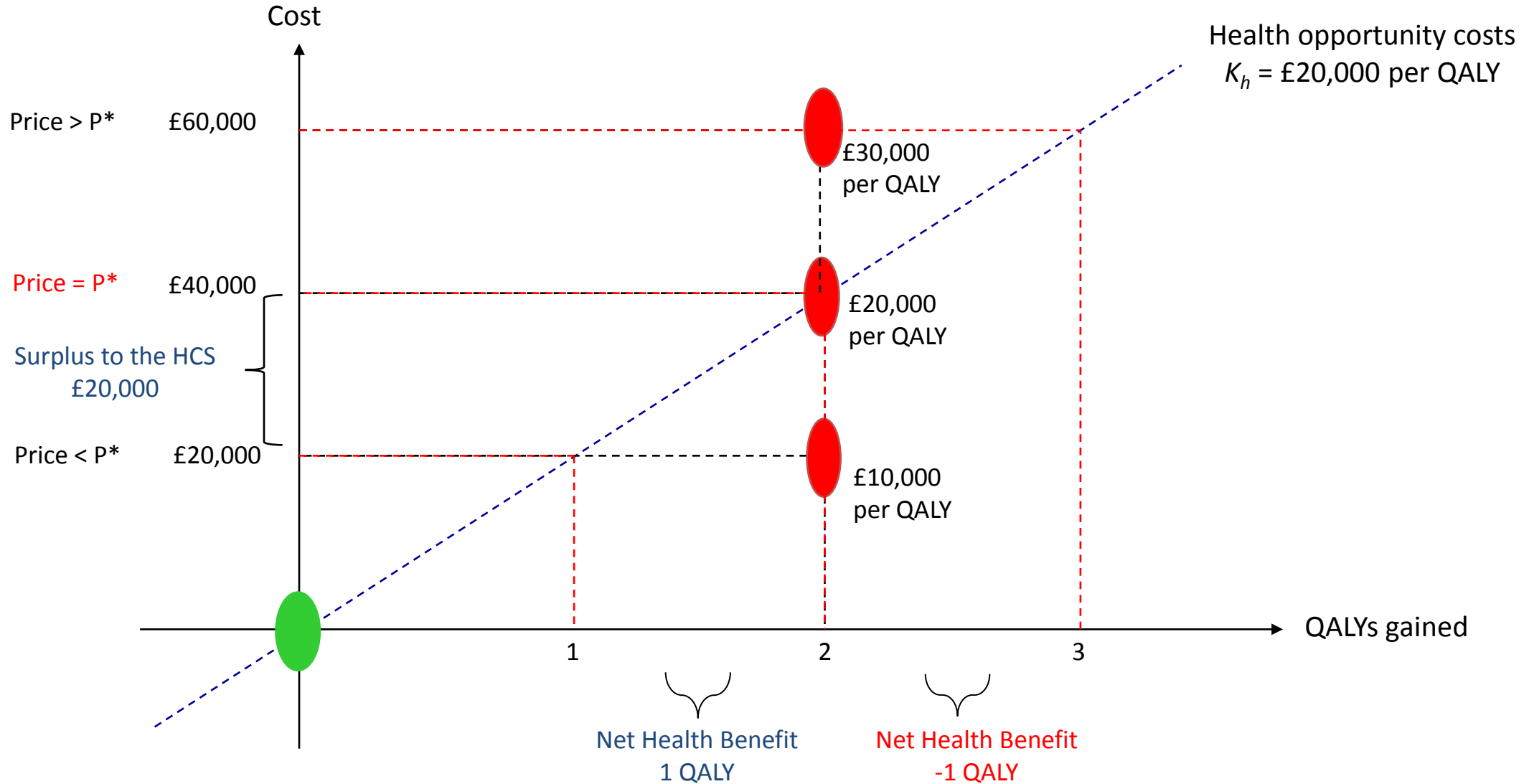


Informing decisions about health care: the importance of assessing health opportunity costs

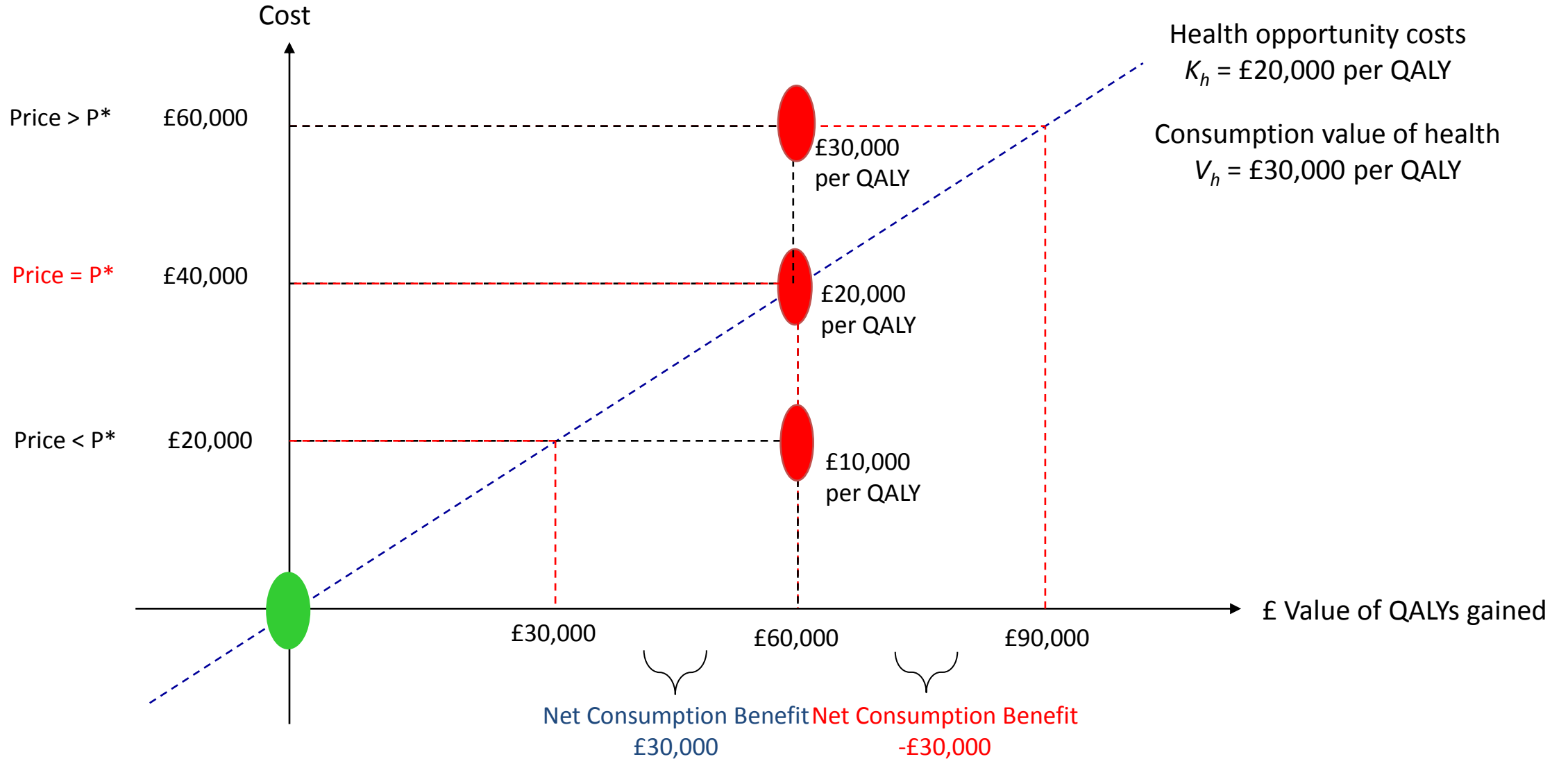
Karl Claxton

7/2/2020

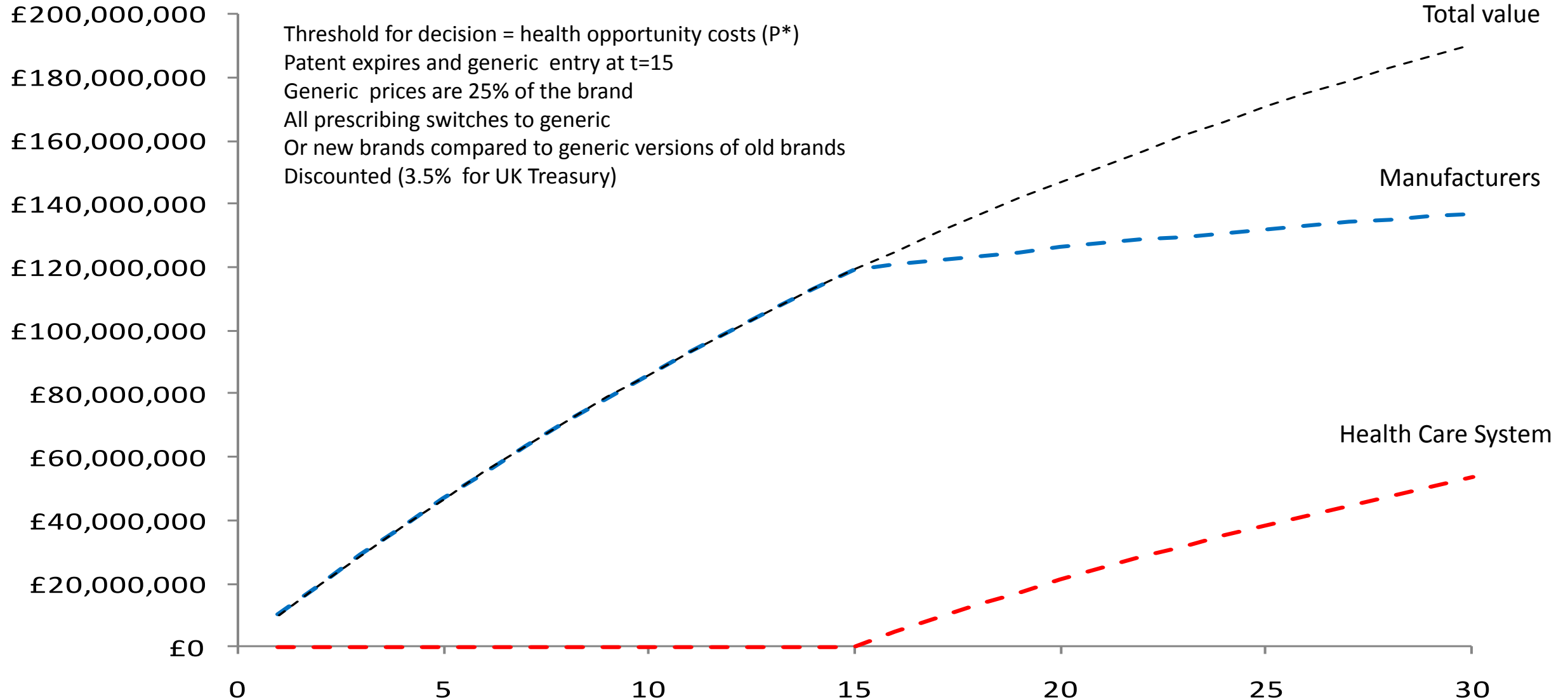
What is a fair price?



