

*Presentation to Economic Society of Australia (Tasmanian Branch)*  
*Department of Treasury and Finance, Hobart*  
*24 July 2014*

**Valuing life and health:  
the cost of air pollution**

**by  
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## *Introduction*

- The history: report presented to delegates' meeting in Paris in February 2014 => declassified by consent of the 34 member-countries in March => published as an OECD book, *The Cost of Air Pollution*, launched by the OECD Secretary-General in Leipzig in May.
- You are invited to access and/or purchase the book at [http://www.oecd-ilibrary.org/environment/the-cost-of-air-pollution\\_9789264210448-en](http://www.oecd-ilibrary.org/environment/the-cost-of-air-pollution_9789264210448-en).

## *Introduction (continued)*

- The pre-history: the new epidemiological evidence base assembled in the Global Burden of Disease project, as published in *The Lancet* from late 2012 – and that has altered significantly the absolute and relative weights attributable to the various risk factors.
- You are invited to access and explore the GBD data at <http://viz.healthmetricsandevaluation.org/gbd-compare/>.

## *Introduction (continued)*

- To put the point provocatively: the last invitation is in fact an imperative to all who work in the field – a precondition for any pretence at evidence-based policy.
- Thus, it would irresponsible to ignore the now known fact that, at global level, air pollution in all categories is the second-largest risk factor in world-wide deaths – larger than tobacco smoking – or that, in Australia, obesity (“high body-mass index”) trumps all else!

## *Introduction (continued)*

- The follow-up: with the OECD – to develop an agreed standard method for calculating the cost of morbidity which is consistent with the established standard method for calculating the cost of mortality – and, also, agreed values for a range of morbidities.
- And with the World Health Organization – to apply my current formula (mortality + 10%) to all 53 countries of the WHO European Region – and, also, to a wider range of risk factors.

## *Introduction (continued)*

- Structure of today's presentation is *roughly* in line with the structure of the book:
- (1) Defining the economic cost of health impacts;
- (2) Reviewing the evidence and calculating the cost of the health impacts of air pollution;
- (3) Rethinking appraisals to mitigate the health impacts of air pollution from road transport.

## *Introduction (continued)*

- However – as befits a presentation to members and guests of our Society –
- The focus here is principally on the theoretical propositions (“valuing life and health”) in Chapter 1;
- With a summary of the (now largely uncontested) evidence in Chapter 2;
- And a generalisation of the argument in Chapter 3.

## *Defining the economic cost of health impacts*

- What precisely do we mean by the “cost” of a mortality or morbidity – the “value” of a life saved or of health restored? For economists, the answer is *not*, as is all too frequently supposed, a sum of money.
- My point of departure here – *a la* Quensay and Smith (and all their successors: from Ricardo to Marx, and from Walras and Arrow) – is thus an explicit rejection of chryso-hedonism: value is to be found not in money but in what lies behind “the monetary veil”.

## *Defining economic cost (continued)*

- In standard economic theory, “value” (aka “use value”, “utility”) is the valuation that individuals place on the objects they desire, incl. consumption, leisure, health and life; and “cost” is a measure of their loss. Money is not the thing being measured but the instrument by which to measure it: these units of utility, these “utils”.
- The economist’s task is to aggregate these individual valuations at their marginal rates of substitution.

## *Defining economic cost (continued)*

- Following Jacques Drèze, economics today possesses a standard method for calculating the cost of mortality – that is, for calculating the loss of the valued object, life – at the level of society as a whole.
- Thus, the “value of statistical life” (VSL), or the marginal rate of substitution between consumption and a reduction in the risk of dying, as derived from aggregating individuals’ “willingness to pay” (WTP).

## *Defining economic cost (continued)*

- A simple logic. Each individual has an expected utility function, EU, relating the utility of consumption over a given period,  $U(y)$ , and the risk of dying in that period,  $r$ , of the form:  $EU(y, r) = (1 - r) U(y)$ .
- The WTP to maintain the same expected utility in the event of a reduction in risk from  $r$  to  $r'$  is the solution to the equation:  $EU(y - WTP, r') = EU(y, r)$ .
- VSL is thus the marginal rate of substitution between these valued objects, consumption and the reduction in the risk of dying, such that:  $VSL = \delta WTP / \delta r$ .

