The Benefits of Avoiding Cancer (or Dying from Cancer): Evidence from a Four-country Study

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Introduction and Motivation

- Environmental, workplace and consumer product regulations can reduce the occurrence of cancer
- Benefit-cost analysis
- Key benefit metrics:
  - Value of a Statistical Case of Cancer (VSCC)
  - Value of a Statistical Life (VSL) (a.k.a. Value of a Prevented Fatality [VPF])
- Is there a cancer VSL "differential" or "premium"?
- Large risk analysis and psychometrics literature suggests that cancer VSL is different than accidental death VSL

Earlier Empirical Research

- Cancer VSL or VSCC:
  - Alberini et al. (2007)
  - Tsuge et al. (2005)
  - Tonin et al. (2009)
- Cancer premium:
  - Cameron et al. (2010)
  - Hammitt and Liu (2004)
  - Hammitt and Haninger (2010)
  - Alberini and Scasny (2011, 2013)
  - OECD (2012)
  - Chilton et al. (2013)

Research Questions

- What VSCC and cancer VSL figures should be used in EU/ECHA policy analyses?
- How important are quality of life and pain in explaining the willingness to pay to reduce cancer mortality risks?
- In stated preference studies
  - Can respondents handle several quantitative attributes (here, two probabilities and one cost)?
  - How do qualitative attributes fare?

Approach

- Stated Preferences
- In each choice card, the respondent must choose between an alternative that reduces risks (at a cost) and the status quo =
- = dichotomous-choice (DC) contingent valuation (CV) questions
- Total of 7 DC CV questions per respondent

What Good Are We Valuing?

- Reduction in the risk of dying from cancer
- This risk is the product of
  - Risk of getting cancer
  - Risk of dying from cancer, conditional on getting cancer in the first place
- Generic cancer (no mention of organs affected, type, etc.)
- Description of quality of life impacts and pain