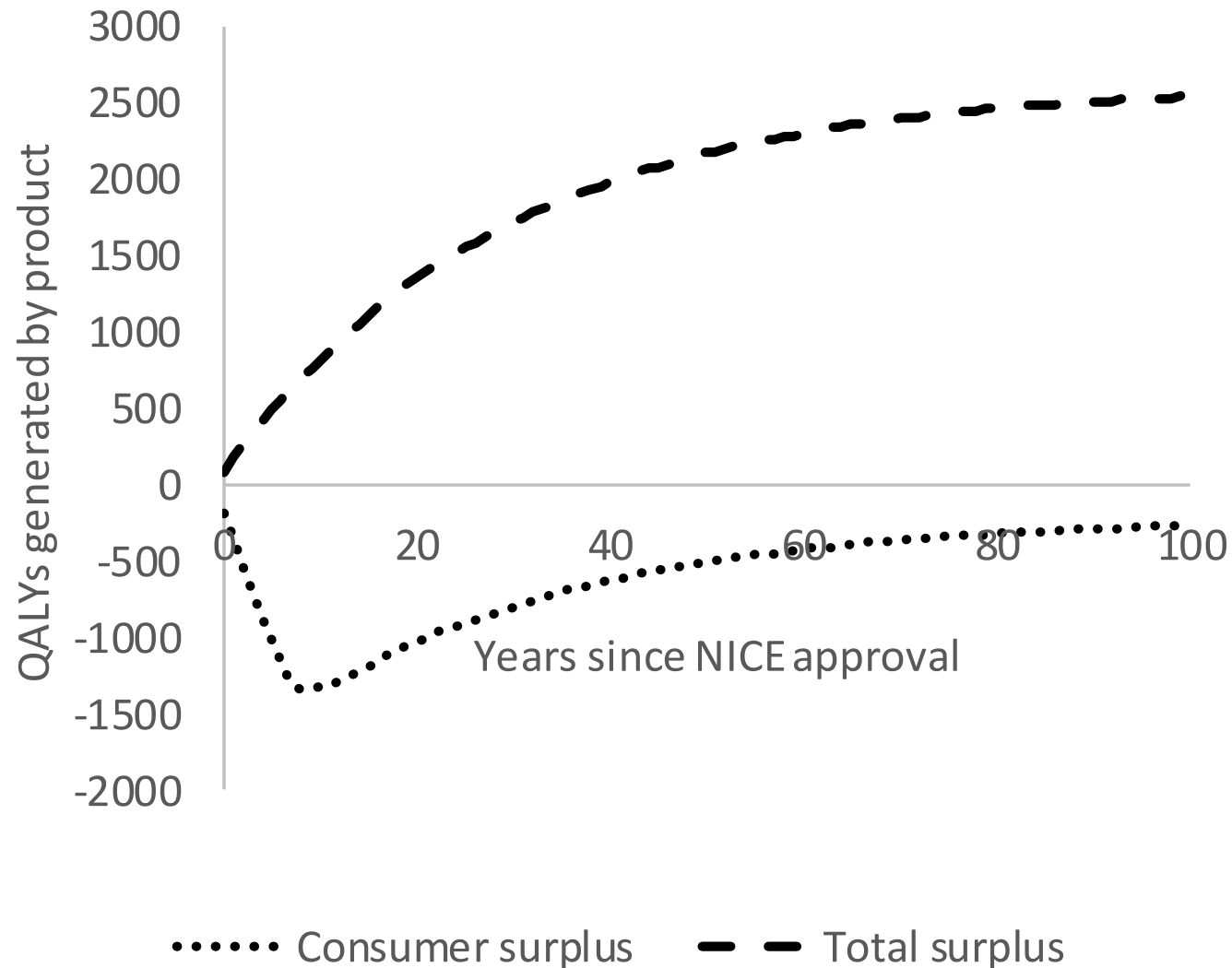
What is a fair price?



What about future innovation?

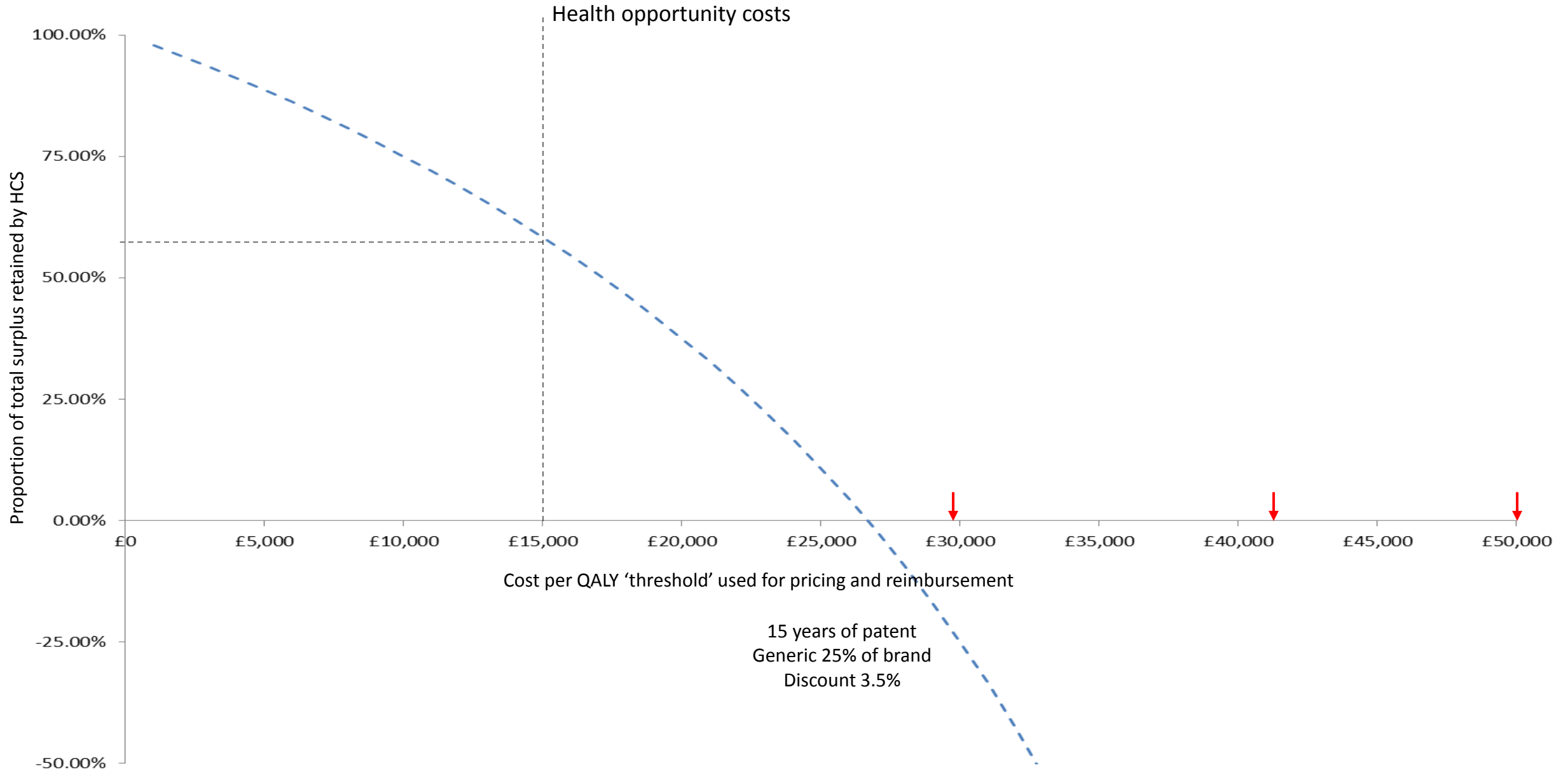


TA391 Cabazitaxel for prostate cancer

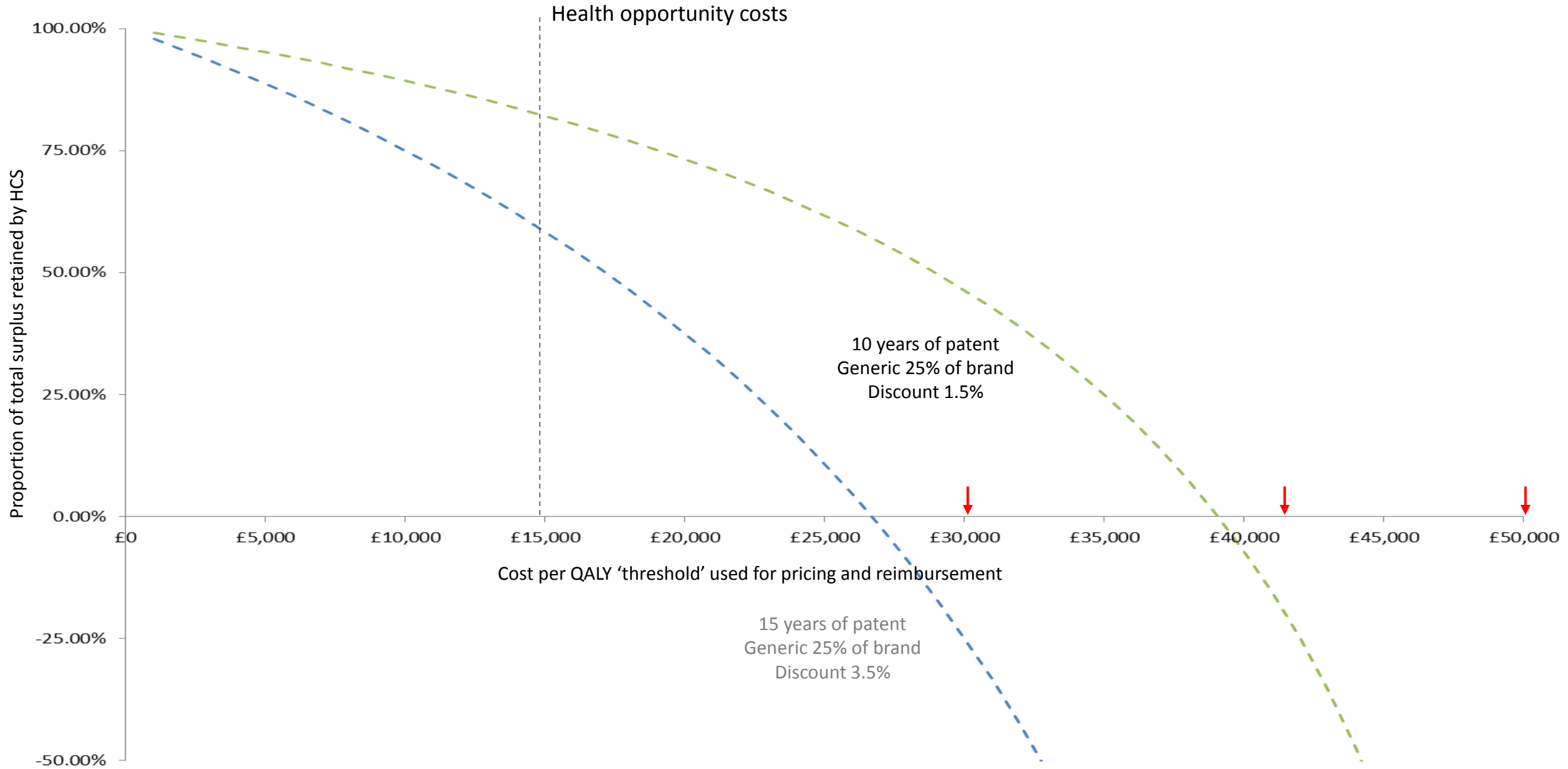


- Consumer surplus does not rise above zero due to high approval norm
- Consumer surplus will be lower if initial approval within the Cancer Drugs Fund taken in to account

