

The economic and financial policies to fight against climate change: The case of the Maghreb

HILMI Nathalie
Centre scientifique de Monaco
hilmi@centrescientifique.mc

SAFA Alain
Université de Nice Sophia Antipolis,
Centre d'Etudes en Macroéconomie et Finance Internationale
safa@unice.fr

Abstract:

Climate change has become a global issue, which only multidisciplinary will understand all aspects: environmental, economic and social. We can not dissociate them from the perspective of sustainable development. Before considering socio-economic struggle against climate change, we must grasp the environmental extent. An application to the case of the Maghreb, with an assessment of areas that are affected, will give a more concrete vision. Market finance, in turn, will help find the funds necessary to carry out policy decisions.

Keywords: Multidisciplinary climate change, economic policies, adaptation, mitigation, financial markets.

Classification JEL : Q01, Q54, Q56, Q58.

The economic and financial policies to fight against climate change: The case of the Maghreb

Introduction: How to measure the effects of climate change?

If the global warming of the planet increases of 4 ° C, rising sea and ocean levels will impact millions of people, drinking water would decrease from 30 to 50% in southern Africa and the Mediterranean region, over 20 to 30% of species of plants and animals would be threatened with extinction. To avoid this, the international community reacts. After the Earth Summit, held in Rio de Janeiro in 1992, the Kyoto Protocol aimed at stabilizing concentrations of greenhouse gases in the atmosphere to avoid disrupting the climate. The U.S. had refused to sign such agreements, although they are the world's largest producers of greenhouse gas emissions. In August 2008, 150 countries met in Ghana to boost the fight against climate change, including deforestation, because the destruction of tropical forests causes 20% of global emissions of greenhouse gas emissions.

To see if we can estimate the biodiversity, an article entitled "The value of the world's ecosystem services and natural capital" written under the direction of Robert Costanza of the University of Maryland and published in Nature in May 1997 opened the discussion of the links between natural sciences and economics. Thus begins the debate on the multidisciplinary of the phenomenon of climate change. The authors conclude that the biosphere yields 33 000 billion dollars per year, almost twice the global GDP. On the one hand, they think that it is worth speaking to people with a language they understand: in terms of costs and benefits. On the other hand, they do not believe that economists are able to estimate the biosphere in monetary value. A European project called RUBICODE (Rationalizing biodiversity conservation in dynamic ecosystems) establishes reliable indicators and tools for decision making on specific ecosystems. While the issue of biodiversity is trying to convince political leaders, global warming became a world issue in 2007. First, Lord Stern's report, released in October 2006, assesses the potential damage from climate change to 20% of global GDP. Then, the final report of the IPCC (Intergovernmental Panel on Climate Change) is full of figures, estimates, economic scenarios to the attention of policy makers. The linkage between environmental science and economics seems obvious.

For development to be socially sustainable, it would require that generations meet their needs without compromising the capability needs of future generations. Here arises the question of transfer of knowledge or intergenerational potentiality. Having established some economic facts about the phenomenon of climate change, we will examine possible measures against global warming. Finally, we will look at how financial markets help in the fight against climate change.

Global warming is expected to continue over the coming decades as a result of economic growth and increasing population. Thus, China and India will contribute significantly to this phenomenon. In fact, emerging and developing countries mainly contribute to the current growth of emissions while the advanced economies have caused the bulk of past emissions.

To measure the economic cost of climate change, we try to find functions linking the loss of GDP and the increase of temperature. These functions separate the impacts related to markets from other consequences (IPCC, 2007). These market-related impacts include effects on climate-sensitive sectors like agriculture, forestry, fishing and tourism, damage to coastal areas due to

increased sea levels, changes in costs of energy (to heat or cool) and changes in water resources. Non-market impacts overlap effects on health (infectious diseases, drinking water, pollution), recreation (sports, outdoor activities), ecosystems (biodiversity loss) and human settlements (cities and cultural heritage can not migrate).

