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CENTRE DE RECERCA EN ECONOMIA
I DESENVOLUPAMENT AGROALIMENTARI

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MEASURING AND MANAGING CONSUMERS' RISK PERCEPTION TOWARDS FOOD RELATED ISSUES

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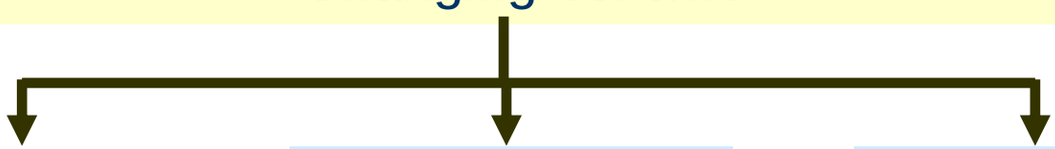
To start with

New food technologies available
Relation between diet and health
Food scares

Mass media

Increasing consumers concerns about food safety and health issues
Risk perception
Changing attitudes
Changing behavior

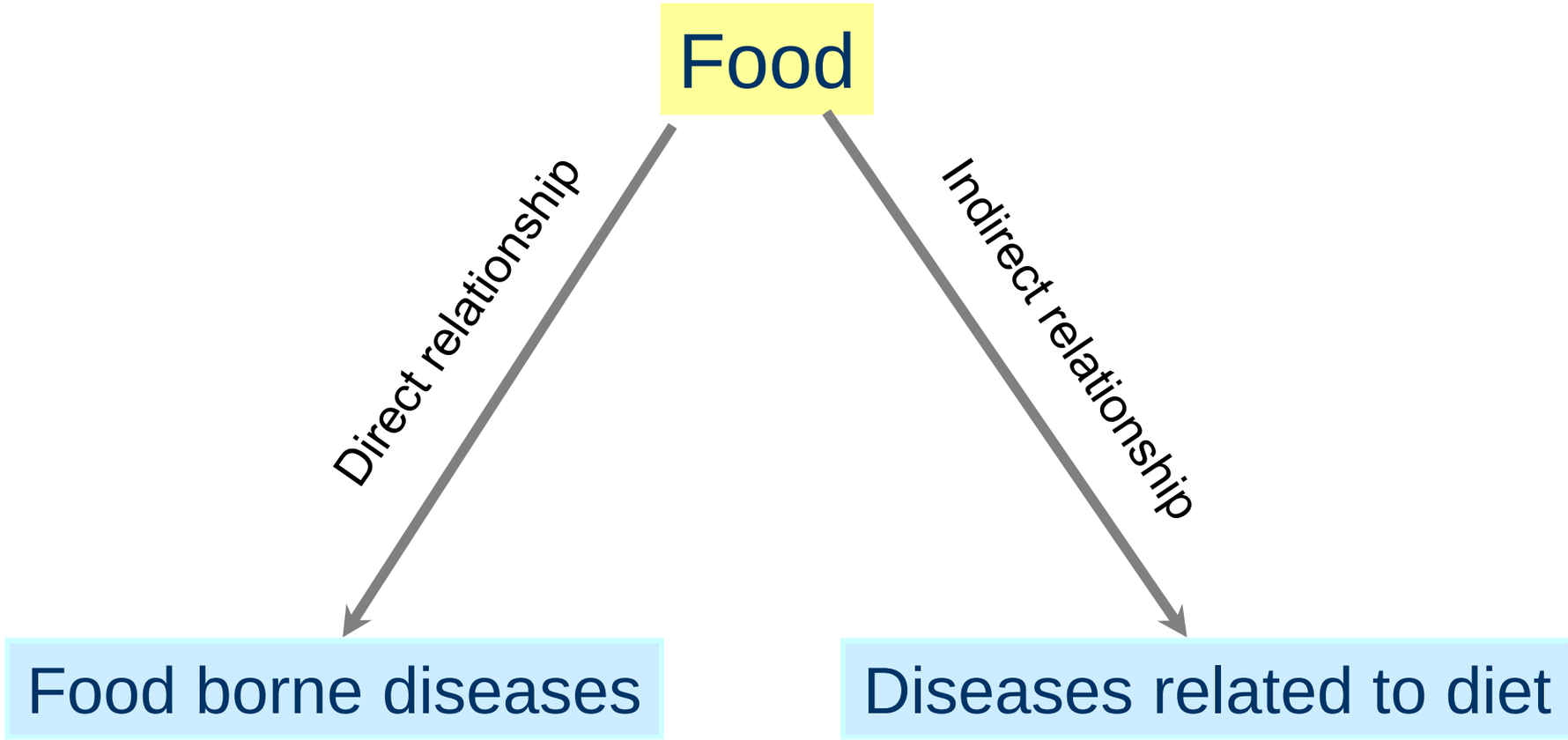


Policy makers
Regulation

Industry
Brands, HACCP
Health claims

Social scientists
Research
multidisciplinary

To start with



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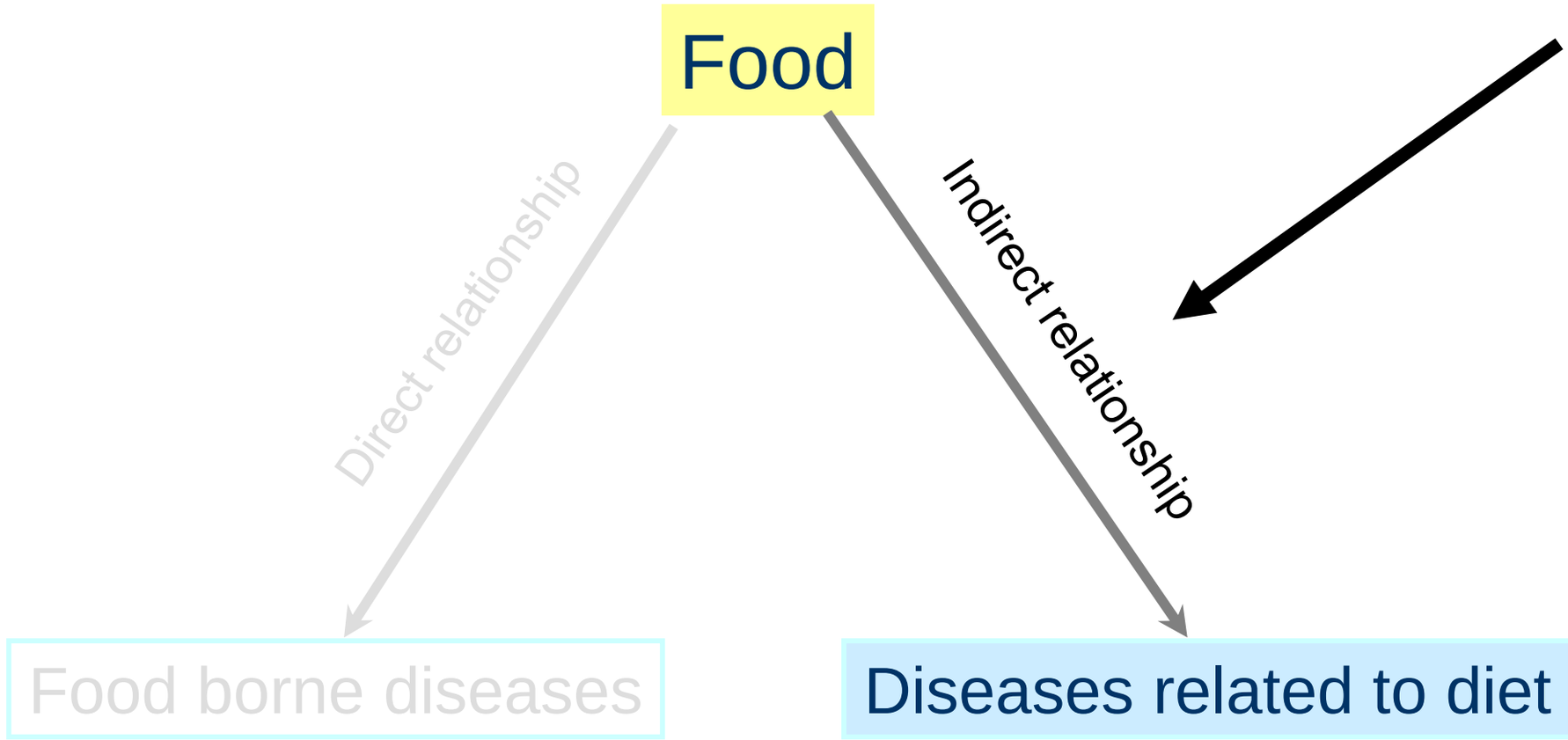

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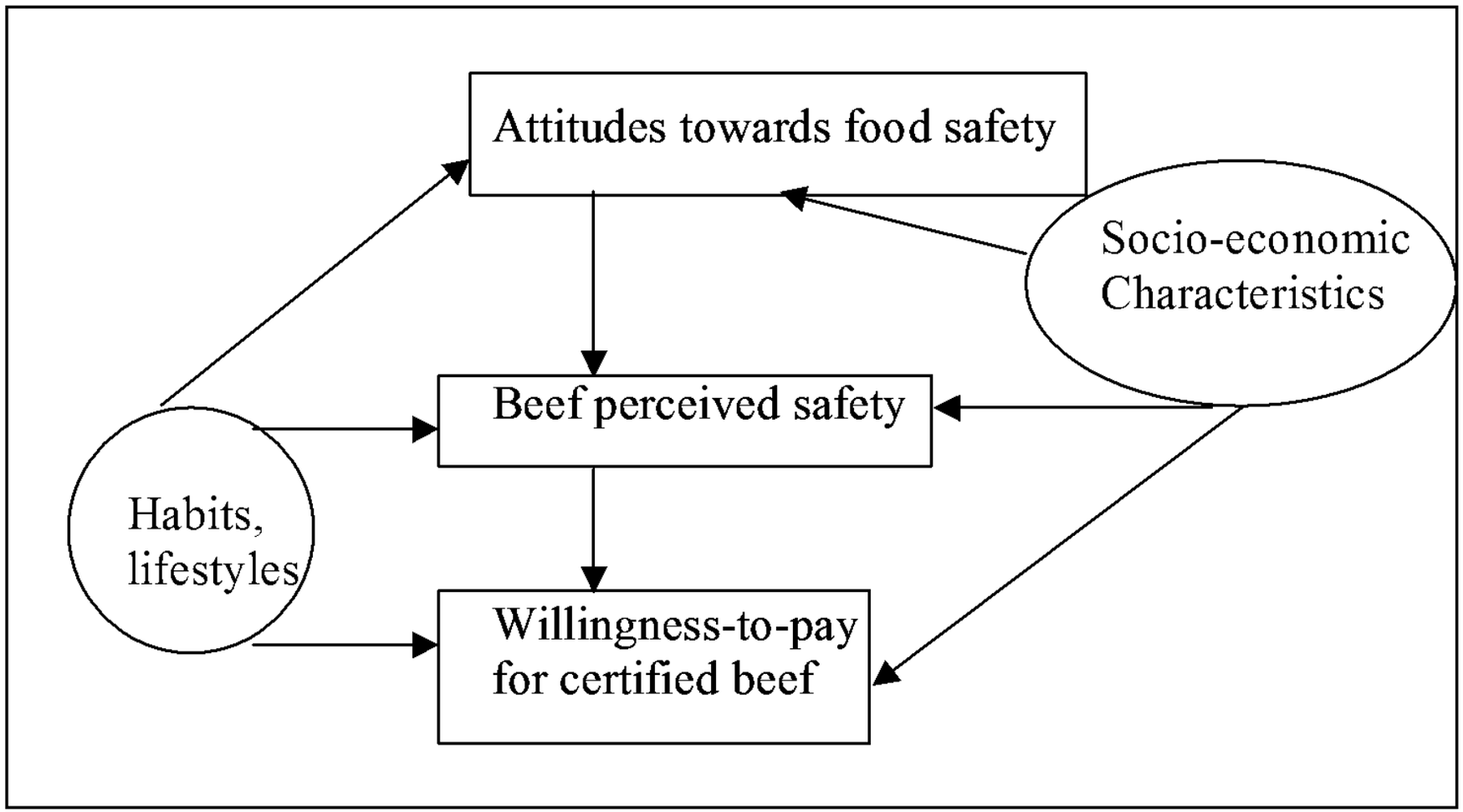
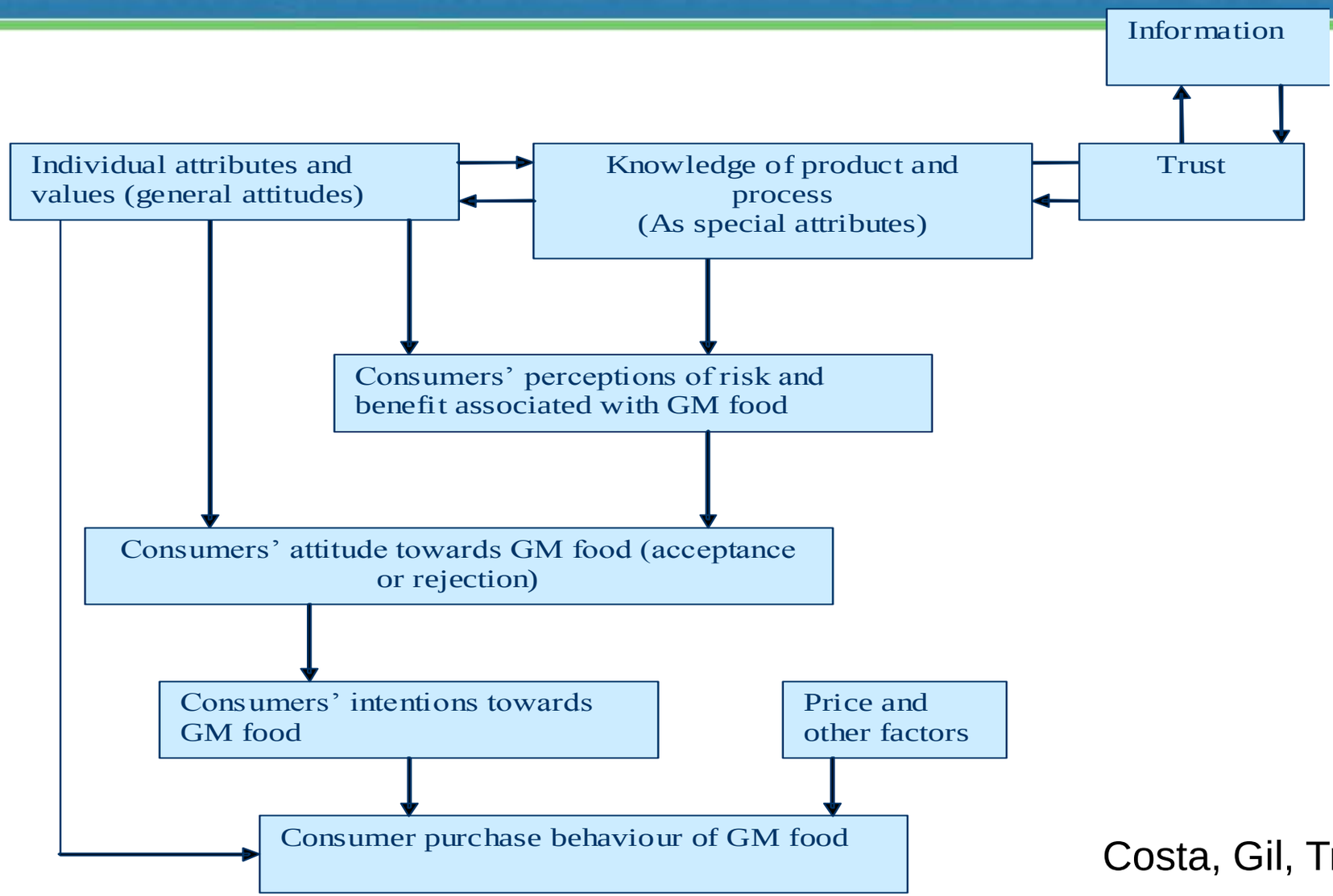