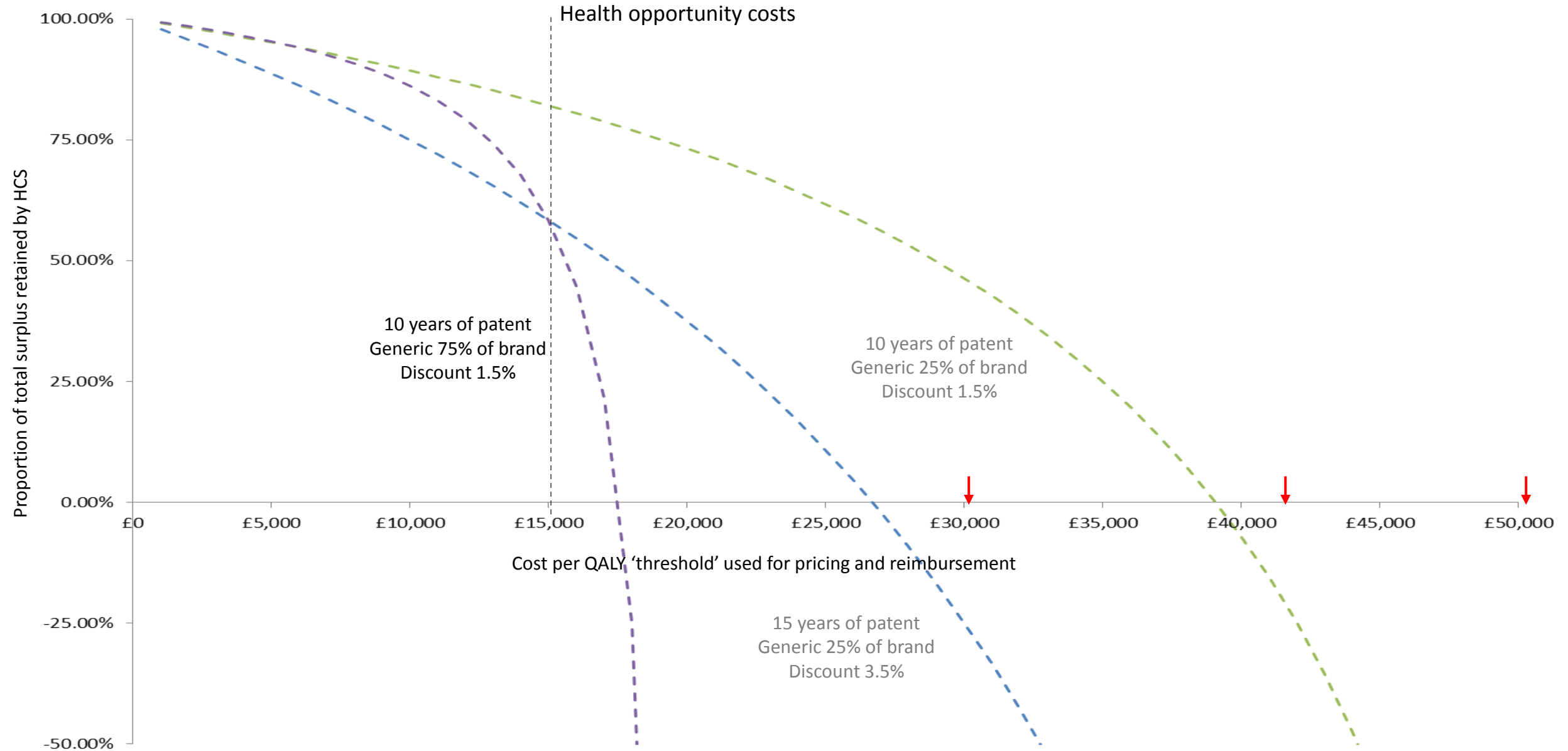
How is value shared?



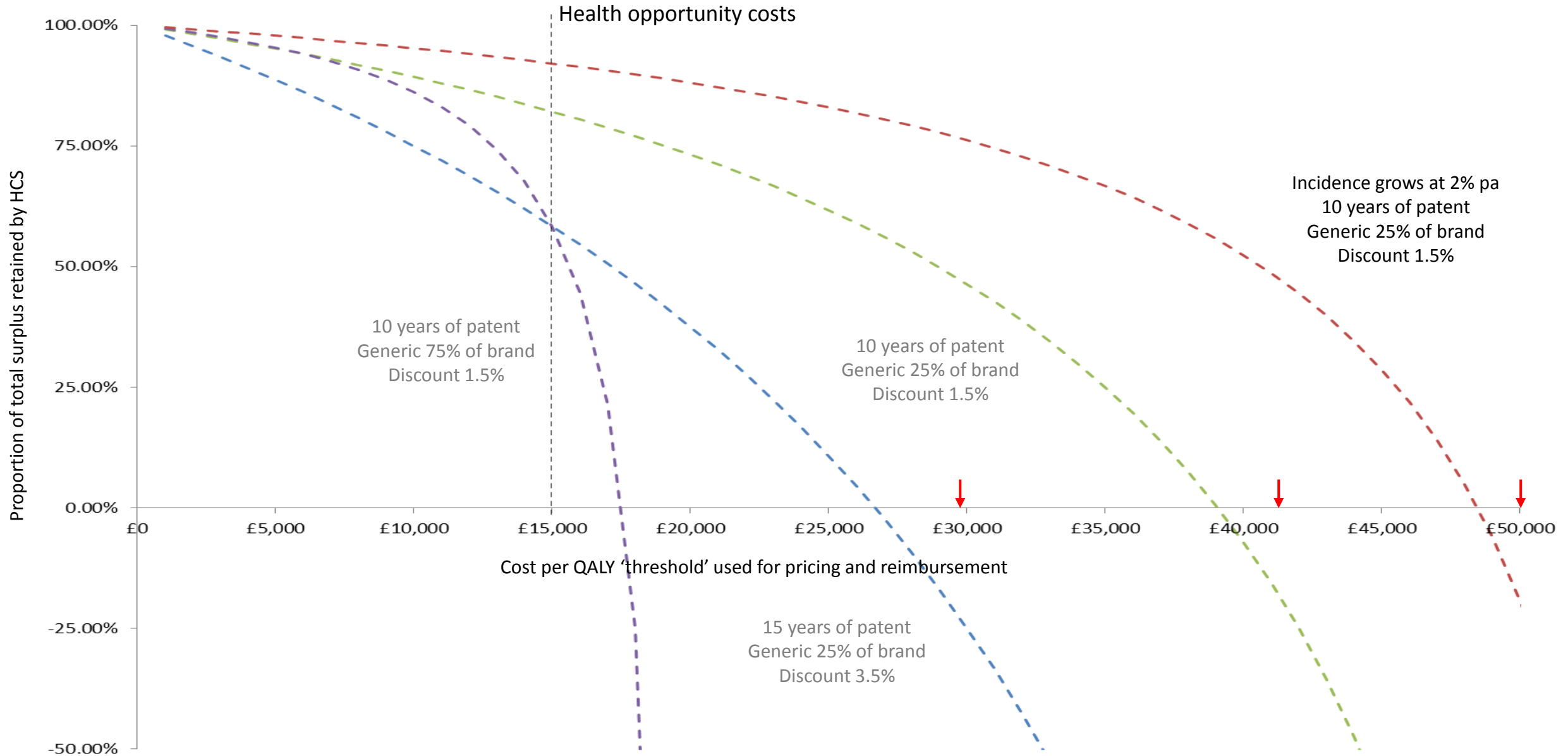
How is value shared?



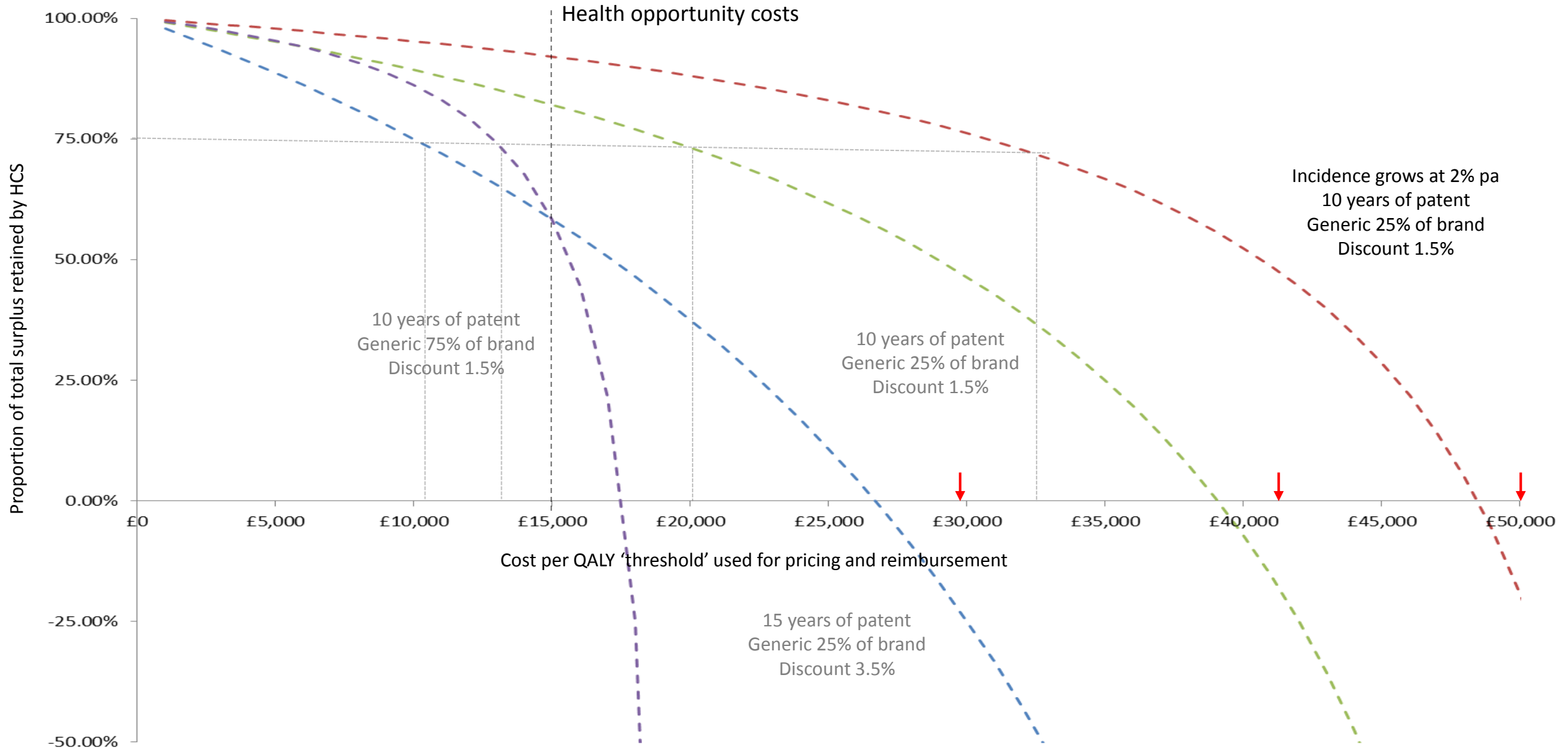
How is value shared?



How is value shared?



How should value be shared?



