



THE VALUE OF INNOVATIVE DRUGS AND THE COST OF ENVIRONMENTAL IMPACT MIXING HORSES AND RABBITS?

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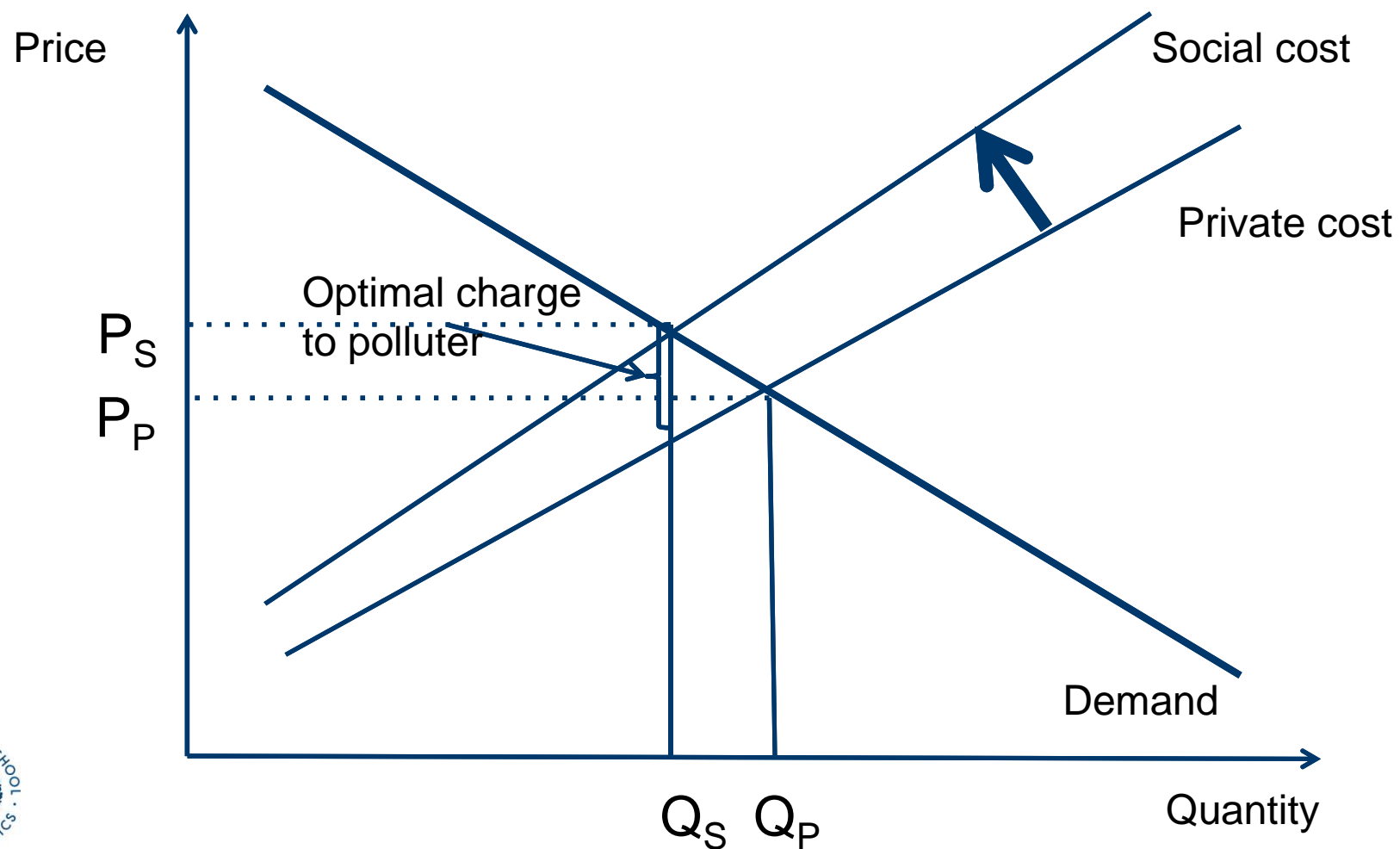
THE TALE OF HORSE AND RABBIT STEW

“Once upon a time a group of eminent chefs were asked to prepare the finest Horse and Rabbit Stew for the King’s Birthday. For days they toiled and argued about how the rabbit should be prepared. Should it be roasted first or simply boiled, or perhaps jugged or marinated in a fine wine sauce. Finally they came to an agreement and as the birthday dawned they prepared the finest rabbit ever tasted for the stew. Sadly all their efforts were completely overwhelmed by the subsequent addition of the horse”.