Some precursors have sought to estimate those damage: Mendelson, Schlesinger and Williams (2000), Nordhaus and Boyer (2000) and Tol (2002). The Stern Review (2007) incorporates and complements these studies. Countries where the economy is based on sectors dependent on climate, where the population is in poor health and where public services are scarce or of inferior quality, such as Africa, South-East Asia (especially India, because of the risk of reversing the cycle of monsoons) and Latin America, may be the most economically affected by climate change. European developed countries risk the reverse of the Atlantic thermohaline circulation. Conversely, China, North America, the advanced countries in Asia and transition countries (especially Russia) are less vulnerable to global warming which will give them, however, good harvests.

But there is considerable uncertainty about the damage caused by climate change. It comes from the imperfect knowledge of the physical and ecological processes of climate change, of the difficulty in how people adapt to change and the inability to quantify now the damage that future generations will suffer. Nevertheless, economists are looking for ways to avoid aggravation of the problem (mitigation) or to best support the consequences (adaptation).

I- Evaluation of environmental and "green" economic sectors of the Maghreb

A policy fighting against climate change is a voluntary guidance of actors involved towards sustainable development. Three main parties are concerned. Firms can review their production techniques so as to avoid those that emit carbon. Household consumption can orient their products to low carbon products. Governments motivate them to do so. A policy of sustainable development implies a participatory management of direct and indirect users of the environmental resource, but also the establishment of indicators to measure and policies (legal, educational, economic and fiscal) to protect it.

To monetary evaluate the damages of climate change on the environment requires a multidisciplinary approach (legal, technical and economic).

The starting point consists in scientific studies (Costanza et al., 1997: "The value of the world's ecosystem services and natural capital" in *Nature*) that will help us to determine the relationship of cause and effect and to quantify the level of the impact of climate change on the environment. Then, the stage of monetary valuation comes.

Economic theory considers a fair assessment is to assign a value to all components impacted by the environment. This will give the "total economic value" which includes the value of real use (direct and indirect) and intrinsic value (option, existence and leg). The first is given by the market price, but the second is priceless. We consider the cost of restoring the resource. In these cases, the total economic value is equal to the cost of restoration plus the costs related to the partial deterioration of the natural resource and ecological and human services it provides during the period from the beginning of the deterioration to the complete restoration.

When restoration can not be realized, economic theory offers other methods: the replacement costs, expenses and protection methods based on revealed preferences or set (McCammon, M., "Evaluation of environmental damage by the Exxon Valdez incident, "in Petroleum Association of Japan, on Issues Concerning Incidents Tanker Routes, Tokyo, 28 February 2003).

In this paper about the Maghreb, we limit our study to the following sectors: agriculture and forestry, fisheries and aquaculture, and tourism. We consider that the major problems facing the Maghreb are: desertification and acidification of the sea and ocean.

a) Agriculture and forestry

In terms of agriculture, a traditional sector, priority was given to certain activities and regions. The population living in rural areas remains very important. Grain production (barley, wheat and corn), legumes, oil cultivation (olive, sunflower, cotton), sugar crops (beet and cane sugar), citrus, gardening (tomato, potato) are the main components of agriculture in the Maghreb.

The forest provides resources of industrial wood and lumber, fire wood and cork. But like all Mediterranean forests, those of the Maghreb have limited productive capacity. The forest consists of green oak, cedar, of cork oak, Argan tree, juniper, but also pine, fir and oak benzene. The cork and silviculture have an important economic role. Other species, such as argan have a pharmaceutical or cosmetic function. The arbutus products wood, bays and is used in pharmacy. The non-timber products from the forest are locust, lichen, flowers, mushrooms, herbs, honey, fodder units, the products of hunting and fishing. Other products such as wild onion, truffles, snails, myrtle, etc., are also very important. The forest trail can serve as livestock.

