Towards a Marginal Adaptation Cost Curve for Health: A critical synthesis

Tim Taylor, Aline Chiabai, Anil Markandya, Philip Staddon and Francesco Bosello

bc3 BASQUE CENTRE FOR CLIMATE CHANGE Klima Aldaketa Ikergai

FONDAZIONE ENI ENRICO MATTEI

UNIVERSITY OF EXETER | MEDICAL SCHOOL

European Centre for Environment & Human Health

EUROPEAN UNION Investing in Your Future European Regional Development Fund 2007-13

European Union European Social Fund Investing in jobs and skills

convergence for economic transformation

Overview

- Current State of the Art
- Theoretical Framework
- Issues in constructing a marginal adaptation cost curve for the health sector
- Issues in integrating bottom-up results into top down models
- Conclusions and areas for further research

Current state of the art

- de Bruin et al (2009) derive the implicit adaptation cost curve in the DICE model, using the AD-DICE model. This shows on aggregate level that the costs of adaptation to avoid the first 15% of gross damage are extremely low. They estimate an optimal level of adaptation on average of 33% of gross damages being reduced due to adaptation.
- The need for integrating “bottom-up” based analysis of adaptation costs – due to fact that not all adaptation falls on the public sector or on the agencies responsible for climate change adaptation – was emphasised by Patt et al (2010). The need for sector specific or region specific analysis and linking between regional or sectoral models and the IAMs was identified.

Current state of the art

- Focus on aggregate health adaptation costing has been in developing countries – with a range of $1.5 to $5bn (Chiabai and Spadaro, forthcoming)
- Existing studies on health adaptation costs in Europe focus largely on heat alert and food borne disease (ClimateCost)
- Studies on costs of health interventions not directly linked to climate change, for malaria, diarrhea, malnutrition (Kiszewski et al, 2007; Hutton and Haler, 2004)

Theoretical framework

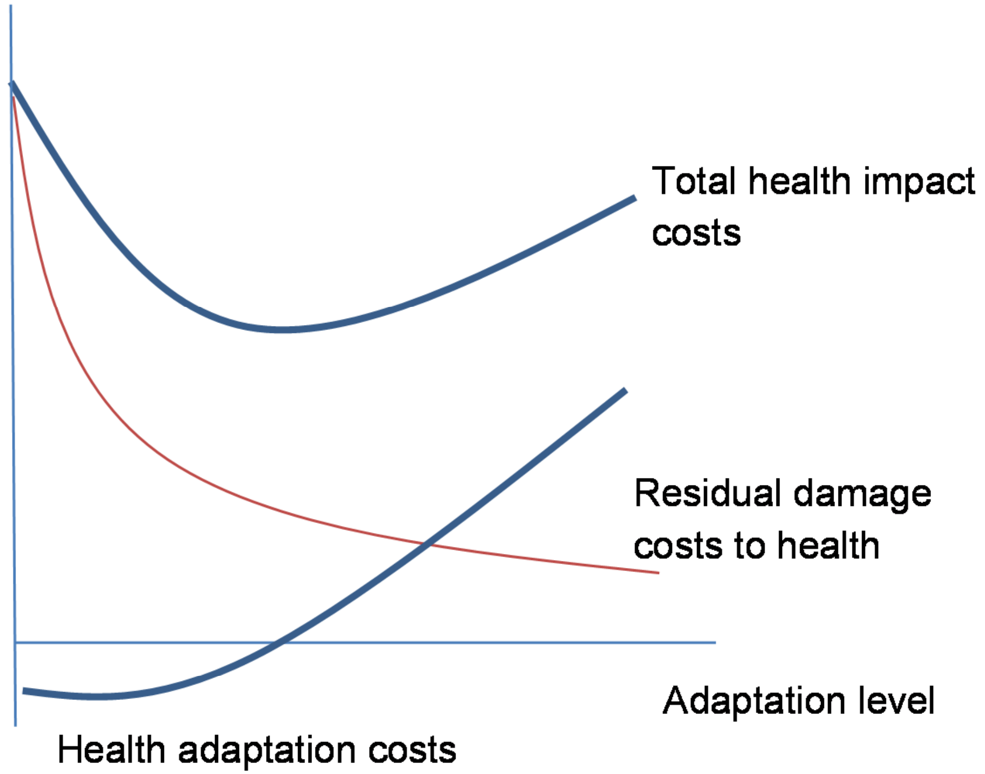


Figure 1: Optimal level of adaptation (adapted from Patt et al, 2010)