Recent UK estimates

- Scale of health opportunity costs
- Type of health effects (mortality, survival and morbidity)
- Where these are likely to occur (disease, age, gender)
- Severity of disease (burden, absolute and proportional)
- Net production effects (marketed and non marketed)
- Impact on health inequality
- Affordability and the scale of budget impact
- Elicitation from clinical and policy experts (surrogacy and extrapolation assumptions)
- Re-estimated for all waves of data
- Other categories of non NHS expenditure (public health, social care)

- Claxton, K., Martin, S., Soares, M., et al.. Methods for the estimation of the NICE cost effectiveness threshold. Health Technology Assessment, 2015; 19(14) (see web page for more materials about this research <https://www.york.ac.uk/che/research/teehta/thresholds/>)
- Claxton K, Sculpher M, Palmer S, Culyer AJ. Causes for concern: is nice failing to uphold its responsibilities to all NHS patients? Health Economics. 2015 Jan 7;24(1):1-7. Available from, DOI: 10.1002/hec.3130
- Love-Koh J, Cookson R, Claxton K, Griffin S. Who gains most from public healthcare spending? Estimated health impacts of changes in English NHS expenditure by age, sex and socioeconomic status. Re-submission MDM
- Lomas J, Claxton K, Martin S, Soares M. Resolving the 'cost-effective but unaffordable' 'paradox': estimating the health opportunity costs of non-marginal budget impacts: Estimating the Health Opportunity Costs of Non marginal Budget Impacts. Value in Health. 2018 Mar;21(3):266-275. Available from, DOI: 10.1016/j.jval.2017.10.006.
- Soares M, Sculpher M, Claxton K (2018) Health Opportunity Costs: Assessing the Implications of Uncertainty Using Elicitation Methods with Experts. Policy Research Unit in Economic Evaluation of Health and Care Interventions. Universities of Sheffield and York. Resubmitted to MDM

What are the expected health consequences of £10m?

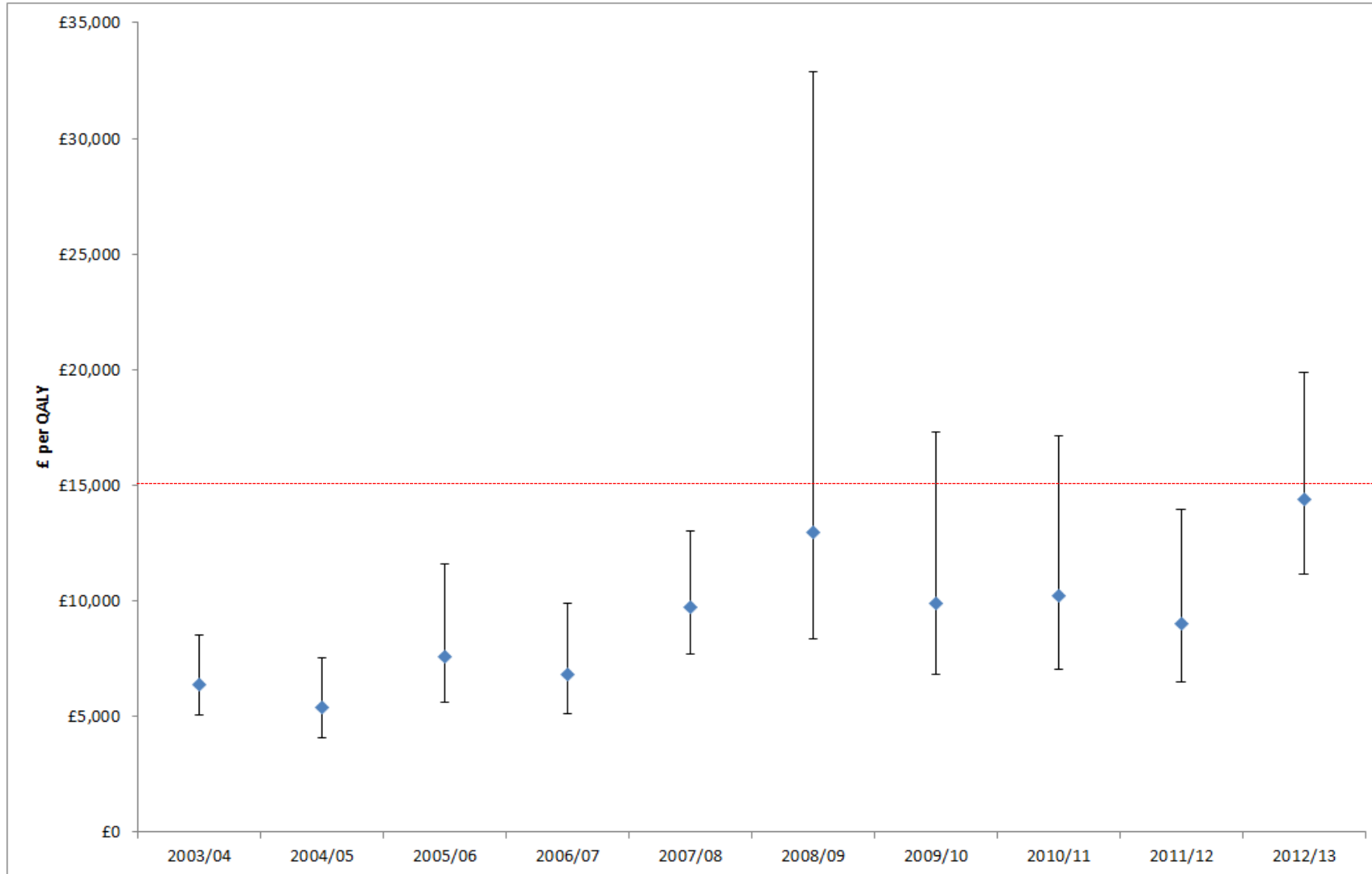
	Change in spend	Additional deaths	LY lost	Total QALY lost	Due to premature death	Quality of life effects
Totals	10 (£m)	51	233	773	150	623
Cancer	0.45	3.74	37.5	26.3	24.4	1.9
Circulatory	0.76	22.78	116.0	107.8	73.7	34.1
Respiratory	0.46	13.37	16.1	229.4	10.1	219.3
Gastro-intestinal	0.32	2.62	24.7	43.9	16.2	27.7
Infectious diseases	0.33	0.72	5.3	15.7	3.6	12.1
Endocrine	0.19	0.67	5.0	60.6	3.2	57.3
Neurological	0.60	1.21	6.5	109.1	4.3	104.8
Genito-urinary	0.46	2.25	3.3	10.6	2.1	8.5
Trauma & injuries*	0.77	0.00	0.0	0.0	0.0	0.0
Maternity & neonates*	0.68	0.01	0.4	0.2	0.2	0.1
Disorders of Blood	0.21	0.36	1.7	21.8	1.1	20.7
Mental Health	1.79	2.83	12.8	95.3	8.3	87.0
Learning Disability	0.10	0.04	0.2	0.7	0.1	0.6
Problems of Vision	0.19	0.05	0.2	4.2	0.2	4.1
Problems of Hearing	0.09	0.03	0.1	14.0	0.1	13.9
Dental problems	0.29	0.00	0.0	6.8	0.0	6.8
Skin	0.20	0.24	1.1	1.9	0.7	1.2
Musculo skeletal	0.36	0.39	1.8	23.2	1.2	22.1
Poisoning and AE	0.09	0.04	0.2	0.8	0.1	0.7
Healthy Individuals	0.35	0.03	0.2	0.7	0.1	0.6
Social Care Needs	0.30	0.00	0.0	0.0	0.0	0.0
Other (GMS)	1.01	0.00	0.0	0.0	0.0	0.0

What type of QALYs are lost/gained and what are the other effects of changes in expenditure?

The effects of 1 QALY gained or lost in each ICD code

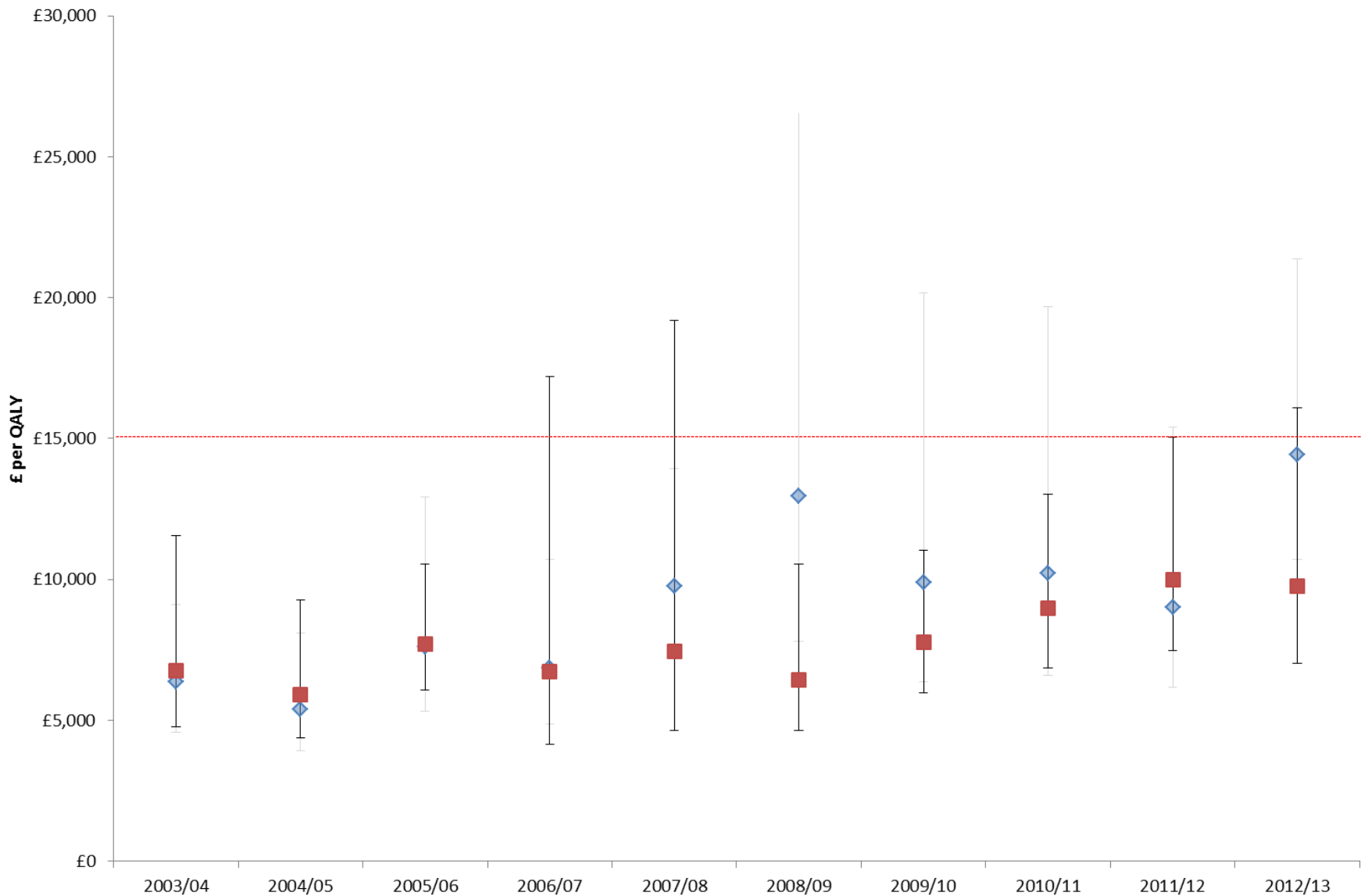
Proportionate Shortfall (% QALY loss)			Absolute Shortfall (QALY loss)			Wider Social Benefits (net production)		
C22	Liver cancer	73%	C22	Liver cancer	10.70	M05	Rheumatoid arthritis	£30,034
C25	Pancreatic cancer	73%	C25	Pancreatic cancer	9.97	E11	Diabetes	£27,421
C34	Lung cancer	71%	C34	Lung cancer	9.68	M45	Ankylosing spondylitis	£26,190
C92	Myeloid leukaemia	38%	F20	Schizophrenia	7.62	F30	Depression	£23,489
G20	Parkinson's disease	31%	G35	Multiple sclerosis	6.18	F20	Schizophrenia	£22,697
C90	Myeloma	31%	C92	Myeloid leukaemia	6.15	J45	Asthma	£20,100
C64	Kidney cancer	22%	G20	Parkinson's disease	4.60	M81	Osteoporosis	£17,910
G35	Multiple sclerosis	18%	C90	Myeloma	4.45	G35	Multiple sclerosis	£15,482
J43	Emphysema and COPD	17%	J43	Emphysema and COPD	3.80	J43	Emphysema and COPD	£14,525
G30	Alzheimer's disease	14%	C64	Kidney cancer	3.75	G40	Epilepsy	£14,245
F03	Dementia	14%	F30	Depression	3.63	L40	Psoriasis	£11,890
F20	Schizophrenia	12%	M05	Rheumatoid arthritis	2.83	Displaced	Average of displaced QALYs	£11,611
M05	Rheumatoid arthritis	11%	E11	Diabetes	2.68	E66	Obesity	£8,138
C61	Prostate cancer	11%	Displaced	Average of displaced QALYs	2.07	C53	Cervical cancer	£6,912
I26	Embolisms, fibrillation, thrombosis	11%	J45	Asthma	1.86	K50	Irritable Bowel Syndrome	£6,284
E11	Diabetes	11%	G30	Alzheimer's disease	1.68	J30	Allergic rhinitis	£5,234
C18	Colon cancer	10%	F03	Dementia	1.68	G20	Parkinson's disease	£3,102
I21	Acute myocardial infarction	9%	G40	Epilepsy	1.32	C50	Breast cancer	£2,888
I64	Stroke	8%	C18	Colon cancer	1.28	G30	Alzheimer's disease	£351
Displaced	Average of displaced QALYs	8%	I26	Embolisms, fibrillation, thrombosis	1.16	A40	Streptococcal septicaemia	-£513
F30	Depression	6%	C61	Prostate cancer	1.06	F03	Dementia	-£2,430
G40	Epilepsy	4%	I21	Acute myocardial infarction	1.00	I64	Stroke	-£6,949
J45	Asthma	4%	I64	Stroke	0.83	C18	Colon cancer	-£8,061
C50	Breast cancer	3%	C53	Cervical cancer	0.60	C61	Prostate cancer	-£10,602
C53	Cervical cancer	3%	C50	Breast cancer	0.55	C64	Kidney cancer	-£13,211
L40	Psoriasis	2%	A40	Streptococcal septicaemia	0.38	I21	Acute myocardial infarction	-£14,395
J10	Influenza	2%	J30	Allergic rhinitis	0.30	I26	Embolisms, fibrillation, thrombosis	-£16,752
M81	Osteoporosis	2%	M81	Osteoporosis	0.28	J10	Influenza	-£21,568
J30	Allergic rhinitis	2%	K50	Irritable Bowel Syndrome	0.26	C90	Myeloma	-£23,382
A40	Streptococcal septicaemia	2%	J10	Influenza	0.19	C92	Myeloid leukaemia	-£24,813
K50	Irritable Bowel Syndrome	1%	L40	Psoriasis	0.19	C22	Liver cancer	-£32,709
E66	Obesity	0%	E66	Obesity	0.18	C34	Lung cancer	-£36,067
M45	Ankylosing spondylitis	0%	M45	Ankylosing spondylitis	0.11	C25	Pancreatic cancer	-£53,860

