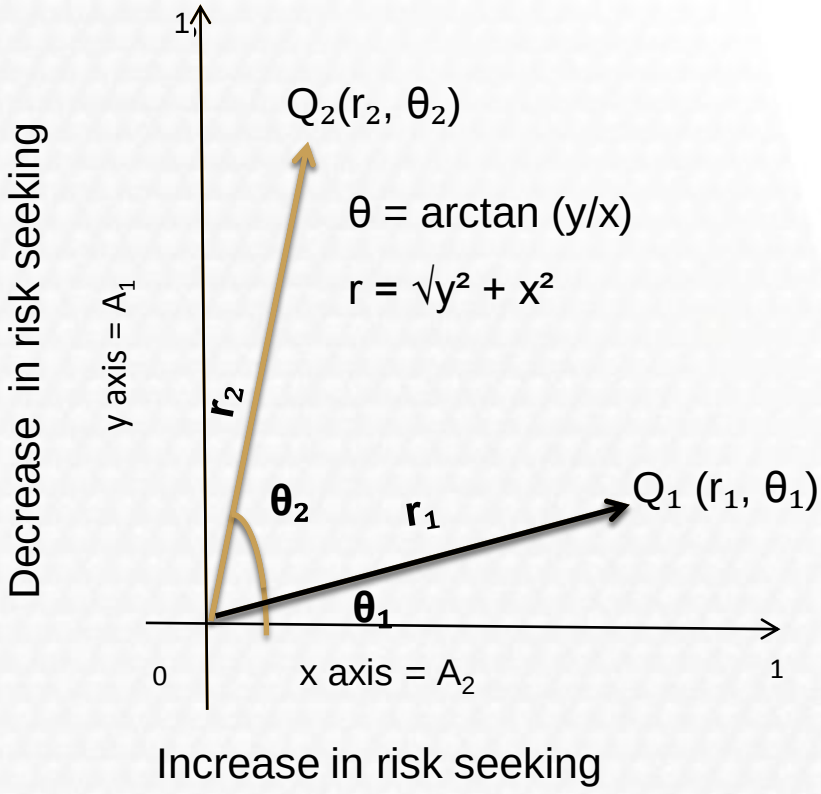
Calibrating Attitudes to Risk

We use concepts from polar coordinates in which each point on a plane is determined by a distance from a fixed point (r) and an angle from the x axis (θ)

Graph 3 a: Risk-Aversion



Graph 3 b : Risk-seeking



Bounded Rational Risk Co-efficient 'R'

- Risk parameter (R) is an f {r, θ}

$$R = \left(r \times \theta / \pi/2 \right) \qquad (5)$$

  - Risk Aversion: R = {0 < X < 1} implies increasing risk aversion
  - Risk Seeking: R = {0 < Y < 1} implies decreasing risk seeking

- Is '*R*' a Unique Value?
  - $r_1 = r_2$ but $\theta_1 \neq \theta_2$ in the feasible region of aspirations
  - Hence, R (r, θ) is the polar representation of A_1 and A_2,
  - R is a bounded rational risk co-efficient

Rational Choice Approach

- The satisficing approach gives every subject a solution set of I(s) which represents investment in the risky asset guaranteeing aspiration set A_1 and A_2
- If we assume a utility function $u(x) = x^{\alpha}$
  - we can imply a range of α for the range of I(s)
    - $0 < \alpha < 1$ implies risk-aversion
    - $\alpha = 1$ implies risk-neutral
    - $\alpha > 1$ implies risk-seeking
  - range of α can be derived by maximising the utility function $u(x) = x^{\alpha}$:

$$u(I) = p[R(E-I) + HI]^{\propto} + p[R(E-I) + LI]^{\propto} \qquad (6)$$

$$\propto = 1 + \left\{ \frac{\log \frac{p(H-R)}{(1-p)(R-L)}}{\log \frac{[R(E-I)+LI]}{[R(E-I)+HI]}} \right\} \qquad (7)$$