Issues in constructing a marginal adaptation cost curve for health

- What does "adaptation cost" mean in health context?
  - e.g. Issue of "treatment costs" which can be seen as being an impact rather than adaptation
  - Appropriate scope of costs (e.g. costs to health service, costs to patients, costs to society)
- Definition of "unit" of adaptation
- Availability of different metrics in the literature (cost per case or per death avoided, DALYs, QALYs, ….)
- How to consider the multiple health benefits that some health programs provide?

Overview of Health Impacts of Climate Change

Type of health impact	Definition
Mortality	
Accidental mortality	Sudden death due to an accident.
Acute mortality	Sudden death due to exposure to an infection or another environmental hazard such as air pollution.
Chronic mortality	Death following exposure to an environmental hazard (or infection), with an intervening period of deteriorating health.
Latent mortality	A special case of chronic mortality in which death follows exposure to an environmental hazard, with an intervening period during which health does not deteriorate.
Morbidity	
Accidental morbidity	Injury due to an accident.
Acute morbidity	Sudden deterioration in state of health due to exposure to an infection or another environmental hazard such as air pollution.
Chronic morbidity	Deteriorating heath following exposure to an environmental hazard or infection.

Based on Metroeconomica (2004)

Issues in constructing a marginal adaptation cost curve for health

- As morbidity and mortality need to be considered, composite measures of health benefit such as *Quality Adjusted Life Years* or *Disability Adjusted Life Years* needed, but:
  - QALYs not uniformly accepted across Europe
  - Criticisms as to methodology (e.g. ECHOUTCOME Project)
  - Difficulties in transferring across contexts

Issues in constructing a marginal abatement cost curve for health

- Timing of adaptation:
  - It is possible to apply the “adaptation pathways” model of Haasnoot (2012, 2013)
  - This model identifies “tipping points” for adaptation, and in the health context these can be seen as:
    - Primary interventions – before damage occurs to minimise exposure (e.g. a number of public health interventions)
    - Secondary interventions – aim to prevent disease before it becomes manifest (e.g. screening tests)
    - Tertiary interventions – applied once impacts occur

Health impacts	Primary	Secondary	Tertiary
Heat stresses	Building and technical solutions. Urban planning (green roofs, etc). Heat health warning systems (preventive). Educational campaign.		Heat health warning systems (reactive). Emergency plans and medical services.
Extreme weather events related deaths, injuries, mental health effects	Structural measures to reduce flooding (dykes, walls) Land-use and urban planning (flood-resistant). Early warning systems and real-time forecasting.	Disease surveillance and monitoring	Emergency and evacuation plans.
Vector-borne diseases	Vector control (vector habitat destruction, bed nets). Information and health education.	Disease surveillance and monitoring. Vaccination.	Diagnosis and treatment (early detection)
Food-borne diseases	Food sanitation and hygiene (refrigeration, chlorination of drinking water, etc). Food safety education.	Disease surveillance and monitoring. Zoonosis program to control disease in animals (salmonella). Microbiological risk assessment.	Diagnosis and treatment (early detection)
Water-borne diseases	Water and sanitation systems. Information and health education.	Disease surveillance and monitoring.	Diagnosis and treatment (early detection).