Re-estimated for all waves of data



Lomas J, Martin S and Claxton K. Estimating the marginal productivity of the English National Health Service from 2003/04 to 2012/13. Value in Health 2019

Alternative approach to identification

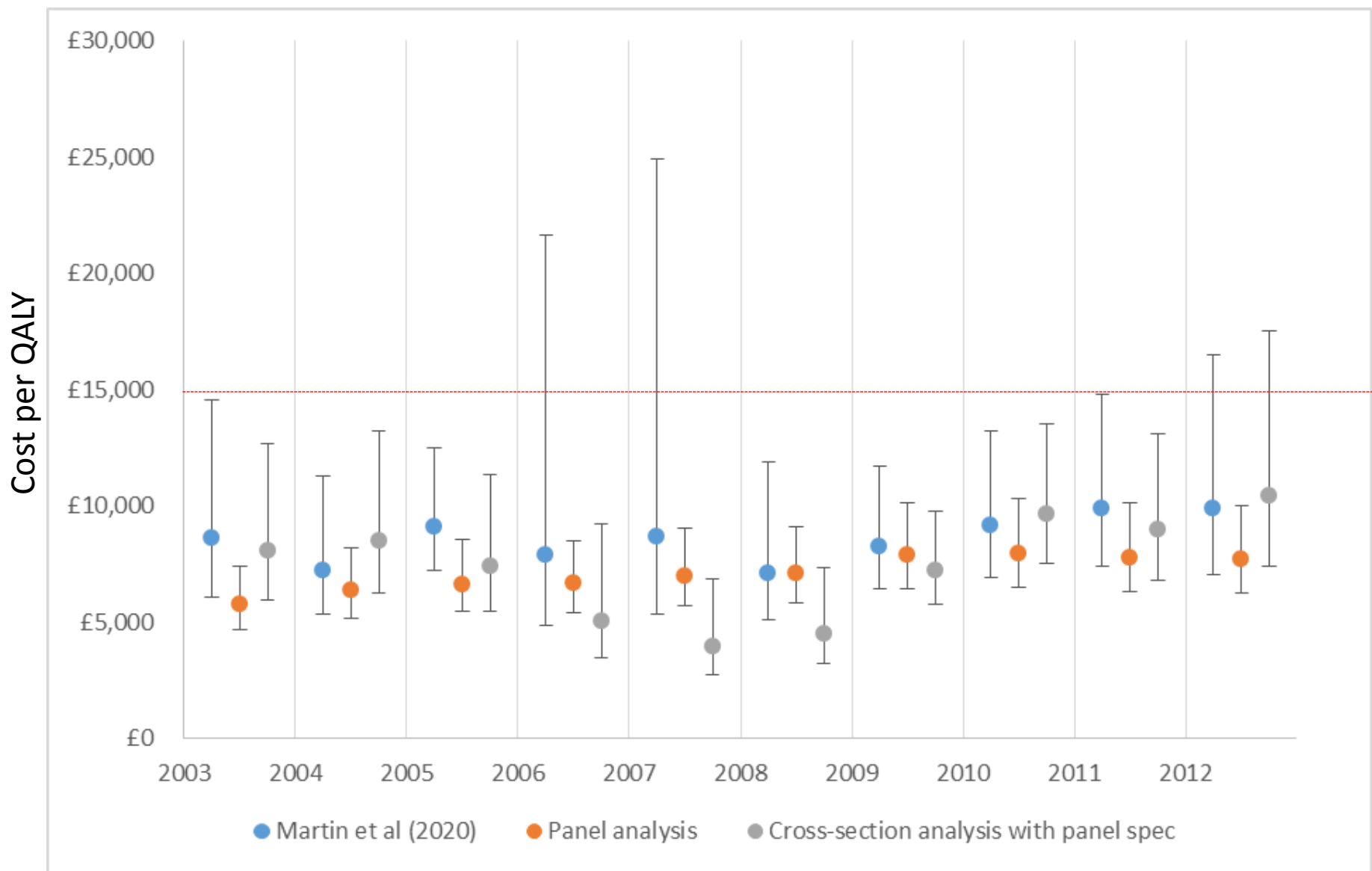


Lomas J, Martin S and Claxton K. Estimating the marginal productivity of the English National Health Service from 2003/04 to 2012/13. Value in Health 2019

Martin S. Lomas J and Claxton K. How effective is marginal health care expenditure? Evidence from England for 2003/04 to 2012/13. Submitted to Social Science and Medicine

Claxton K, Lomas J, Martin S. The impact of NHS expenditure on health outcomes in England: Alternative approaches to identification in all-cause and disease specific models of mortality. Health Economics. 2018 Apr 2. Available from, DOI: 10.1002/hec.3650

Panel analysis



Lomas J, Martin S, Longo F and Claxton K.
Estimating the marginal productivity of the
English NHS: a panel analysis. Submission to
Health Economics

Public health expenditure (2013/14)

	Mortality elasticity (pubic health)	Mortality elasticity (health care)	Cost per QALY (public heath)	Cost per QALY (health care)
Pubic health only	-0.115 [0.048]	-	£3,412	-
Public health and health care		-		
Backward selection	-0.081 [0.034]	-0.672 [0.233]	£4,845	£14,912
Forward selection	-0.144 [0.04]	-0.837 [0.269]	£2,725	£11,973

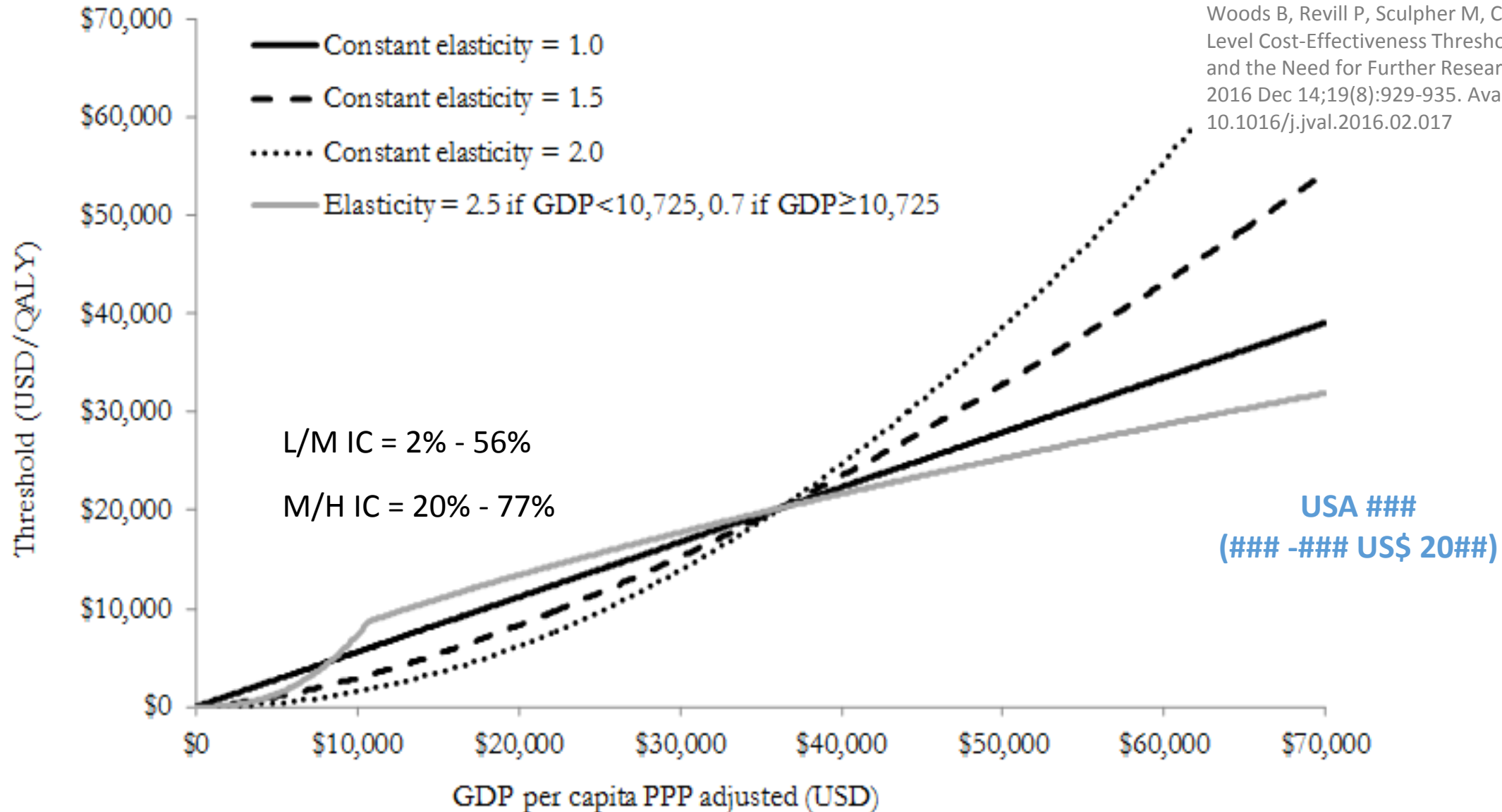
Public health expenditure is currently in the fourth year of a five-year funding squeeze that will see real spending per person fall by nearly one-fifth between 2015/16 and 2019/20 (Finch, 2018 and DH, 2019).