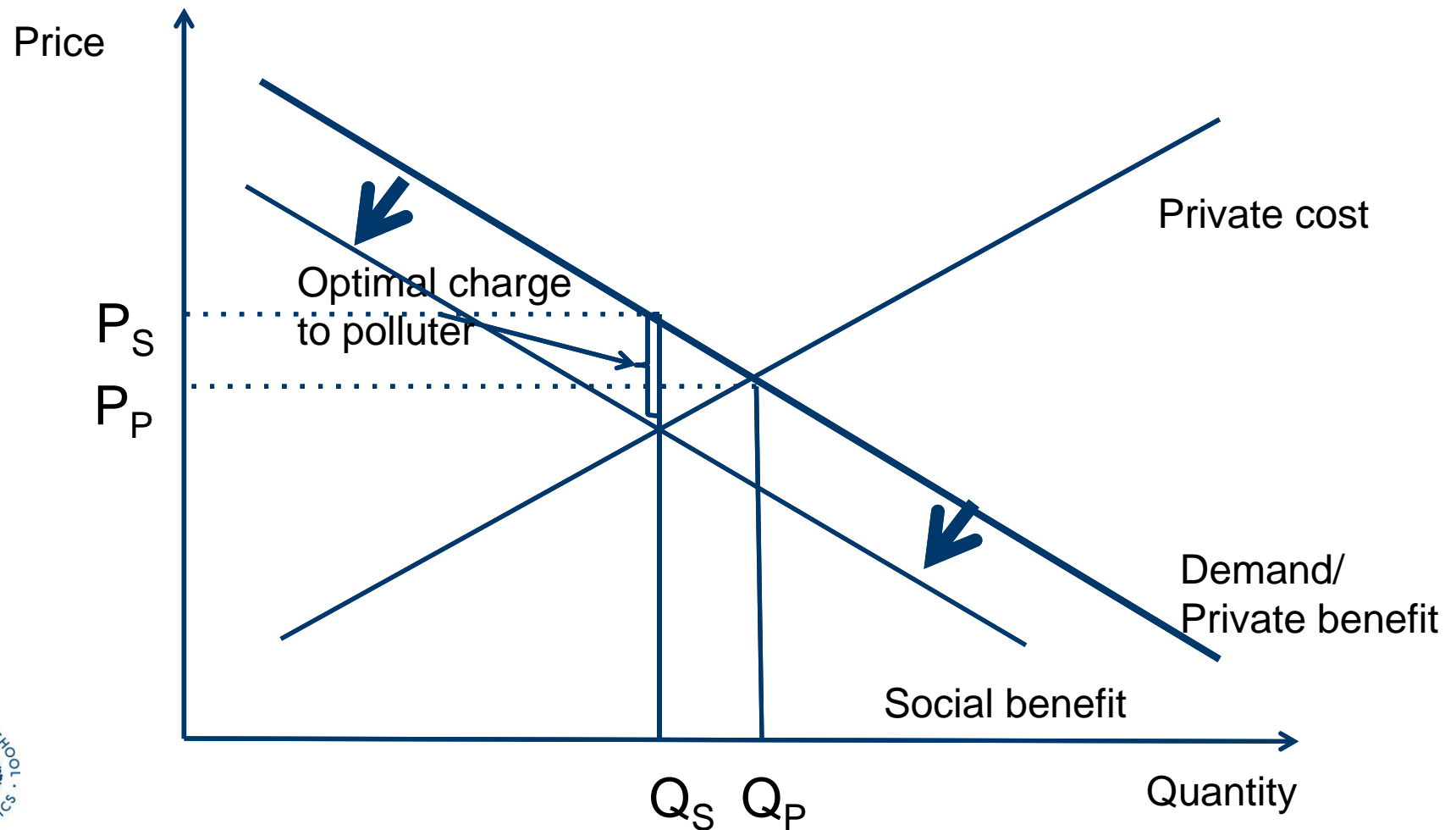
ENVIRONMENTAL ECONOMICS 1

PRIVATE VERSUS SOCIAL COSTS



ENVIRONMENTAL ECONOMICS 1B

PRIVATE VERSUS SOCIAL BENEFITS; ANTIBIOTIKA RESISTANCE



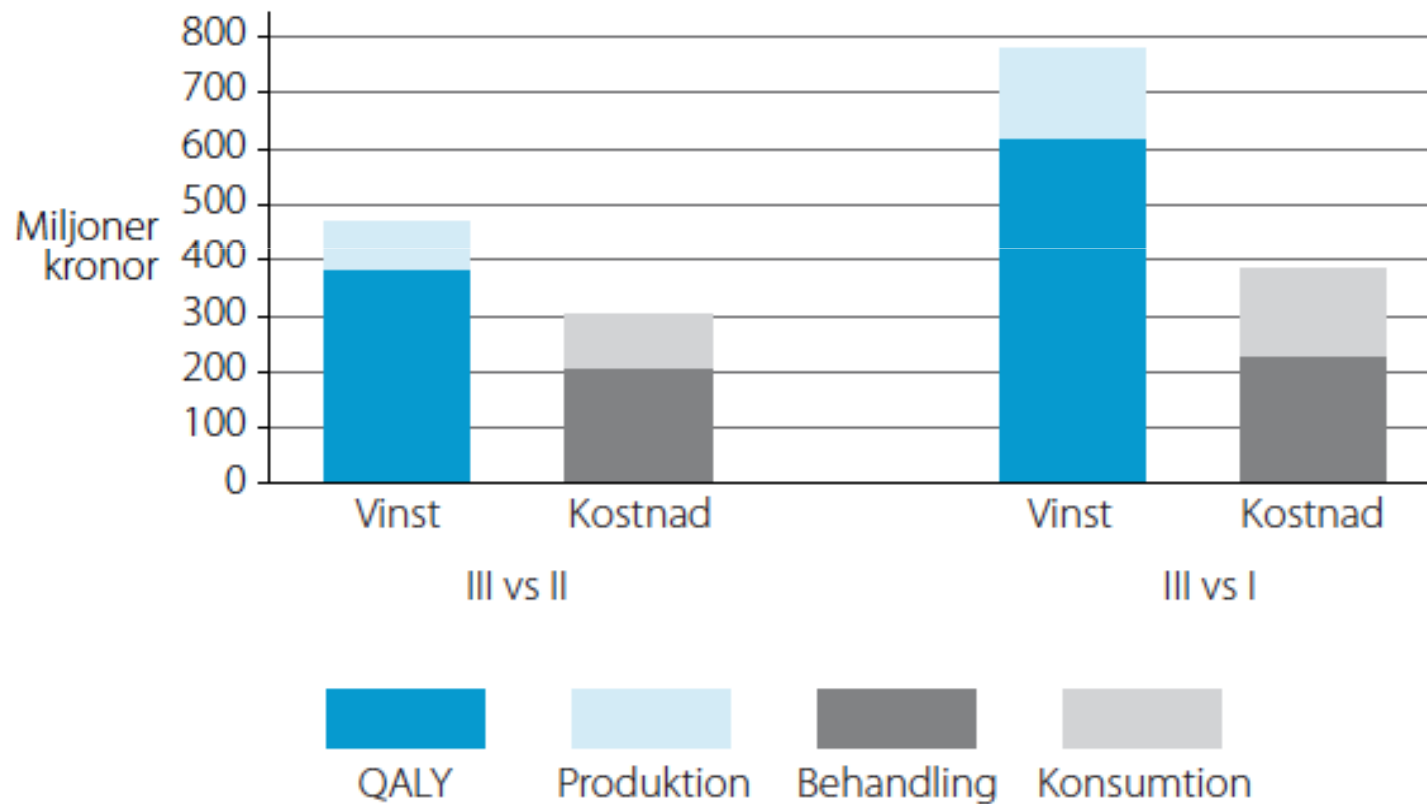
BENEFITS AND COSTS OF PHARMACEUTICAL INNOVATION

LEADING TO NEW OPTIONS FOR PREVENTION AND TREATMENT

- Costs
 - R&D
 - **Production**
 - Marketing
 - Distribution
 - Diagnosis, administration and follow-up in clinical practice
 - Side effects
- Benefits
 - Improvements in health
 - Survival
 - Quality of life
 - QALY gained
 - Improvements in quality of care
 - Reduction of costs for other health care
 - Reductions in indirect costs