Table 1 : Part of agricultural lands and forests over the total surface in the Maghreb

Agricultural land (% of land area)	2001	2002	2003	2004	2005
Algeria	17	17	17	17	17
Morocco	68	68	68	68	68
Tunisia	61	63	63	63	63

Forest area (% of land area)	2001	2002	2003	2004	2005
Algeria	1	1	1	1	1
Morocco	10	10	10	10	10
Tunisia	6	6	7	7	7

Source: World Bank Environment Indicators, 2008.

In Table 1, we see the importance of agricultural land in Tunisia and Morocco. Forests also represent 10% of Moroccan territory. But, for Algeria, agricultural crops and forest are less important. The climate impact will not be economically the same way on these three countries. The strategy of the World Bank is to maximize the income from forestry and agriculture for poverty reduction, economic growth and environment protection. This program is implemented in the Department of Agriculture and Rural Development, which is part of the Sustainable Development Network of the World Bank.

b) Fisheries and Aquaculture

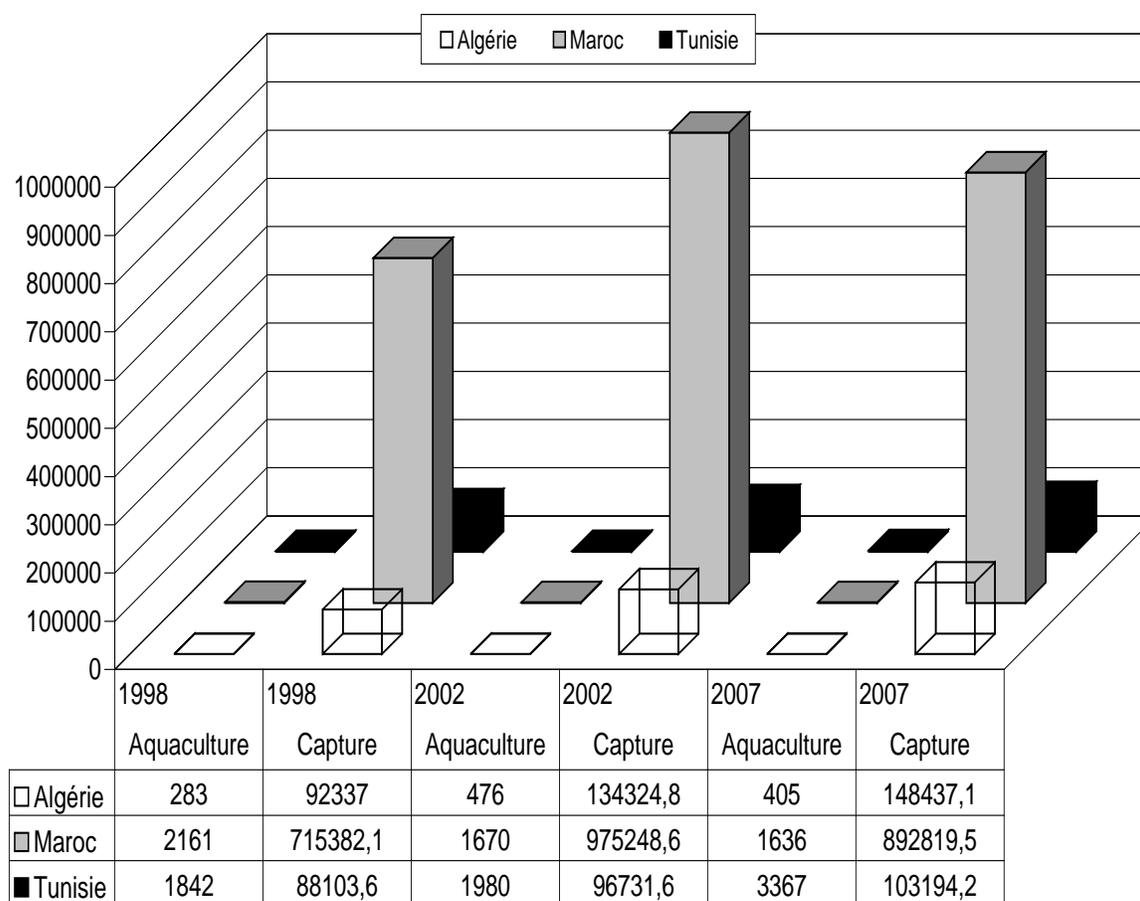
In terms of fish, there are sardines and anchovies, mackerel, horse mackerel, sword fish and tuna. Demersal fish are fairly diversified. In the Mediterranean, there are sea bream (bug and besugue), gadoid fish (hake and poutassu) and mullet. In the North and Central Atlantic, there are dentates, pagers, sars and sea breams. The sea bream and pandora live on the North of the

