Sea Level Rise' Economic Impact

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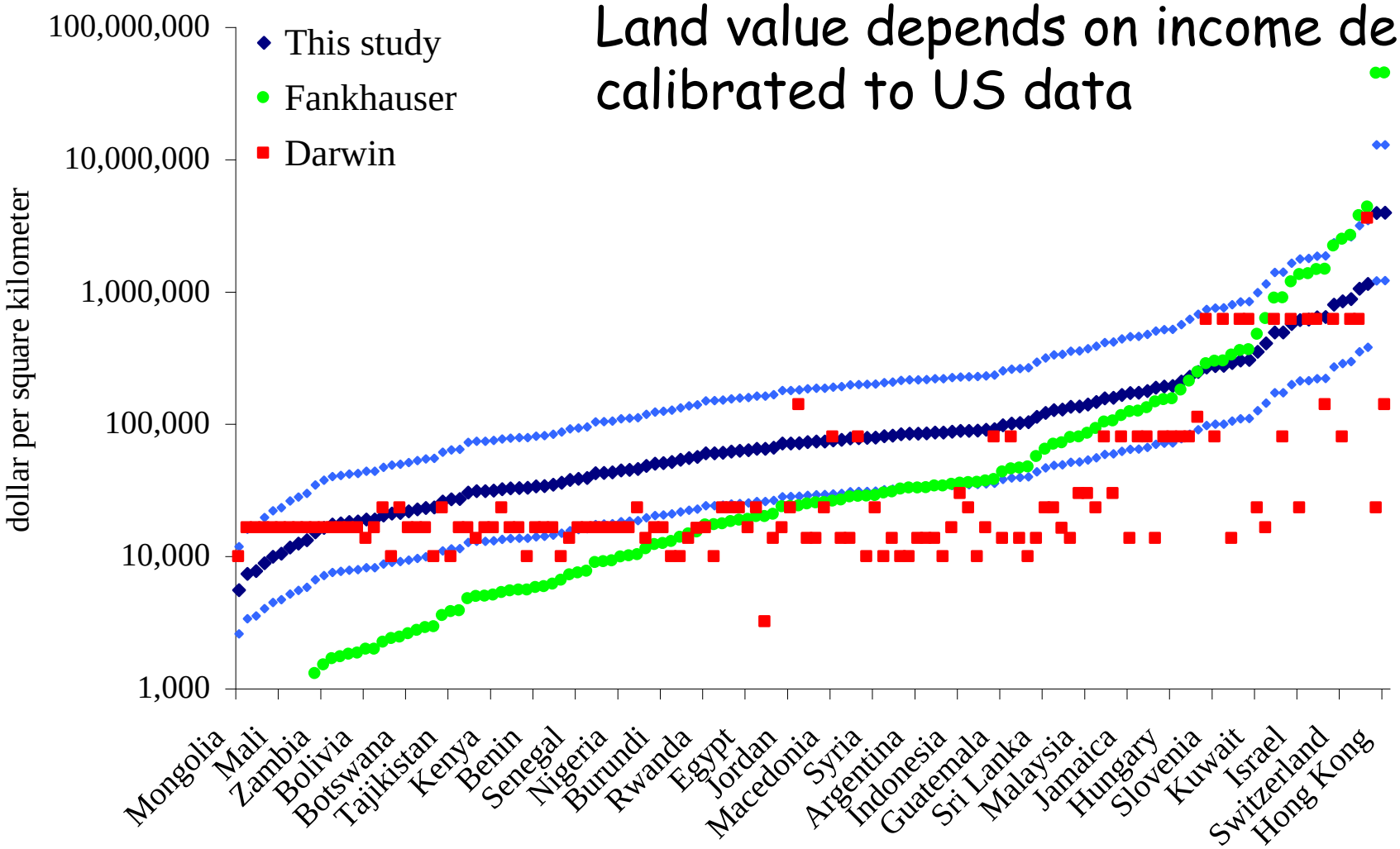
Introduction

- Prof Nicholls discussed the impact of sea level rise on the coast
- I will discuss the economic implications, focussing on
  - direct costs
  - adaptation
  - general equilibrium effects

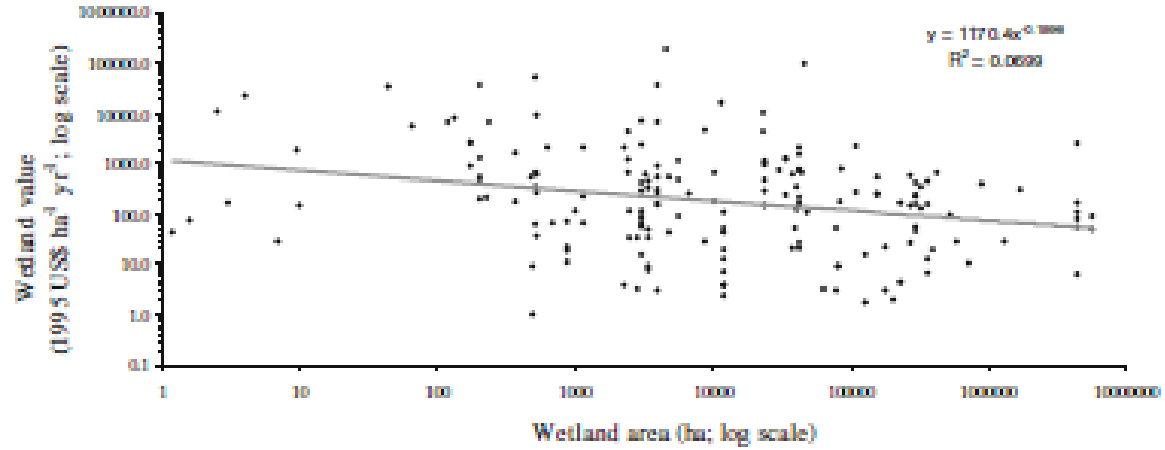
Direct costs

- Sea level rise has a number of impacts
  - Inundation / land loss
  - Flood frequency
  - Wetland loss
  - Coastal protection
  - Saltwater intrusion
  - …
- For each of each, you can estimate a unit cost and multiply that with the impact estimate of the previous presentation
- The sum is the direct cost