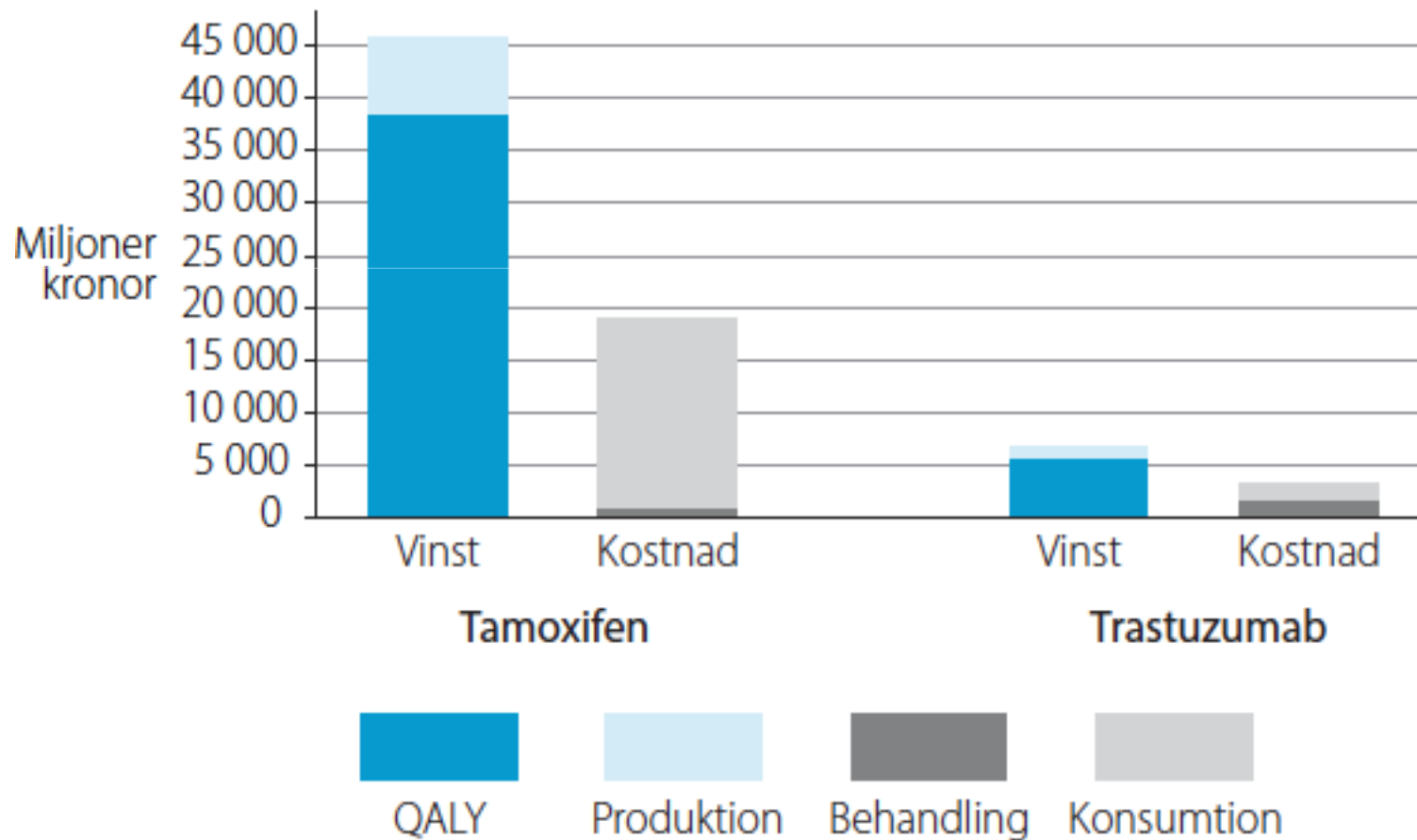


COST AND BENEFITS OF IMPROVED TREATMENTS FOR CML A COMPARISON OF A COHORT OF SWEDISH PATIENTS IN THE 1980s (I), 1990s (II) AND AFTER 2000(II)



