IPCC WG2 AR5 Ch10
Key Economic Sectors & Services

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Delineation

- WG2 report is on the impacts of and adaptation to climate change
- Chapter 10 is on *key economic sectors and services*
- Every sector or service is key to someone, so we go systematically through the two-digit ISIC classification – skimming over those sectors for which there is little material

Delineation -2

- The outline was decided by committee
- Ch 10 interacts with
  - Ch 3 Water
  - Ch 4 Land
  - Ch 5 Coasts
  - Ch 6 Oceans (incl. fish)
  - Ch 7 Food
  - Ch 8 Cities
  - Ch 9 Countryside
  - Ch 11 Health
  - Ch 14 Adaptation
  - Ch 15 Adaptation
  - Ch 16 Adaptation
  - Ch 17 Adaptation
  - Ch 19 Total impacts

Delineation -3

- In theory
  - Ch 3-11 will deal with the "physical" impacts of climate change (except Ch 7 Food which might deal with markets too)
  - Ch 10 will deal with demand, supply and markets
  - Ch 19 will deal with impact on welfare
- In practice
  - Wait and see
  - For example, Ch 9 Countryside covers much the same material as our Ch 10

Outline

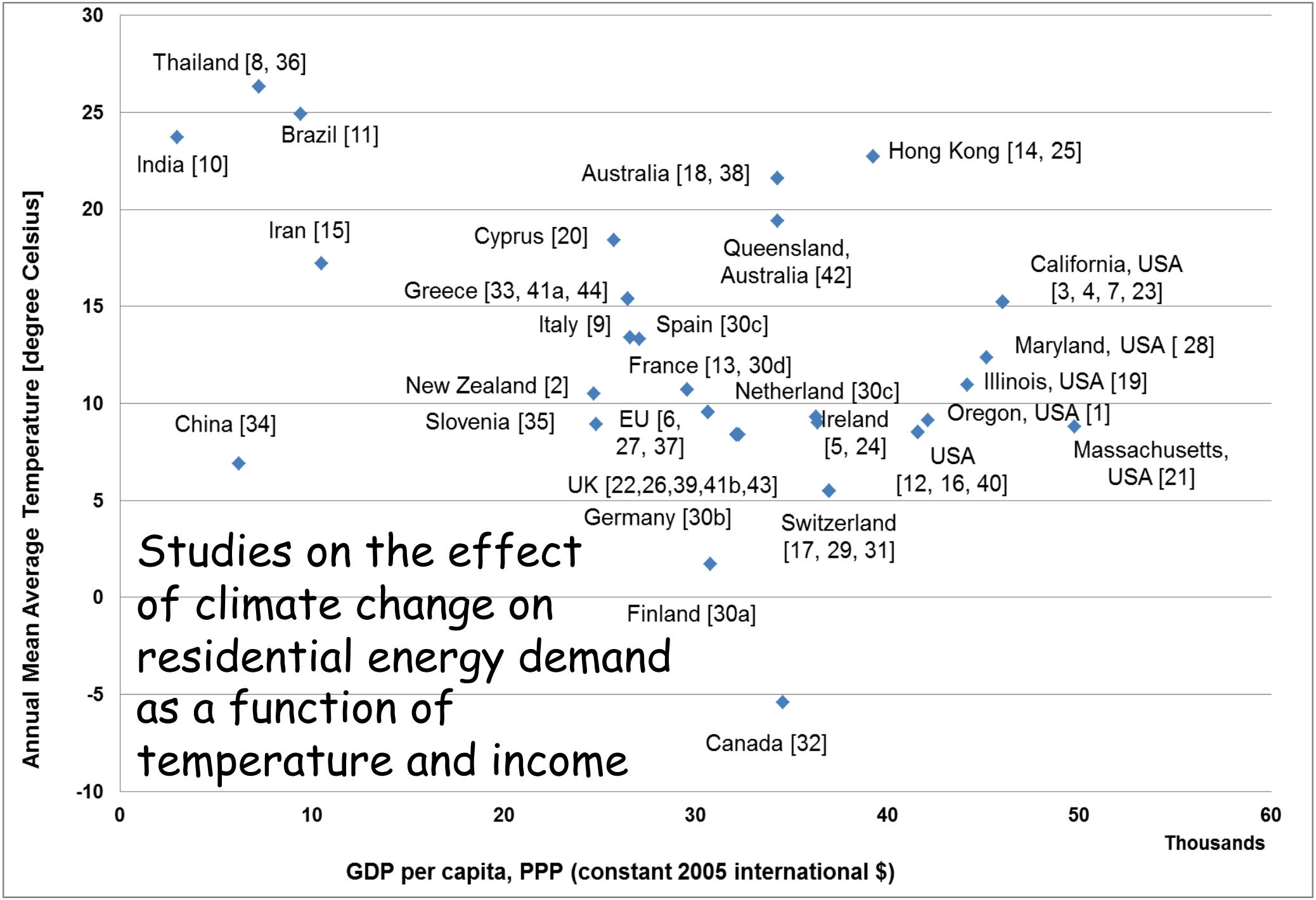
- (Agriculture in Ch 7)
- Energy
- Water
- Transport
- Other primary and secondary
- Tourism
- Insurance
- Other tertiary
- Indirect impacts