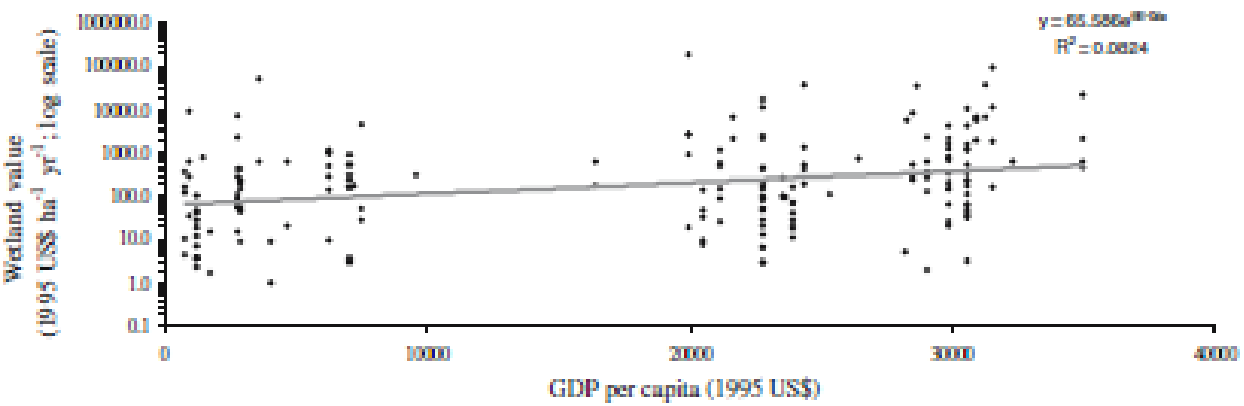
Land value depends on income density calibrated to US data



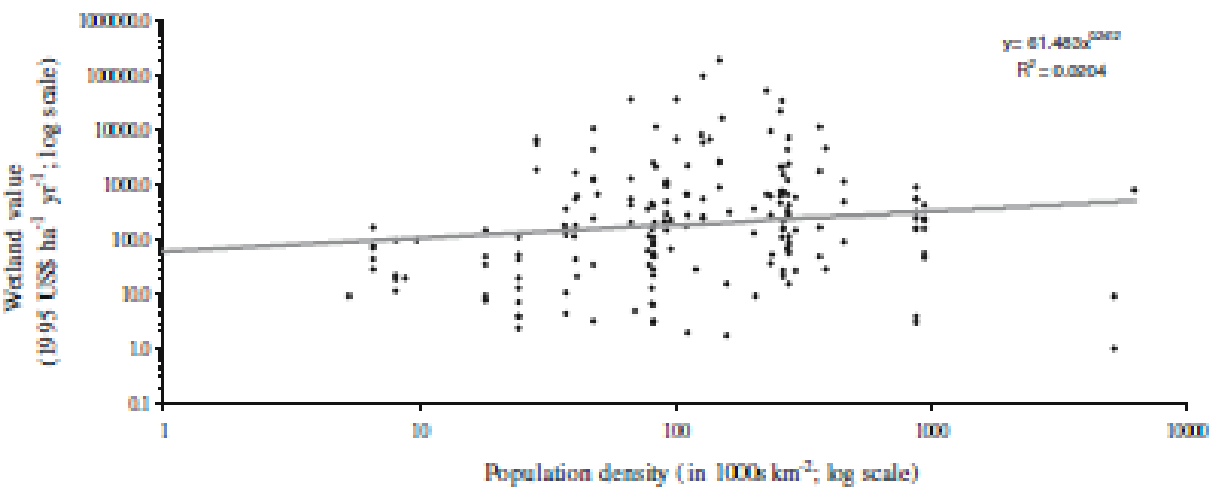
Use average values rather than beach front values as property markets will adjust to coastal realignment