Angulo and Gil (2007). Food Quality and Preference

To start with



Costa, Gil, Traill (2008). Food Policy

Outline of the presentation

- Risk Perception & Risk Aversion
- Linking Risk Perception & Risk Attitudes
- Measuring Risk Attitudes: Simple Methods
- Expected Utility Framework
- Prospect Theory Framework
- Measuring Risk Attitudes: Complex Method
- Empirical Application
- Estimating Prospect Theory Parameters
- Preliminary Results 1
- Relating Risk Attitudes & BMI
- Preliminary results 2

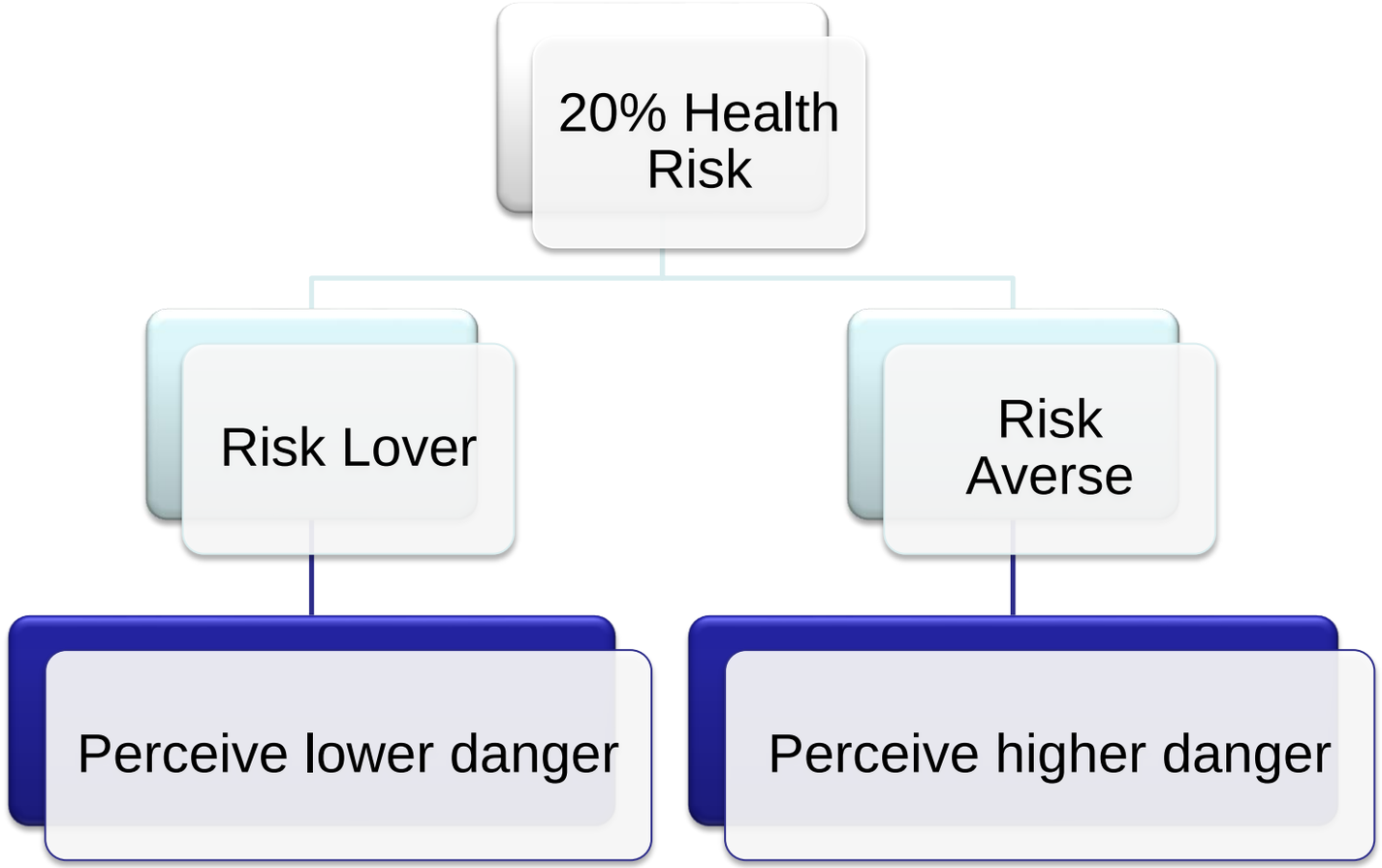
Risk Perception & Risk Aversion 1

- In Business:
- A person's risk propensity influences evaluation of risky situation.
- Risk propensity may impact risk perception (Brockhaus 1980; Vlek and Stallen 1980).
- Risk propensity has an inverse effect on risk perception (Keil et al.,2000; Forlani et al. (2002).

Risk Perception & Risk Aversion 2

- Food Safety
- Less risk averse consumers perceive food safety risk to be very low in case of an outbreak (Schroeder et al. 2017; Weller, Andrea and Caleb (2012).
- Consumption only reduces when the risk perception is relatively high
- Consequently, less risk averse people rarely reduce consumption

Linking Perception & Attitudes 1



Based on results from Schroeder et al. (2017) Weller, Andrea and Caleb (2012)

Linking Perception & Attitudes 2

So,

- Risk attitudes negatively affect risk perceptions
- Risk attitudes are inherent to consumers
- Risk perceptions are more conjectural (measurement is ad hoc and case specific) and depend on information, the technology itself, mass media or social networks and risk attitudes

- Other presentations on risk perception
- We focus on risk attitudes and, more specifically, **how to measure them?**

Measuring Risk Attitudes 1

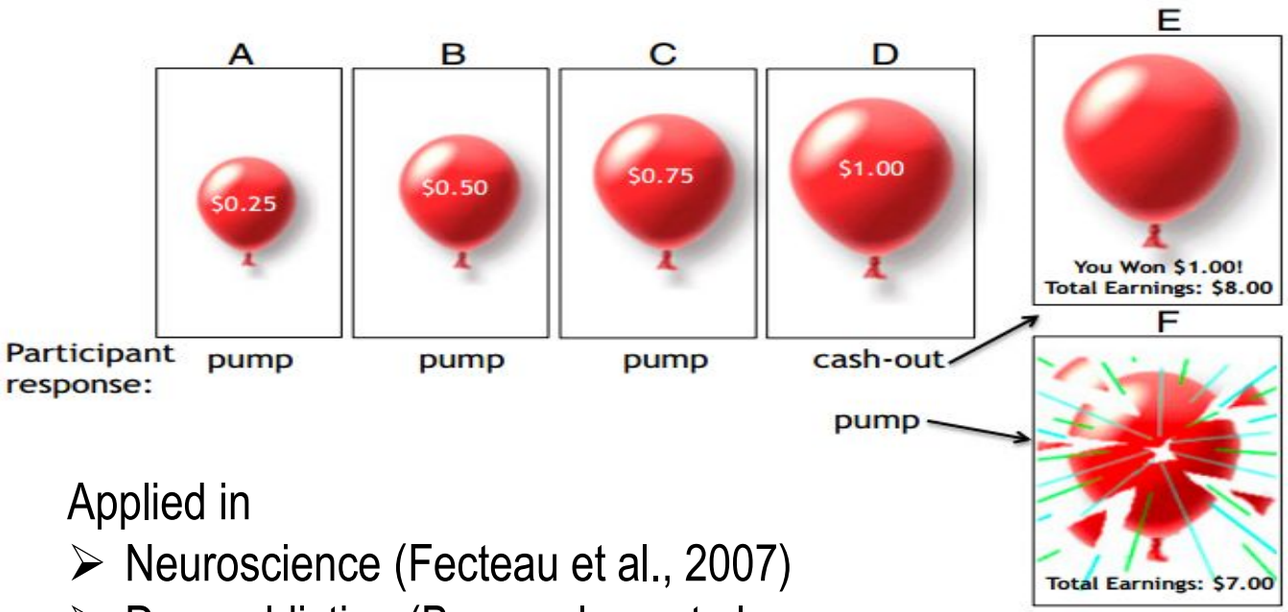
- Respondents give a global assessment of their willingness to take risks.
- Framing
  - "How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks"
- Respondents are assessed on the scale of 0 - 10:
  - 0 => not at all willing to take risks
  - 10 => very willing to take risks