Primary sectors

- (Agriculture in Ch 7 – or so we thought)
- Fisheries – little quantitative understanding of the biological impact; few economic analyses based on random scenarios
- Foresty – a handful of older studies
- Mining and quarrying – sensitive to extreme weather, but no quantification of impacts

Energy

- There have been many recent papers on the impact of climate (change) on energy demand and supply
- Most papers are about a particular sector in a particular part of the world, all using different assumptions and methods
- Lots of trees, hard to see a forest


Studies on the effect of climate change on residential energy demand as a function of temperature and income
Annual Mean Average Temperature [degree Celsius]
GDP per capita, PPP (constant 2005 international $)
Thousands
30
25
20
15
10
5
0
-5
-10
0
10
20
30
40
50
60
Thailand [8, 36]
Brazil [11]
India [10]
Hong Kong [14, 25]
Australia [18, 38]
Iran [15]
Cyprus [20]
Queensland, Australia [42]
California, USA [3, 4, 7, 23]
Greece [33, 41a, 44]
Italy [9]
Spain [30c]
Maryland, USA [28]
France [13, 30d]
New Zealand [2]
Netherland [30c]
Illinois, USA [19]
China [34]
Slovenia [35]
EU [6, 27, 37]
Ireland [5, 24]
Oregon, USA [1]
USA [12, 16, 40]
Massachusetts, USA [21]
UK [22,26,39,41b,43]
Germany [30b]
Switzerland [17, 29, 31]
Finland [30a]
Canada [32]

Energy supply

- Impacts are many and varied
  - Thermal efficiency (fossil, nuclear)
  - Cooling water (fossil, nuclear)
  - Cloudiness, temperature (solar)
  - Windiness (wind)
  - Precipitation (hydro)
  - Temperature, wind, ice (power grid)

- Lots of detailed studies – real need for an assessment

Water

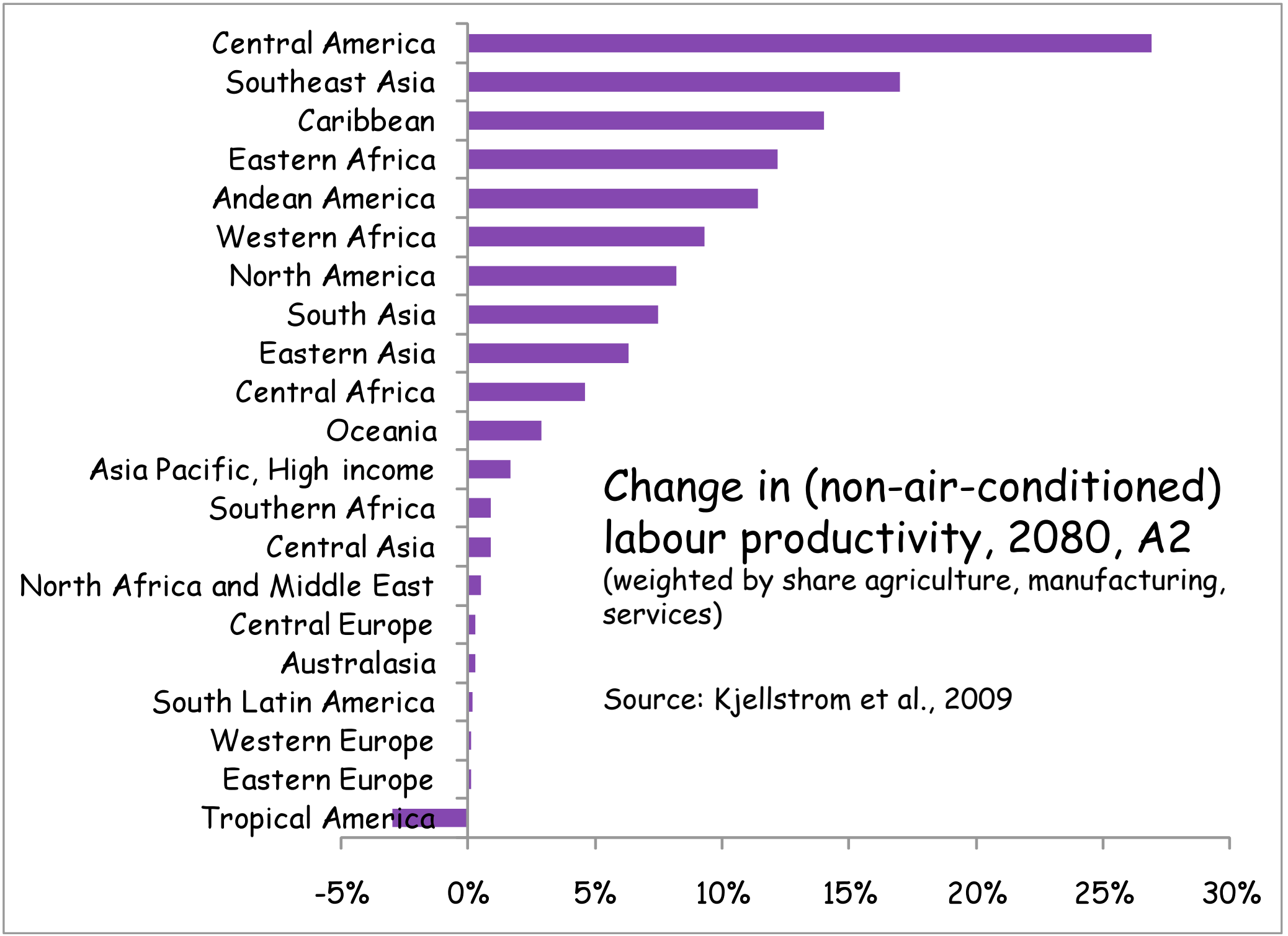
- Climate change would have substantial impacts on water resources and water use, but the economic implications are not well understood
- Flooding can have major economic costs, both in term of impacts (capital destruction, disruption) and adaptation (construction, defensive investment).
- Water scarcity can have major costs too.