Smaller wetlands command higher price per acre



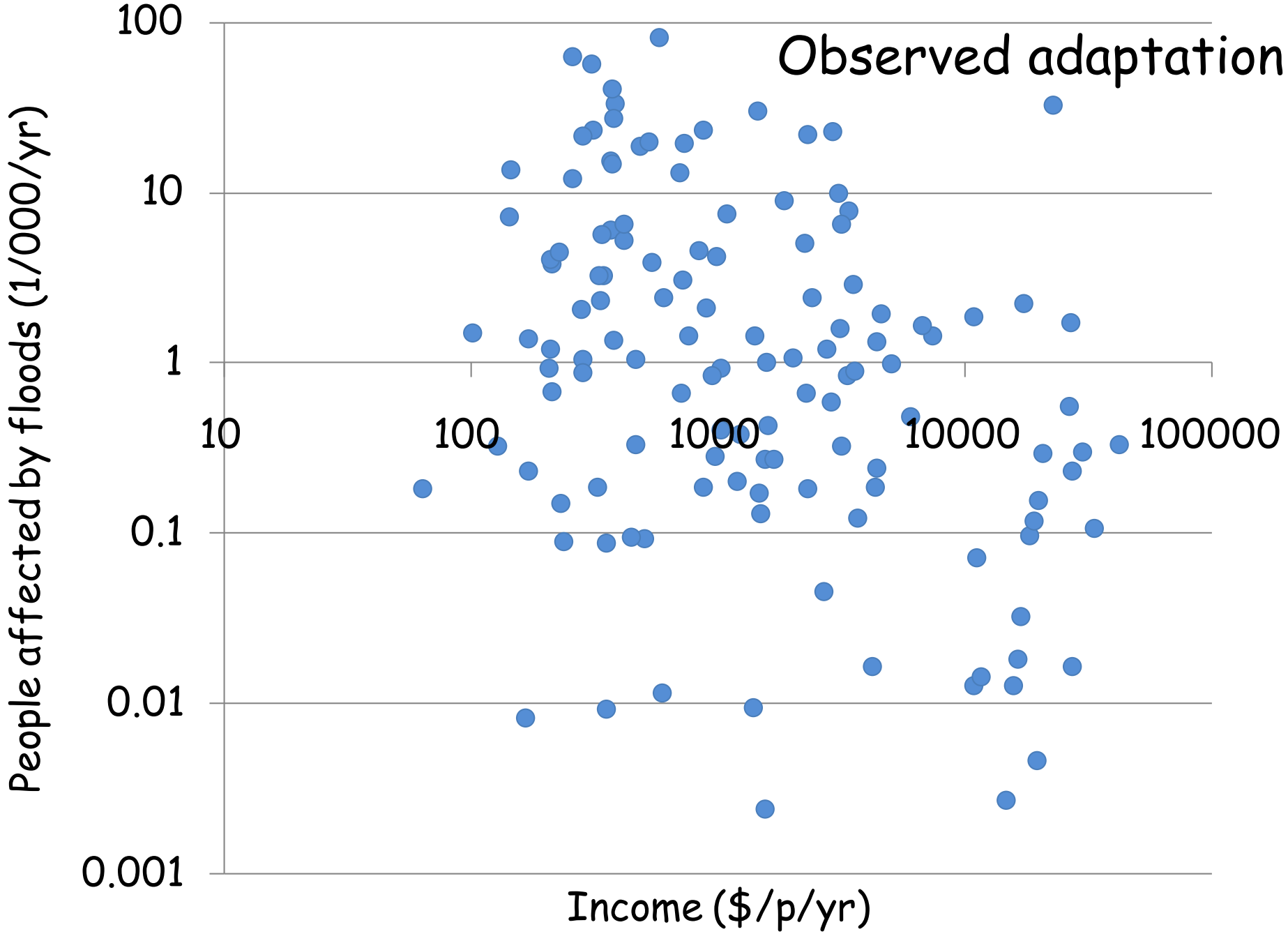
Wetlands in richer countries are more valuable