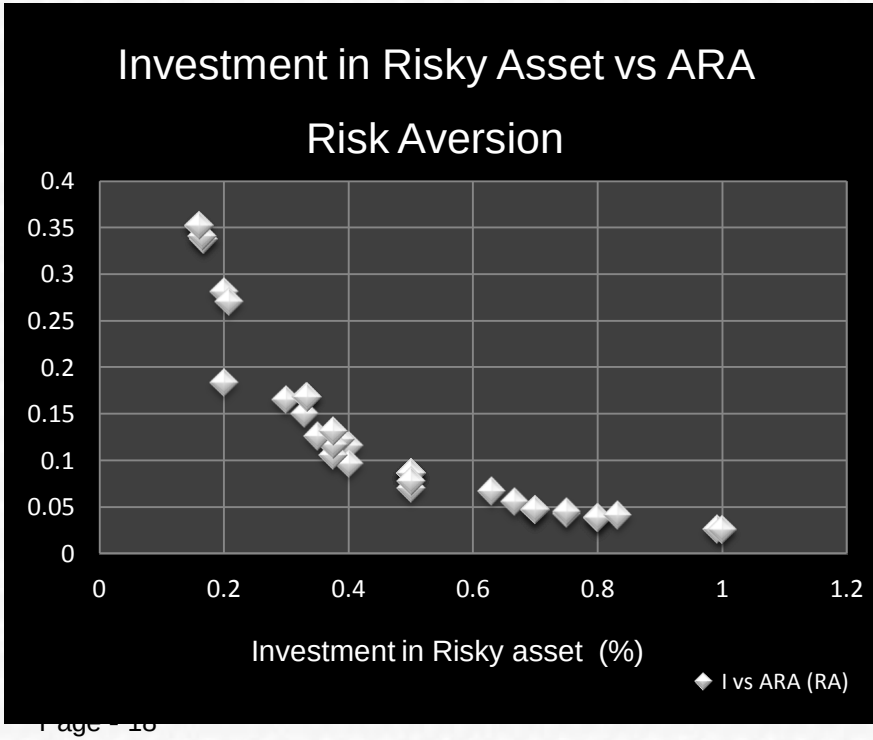
- As I approaches 0, α is undefined hence to facilitate estimation we set α value to 0

Exhibit 4: Mapping I with ARA

Arrow Pratt Measure of Risk Aversion (ARA) for $u(x) = x^{\alpha}$

$$ARA = -\frac{u''(x)}{u'(x)} = \frac{(1-\alpha)}{x}$$

- ARA = {0 < X < 1} implies increasing risk aversion
- ARA = {- ∞ < Y < 0} implies increasing risk seeking