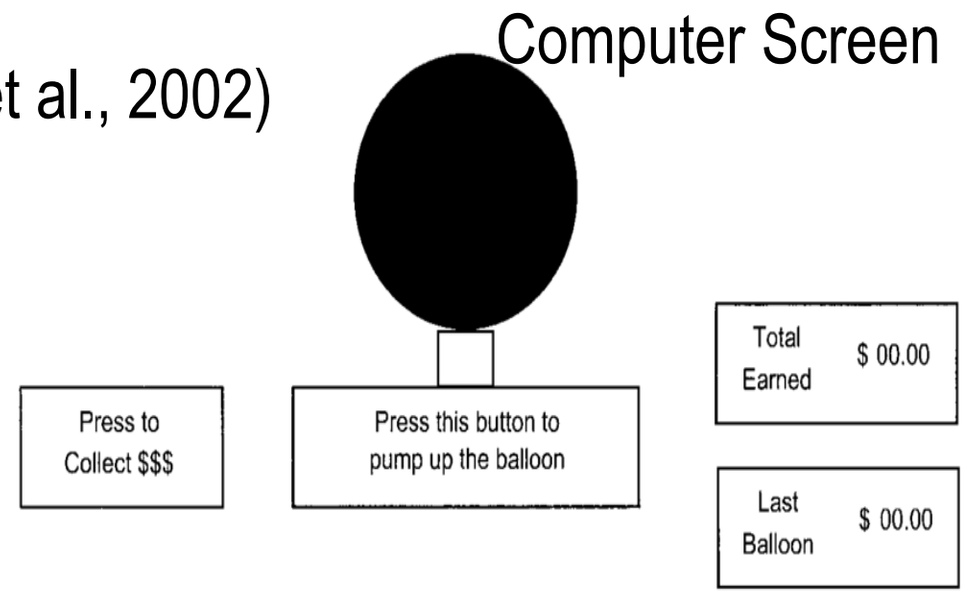
(Dohmen et al., 2011)

Measuring Risk Attitudes 2

Experimental Methods - Simple

1. Balloon Analogue Risk Task (Lejuez et al., 2002)





Applied in

- Neuroscience (Fecteau et al., 2007)
- Drug addiction (Bornovalova et al., 2005) and
- Psychopathology (Hunt et al., 2005).

WEAKNESS

- It is not clear if risk preferences extend to other domains
- Requires a computer and multiple trials to implement

Measuring Risk Attitudes 3

Healthy & Safety	8 items
Ethical	8 items
Recreational	8 items
Social	8 items
Gambling	4 items
Investment	4 items

very unlikely	unlikely	not sure	likely	very likely
1	2	3	4	5

- Simple to understand method

Critics:

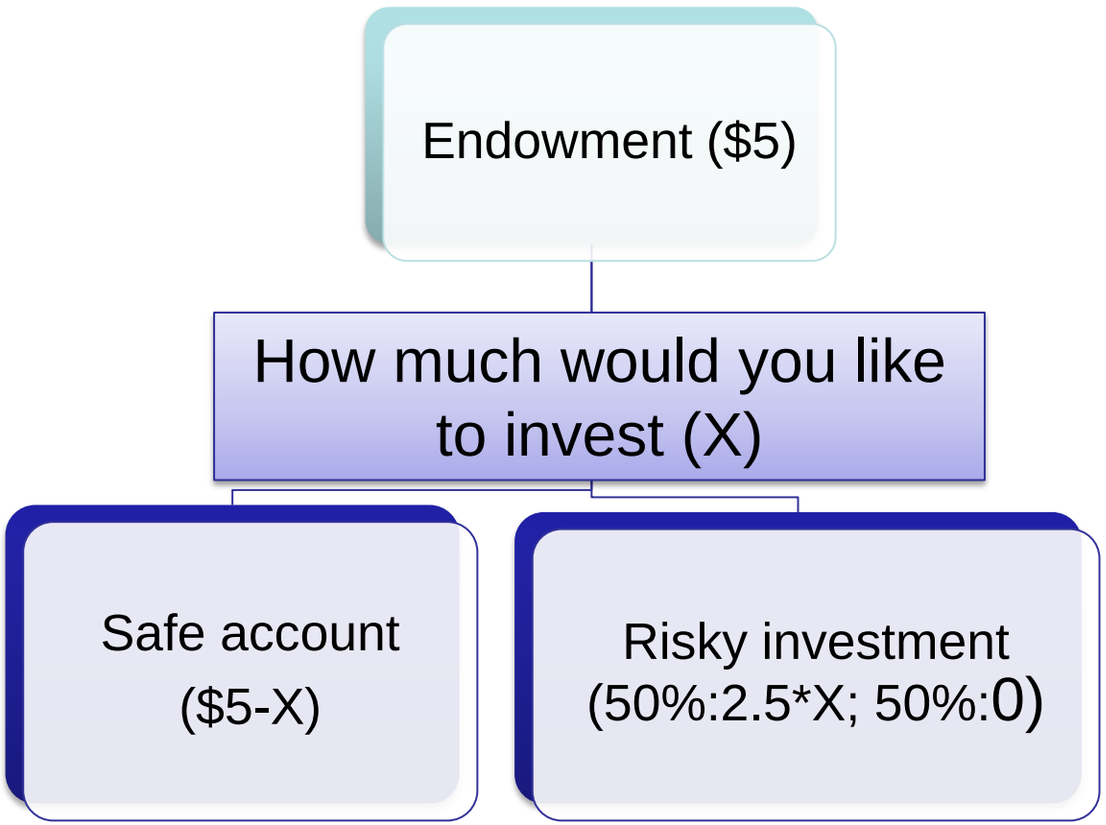
- Questionnaires are not incentivized:
  - Hence, elicited risk preferences may partially reflect an individual's true attitudes toward risk

- Hanoch et al. (2006) used the DOSPERT to demonstrate the domain-specific nature of risk preferences.

Preference (X) = a*Expected Benefit (X) + b*Perceived Risk (X) + c

Measuring Risk Attitudes 4

3. The Gneezy and Potters method



- Used to elicit myopic loss aversion in the financial decisions among
  - students (Gneezy and Potters, 1997),
  - professional traders (Haigh and List, 2005)
- Compare gender differences in risk attitudes (Charness and Gneezy, 2012).
- Risk preferences of bridge players

Critics:

- Does not distinguish between risk-seeking and risk-neutral preferences

The Investment game risk-elicitation method: from certain to uncertain

Measuring Risk Attitudes 5

4. Eckel-Grossman Task

The Eckel and Grossman measure.