Source: Lundquist et al 2013

COSTS AND BENEFITS FROM TAMOXIFEN 1979-2004 AND TRASTUZUMAB 2000-2011



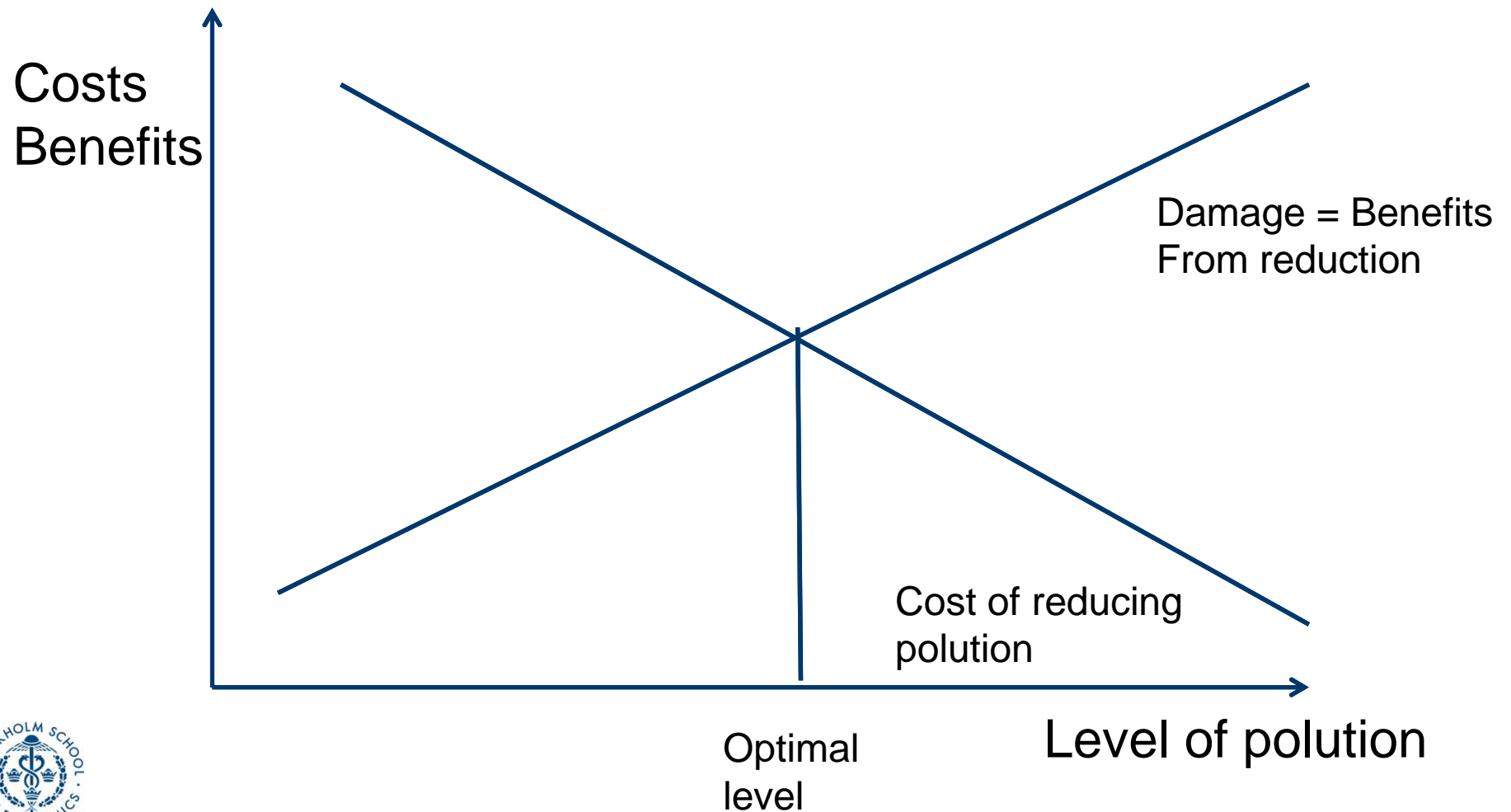
ENVIRONMENTAL IMPACT OF PHARMACEUTICAL PRODUCTION AND CONSUMPTION

- Sources of emissions
 - The production site
 - Unused drugs
 - Excretion from patients
 - (Use in animals)
- Cost and benefits of reducing the impact on the environment
 - Damage function
 - Cost function for reducing the damage