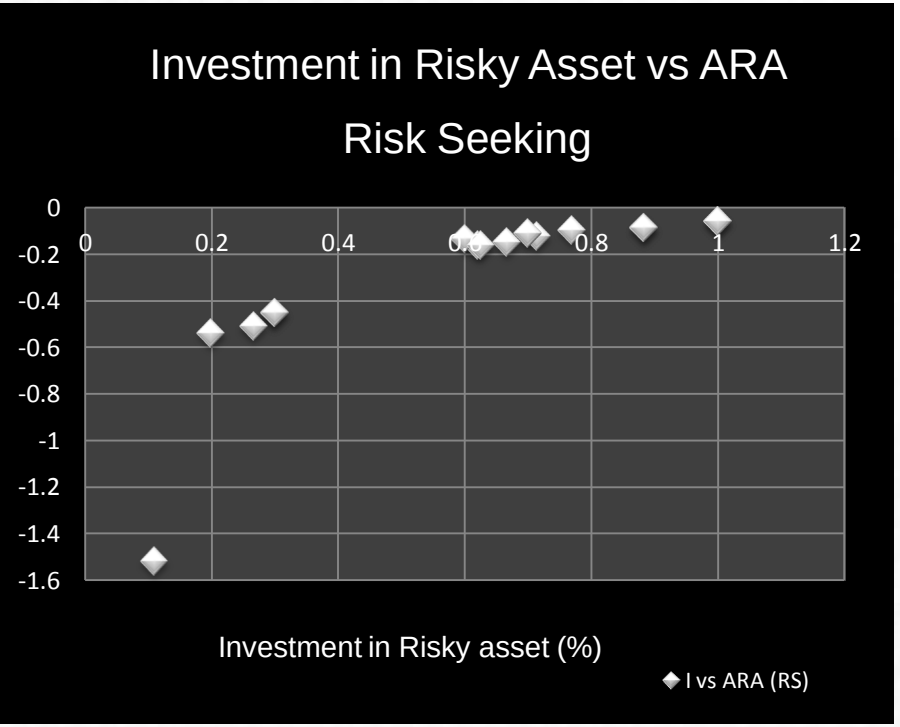
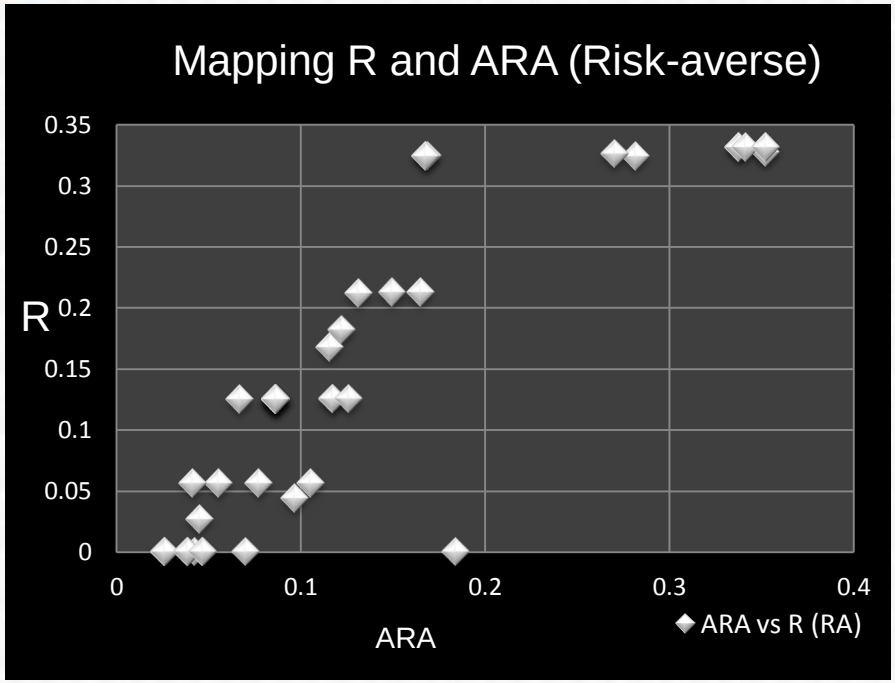
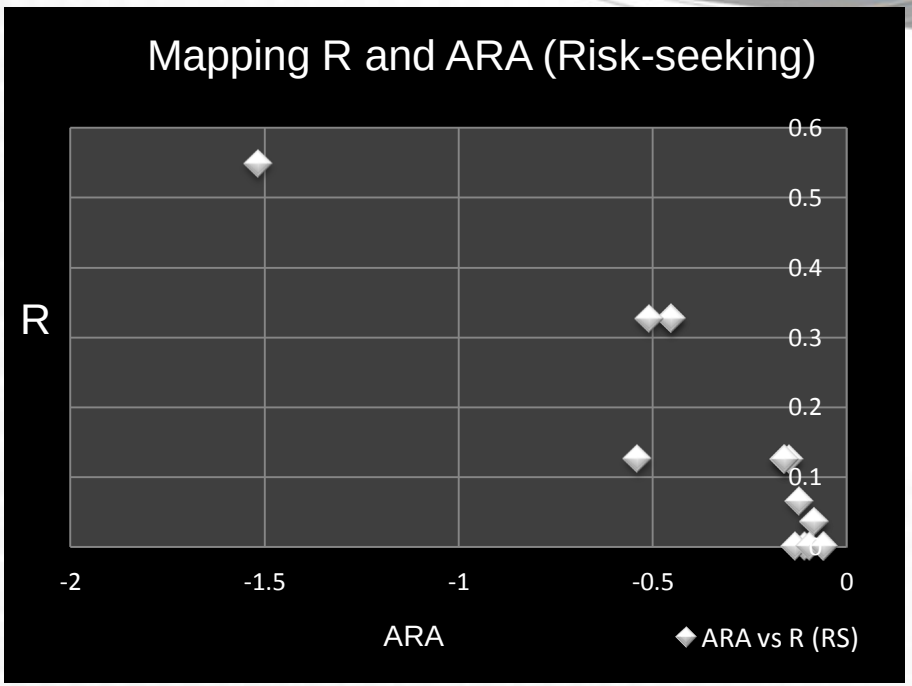