Choice (50/50 Gamble)	Low payoff	High payoff	Expected return	Standard deviation	Implied CRRA range
Gamble 1	28	28	28	0	$3.46 < r$
Gamble 2	24	36	30	6	$1.16 < r < 3.46$
Gamble 3	20	44	32	12	$0.71 < r < 1.16$
Gamble 4	16	52	34	18	$0.50 < r < 0.71$
Gamble 5	12	60	36	24	$0 < r < 0.50$
Gamble 6	2	70	36	34	$R < 0$

- Results correlated significantly with those elicited through the other methods (Reynaud and Couture, 2012)
- Produced significantly less noisy estimates of risk preferences more than complex (Dave et al., 2010)
- Relatively easy for individuals to understand

Critics:

- it cannot differentiate between different degrees of risk-seeking behaviour

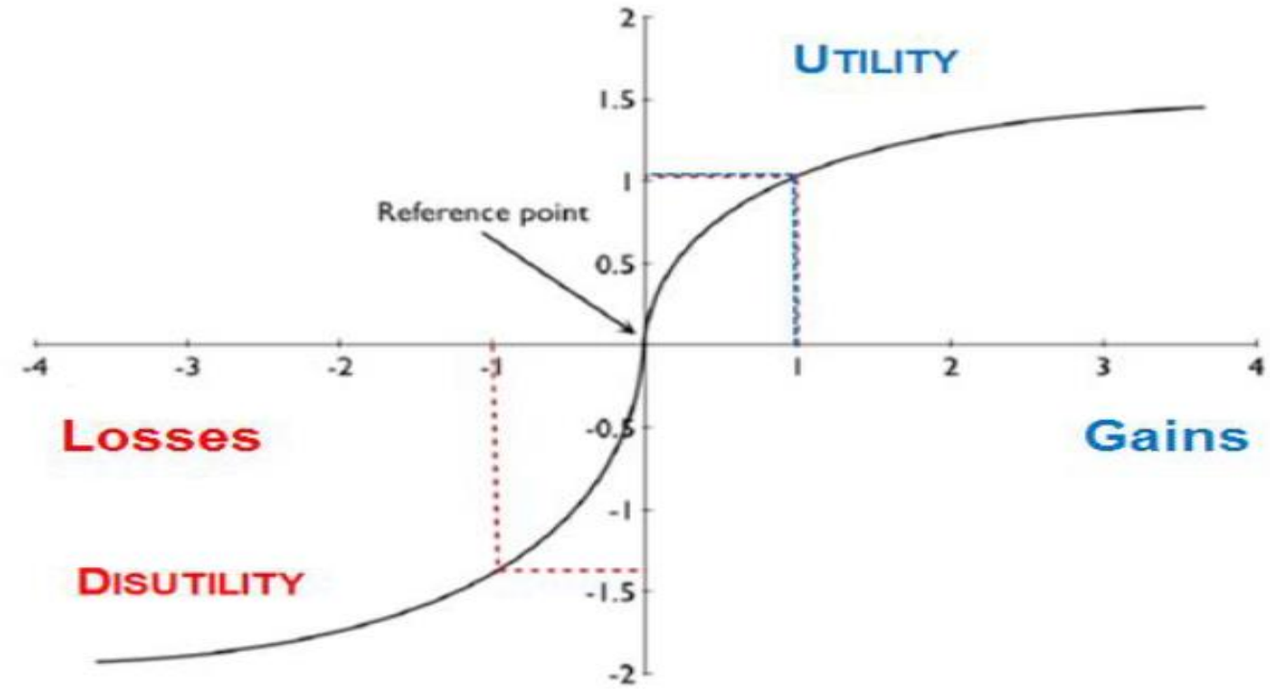
Expected Utility

- Preferences towards risky choices are represented by utility function (ordinal, not cardinal) U(a)
  - von Neumann Morgenstern utility function
- Decisions are made to maximize expected utility EU(a)
  - E is the expectation operator based on subjective probability distributions of a
- Independence assumption violated (assumption of linearity in probabilities may not hold).
- Risk preference characterized by expected utility (EU) assume that,
  - Risk aversion is the sole parameter for determining the curvature of the utility function.

Prospect Theory 1

- In Prospect Theory (PT) losses are valued more heavily than gains
  - Presence of loss aversion
- PT postulate
  - risk aversion for gains, concave utility function
  - risk seeking to avoid losses, convex utility function