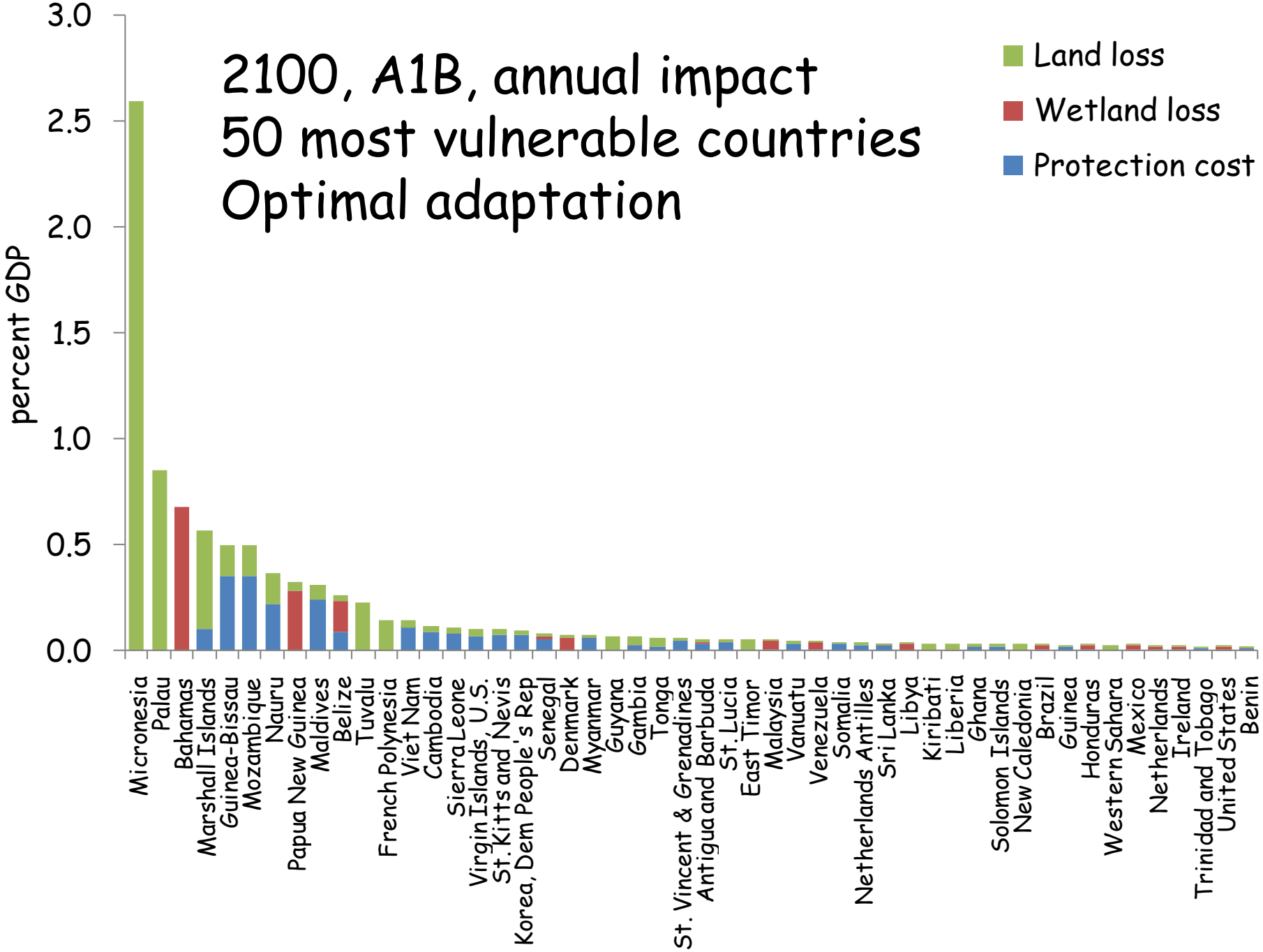


Wetlands in more densely populated countries are more valuable

Brander, Florax, Vermaat, 2006, Ecological Economics

One cannot study impacts without studying adaptation

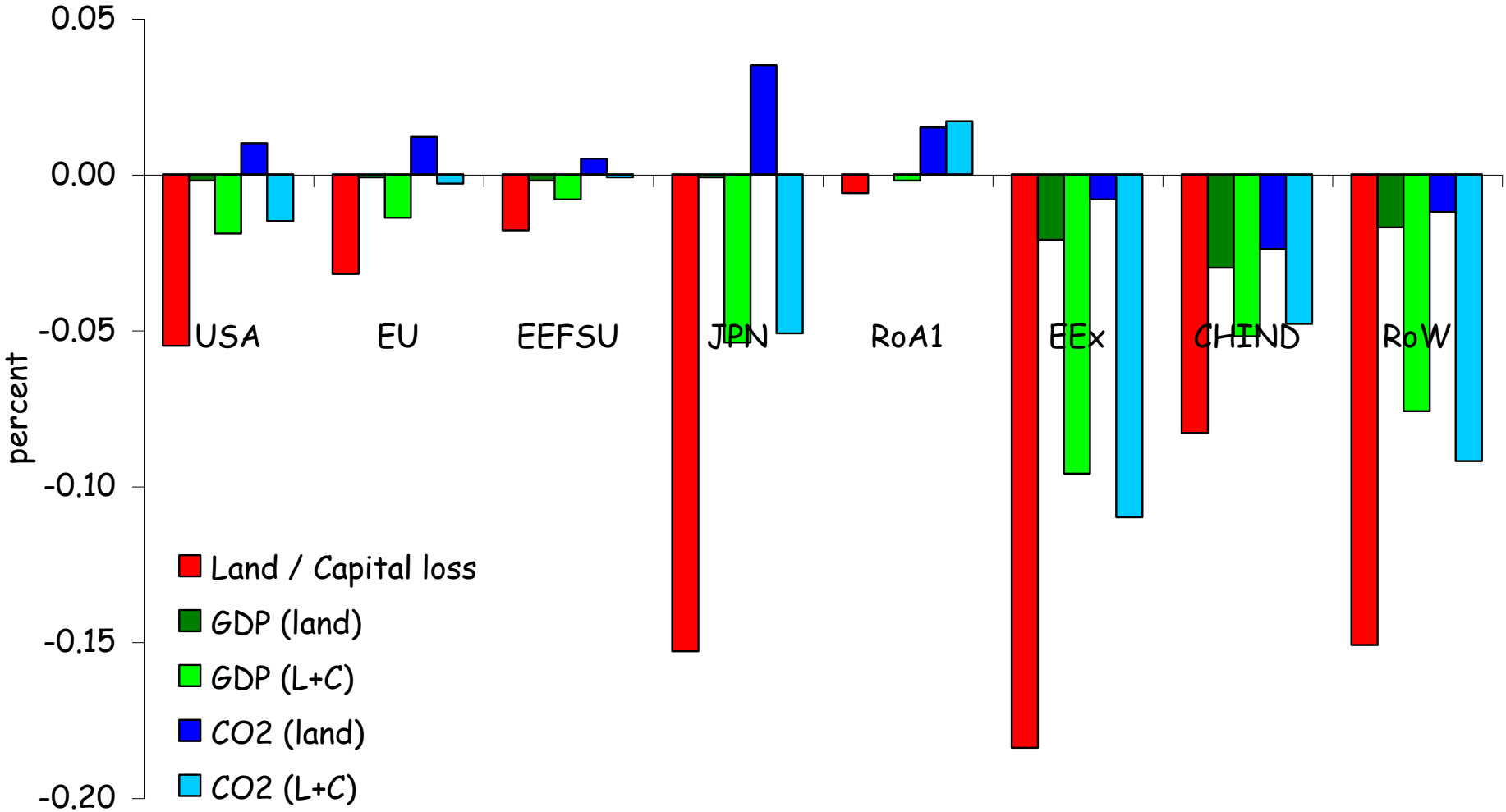

Observed adaptation
100
10
1
0.1
0.01
0.001
10
100
1000
10000
100000
People affected by floods (1/000/yr)
Income ($/p/yr)


2100, A1B, annual impact
50 most vulnerable countries
Optimal adaptation
Land loss
Wetland loss
Protection cost
percent GDP
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Micronesia
Palau
Bahamas
Marshall Islands
Guinea-Bissau
Mozambique
Nauru
Papua New Guinea
Maldives
Belize
Tuvalu
French Polynesia
Viet Nam
Cambodia
Sierra Leone
Virgin Islands, U.S.
St. Kitts and Nevis
Korea, Dem People's Rep
Senegal
Denmark
Myanmar
Guyana
Gambia
Tonga
St. Vincent & Grenadines
Antigua and Barbuda
St. Lucia
East Timor
Malaysia
Vanuatu
Venezuela
Somalia
Netherlands Antilles
Sri Lanka
Libya
Kiribati
Liberia
Ghana
Solomon Islands
New Caledonia
Brazil
Guinea
Honduras
Western Sahara
Mexico
Netherlands
Ireland
Trinidad and Tobago
United States
Benin