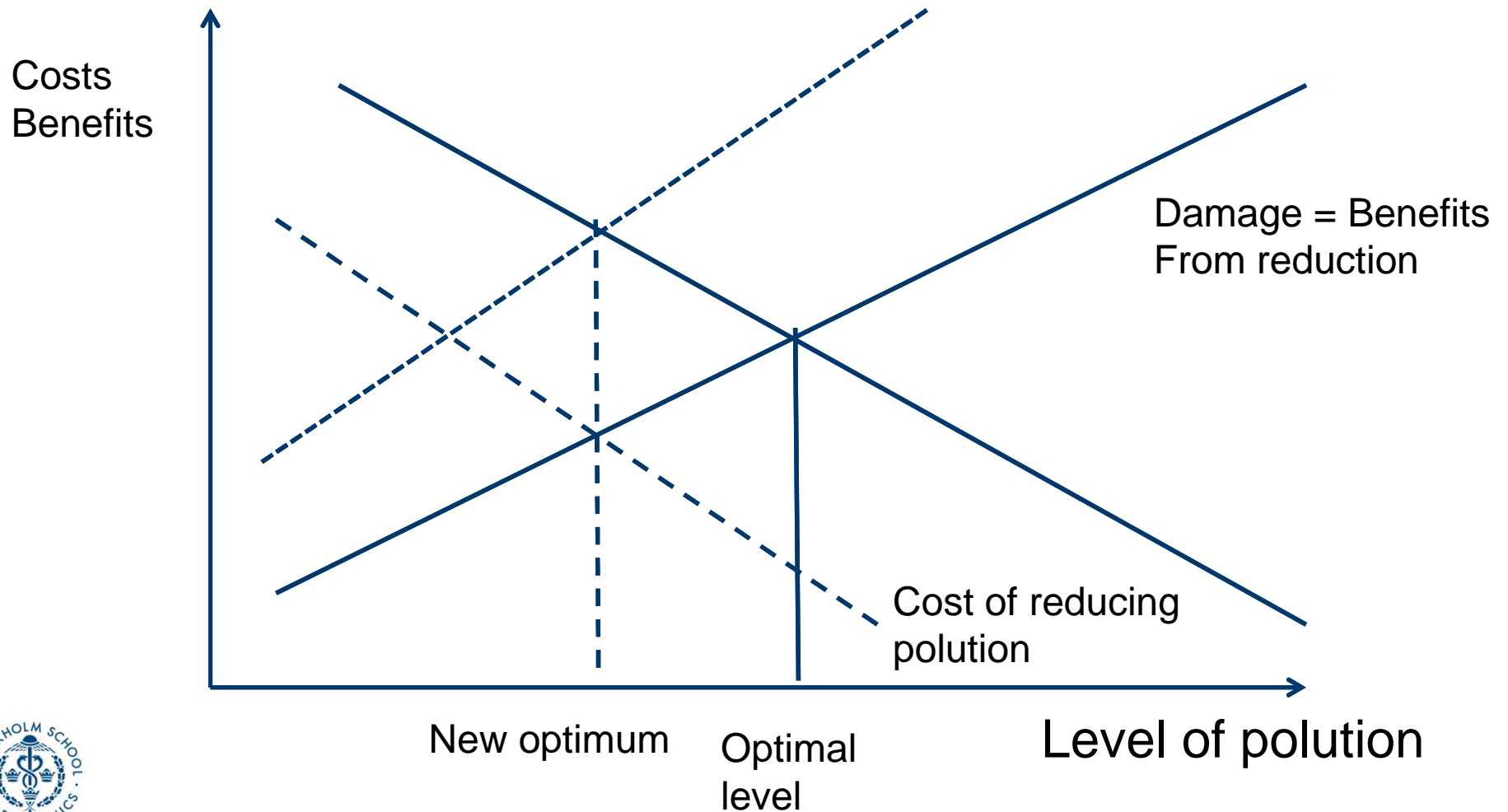
Environmental economics 2

The optimal level of pollution



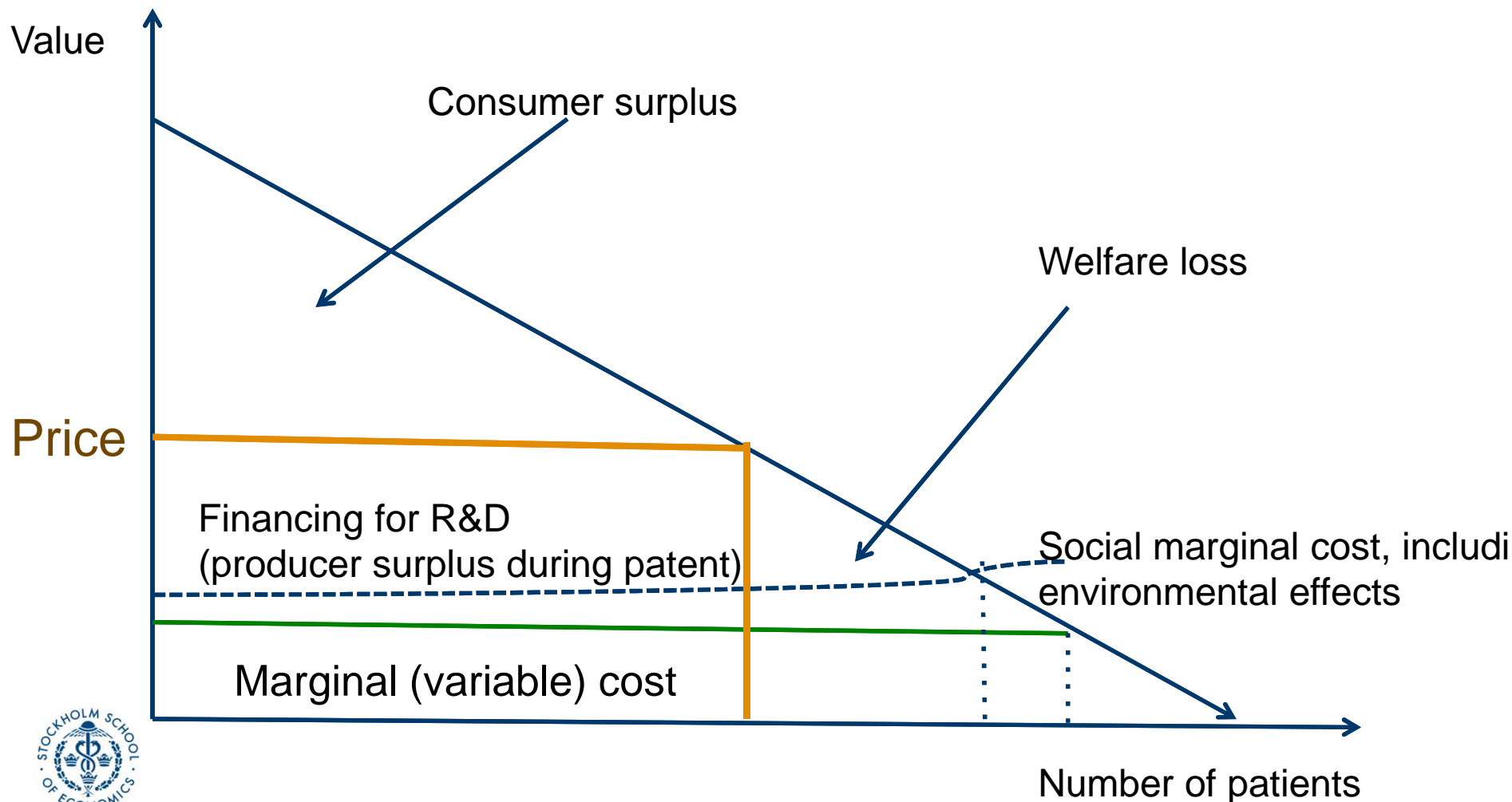
ENVIRONMENTAL ECONOMICS 2

THE OPTIMAL LEVEL OF POLLUTION WHEN COSTS ARE REDUCED OR DAMAGE INCREASED



The economics of pharmaceutical innovation

R&D, patents and prices –Dynamic versus static efficiency



BENEFITS OF PHARMACEUTICAL INNOVATION

STATINS AS EXAMPLE

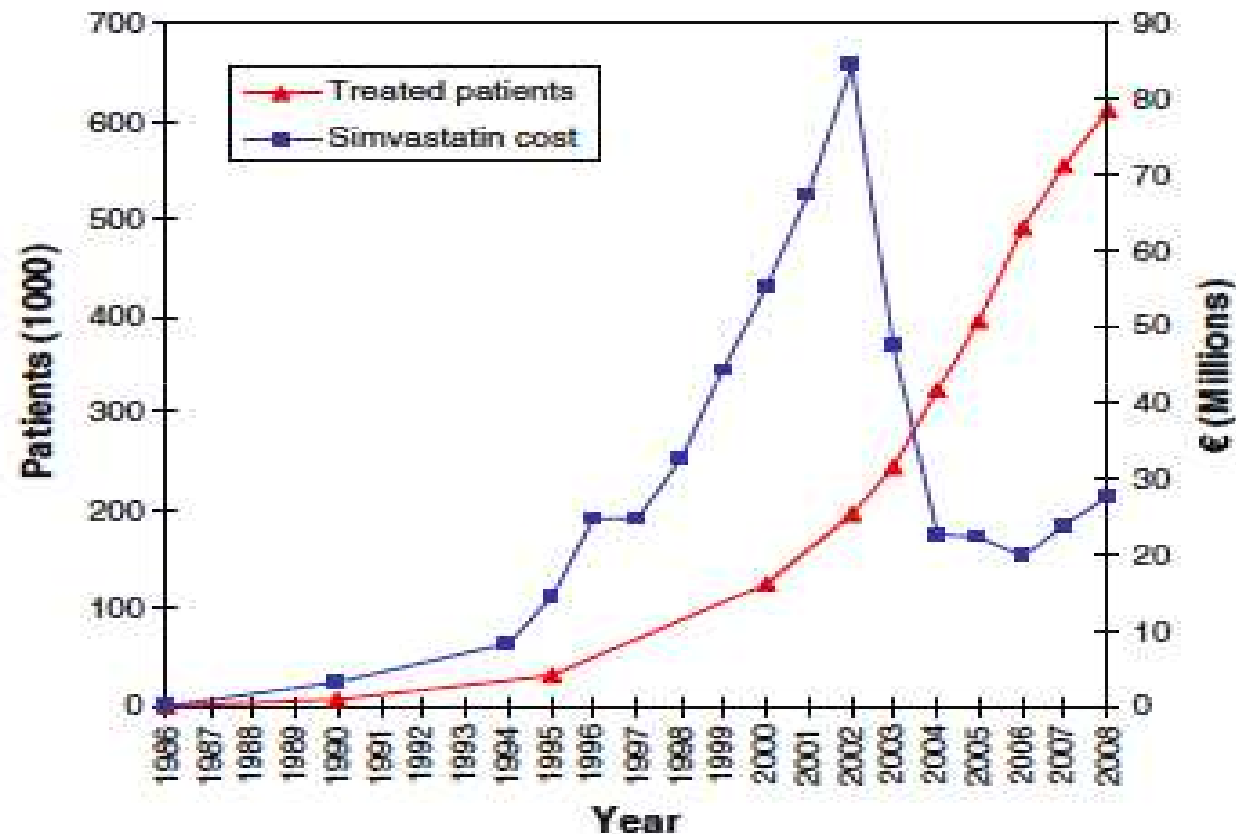


Fig. 1 The total cost of simvastatin prescriptions and the number of patients treated in Sweden 1987–2008. Source: National board of Health and Welfare [21], sales data from MSD Sweden AB and Apoteksbolaget AB (data on file)

BENEFITS OF SIMVASTATIN 1987-2028

Table 1 Sales, social surplus (million € per million inhabitants) of simvastatin treatment, and the distribution of surplus appropriation over time

Period	1987–2002	2003–2008	2009–2018	2019–28	Total
Total sales	50	19	25	19	113
Savings (direct and indirect costs)	5	12	24	19	59
Net social costs	45	7	1	0	54
Consumer surplus					
Based on VSL	161	501	948	706	2,315
Based on LYG	90	325	602	448	1,465
Based on QALY	54	237	454	338	1,083
Producer surplus (profit)	40	4	5	4	52
Total social surplus					