Prospect Theory 2

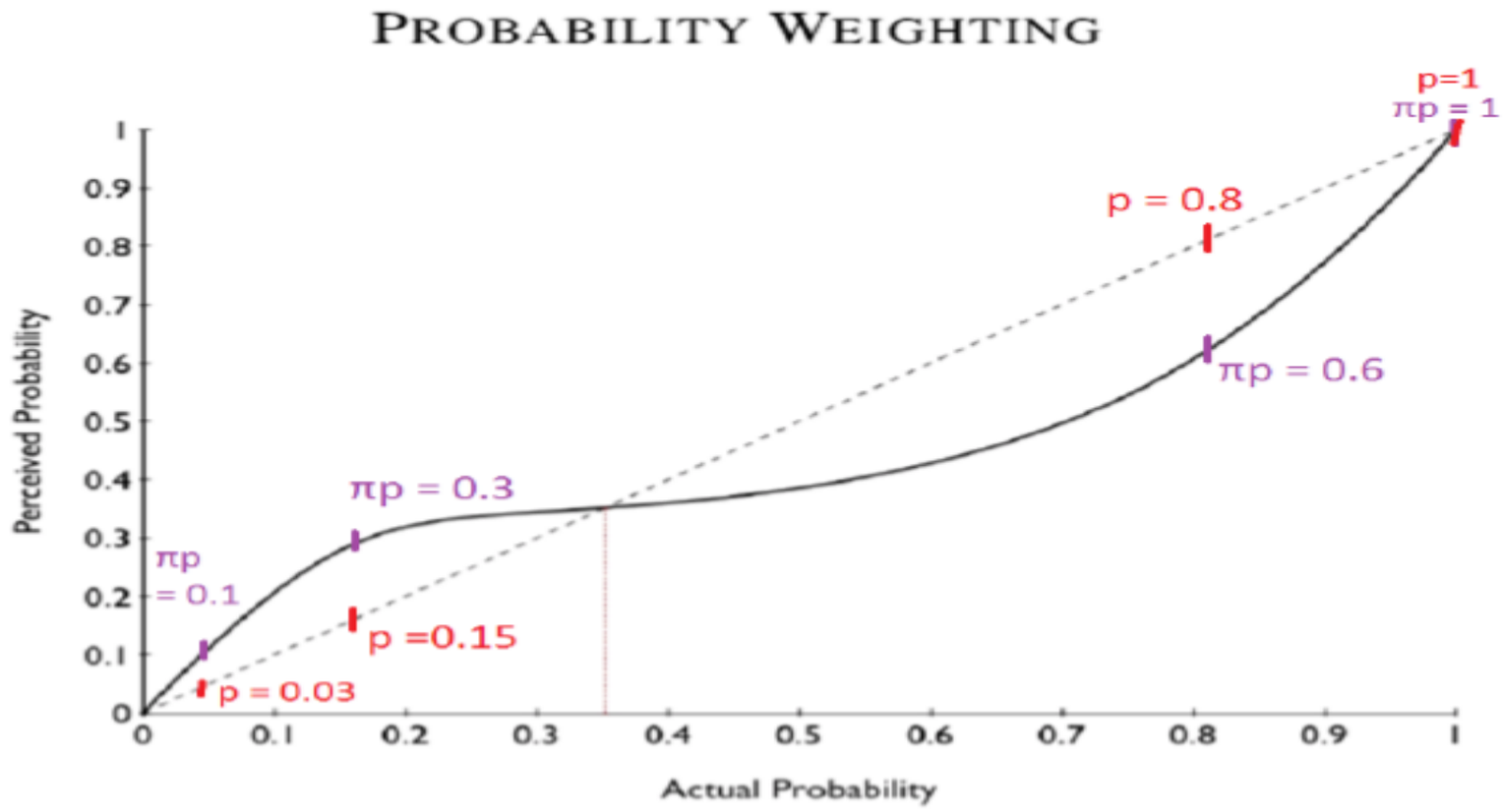


Loss aversion and Risk Aversion in Prospect Theory

Prospect Theory 3

- In PT the shape of the utility function is jointly determined by
  - risk aversion,
  - loss aversion (which measures one's sensitivity to loss compared to gain),
  - and nonlinear probability weighting (the individual tendency of overweighting small (large) probabilities and underweighting large (small) probabilities).

Prospect Theory 4



Probability Weighting in the Prospect Theory

Prospect Theory 5

- The MPL was designed to allows the researcher to estimate models that
  - nest both EU and PT
- Also MPL allows the results from the experiment to determine whether EU or PT better fits the data.

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Measuring Risk Attitudes 1

Complex Method: Holt–Laury measure of risk aversion

MPL method.

Option A	Option B	Option A	Option B
1/10 of $2, 9/10 of $1.60	1/10 of $3.85, 9/10 of $0.10	☐	☐
2/10 of $2, 8/10 of $1.60	2/10 of $3.85, 8/10 of $0.10	☐	☐
3/10 of $2, 7/10 of $1.60	3/10 of $3.85, 7/10 of $0.10	☐	☐
4/10 of $2, 6/10 of $1.60	4/10 of $3.85, 6/10 of $0.10	☐	☐
5/10 of $2, 5/10 of $1.60	5/10 of $3.85, 5/10 of $0.10	☐	☐
6/10 of $2, 4/10 of $1.60	6/10 of $3.85, 4/10 of $0.10	☐	☐
7/10 of $2, 3/10 of $1.60	7/10 of $3.85, 3/10 of $0.10	☐	☐
8/10 of $2, 2/10 of $1.60	8/10 of $3.85, 2/10 of $0.10	☐	☐
9/10 of $2, 1/10 of $1.60	9/10 of $3.85, 1/10 of $0.10	☐	☐
10/10 of $2, 0/10 of $1.60	10/10 of $3.85, 0/10 of $0.10	☐	☐

From Holt and Laury (2002).

- Participants are typically informed that one decision will be selected at random and the chosen gamble will be played for real.
- Subjects are then paid according to that outcome.

- Study relationship between
  - risk aversion and cognitive ability (Dohmen et al. 2010)

Measuring Risk Attitudes 2

- Modified/Double Multiple Price List Method all 3 prospect theory parameters
  - concavity,
  - loss aversion,
  - and weighting function parameters.

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Measuring Risk Attitudes 3

- Modified MPLs

Option A	Option B	Expected payoff difference (A-B)
Series 1		
3/10 of 40,000 and 7/10 of 10,000	1/10 of 68,000 and 9/10 of 5,000	7,700
3/10 of 40,000 and 7/10 of 10,000	1/10 of 75,000 and 9/10 of 5,000	7,000
3/10 of 40,000 and 7/10 of 10,000	1/10 of 83,000 and 9/10 of 5,000	6,200
3/10 of 40,000 and 7/10 of 10,000	1/10 of 93,000 and 9/10 of 5,000	5,200