General equilibrium effects

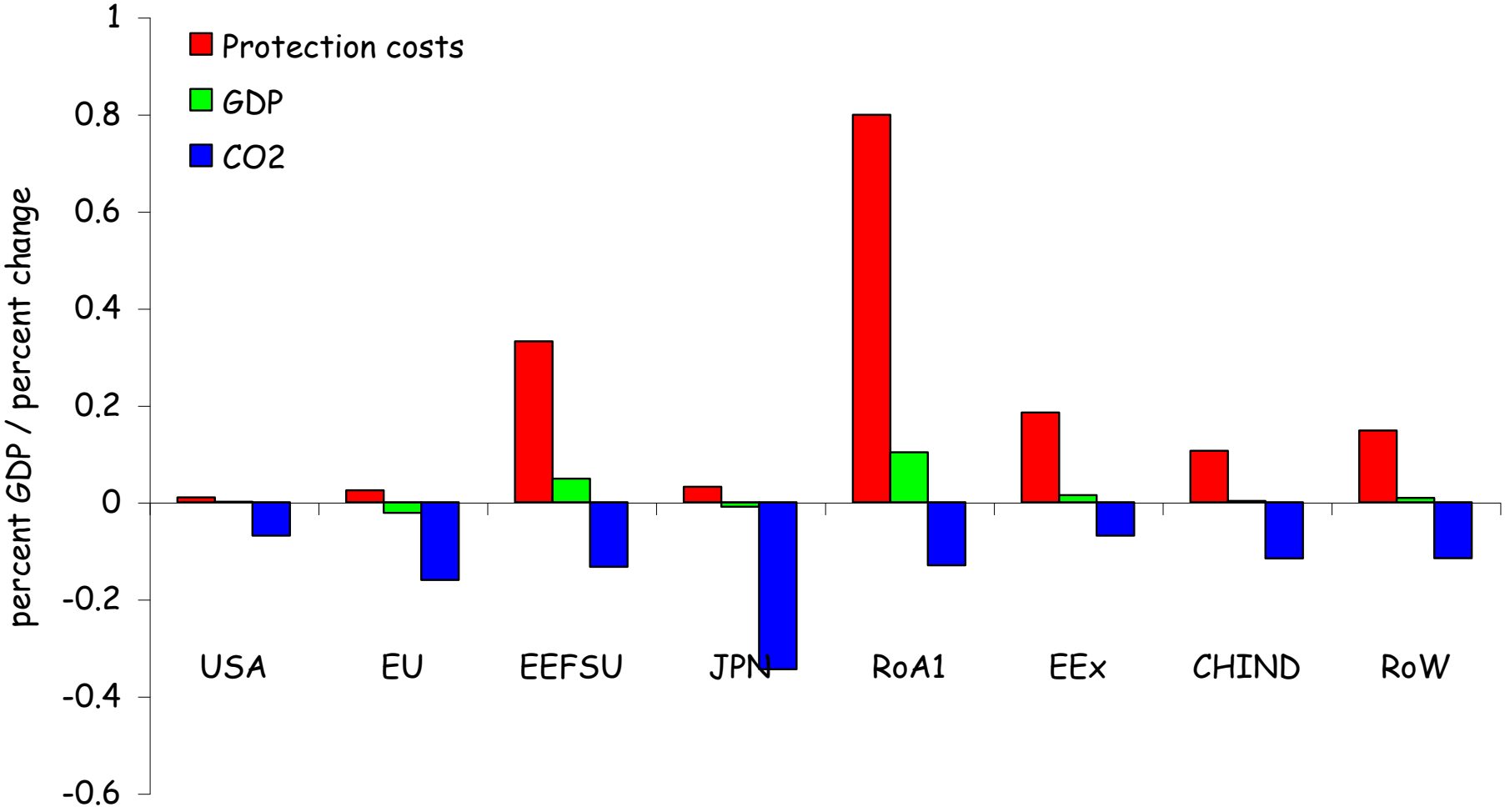
- What are the wider economic implications?
- Land loss would affect agriculture, and hence all other markets
- Coastal protection would affect construction and capital
- Static CGE model
- Dryland lost is a loss of the endowment land; we also include a case in which a proportional amount of capital is lost
- Coastal protection is a defensive investment, financed by a forced increase in savings

No protection; 2050; 25 cm SLR



Bosello, Roson, Tol, 2007, Environmental and Resource Economics

Full protection; 2050; 25 cm SLR



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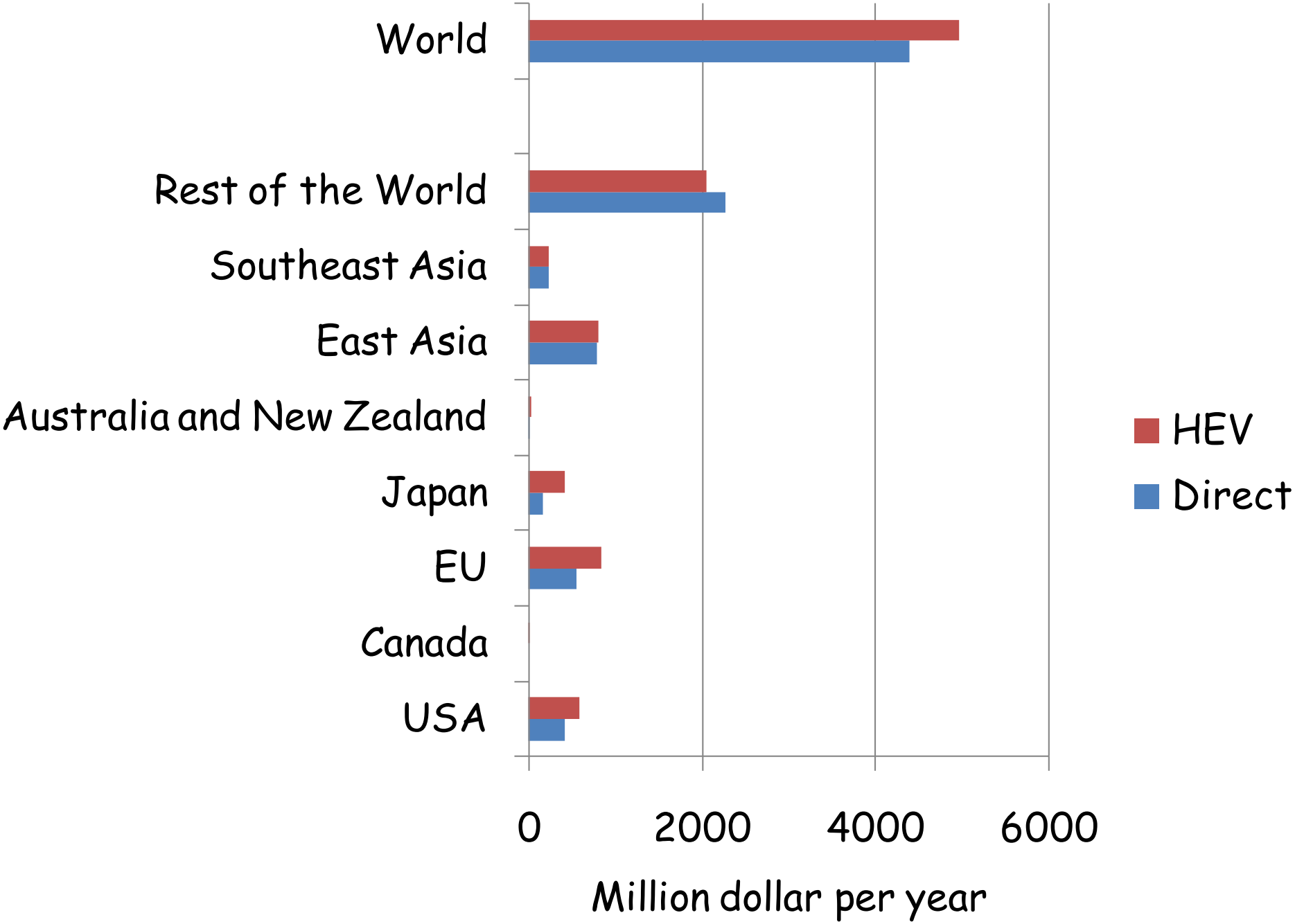