Saharan coast. In the South and Saharan Atlantic, the most common species of fish are sea breams, croakers, grunts, groupers, soles and flatfishes. The pink shrimp (species most captured), shrimp or deep royal shrimp are living in the Atlantic. In the North and Central Atlantic, there are lobsters, spider crabs, red lobsters. In the South Atlantic and the Sahara, the main species of shellfish marketed is pink lobster. Other species are also exploited in Atlantic: green lobster or red crab of deep sea. Cephalopods are also subject to commercial exploitation: The main species caught are octopus, squid and cuttlefish.

Among other marine resources, there are the red algae, brown algae and green algae. Coral is a valuable marine resource, but it is very fragile due to its slow reproduction. The coasts also provide sand, gravel and pebbles, with more or less important accumulations depending on the area, commercially exploited for the needs of the building.

Many aquaculture projects were implemented. For example, in Morocco: Project AQUA GRUPPEN MOROCCO, MAROST Project, Project AQUASUR. As fish farming and production of trout, salmon and sturgeon, the production of Black-bass, pike and pike-perch, carp farming has also developed.

Figure 1: The allocation of the fishery between aquaculture and capture (in metric tons) in the Maghreb



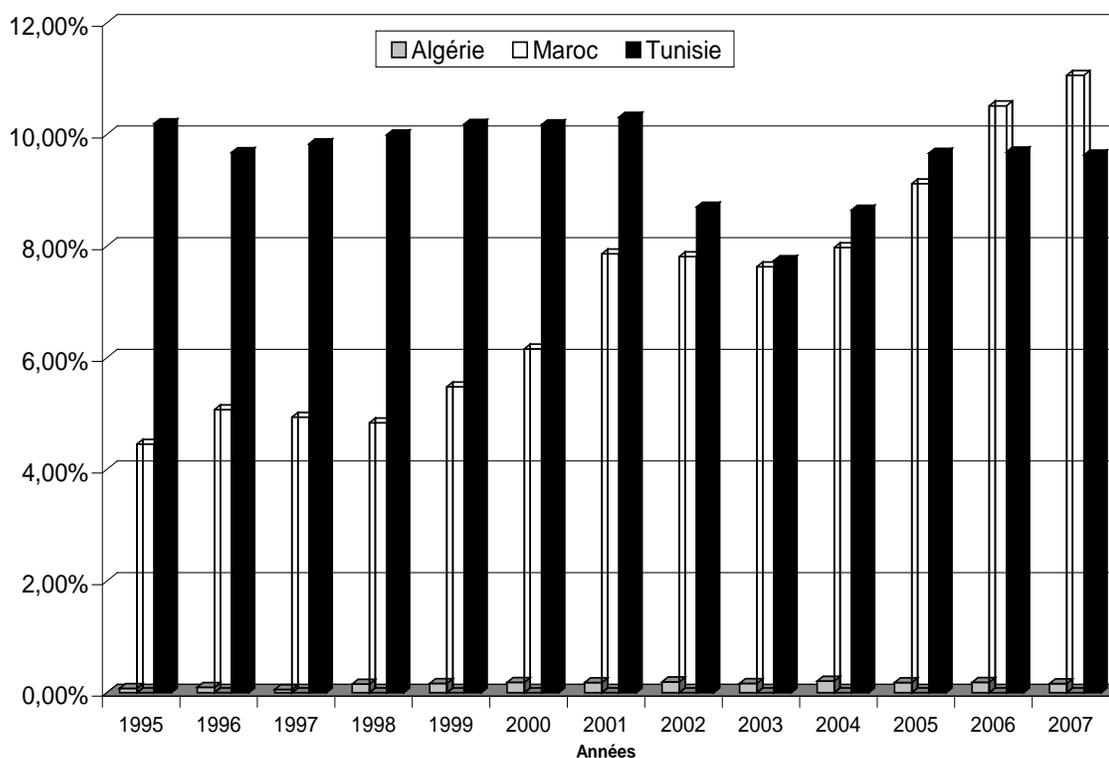
Source : FAO, Fishstat.