Exhibit 5: Mapping R and ARA





Intuitively,

- Higher ARA and R for risk-averse category implies increasing risk aversion
- Higher ARA (-ve) implies more risk-seeking, while a higher R implies less risk-seeking for risk-seeking category

Summary of Findings for the Estimated Risk Parameter

Respondent's Task	State aspiration levels in low state and high state for an investment amount			
Valid Response %	80%			
Decision Approach	Satisficing Approach			
Descriptive for Risk-averse Category	Range		Mean (SD)	N
	Low	High		
Aspiration in low state (A_1)	0.000001	0.49	0.21 (0.19)	44
Aspiration in high state (A_2)	0.48	1	0.78 (0.14)	44
Risk Parameter – R	0.000001	0.34	0.14 (0.13)	44
ARA	0.02	0.35	0.13 (0.10)	44
Descriptives for Risk-seeking Category	Range		Mean (SD)	N
	Low	High		
Aspiration in low state	0.000001	0.79	0.20 (0.23)	16
Aspiration in high state	0.48	0.95	0.82 (0.12)	16
Risk Parameter - R	0.000001	0.54	0.14 (0.16)	16
ARA	- 1.51	- 0.05	- 0.29 (0.37)	16

Discussion

- Models of economic decisions often assume people maximize a preference or utility function
- In this study, bounded rationality is operationalised. We arrive at individual risk preferences, even if the individual is satisficing
- Reflective that satisficing approach could be liked to attitudes to risk
- We find that satisficing as a measure of risk, is not inconsistent with the basic measure of risk-aversion
- Satisficing as an approach presents a less risky prospect since the lotteries get bounded or truncated, hence would be interesting to ponder whether satisficing by itself increases risk aversion.

Segmentation of Investor Types

- Investors are heterogeneous group with varied investment goals, experience, risk preferences, values and beliefs
- Traditionally market is segmented based on demographics (Friend and Blume, 1975; Barnewall, 1987, Riley and Chow, 1992)
- To know underlying motives towards making decisions, research lead to segmentation by Pyschographics (Kahle et. Al, 1997)
- Values and value systems are predictors of consumer behaviour (Schwartz and Bilsky, 1987)

Study attempts to explore heterogeneity among investors in terms of their attitude to risk and personal value systems