Darwin, Tol, 2001, Environmental and Resource Economics

Conclusions

- Sea level rise is one of the better understood impacts
- Estimates are uncertain, however, partly because the current data are not very good, and partly because the impact is in a remote future
- Two big uncertainties are wetland value and adaptation
- Unknowns include saltwater instrusion and storms

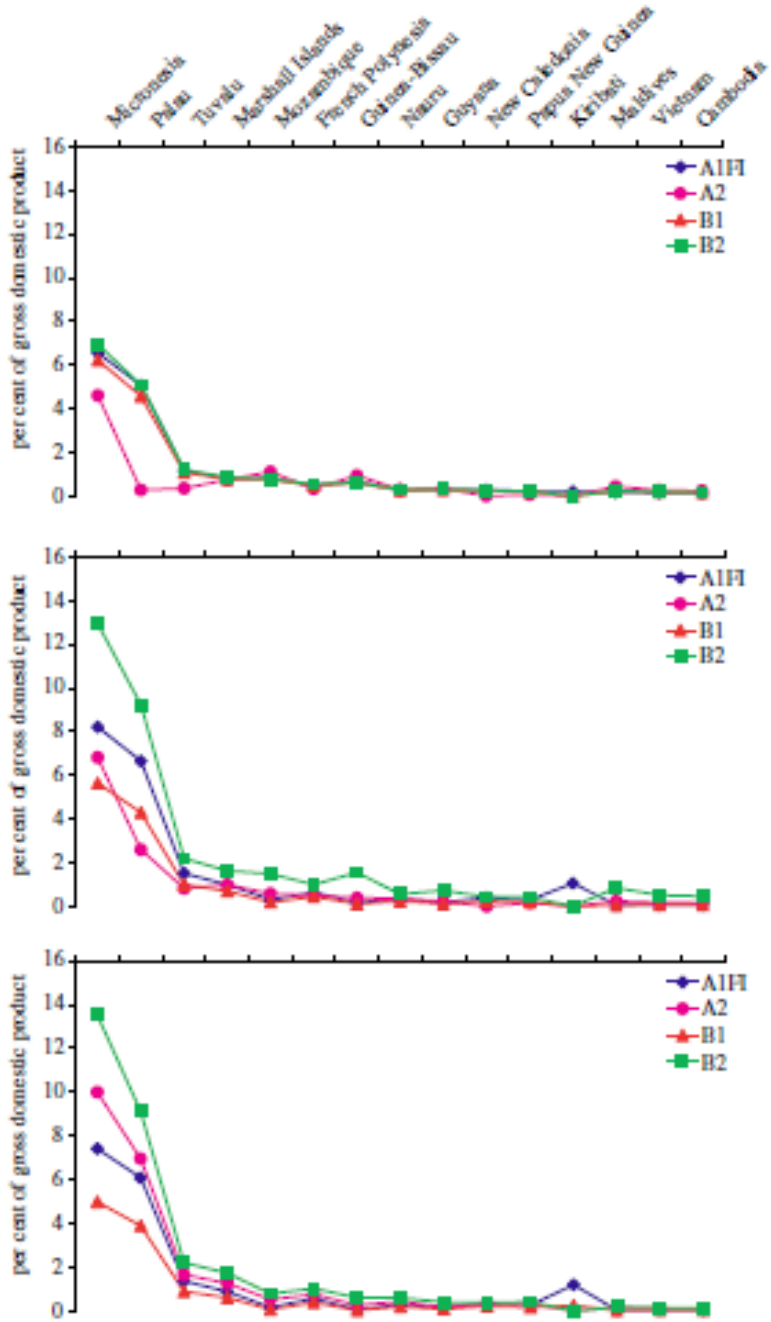
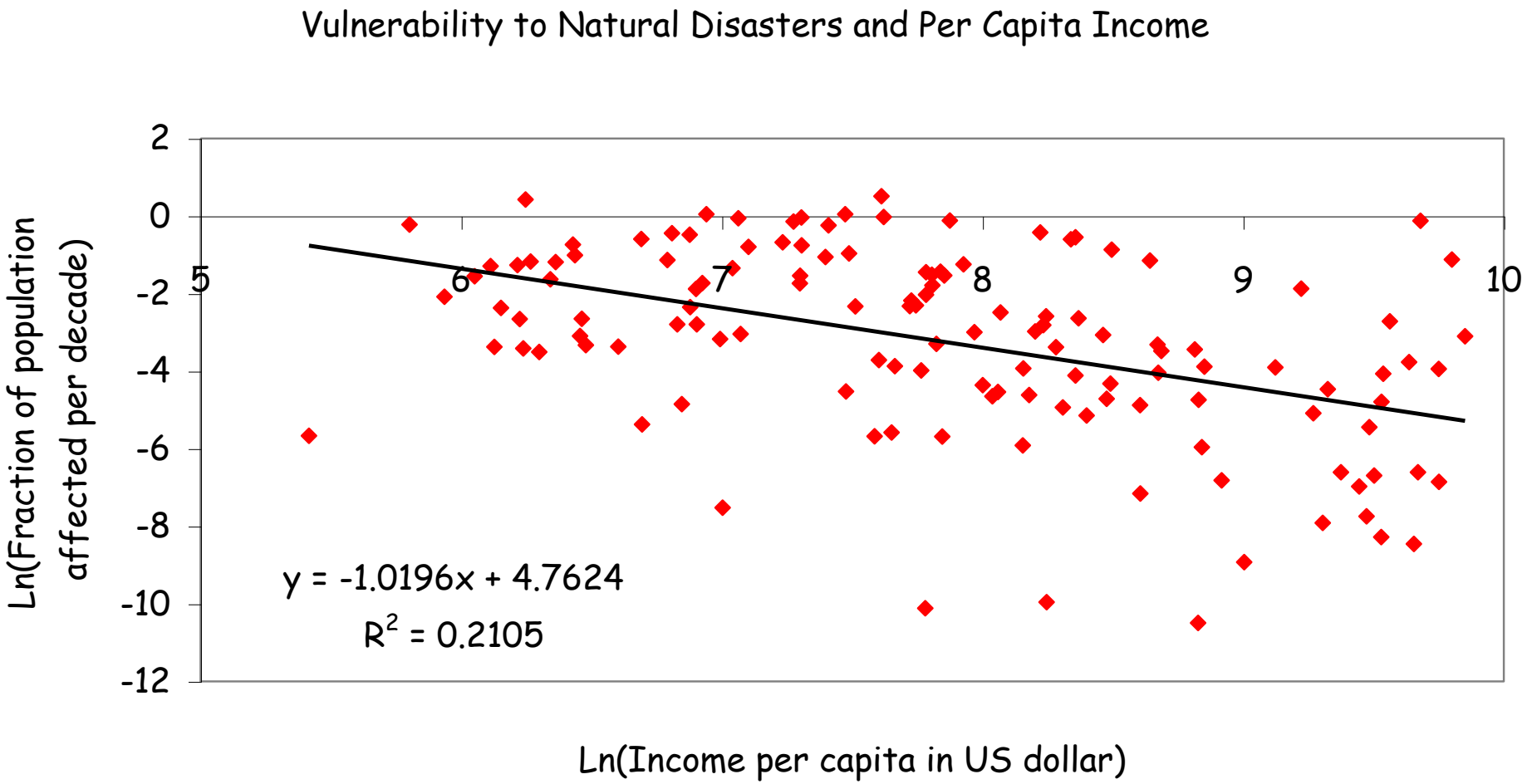
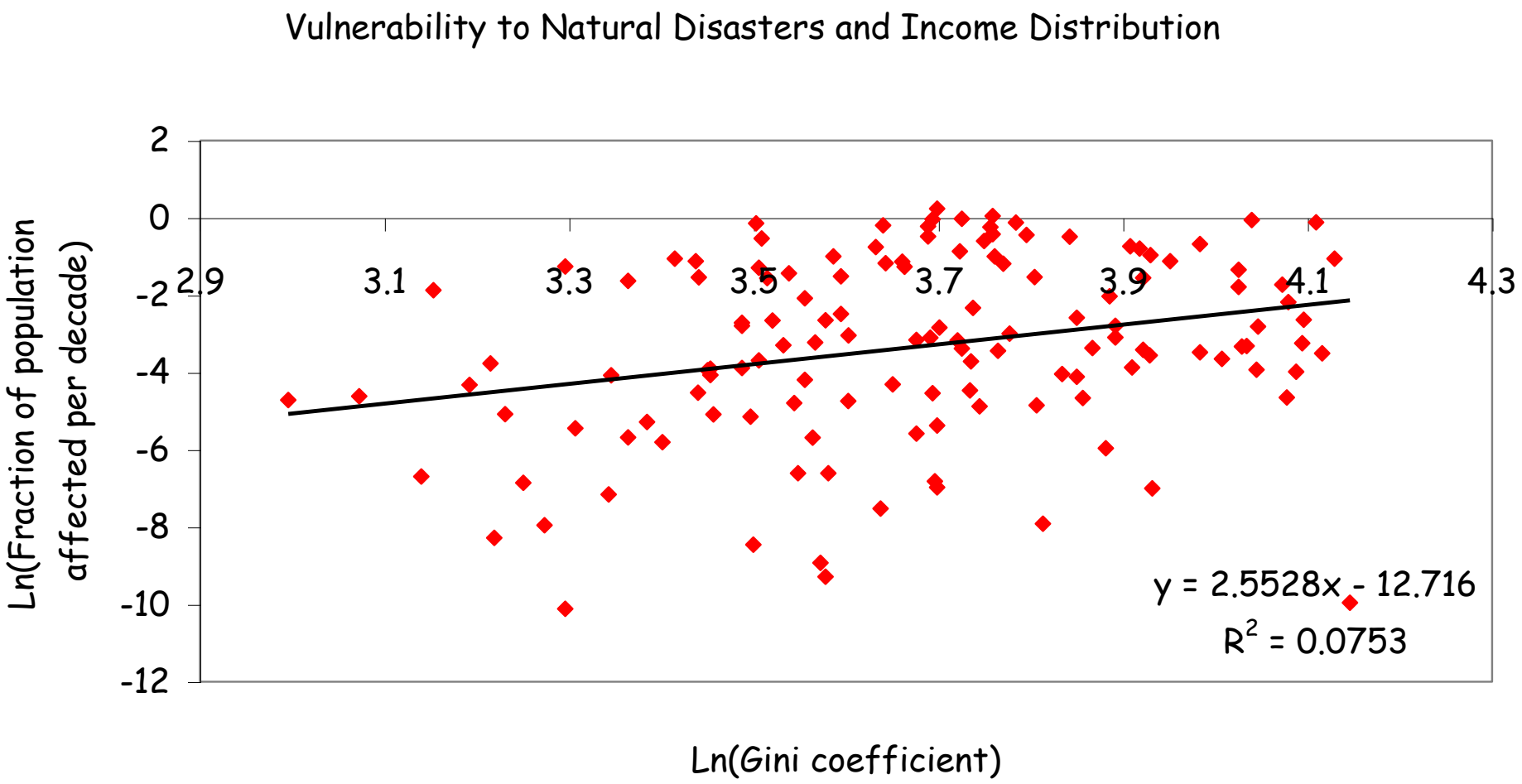