## *Defining economic cost (continued)*

- A simple search. “[A] survey finds an average WTP of USD 30 for a reduction in the annual risk of dying from air pollution from 3 in 100 000 to 2 in 100 000. This means that each individual is willing to pay USD 30 to have this 1 in 100 000 reduction in risk. In this example, for every 100 000 people, one death would be prevented with this risk reduction. Summing the individual WTP values of USD 30 over 100 000 people gives the VSL value – USD 3 million in this case.”

## *Defining economic cost (continued)*

- A simple result. The economic cost of the impact being studied – in the present case, the cost of mortalities from air pollution – becomes the VSL value multiplied by the number of premature deaths.
- And the economic benefit of a mitigating action – for example, those identified in the EU's Thematic Strategy on Air Pollution (TSAP) – becomes the same VSL value multiplied by the number of lives saved.

## *Defining economic cost (continued)*

- In contrast to mortalities, morbidities entail a plurality of endpoints – from the relatively trivial to the very severe – and impose a plural loss of utility – not only health but also consumption and leisure – and on a plurality of agents ... all of which greatly complicates the task of eliciting and aggregating valuations.
- There is not as yet an agreed standard method – and agreed values – for calculating the cost of morbidities.

## *Defining economic cost (continued)*

- Hence, the new OECD research programme to develop an agreed standard method, covering:
  - “resource costs”, both medical and non-medical;
  - “opportunity costs”, or the indirect costs of lost income and lost leisure;
  - “disutility costs”, as given by individual WTP values.
- In lieu of an agreed standard method and agreed values, I have applied the best estimate available: 10% of the cost of mortalities as given by mean VSLs.

## *Defining economic cost (continued)*

- A final point: mortalities and morbidities impose not only an economic cost as defined here – the loss of utility by individuals, aggregated as a loss in social welfare – but also a negative impact on the macro-economy: a subtraction from potential GDP as a result of reduced labour supply and reduced productivity.
- There is a need to calculate, separately, this impact on GDP – but without surrendering the standard welfare-economic definition and calculation of “cost”.

## *Reviewing the evidence on the health impacts of air pollution*

- My point of departure here is the new epidemiological evidence-base. GBD 2010 reports a global death toll from ambient particulate matter pollution for 2010 that is four times greater than the figure for 2000 in GBD 2000.
- But note: this is primarily the result of improved reporting – more advanced monitoring technology for measuring pollutant emissions and ambient concentrations, more comprehensive methodology for analysing data. A need to communicate its urgency but without false pessimism.

## *Reviewing the evidence (continued)*

- Sector-specific evidence base has not yet caught up with the new epidemiological evidence base: not yet possible to calculate robustly the share of health impacts of air pollution specifically attributable to road transport. Hence, a need to develop sector-specific estimates of GBD toll.
- For most OECD countries: a downward trend in road transport emissions – but not from diesel vehicles and hence threatened by the shift to diesel. For most other countries: an upward trend compounded by dieselisation.

## *Reviewing the evidence (continued)*

- As at 2010, “ambient air pollution” (ambient PM pollution + ambient ozone pollution) imposed:
- A global death toll of  $\approx 3.4$  million, increase of  $\approx 135,000$ , or  $\approx 4\%$ , compared to 2005, comprising:
- a modest net reduction of  $\approx 20,000$ , or  $\approx 4\%$ , compared to 2005, for the OECD-34 (though not in each country);
- an increase of  $\approx 20,000$  in the non-OECD world outside China and India and of  $\approx 135,000$  in China and India.
- China’s toll:  $\approx 1.3$  million, a  $\approx 5\%$  increase from 2005.
- India’s toll:  $\approx 0.7$  million, a  $\approx 12\%$  increase from 2005.

## *Calculating the cost of the health impacts of air pollution*

- My point of departure is the OECD (2012) meta-analysis of VSL studies – 1095 values from 92 published studies – leading to the recommended base value of USD 3 million for the OECD world in year 2005 in 2005 USD.
- And a simple formula to translate this into values for selected countries, accounting for income differences, in the selected year, accounting for income growth:  $VSL C_{2010} = VSL OECD_{2005} \times (Y C_{2005}/Y OECD_{2005})^\beta \times (1 + \% \Delta P + \% \Delta Y)^\beta$ .