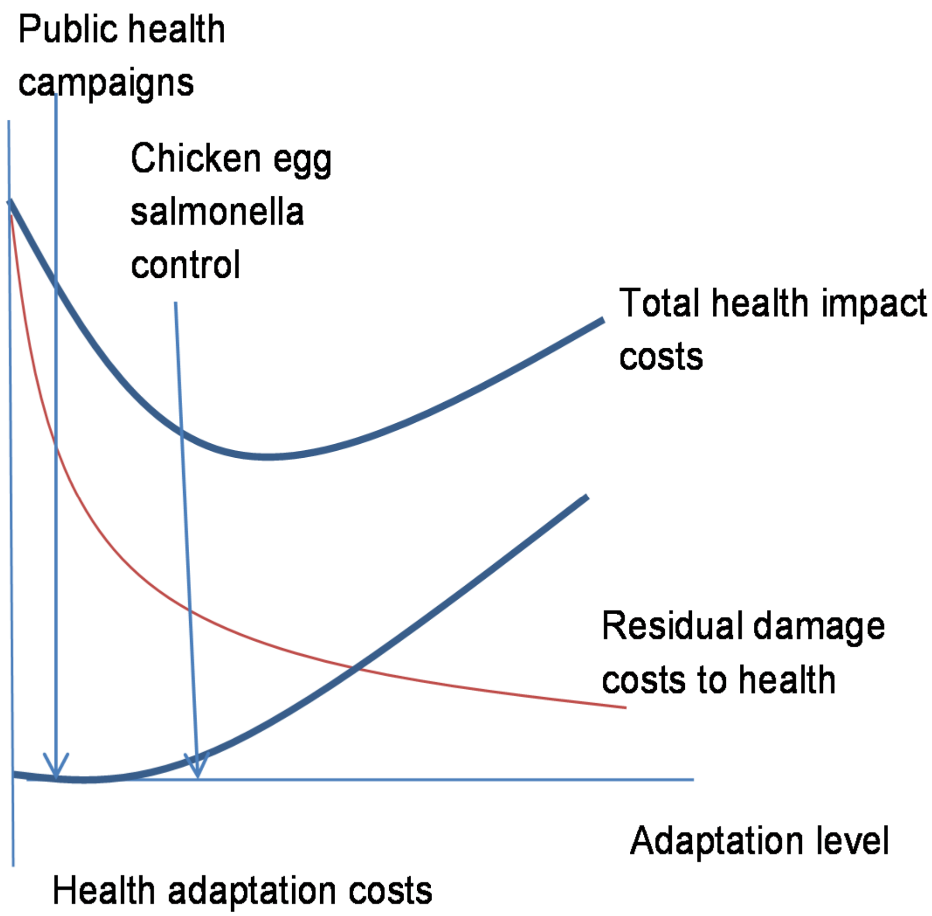
Issues in integrating bottom-up results into top-down models

- Spatial coverage – translating national and regional curves to global scale. Extent to which this is necessary depends on how disaggregated is the IAM.
- Different components of health impacts may have different curves (e.g. heat stress has a low marginal cost, malaria has a much higher cost)
- Capturing of uncertainty in costings and timing of adaptation
- Unit costs should be linked with specific increases in temperature

Example: existing cost estimates

- Salmonella in chicken eggs (Korsgaard et al, 2009):
  - Cost of salmonella control in chicken eggs in Denmark: €0.4 to €4.3 million per annum 1997-2002 (note: €2.3 to €4.3 million when state testing)
  - Avoided societal costs of €21 million in 1998-2002
  - Salmonella control in eggs has positive net present value benefits
- Note this study does not consider climate change, but under CC scenarios salmonella likely to rise => even greater net present value benefits

Stylised adaptation cost curves



Conclusions and Further Research

- “Bottom-up” evidence on health adaptation costing is limited to date in Europe – more focussed on developing country context
- Difficulties exist in harmonising results across countries and across health conditions
- There is need for further work to gain from richness of “bottom-up” studies in “top-down” models.

Acknowledgements

BASE BOTTOM-UP CLIMATE ADAPTATION STRATEGIES FOR EUROPE

SEVENTH FRAMEWORK PROGRAMME