Morocco, with its large Atlantic coastline, fishes more than Tunisia and Algeria. The phenomena of rising sea temperatures and ocean acidification will have a greater impact on the Moroccan economy. In the three countries, the share of aquaculture is still far below the catch. This sector still has a good potential for development. It should therefore move towards species that are less, or less quickly, impacted by climate change and its consequences.

c) Tourism

Tourists usually seek a more protected environment than at home: the beaches in summer or the historic cities and monuments. Ecotourism is a recreational activity assuming that the environment is preserved. The mountain (mountain of the High Atlas of Marrakech, for example) is increasingly a place of tours and the protected parks attract many nationals and foreigners. Hikes in the biological reserves are attractive as well.

Figure 2: Tourism receipts as a percentage of GDP of the Maghreb countries



Source : World Development Indicators, 2008.

In this area too, we note differences between the three countries. Algeria is less oriented towards tourism than Morocco and Tunisia. Tunisia seems to have reached a maximum around 10%, with a fall between 2002 and 2004, while Morocco has shown steady growth of its tourism sector. The impact of climate change on tourism is very difficult to be evaluated because it is very complex. In fact, these three sectors deserve a very careful study and each one may be an article. This is what we propose in our future research. Similarly, we recommend a multidisciplinary approach to capture the full impact of climate change on the Maghreb economies and propose appropriate economic policies.

Indeed, it would be better to first evaluate these sectors of activities before the impact of climate change. Hence the need for a multi-disciplinary approach: economists evaluate the

biodiversity and natural scientists establish scenarios on climate change according to their experiments and applications. Then, economists study the impacts of such climate change on different sectors and make forecasts for different scenarios proposed by scientists. Then, they will recommend economic policies to mitigate the effects of climate change or best adapt. Policy makers will take decisions.

II - The political fight against climate change can be done in two ways: adaptation and mitigation.

1) Adaptation

The human being should plan his adaptation. This is necessary else nature, agriculture and human organization can no longer adapt to climate change.

The role of government in the adaptation: Climate change may affect both tax revenue and public expenditure. Negative effects on the fiscal balance are, for example, rising sea levels that will affect sectors such as tourism and agriculture, or the weather.

The costs of adaptation: The magnitude of adjustment costs is poorly defined. According to the World Bank (2006), the annual costs of adjustment will amount to tens of billions of dollars a year for low-income countries.

2) Mitigation

By adopting mitigation measures, we gain a lower concentration of greenhouse gas emissions, improved health and reduced energy demand.

The role of government: To address the market failures in mitigation, households, businesses and governments who make efforts to reduce emissions of greenhouse gas emissions support costs while the benefit is withdrawn by the community. Furthermore, mitigation will benefit to future generations. So, as R & D is expensive, there may be little investment. The government could give tax incentives or subsidies to motivate them.

The costs of mitigation: The IMF has developed a G-Cubed model to assess them. It studies the global mitigation with a uniform tax on carbon. This model shows that the abatement cost varies from one country to another.