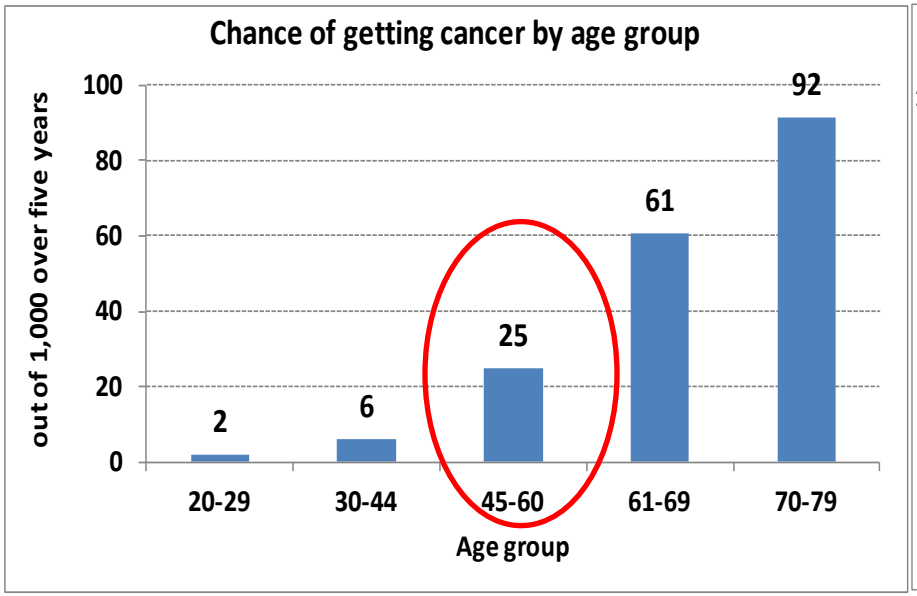
Attributes and Levels

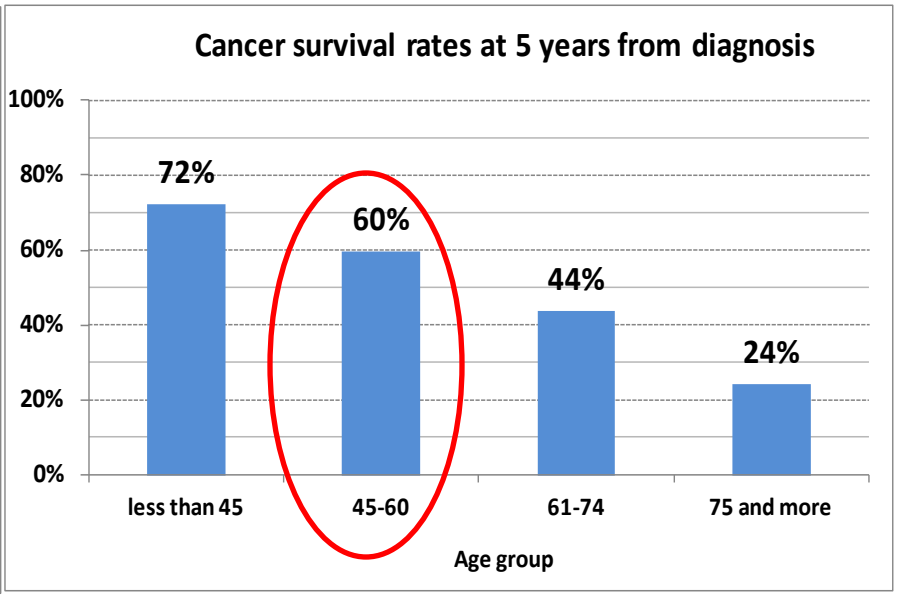
Reduction in the chance of getting cancer within the next 5 years	0 (baseline), 2, 3, 5 in 1000 over 5 years
Chance of survival at 5 years (if you get cancer)	60% (baseline), 65%, 70% and 80%
Effects on everyday activities (if you get cancer)	Fully active No heavy physical work Unable to work Confined to bed half of the time
Pain (if you get cancer) during treatment, recovery, or any other times	Mild pain Moderate pain
Cost (euro)	110 225 370 540

Valuation Scenario

- Private, individual action
- The respondent is the only person (in the family, for example) whose cancer risks and survival chances would be affected
- No link to environmental policies or exposure to chemicals
- The risk reductions cost money

Valuation Scenario: Baseline Risks

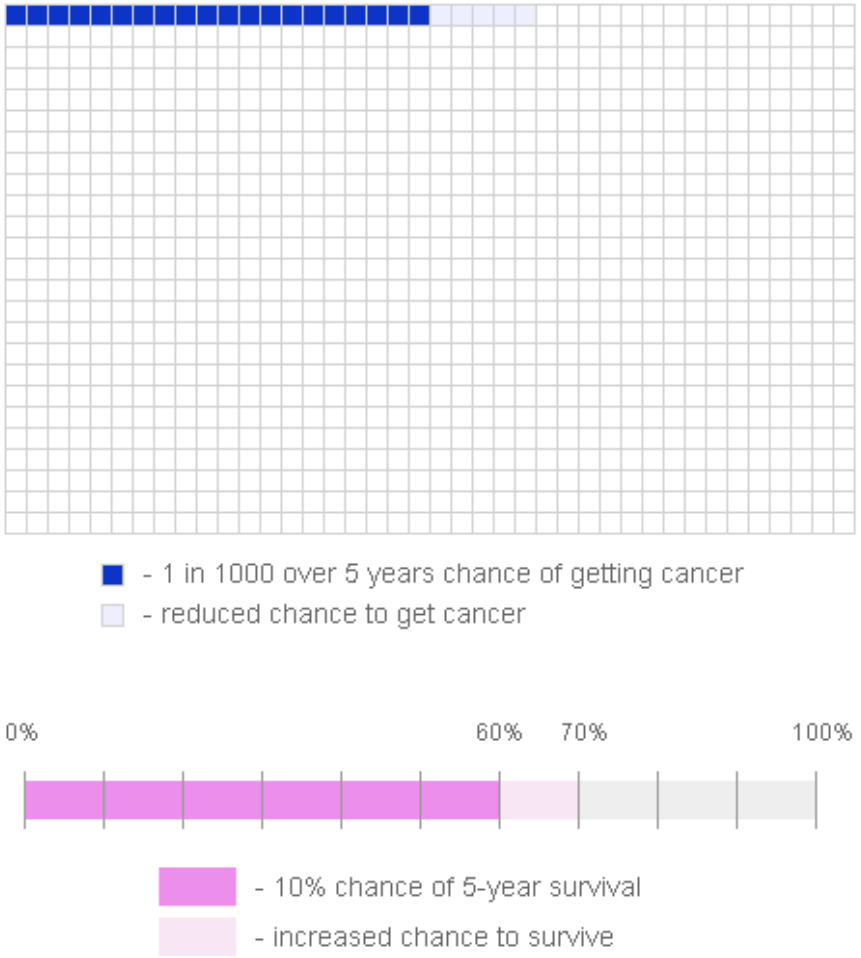




In real life, risks and survival chances vary continuously with age, but we show the same risks and survival chances to all our respondents (who are aged 45-60)