Lomas J, Martin S, and Claxton K. Is an ounce of prevention worth a pound of cure? Estimates of the impact of English Public Health Grant on mortality. Submitted to BMJ Open

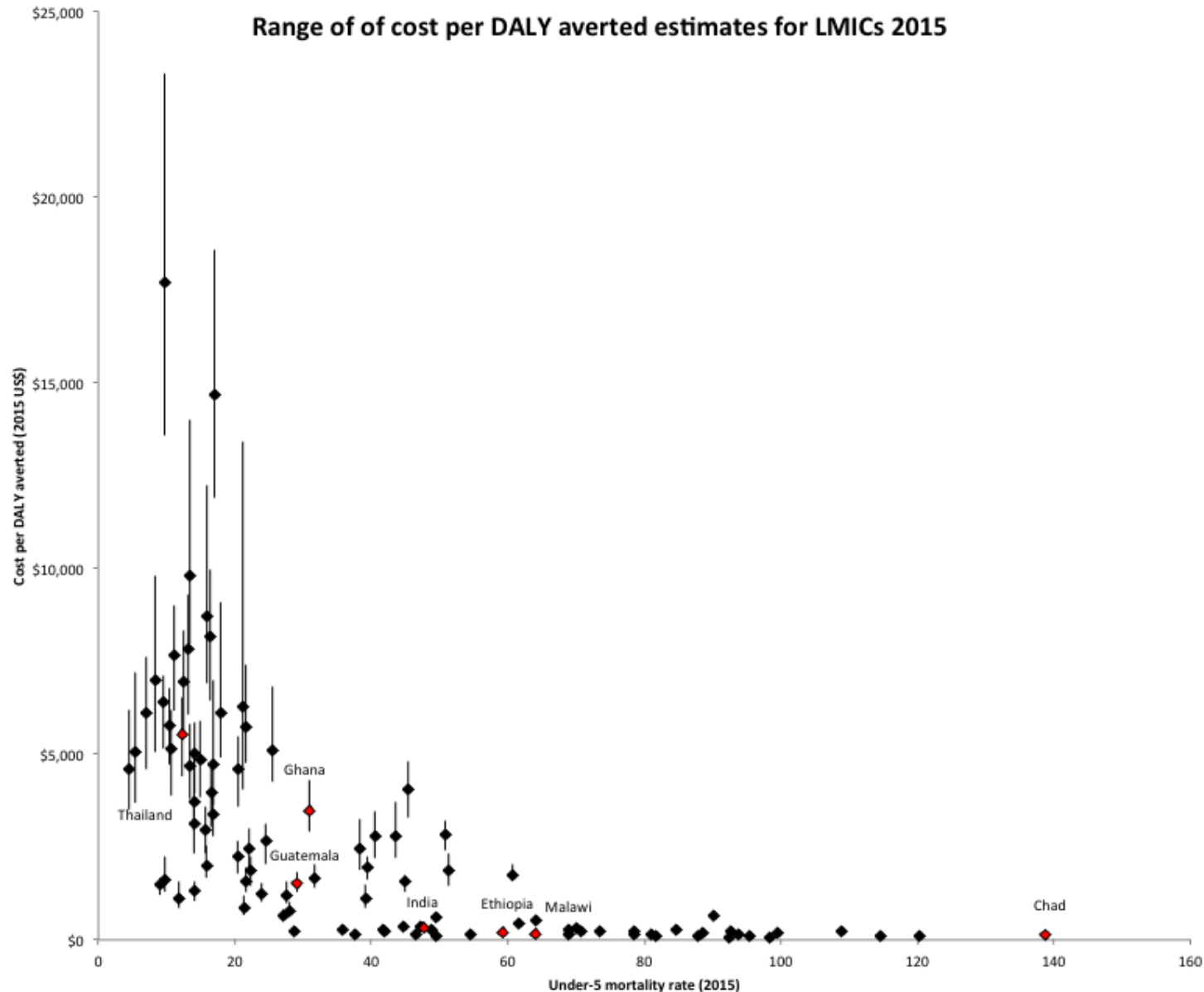
Other estimates using within country data

- Australia (Edney et al)
 - \$28,033 per QALY AUD (\$20,758 to \$37,667)
- Spain (Vallejo-Torres et al)
 - 22,000€ to 25,000€ per QALY
- Netherlands (van Baal)
 - 41,000€ per QALY (CVD hospital care only)
- Sweden (Siverskog and Henriksson)
 - 39,000€ per QALY
- Indonesia (Kreif et al)
 - \$331 per DALY averted (USD)
- South Africa (Edoka and Hofman)
 - \$3,000 per DALY averted (USD)

Evidence of health opportunity costs



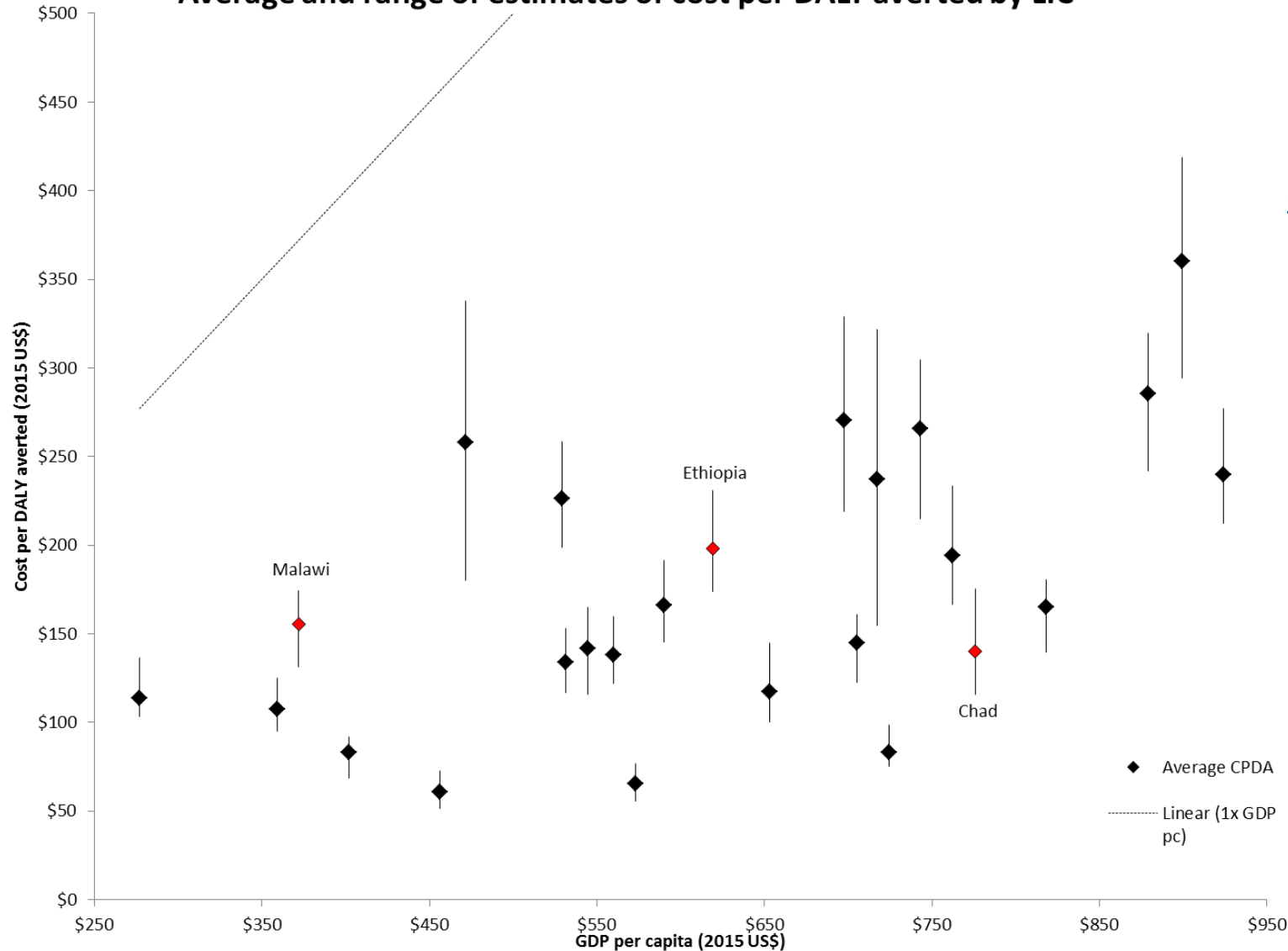
Evidence of health opportunity costs



Ochalek J, Lomas J, Claxton K. Estimating health opportunity costs in low-income and middle-income countries: a novel approach and evidence from cross-country data. *BMJ Global health*. 2018 Nov 5;3(6):e000964. <https://doi.org/10.1136/bmjgh-2018-000964>