Transport

- The impact of climate (change) on transport is qualitatively well-understood at the engineering level
  - High temperatures
  - Freeze-thaw cycles
  - Melting permafrost
  - Floods
  - River flow
- Few quantitative analyses, fewer economic studies

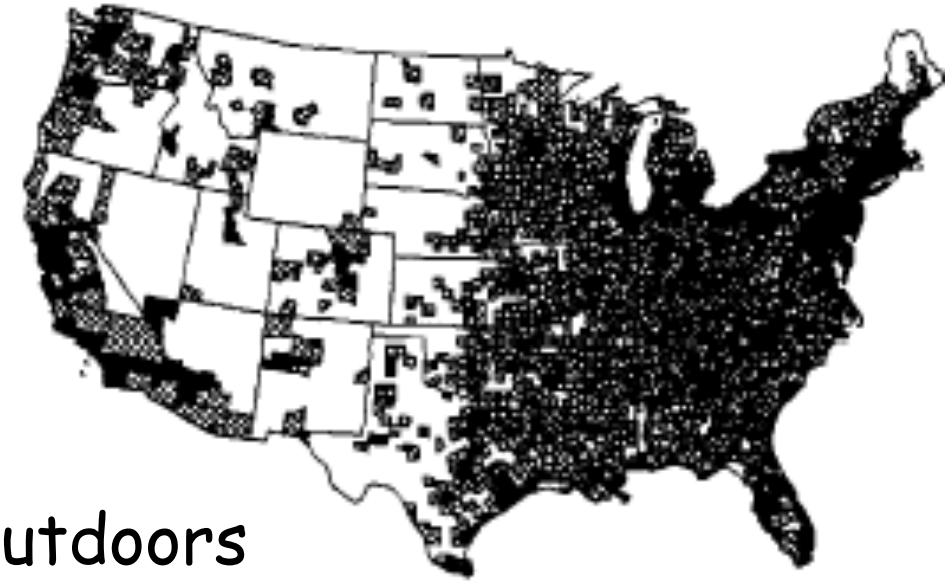
Other secondary sectors

- Manufacturing – some work on energy demand and labour productivity but no studies of the effect on other aspects of manufacturing process
- Construction – qualitative understanding of disruptions due to extreme weather, and of effect of climate on building material and design


Central America
Southeast Asia
Caribbean
Eastern Africa
Andean America
Western Africa
North America
South Asia
Eastern Asia
Central Africa
Oceania
Asia Pacific, High income
Southern Africa
Central Asia
North Africa and Middle East
Central Europe
Australasia
South Latin America
Western Europe
Eastern Europe
Tropical America
-5%
0%
5%
10%
15%
20%
25%
30%
Change in (non-air-conditioned) labour productivity, 2080, A2
(weighted by share agriculture, manufacturing, services)
Source: Kjellstrom et al., 2009