Instruments:

- **The pricing of emissions:** Emissions are billed to each emitter on a unit price equal to the damage he causes. The same price is charged to all programs, regardless of their origin or location of damage. We must find the proper update rate of this "carbon tax". If it is too fast, the owners of fissionable fuels might be tempted to increase the current extraction, less expensive (Sinn, 2007). This is the challenge that the government is facing. The advantage is a stable price, linked to the goal of mitigation. Tax revenues will probably go towards the low-income countries, where carbon is used. This is a good burden sharing.

- **The Emissions Trading: The system of cap and trade.** Emission permits are distributed (free or not), then purchased by those who fail to curb their emissions to those who need it least. The advantage of these systems is to guarantee the predictability of global emissions. Furthermore, as Africa and India would be vendors and industrialized countries would be buyers, it is a good way of transferring resources from high-income countries to countries with lower incomes. This is in the sense of fairness.

These instruments can be combined, which will provide forms of hybrid instruments. In addition,

governments can supplement them with macroeconomic policies and financial measures. Also, the financial market can sustain future economic decisions.

III - The role of financial markets is essential for mitigation and adaptation.

a) Financial markets and mitigation:

Since the 80s, "**green**" investment funds accompany the movement of "socially responsible" or "ethical" investments. These funds should only invest in companies pledging to reduce their environmental damage. Since then, new funds invest in companies, projects and technologies with the aim of reducing emissions of greenhouse gas emissions. The **development mechanism (CDM) of Kyoto Protocol** allows issuing of licenses by the United Nations for transfer of emission reductions from emerging countries and low-income to high income countries.

The **exchange of emission permits** has been integrated into the Kyoto Protocol and mechanisms are in force in the European Union, Australia and the United States. Initially, the main players in this market were energy companies, rapidly joined by investment banks and hedge funds.

b) Financial markets and the adaptation:

Financial markets can reallocate assets to sectors or regions where there is less risk and lower costs of adaptation to climate change. The first instrument consists of **weather derivatives** associated with climate swaps and insurance contracts covering weather risks and crops. The second instrument is the **catastrophe bonds** that allow financial markets to better allocate catastrophic climate risks (Hofman, 2007). Both reduce the cost of macroeconomic adjustment by generating price signals to encourage the reallocation of people to low-risk regions and the reallocation of capital to new industries or regions. They thus reduce the social cost of adjustment. We note, in recent years, a strong increase in the exchange of weather derivatives and bonds transferring disaster risks.

25 and 26 May 2009, the 16 most polluting countries in the world gathered in Paris to prepare for the Copenhagen conference in December, where an international agreement post-2012 will be found to replace the Kyoto Protocol. United States, Japan, Germany, France, United Kingdom, Italy, Canada, Russia (G8), China, India, Brazil, South Africa, Mexico, South Korea, Indonesia and Australia: they account for 80% of emissions greenhouse gas emissions on the planet. What will be the conclusions of the Copenhagen conference?

Conclusion: "Escaping the red with green?"

Policymakers should quickly take action against global warming. However, they tend to worry of the current problems than look to the future. Hence the role of economists to show a sustainable development strategy must be considered. They imagined a system called sustainomics which is to make development more sustainable, balancing the three elements (social, economic and environmental) and integrating multidisciplinary. Political authorities tend to listen to economists because they speak the same language, but they also need the lighting by scientists to understand the phenomenon of climate change before making decisions. The recent economic crisis has shown the limits of the current growth model which has too much pressure on the environment. This is why Lord Stern, renowned author of "Stern Review on the Economics of Climate Change" and former Chief Economist at the World Bank, wrote a recent book entitled "A Blueprint for a Safer Planet: How to Manage Climate Change and Create A New Era of Progress and Prosperity ". He stressed the need for international collaboration to save our future prosperity while preserving our planet.