Based on VSL	200	504	953	709	2,368
Based on LYG	130	329	607	452	1,518
Based on QALY	94	241	459	342	1,135
Producer surplus as % of total social surplus					
Based on VSL	20%	1%	1%	1%	2%
Based on LYG	31%	1%	1%	1%	3%
Based on QALY	43%	2%	1%	1%	5%

Social surplus is the sum of consumer and producer surpluses, where consumer surplus is the value of health benefits plus cost-savings minus treatment costs and producer surplus is the cost of drug minus the cost of production (i.e., profits). Costs are expressed in 2008 years values (adjusted with the consumer price index) with future values discounted at 3% per year. *VSL* value of statistically saved life, *LYG* life years gained, *QALY* quality-adjusted life year

NUMBER OF PATIENTS TREATED, AGGREGATE HEALTH GAINS MEASURED AS QALYS, AND MONETARY VALUE OF HEALTH GAINS (MILLION SEK) FROM TAMOXIFEN IN SWEDEN DURING 1979–2004. SOURCE: LUNDQVIST ET AL (2013B).

	Patients treated Number (%)	Aggregate health gains QALY (%)	Monetary value Million SEK (%)
Disseminated disease	19,500 (26)	8,100 (18)	6,800 (18)
Adjuvant therapy	55,700 (74)	37,500 (82)	31,700 (82)
Of which			
1 year	4,900	2,000	1,700
2 years	16,40 0	8,800	7,500
5 years	34,30 0	26,700	22,600
Total	75,100	45,600	38,500



NUMBER OF PATIENTS TREATED, AGGREGATE HEALTH GAINS MEASURED AS QALYs, AND MONETARY VALUE OF HEALTH GAINS (MILLION SEK) FROM TRASTUZUMAB IN SWEDEN DURING 2001–2011.

	Patients treated Number (%)	Aggregate health gains QALY (%)	Monetary value Million SEK (%)
Disseminated disease	3,300 (51)	3,300 (48)	2,800 (48)
Adjuvant therapy	3,200 (49)	3,500 (52)	3,000 (52)
Total	6,500	6,800	5,800

PHILIPSON AND JENA (2005) ON THE VALUE OF NEW DRUGS FOR HIV/AIDS

- The social value of an innovation is its value to consumers and producers (innovators)
- The producer surplus is only 5% of the total social value created by these drugs
- Advocating cost-effectiveness criteria may further reduce this share and hence incentives for innovation





CONCLUSIONS

- Cost of environmental impact should be considered in the assessment of costs and benefits of new innovative drugs
- Consumption is restricted during patent protection, thus reducing environmental impact
 - Personalized medicine also reduce exposure
- Costs and benefits of reducing exposure to the environment should be calculated "at the margin"
 - But damage functions yet unknown, making it difficult to design evidence based interventions for the generic market