Example Choice Card

	The current situation	Option A (reduced risks)
Chance of getting cancer over 5 years	25 in 1 000	20 in 1 000
Chance of 5-year survival (if you get cancer)	60 %	70 %
Effects on everyday activities (if you get cancer)	Unable to work	Unable to work
Pain (if you get cancer)	Mild pain	Mild pain
Annual cost for each of the next 5 years (total in parentheses)	£ 0 (in total £ 0)	£ 210 (in total £ 1050)
Which would you choose?	The current situation	Option A (reduced risks)



Design

- 32 blocks where the risk-reducing alternative is selected at random from the full factorial design
- QOL and pain always the same for alternative and status quo, but change over the choice cards
- structure of the blocks:

	Blocks 1-16	**Blocks 17-32**
First 3 choice cards	$\Delta S=0$, only $\Delta R\neq 0$	$\Delta R=0$, only $\Delta S\neq 0$
Choice cards 4-7	ΔS and ΔR are both varied	ΔS and ΔR are both varied

Estimating the VSL -- The Model

$$WTP_{ij}^{*} = \alpha + \mathbf{QOL}_{ij}\boldsymbol{\beta} + PAIN_{ij}\gamma + \Delta MORT\ RISK_{ij}\delta + \varepsilon_{ij}$$

Latent WTP

Reduction in the unconditional risk of dying from cancer

Cancer VSL

The Model (cont'd)

But

$$\Delta MORT\ RISK = \Delta R \cdot (1 - S_0) + R_0 \cdot \Delta S - \Delta R \cdot \Delta S$$

Where

ΔR=reduction in the risk of cancer

ΔS=increase in the chance of surviving cancer

R_0=baseline risk of cancer

S_0=baseline chance of surviving cancer

So…

$$WTP_{ij}^{*} = \ldots + \delta \cdot [\Delta R \cdot (1 - S_0) + R_0 \cdot \Delta S - \Delta R \cdot \Delta S] + \varepsilon_{ij}$$

Estimating the VSL

$$WTP_{ij}^{*} = \ldots + \delta \cdot [\Delta R \cdot (1 - S_0) + R_0 \cdot \Delta S - \Delta R \cdot \Delta S] + \varepsilon_{ij}$$

VSL

Only this if choice cards 1-3, blocks 1-16

Only this if choice cards 1-3, blocks 17-32

Estimating the VSCC

$$WTP_{ij}^{*} = \ldots + \delta \cdot [\Delta R \cdot (1 - S_0) + R_0 \cdot \Delta S - \Delta R \cdot \Delta S] + \varepsilon_{ij}$$

So…

$$VSCC = \frac{\partial WTP^{*}}{\partial \Delta R} = \delta(1 - S_0) - \delta \Delta S$$

- The VSCC declines with the size of the improvement in the chance of survival
- If $\Delta S=0$ (choice cards 1-3, blocks 1-16), then $VSCC=VSL \times (1-S_0)$

Estimation details

- We don’t observe the actual WTP
- We only have yes/no responses to each choice card
- Probit model – RHS is augmented with COST
- Random effects probit to allow for correlated responses
- In earlier slides, QoL and Pain are additive—in alternate specifications, they can be entered as interactions with the reduction in the risk of dying
- Country fixed effects always included

Survey Administration

Pilot

- February 25th - March 9th 2014
- CZE and UK
- N=276

Main wave

- March 20th – April 22nd, 2014
- CZE, ITA, NL, UK
- Final sample N=3612

- Mode of survey administration: CAWI and CASI
- Universe: adults aged 45 – 60
- Sampling: quotas based on region, age, gender and household income
- N=8556 contacted, N=3888 completed (survey response rate: raw 45%, 83% if we disregard those who were discarded b/c quotas were already met)

The Data:
Sample Sizes

Country	**Pilot**	**Main wave**
Czech Republic	148	1 145
United Kingdom	128	733
Netherlands	-	910
Italy	-	824
Total	**276**	**3 612**