3/10 of 40,000 and 7/10 of 10,000	1/10 of 106,000 and 9/10 of 5,000	3,900
3/10 of 40,000 and 7/10 of 10,000	1/10 of 125,000 and 9/10 of 5,000	2,000
3/10 of 40,000 and 7/10 of 10,000	1/10 of 150,000 and 9/10 of 5,000	-500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 185,000 and 9/10 of 5,000	-4,000
3/10 of 40,000 and 7/10 of 10,000	1/10 of 220,000 and 9/10 of 5,000	-7,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 300,000 and 9/10 of 5,000	-15,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 400,000 and 9/10 of 5,000	-25,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 600,000 and 9/10 of 5,000	-45,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 1,000,000 and 9/10 of 5,000	-85,500
3/10 of 40,000 and 7/10 of 10,000	1/10 of 1,700,000 and 9/10 of 5,000	-155,500
Series 2		
9/10 of 40,000 and 1/10 of 30,000	7/10 of 54,000 and 3/10 of 5,000	-300
9/10 of 40,000 and 1/10 of 30,000	7/10 of 56,000 and 3/10 of 5,000	-1,700
9/10 of 40,000 and 1/10 of 30,000	7/10 of 58,000 and 3/10 of 5,000	-3,100
9/10 of 40,000 and 1/10 of 30,000	7/10 of 60,000 and 3/10 of 5,000	-4,500
9/10 of 40,000 and 1/10 of 30,000	7/10 of 62,000 and 3/10 of 5,000	-5,900
9/10 of 40,000 and 1/10 of 30,000	7/10 of 65,000 and 3/10 of 5,000	-8,000
9/10 of 40,000 and 1/10 of 30,000	7/10 of 68,000 and 3/10 of 5,000	-10,100
9/10 of 40,000 and 1/10 of 30,000	7/10 of 72,000 and 3/10 of 5,000	-12,900
9/10 of 40,000 and 1/10 of 30,000	7/10 of 77,000 and 3/10 of 5,000	-16,400
9/10 of 40,000 and 1/10 of 30,000	7/10 of 83,000 and 3/10 of 5,000	-20,600
9/10 of 40,000 and 1/10 of 30,000	7/10 of 90,000 and 3/10 of 5,000	-25,500
9/10 of 40,000 and 1/10 of 30,000	7/10 of 100,000 and 3/10 of 5,000	-32,500
9/10 of 40,000 and 1/10 of 30,000	7/10 of 110,000 and 3/10 of 5,000	-39,500
9/10 of 40,000 and 1/10 of 30,000	7/10 of 130,000 and 3/10 of 5,000	-53,500
Series 3		
5/10 of 25,000 and 5/10 of -4,000	5/10 of 30,000 and 5/10 of -21,000	6,000
5/10 of 4,000 and 5/10 of -4,000	5/10 of 30,000 and 5/10 of -21,000	-4,500
5/10 of 1,000 and 5/10 of -4,000	5/10 of 30,000 and 5/10 of -21,000	-6,000
5/10 of 1,000 and 5/10 of -4,000	5/10 of 30,000 and 5/10 of -16,000	-8,500
5/10 of 1,000 and 5/10 of -8,000	5/10 of 30,000 and 5/10 of -16,000	-10,500
5/10 of 1,000 and 5/10 of -8,000	5/10 of 30,000 and 5/10 of -14,000	-11,500
5/10 of 1,000 and 5/10 of -8,000	5/10 of 30,000 and 5/10 of -11,000	-13,000