Evidence of health opportunity costs

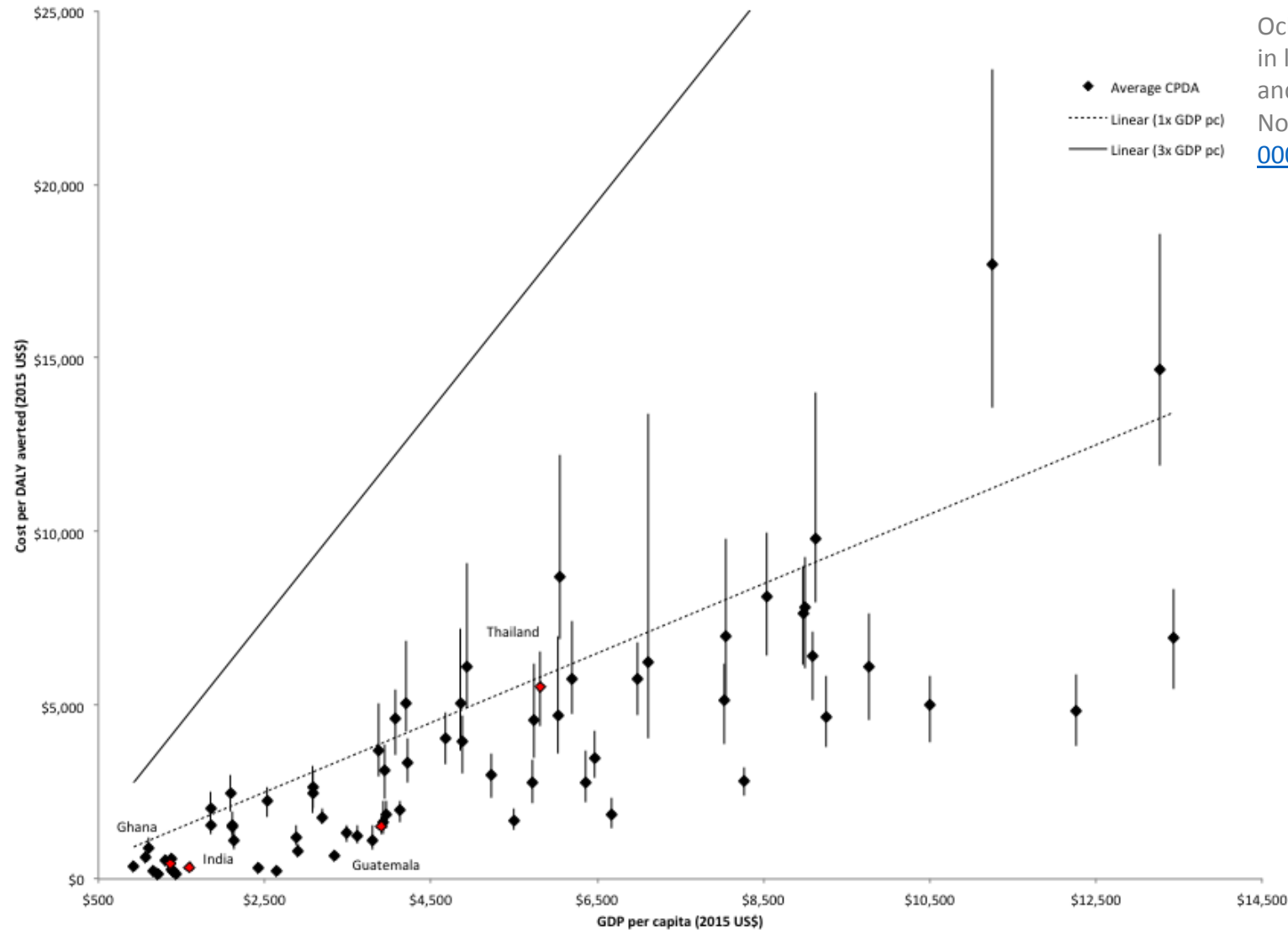
Average and range of estimates of cost per DALY averted by LIC



Ochalek J, Lomas J, Claxton K. Estimating health opportunity costs in low-income and middle-income countries: a novel approach and evidence from cross-country data. *BMJ Global health*. 2018 Nov 5;3(6):e000964. <https://doi.org/10.1136/bmjgh-2018-000964>

Evidence of health opportunity costs

Range of cost per DALY averted estimates for MICs 2015



Ochalek J, Lomas J, Claxton K. Estimating health opportunity costs in low-income and middle-income countries: a novel approach and evidence from cross-country data. *BMJ Global health*. 2018 Nov 5;3(6):e000964. <https://doi.org/10.1136/bmjgh-2018-000964>

Estimating health opportunity costs in Canada

Cost per DALY averted ≈ QALY gained for (2013 C\$)

	Claxton et al (-1.028)	Andrews et al (-0.705)	Bokhari et al (-0.193)
Canada	\$19,914	\$29,032	\$97,321
Alberta	\$26,060	\$37,991	\$125,997
British Columbia	\$19,227	\$28,029	\$96,042
Manitoba	\$21,722	\$31,667	\$104,498
New Brunswick	\$18,265	\$26,628	\$90,166
Newfoundland and Labrador	\$21,392	\$31,186	\$104,902
Northwest Territories	\$52,191	\$76,087	\$249,536
Nova Scotia	\$18,002	\$26,244	\$89,814
Nunavut	\$41,776	\$60,903	\$177,375
Ontario	\$19,606	\$28,582	\$95,706
Prince Edward Island	\$16,425	\$23,945	\$82,939
Quebec	\$17,936	\$26,147	\$87,446
Saskatchewan	\$20,804	\$30,329	\$99,467
Yukon	\$30,633	\$44,659	\$155,899

Cost per DALY averted ≈ QALY gained for (2015 US\$)

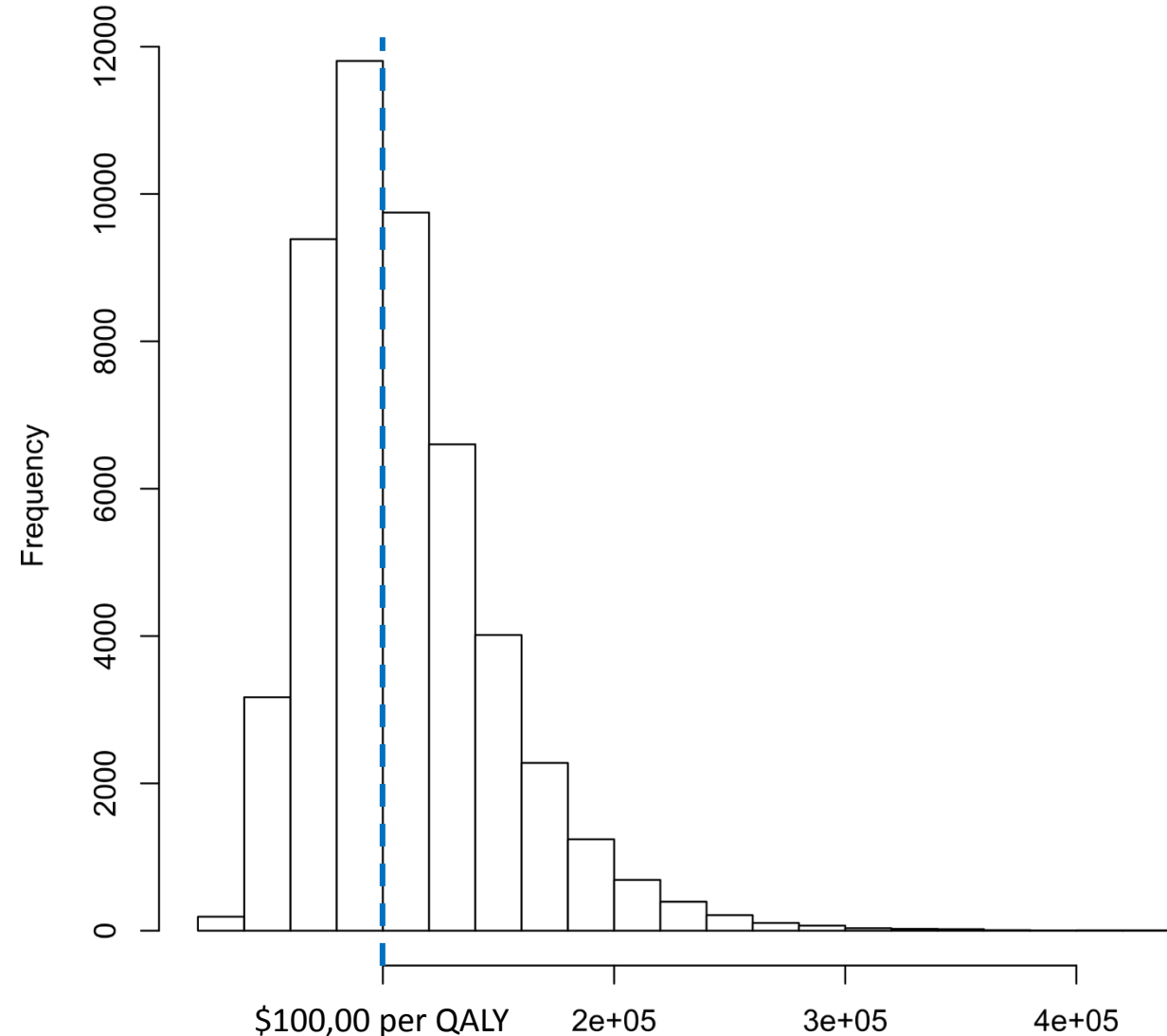
	Claxton et al (-1.028)	Andrews et al (-0.705)	Bokhari et al (-0.206.)
USA	\$16,048	\$23,397	\$80,234

What are the health effects of additional health care costs in the USA?