The Data: Data Cleaning

- Completed questionnaires N=3612
- No “speeders”
  - Speeder = questionnaire completed in less than 13 mins.
  - 444 speeders (12.29%)
- No respondents who failed the probability quiz
  - 891 “flunkers” (24.62%)

The Data: Sociodemographics

Characteristic	Sample mean
Female	0.51
Age	52.22
Household size	2.65
Single	0.17
Couple	0.34
No children	0.71
Children	0.41
Household income (after tax per month, € PPS)	1,871
No information about household income	0.14

The Data: Familiarity with Cancer

	CZE	UK	ITA	NL
Has had a benign tumour	18.4 %	15.7 %	14.0 %	18.0 %
Has had cancer	7.4 %	12.6 %	5.5 %	6.4 %
Any of the closest family members (e.g., parents, siblings, spouse, or children) have been diagnosed with cancer	51.6 %	56.7 %	56.1 %	61.6 %
Believes that there is a predisposition towards cancer in the family	33.4 %	21.5 %	24.7 %	26.1 %
Any friends have been diagnosed with cancer	68.2 %	65.3 %	71.7 %	61.9 %

The Data: Dread

Description	Percent of the sample that rate this the highest level of dread (5 on scale from 1 to 5)
Dying in a car accident	17.64
Dying in a domestic accident	10.52
Surgery on an emergency basis	11.09
Developing a chronic respiratory illness	11.71
Getting **cancer**	**39.84**
Becoming paralyzed	37.46
Having a heart attack	24.47
Developing an illness that makes me completely dependent on being taken care of by someone else	48.46

Key Results – t stats in parentheses

	(A): Blocks 1-16 Choice cards 1-3 Only ΔR≠0 Nobs: 3483	**(B): Blocks 17-32 Choice cards 1-3 ΔS≠0** Nobs: 3759	**(C): All blocks, all choice cards** Nobs: 16873
QOL=1 dummy	-0.1343	0.1625	-0.0486
	(-1.067)	(1.269)	(-1.175)
QOL=2 dummy	0.0026	0.1762	-0.0892
	(0.018)	(1.107)	(-1.918)
QOL=3 dummy	-0.1701	0.1357	-0.1756
	(-1.148)	(0.827)	(-4.083)
Moderate pain dummy	0.1246	0.0867	0.0190
	(1.311)	(0.977)	(0.620)
ΔMORTRISK	15023.027	6136.54	5324.53
	(8.070)	(10.175)	(30.271)
Cost	-0.00265	-0.00325	-0.00249
	(-9.223)	(-7.938)	(-25.181)
Implied VSL (mill. PPP euro)	**5.676**	**1.887**	**2.144**
	(s.e. 0.866)	(s.e. 0.284)	(0.102)
Implied VSCC (mill. PPP euro)	**0.551**	n/a	Varies with ΔS
	(s.e. 0.084)		

VSCC from all choice cards, all blocks

Value of $\Delta S=0$	**VSCC (million PPP euro)**
No change	0.339 (s.e. 0.035)
5% at 5 years	0.266 (s.e. 0.025)
10% at 5 years	0.198 (s.e. 0.021)
20% at 5 years	0.073 (s.e. 0.032)

Effect of…on WTP

- Female: positive but v. small and statistically insignificant
- Age: negligible
- Interacting the mortality risk reduction with QoL and pain dummies: no effect whatsoever

Results: Dread

Cancer dread = 5	0.4575**
(dummy)	(4.99)
Unconditional mortality	5321.39**
risk reduction	(30.26)
cost	-0.00249**
	(-25.18)

Xtprobit regression also includes country fixed effects, QoL and pain.

Conclusions

- Respondents take into account the quantitative attributes of risks
- Quality of life and pain attributes not important. Why?
  - They were varied across choice cards but not across alternatives within a choice card, so maybe respondents didn't pick up on them?
  - "Cancer is cancer" and so perhaps respondents didn't distinguish among cases of cancer?
  - In hindsight, QoL and Pain not very helpful for cost-benefit policy analyses based on ex ante estimates of cancer/cancer mortality risks associated with exposure to carcinogens

Conclusions - 2

- Subjective dread assessments still matter
- All in all, estimates of the cancer VSL similar to existing figures from other studies, and higher than VSL for any cause of death used for environmental policy purposes in Europe

Thank you!