Critics:

- Most subjects will fail to understand the procedure
  - reduces the reliability of estimates
- Some participants may make inconsistent decisions
  - Solved by imposing strict monotonicity and enforcing transitivity.
- No consensus about the application in other domain
- Applied to examine the preferences of Vietnamese villagers (Tanaka et al. 2010)

Empirical Application 1

- Many researchers have applied the MPL to elicit risk preferences (Dohmen et al. 2011; Charness and Viceisza, 2011; Anderson and Mellor, 2009; Lonnqvist et al., 2011; Reynaud and Couture, 2012; Dave et al., 2010).
- Applied to sample population that include:
  - Students, Farmers, rural villagers and residents
- No study yet on consumer behaviour
  - area of food/health policy

Empirical Application 2

- We study risk attitudes of consumers by
  - Analysing correlation between risk aversion and BMI
- We used the
  - cumulative prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992)
  - and the one-parameter form of Prelec's (1998) axiomatically derived weighting function

Estimating Prospect Theory Parameters

- Under the PT, Utility function is modelled by
  - $PT(x, y; p) =$

$$pv(x) + (1-p)v(y); \qquad x > y > 0 \text{ or } x<y<0$$

$$w(p)v(x) + w(p)v(y); \qquad x<0<y$$

- Value Function:

$$v(x) = \begin{cases} x^{\sigma} & for\ x \geq 0 \\ -\lambda(-x^{\sigma}) & for\ x < 0 \end{cases}$$

- Weighting function:

$$w(p) = exp[-(-\ln p)^{\gamma}]$$

Estimating Prospect Theory Parameters

- Series 1 and series 2 were used to estimate
  - the curvature of the utility function (σ)
  - and the nonlinear probability weighting parameter (γ) for each respondent
- Using σ, γ estimated from above and the switching point of series 3,
- we estimated the loss aversion parameter (λ)

Preliminary Results 1

- Average risk aversion parameter to be 0.5875,
  - Consumers are in general risk averse.
- The average loss aversion parameter is 3.67,
  - In general consumers are loss averse.
- Average of the probability weighting parameter is 0.69,
  - In general consumers have the tendency to overweight low probabilities.
- Since σ is not equal to 1 and γ is not equal to 1
  - We reject expected utility framework

Relating Risk Attitudes and BMI

- Past studies suggest that
  - increase in risk aversion will lead to a decrease in BMI,
  - an increase in loss aversion will lead to an increase in individual´s BMI.
- As such we postulate that risk aversion and loss aversion correlate with an individual´s BMI.

Relating Risk Attitudes and BMI

- We estimate linear regression model (with robust standard errors):
  - relate risk preference parameters to BMI and other socioeconomic characteristics
- $\sigma_i = \delta_0 + \delta_1 BMI_i + \delta_3 \gamma_i + \delta_4 gender_i + \delta_5 Age_i + \delta_6 mar_i + \delta_7 + prim_i + \delta_8 sec_i$
  - Mar implies the person is married
  - *prim* is 1 if the individual´s highest level of education is primary,
  - *sec* is 1 if the individual´s highest level of education is secondary education and 0 if otherwise.

Preliminary Results 2

	ersion	Aversion
BMI	0.01*	.03
Age	-0.01**	0.06***
Probability weighting	0.05	-2.12
Married	-0.05	0.79
Gender	0.08	-0.73
Primary education	0.09	-0.10
Secondary education	0.10**	-0.85
Constant	0.50*	2.05

Obese persons are less risk averse

Older People are more risk averse

Older People are less loss averse

Secondary school leavers are less risk averse than university graduates

*,**,*** respresent significant at 10%, 5%, 1%, respectively.

Preliminary Results 2

- We performed a robustness check by
  - excluding all individuals who did not switch from A to B or chose option B throughout.

Obese persons are less risk averse

Older People are more risk averse

Secondary school leavers are less risk averse than university graduates

Increase in BMI increases loss aversion

	Risk Aversion	Loss Aversion
BMI	0.01*	-0.125**
Age	-0.010***	0.042
Probability weighting	0.049	-0.733
Married	-0.045	-0.088
gender	0.081	-0.653
Primary education	0.094	-0.673
Secondary education	0.096**	0.214
Constant	0.499*	4.327**

*,**,*** respresent significant at 10%, 5%, 1%, respectively.

Measuring Risk Attitudes

Thank you