## *Calculating the cost (continued)*

- Applied to the data in GBD 2010, the economic cost of deaths from ambient air pollution for OECD-34 in 2010 can then be calculated as  $\approx$  USD 1.571 trillion. (But note: “national” VSLs are, necessarily, no more than approx.)
- Applying an indicative estimate of  $\approx$  10% to account for the cost of morbidities, we arrive at this result for the economic cost of health impacts from ambient air pollution for OECD-34 in 2010:  $\approx$  USD 1.728 trillion.

## *Calculating the cost (continued)*

- VSL values for OECD countries are a high multiple of the VSL values for China and India, reflecting the still-large gaps in per capita incomes and hence in the ability to trade-off consumption for a reduction in the risk of death.
- But given the rapid increase in per capita GDP in China and India, and given the high and still-rising death toll, the economic cost of the health impacts of air pollution in China and India is also, and unsurprisingly, high. In 2010:  $\approx$  USD 1.371 trillion in China,  $\approx$  USD 0.459 trillion in India.

## *Calculating the cost (continued)*

- From the evidence available, there is good reason to suppose that, in the OECD countries taken as a whole, the share of the economic cost of health impacts from ambient air pollution that is attributable to road transport is  $\approx 50\%$ . That is to say, not far short of USD 1 trillion.
- In China and India, road transport's share is likely to be less than the 50% share estimated for the OECD (and the share for industry and energy is likely to be higher). But a  $<50\%$  share of  $\approx$  USD 1.830 trillion is a large burden.

## *Mitigating the health impacts of air pollution from road transport*

- Reflecting on the final chapter on mitigating actions following the book's publication, here is a more structured development of the argument and a generalisation of it beyond the particular problem of air pollution.
- Recalling the tripartite model for correcting externalities in Roy (2008) – pricing/investment/regulation – but reversing the order of priorities. Thus: regulation/investment/pricing.

## *Mitigating the impacts (continued)*

- The case for regulation. Pricing as a “discovery procedure” is not always needed where there is sufficient information on the problem and its solution. Cf. the case of compulsory seat belts as a road safety policy tool.
- In the present case: the case for maintaining successful regulatory regimes – in particular, a strict vehicle standards regime. Cf. the relative progress of the EU member-countries of the OECD within the OECD-34 – and, per contra, the relative regress in Australia!

## *Mitigating the impacts (continued)*

- The case for investment in mitigating actions on the basis of available evidence and using shadow prices ... that is, without waiting for a “corrected” schedule of prices that would deliver a “corrected” schedule of demand.
- In the present case: the cost burden imposed by the health impacts of air pollution – USD 1.7 trillion in OECD, USD 1.8 trillion in China/India – suggests that the welfare benefits from reducing *these* costs could easily outweigh the cash costs of ambitious mitigation programmes.

## *Mitigating the impacts (continued)*

- A problem. In the field of pollution-mitigation as well as elsewhere, the case for welfare-maximising investments has been trumped by macro-economic arguments on the supposedly negative impacts of public spending.
- Hence, the need for a macro-economic case for such welfare-maximising investments, incl. a calculation of the subtraction from GDP caused by air pollution ... alongside a renewed effort to communicate the welfare-economic case based on the true “economic cost”.

## *Mitigating the impacts (continued)*

- And finally to pricing. In principle, there is of course a clear case for taxing all externalities, here as elsewhere, so as to raise the market price of each externality-generating product to its marginal social cost.
- However: governments have a poor record in the use of this instrument and especially so in the field of environmental externalities. (Is welfare-positive taxation structurally more difficult than welfare-positive spending?)

## *Mitigating the impacts (continued)*

- In the present case, it is the supposed attempt to correct the externality of climate change that has provided a tax advantage to diesel vehicles – and, in its wake, the environmentally damaging trend of dieselisation!
- Hence, and without retreating from the argument for taxing externalities so as to deliver  $P = MC$ , the most urgent task in regard to the use of the tax instrument in the present case is to undo the tax advantage for diesel.

## *Mitigating the impacts (continued)*

- To conclude with a more general remark. Please let's conduct the debate on the economics of health primarily in terms of value and cost, properly defined, not in terms of the relatively second-order issue of the health budget.
- And please let's conduct the debate on economics tout court in terms of value and cost, properly defined, not in terms of the modern reincarnation of that ancient chrysohedonism from which Adam Smith sought to free us.