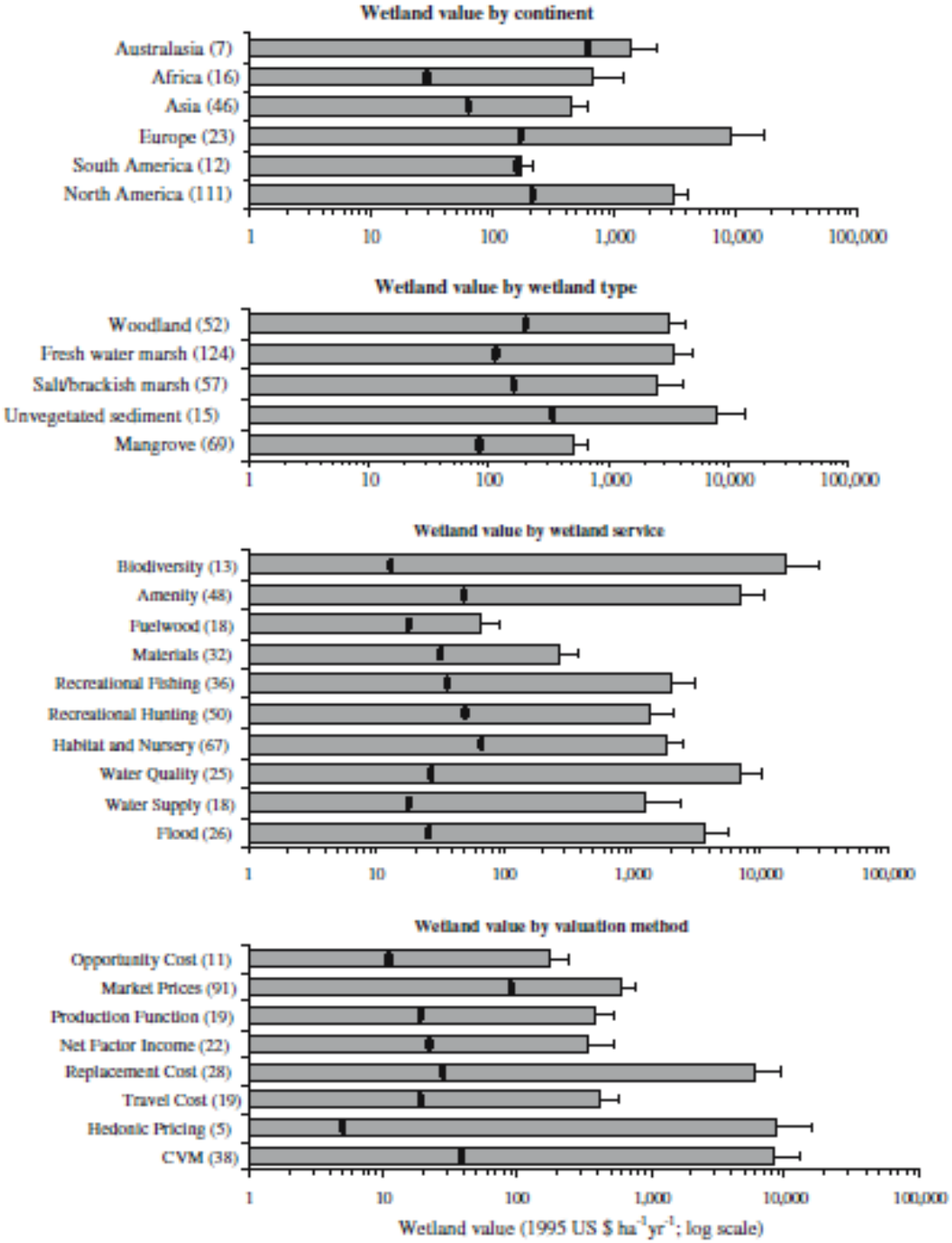
Figure 10. Protection costs as a percentage of current gross domestic product for the 15 most affected countries under the four SRES worlds (A1FI, A2, B1, B2): 2020s (*a*), 2050s (*b*) and 2080s (*c*).



Yohe and Tol, 2002, GEC



Yohe and Tol, 2002, GEC


Wetland value by continent
Australasia (7)
Africa (16)
Asia (46)
Europe (23)
South America (12)
North America (111)
1
10
100
1,000
10,000
100,000
Wetland value by wetland type
Woodland (52)
Fresh water marsh (124)
Salt/brackish marsh (57)
Unvegetated sediment (15)
Mangrove (69)
1
10
100
1,000
10,000
100,000
Wetland value by wetland service
Biodiversity (13)
Amenity (48)
Fuelwood (18)
Materials (32)
Recreational Fishing (36)
Recreational Hunting (50)
Habitat and Nursery (67)
Water Quality (25)
Water Supply (18)
Flood (26)
1
10
100
1,000
10,000
100,000
Wetland value by valuation method
Opportunity Cost (11)
Market Prices (91)
Production Function (19)
Net Factor Income (22)
Replacement Cost (28)
Travel Cost (19)
Hedonic Pricing (5)
CVM (38)
1
10
100
1,000
10,000
100,000
Wetland value (1995 US $ ha-1yr-1; log scale)