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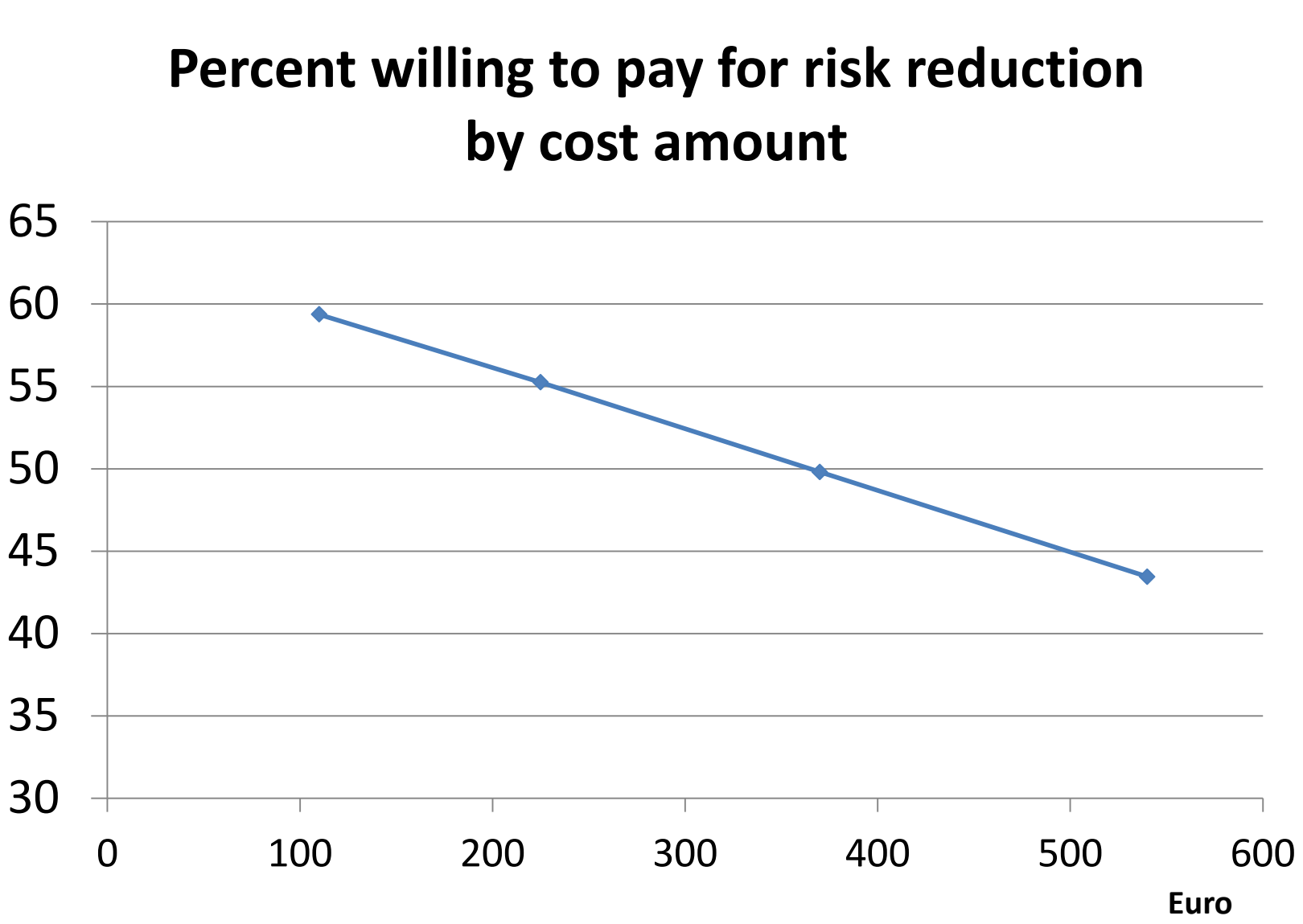
The Data: Valuation Questions

choice card	% choosing the risk-reducing alternative over the current situation
1	48.26
2	47.76
3	45.71
4	57.45
5	54.68
6	53.13
7	56.09


Percent willing to pay for risk reduction by cost amount
65
60
55
50
45
40
35
30
0
100
200
300
400
500
600
Euro

Structure of the questionnaire

- A: Health status
- B: Probability tutorial
- C: Dread
- D: Cancer risks
- E: Effects of cancer on quality of life, social and personal relationships, etc.
- F: Factors affecting cancer
- H: Valuation including de-briefing
- K: Socio-demographics