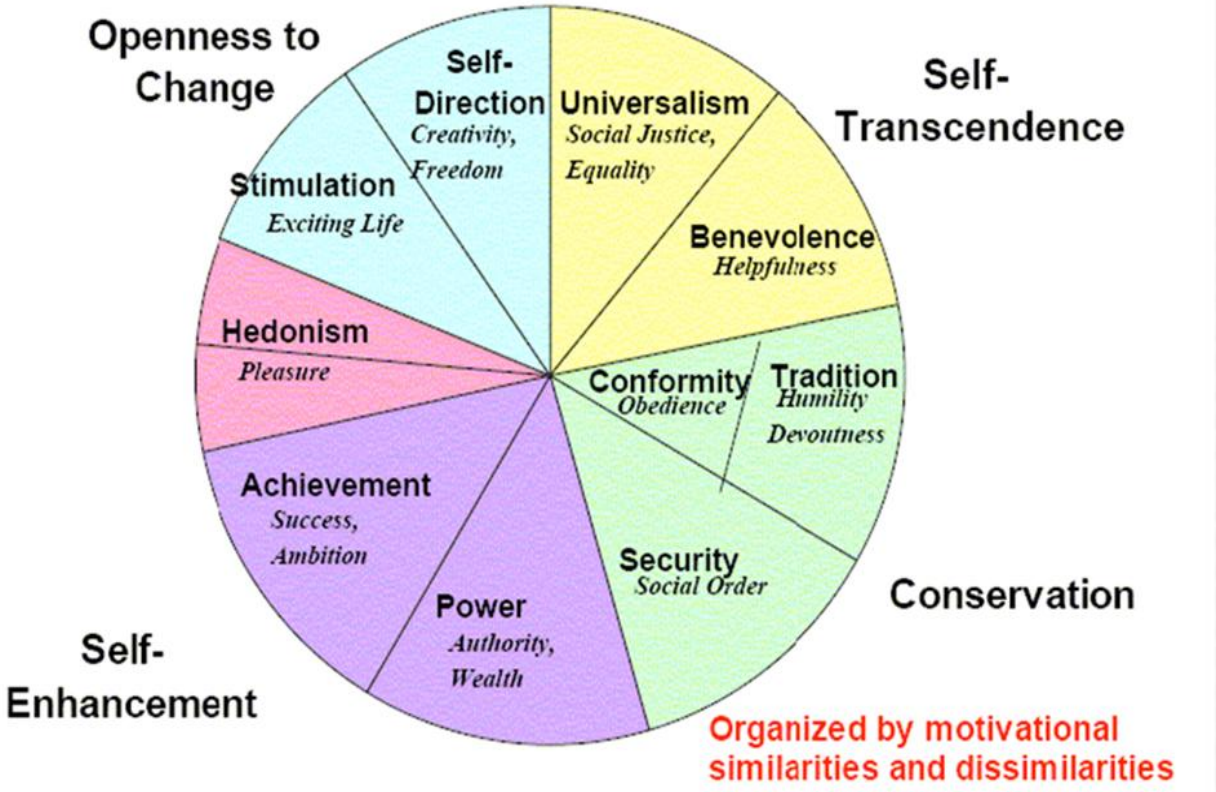
Personal Values and Measurement

- Personal values are cognition of what is desirable.
- Guiding principles, *Kluckhohn 1961;* Beliefs, *Rokeach 1973;* Tendencies, *Hofstede 1980;* Goals, *Schwartz 1994a and* Cognitions, *Holland 2002*
- Literature recognizes the value systems influences decision making process
- Therefore this study answers the question; do values like security, conformity, achievement, stimulation or more segment investors with different risk preferences?
- Measurement –
  - » Schwartz (1992, 1994) Value Survey (SVS) identifies 10 motivationally distinct value types that act as 'guiding principles in one's life'
  - » **Riskitude. Personal values**

Descriptive Statistics of Clusters

Ward Method		N	Min	Max	Mean (SD)
Cluster 1	Risk Parameter	36	0.8	0.22	.15 (0.08)
	Achievement	36	4.00	9.00	7.26 (1.26)
	Hedonism	36	2.00	9.00	6.27 (2.03)
	Power	36	2.00	9.00	6.13 (2.15)
	Self direction	36	6.00	9.00	7.73 (0.94)
	Stimulation	36	5.00	9.00	7.13 (1.25)
Cluster 2	Risk Parameter	8	0	0.14	0.06 (0.11)
	Benevolence	8	7.00	9.00	7.88 (0.64)
	Conformity	8	6.00	9.00	7.25 (1.03)
	Security	8	7.00	9.00	7.87 (0.64)
	Tradition	8	5.00	8.00	6.75 (1.28)
	Universalism	8	7.00	9.00	8.25 (0.70)

Cluster Description



Cluster 1 – This cluster of investors exhibit lower risk aversion and prime values like self-direction, achievement, stimulation, power and hedonism. The motivation goals for these values is to enhance one's own welfare and pursue individualistic interests.

Cluster 2 - This cluster represents investors with higher risk aversion guided by values like security, benevolence, conformity, universalism and tradition. Therefore, we see that the intrinsic motivation for risk-averse counter-parts is conservatism and self-transcendence .

Implications from the Study

- Reflective about behavioral linkages to the decision making process
- Investors may not make decisions adhering to principles of rationality
- Explore more natural ways of calibrating risk attitudes by relating aspiration formations with risk attitudes
- Attitude to risk is psychologically intuitive therefore linked to personal values
- Value based segmentation explains motivational goals that drive risk preferences
- There is a need to better understand the determinants that drive risk preferences to allow financial services and advice to be more effective.

Thank You

Suggestions & Comments