References

- Adam Rose (2009), *The Economics of Climate Change Policy, International, National, and Regional Mitigation Strategies*, Edward Elgar Publishing.
- Banque mondiale, (2006), Clean Energy and Development: Towards an Investment Framework (Washington).*
- Costanza et al. , 1997 : « The value of the world's ecosystem services and natural capital » in *Science*
- Fonds monétaire international, (2008), "Climate Change and the Global Economy," *World Economic Outlook*, April (Washington).
- Gersbach, Hans (2008) "A New Way to Address Climate Change: A Global Refunding System," *The Economists' Voice: Vol. 5: Iss. 4, Article 2.* Available at: <http://www.bepress.com/ev/vol5/iss4/art2>
- Hofman, David, (2007), «*Comment maîtriser le coût des catastrophes*», *Finances et Développement, vol. 44 (mars), p. 42–45.*
- Hope, Chris, (2000), "The Marginal Impact of CO from PAGE 2002 : An Integrated Assessment Model Incorporating the IPCC's Five Reasons for Concern," *Integrated Assessment, Vol. 6 , No.1, pp. 19–56 .*
- Intergovernmental Panel on Climate Change (IPCC), 2007, *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. by B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, and L.A. Meyer (Cambridge, United Kingdom: Cambridge University Press). Available via the Internet: www.ipcc.ch/ipccreports/ar4-wg3.htm.
- Martin L., (1974), "Prices Versus Quantities," *Review of Economic Studies*, Vol. 41, pp. 477–91.
- World Bank, 2006, *Clean Energy and Development: Towards an Investment Framework (Washington).*
- McCammon, M., «Evaluation of environmental damage by the Exxon Valdez Incident », in *Petroleum Association of Japan, Issues Concerning Incidents on Tanker Routes, Tokyo, 28 February 2003*
- McKibbin, Warwick J., and Peter J. Wilcoxon, (1998), "The Theoretical and Empirical Structure of the G-Cubed Model," *Economic Modelling*, Vol. 16 (January), p. 123–48.
- Mendelsohn, Robert, Michael Schlesinger, and Larry Williams, (2000), "Comparing Impacts Across Climate Models," *Integrated Assessment, Vol. 1 (March), pp. 37– 48.*
- Munasinghe, Mohan, (2007), *Making Development More Sustainable: Sustainomics Framework and Practical Applications (Colombo, Sri Lanka: MIND Press, Munasinghe Institute for Development); www.mindlanka.org*
- Neil A. Powe (2009), *Redesigning Environmental Valuation, Mixing Methods with Stated Preference Techniques*, Edward Elgar Publishing.
- Nordhaus, William, and Joseph Boyer, (2000), *Warming the World: Economic Models of Global Warming (Cambridge, Massachusetts: MIT Press).*
- Richard Carson (2009), *Contingent Valuation*, Edward Elgar Publishing.
- Richard S. J., (2005), "Adaptation and Mitigation: Trade-Offs in Substance and Methods," *Environmental Science and Policy, Vol. 8, pp. 395–418.*Weitzman,
- Robert J. Brent (2009), *Applied Cost-Benefit Analysis, second edition*, Edward Elgar Publishing.
- Sinn, Hans-Werner, (2007), "Public Policies Against Global Warming," *CESifo Working Paper No. 2087 (www.csfinfo.de).*Stern,
- Stern, Nicholas and others, (2007), *The Economics of Climate Change: The Stern Review (Cambridge: Cambridge University Press).*
- Stern, Nicholas, (2008), "The Economics of Climate Change," *Richard T. Ely Lecture, American Economic Association Meetings, New Orleans, Louisiana (January 4).*

- Stern, Nicholas, and others, (2007), *The Economics of Climate Change: The Stern Review* (London: HM Treasury).
- Tol, Richard S.J., (2002), "Estimates of the Damage Costs of Climate Change. Part 1 : Benchmark Estimates," *Environmental and Resource Economics*, Vol. 21 (January), pp. 47–73.
- Warwick J. McKibbina, Peter J. Wilcoxon (1998), The theoretical and empirical structure of the G-Cubed model, *Economic Modelling*, 16 1999, 123-148, Elsevier.