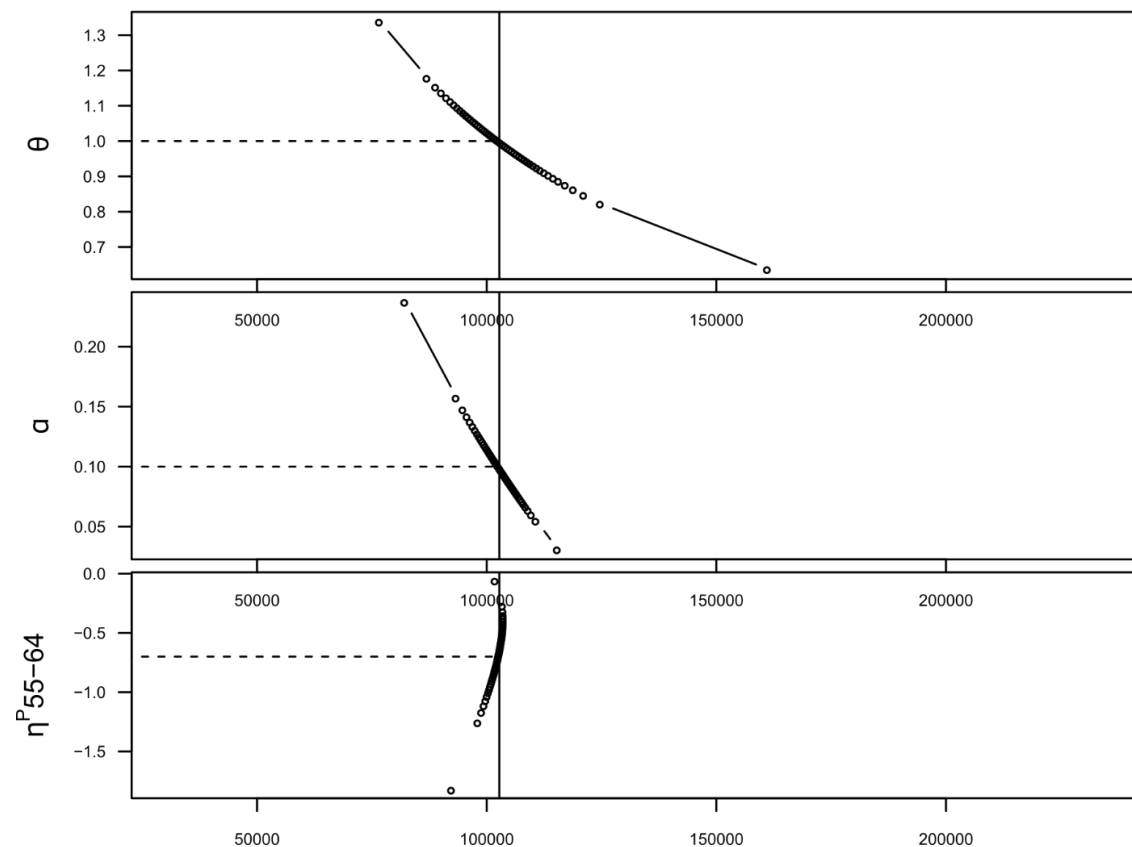
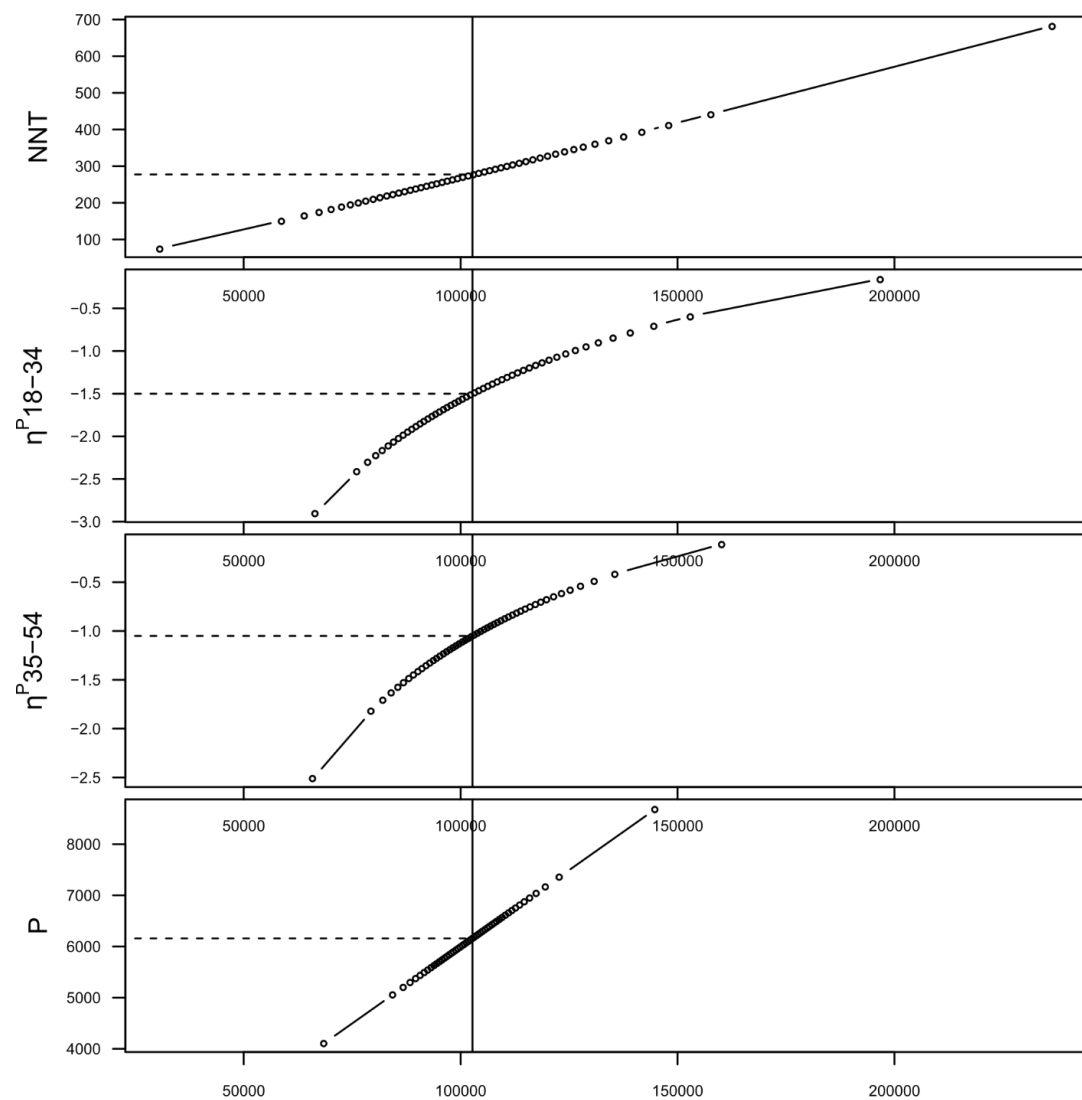
- Single payer health care systems (marginal productivity of expenditure)
 - Medicaid (50 systems), federal and state \$
 - Veterans Administration, federal \$
 - Medicare (not allowed make decisions, still good to know you what get for federal \$)
- Private health insurance plans
 - Health effect of being 'priced out' at plan choice or point of care
 - Costs net of the co-pay are passed on
 - Co-pay for the new drug has health (at point of care), consumption, and federal \$ (HAS) effects
 - Employers or employees may decide
 - Stop offering/buying coverage (has health and consumption effects)
 - Reduce the benefits offered to control costs (has health and consumption effects)
 - Increase in co-pays and deductibles (has health, consumption, and federal \$ effects)
 - Health and consumption effects likely greater for lower income and greater health need

Estimating health opportunity costs for private plans in the USA

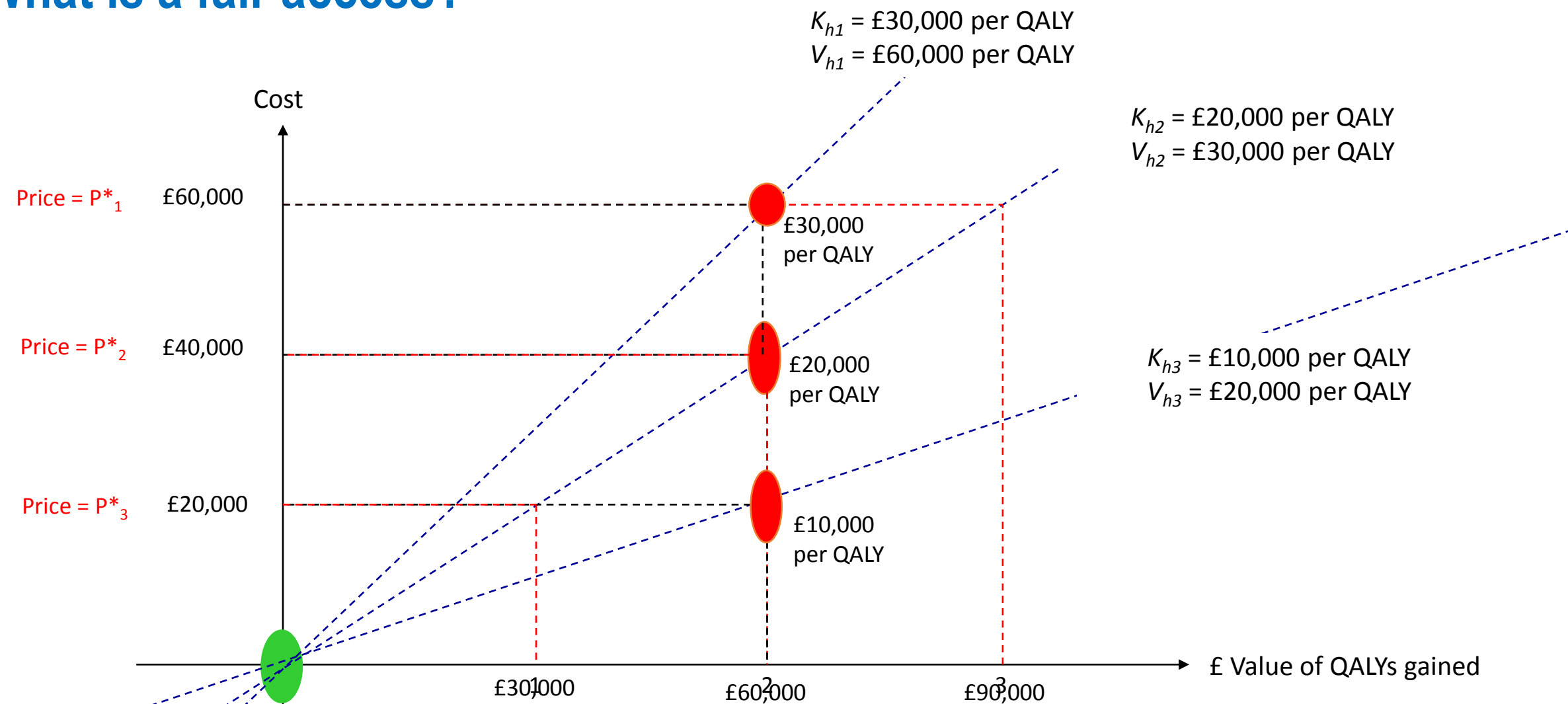
- Dave Vanness iHEA 2017
 - Proportion insured by age
 - 100% pass through
 - Elasticity coverage wrt premium
 - Mortality effects of loss of coverage
 - Quality adjusted survival effects
 - Morbidity effects of loss coverage
 - Quality life effects of survivors
 - QALY effects of additional costs
 - = £100,000 per QALY



Estimating health opportunity costs for private plans in the USA



What is a fair access?



Thresholds and prices	Plan 1	Plan 2	Plan 3
$P^*_1 (K_{h1}, \text{ and } V_{h1})$	$2 * £60,000 - 2 * £60,000 = 0$		
$P^*_2 (K_{h2}, \text{ and } V_{h2})$		$2 * £30,000 - 2 * £30,000 = 0$	
$P^*_3 (K_{h3}, \text{ and } V_{h3})$			$2 * £20,000 - 2 * £20,000 = 0$

What are the effects of approving a new drug

- New drug 1, 2, or 4 QALYs gained ppt (100 patients)
- Costs additional \$200,000 ppt
- 20% co-pay, 10% have HSA, will be topped up
- Marginal costs of public finance 1.2 (\$1 federal = \$1.20 in your pocket)
- Marginal income tax 25%
- Health opportunity costs, $k_h = \$100,000$ per QALY (Vanness)
- Consumption value of health $V_h = \$100,000$ per QALY (Phelps)

	\$200,000per QALY	\$100,000 per QALY	\$50,000 per QALY
Health effects	100 QALYs	200 QALYs	400 QALYs
Total net plan cost	-\$16,000,000	-\$16,000,000	-\$16,000,000
Health opportunity cost	-160 QALYs	-160 QALYs	-160 QALYs
Patient cost (no HSA)	-\$3,600,000	-\$3,600,000	-\$3,600,000
Patient cost (HSA)	-\$300,000	-\$300,000	-\$300,000
Consumption value of Federal \$ effects	-\$120,000	-\$120,000	-\$120,000
Total cost (plan + consumption)	-\$20,020,000	-\$20,020,000	-\$20,020,000
Net health effects	-40 QALYs	+40 QALYs	+240 QALYs
Consumption cost per QALY	-\$333,667	\$500,500	\$83,417

Require QALY benefit of 3.602, crude cost per QALY = \$55,524 for consumption cost per QALY = \$100,000

What else do we need?

- Courage
 - We use estimates of health opportunity costs because you don't pay for your health care, other people do, sometimes with their lives and the lives and dignity of their loved ones
- Honesty (tell the truth)
 - K_h and V_h differ across your health care 'systems' and 'plans' or tell a story
 - Reduce health overall
 - Force those who can afford it least to pay too much for their health care
 - Impoverish those already struggling with non health care bills
 - Reveal the implications of current arrangements and add to the accountability of those responsible for them
- Humility
 - There is no such thing as a 'decision rule'
 - But there can be accountable decisions
 - Accountable to reason, evidence and reasonably held, but disputed social values