Tourism and recreation

- Tourism involves overnight stay (cue Paco)
- Many studies of the effect of weather on recreation (incl. a recent NBER paper that finds that people stay indoors when it rains)
- Effect of climate and climate change not known

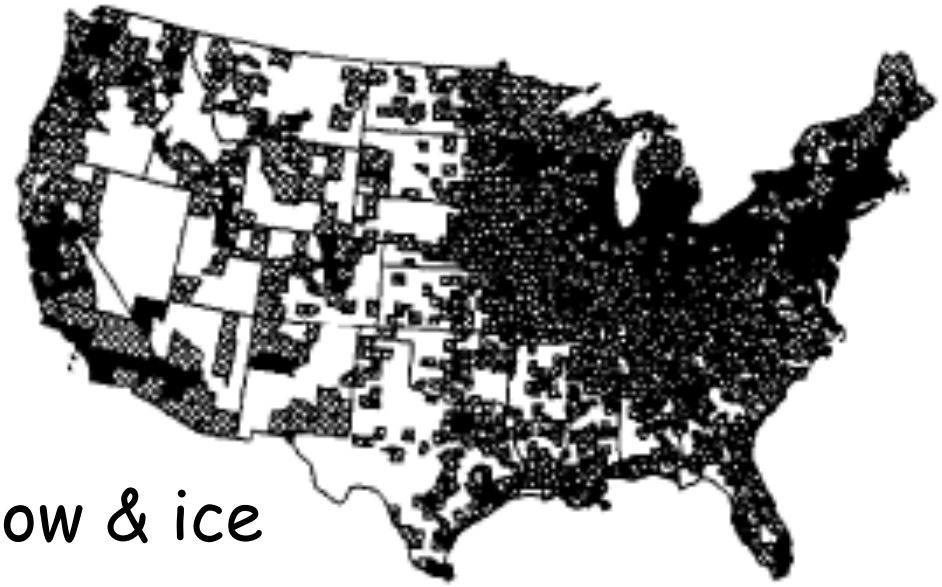


Outdoors

Participants UNDER 14.0 14.0 TO 89.1 OVER 89.1

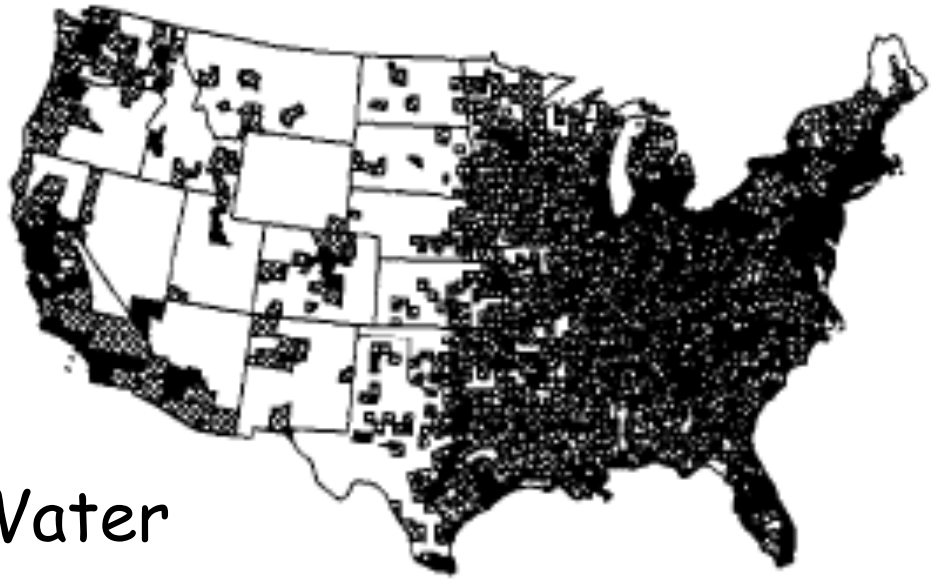
This is the only analysis of climate and recreation.

Recreationists per square mile by residence, 1995



Snow & ice

Participants UNDER 2.0 2.0 TO 22.4 OVER 22.4



Water

Participants UNDER 12.7 12.7 TO 77.7 OVER 77.7

Cordell et al., 1999

Tourism

- Biometeorological studies show effect of climate change on hypothetical tourist
- Many studies that focus in quite some detail on a particular activity in a particular place (but ignore substitution)
  - E.g., less snow means less skiing … and greater scarcity rents for the remaining resorts
- A few studies that have substitution but a rudimentary representation of the impact of climate (change)

Insurance

- Wealth of material
- Changing patterns of extreme weather and increased uncertainty affects demand and supply of insurance
- Little quantification of the impacts
- Focus is on adaptation options, particularly alternative mechanisms for risk sharing and reduction

Other tertiary sectors

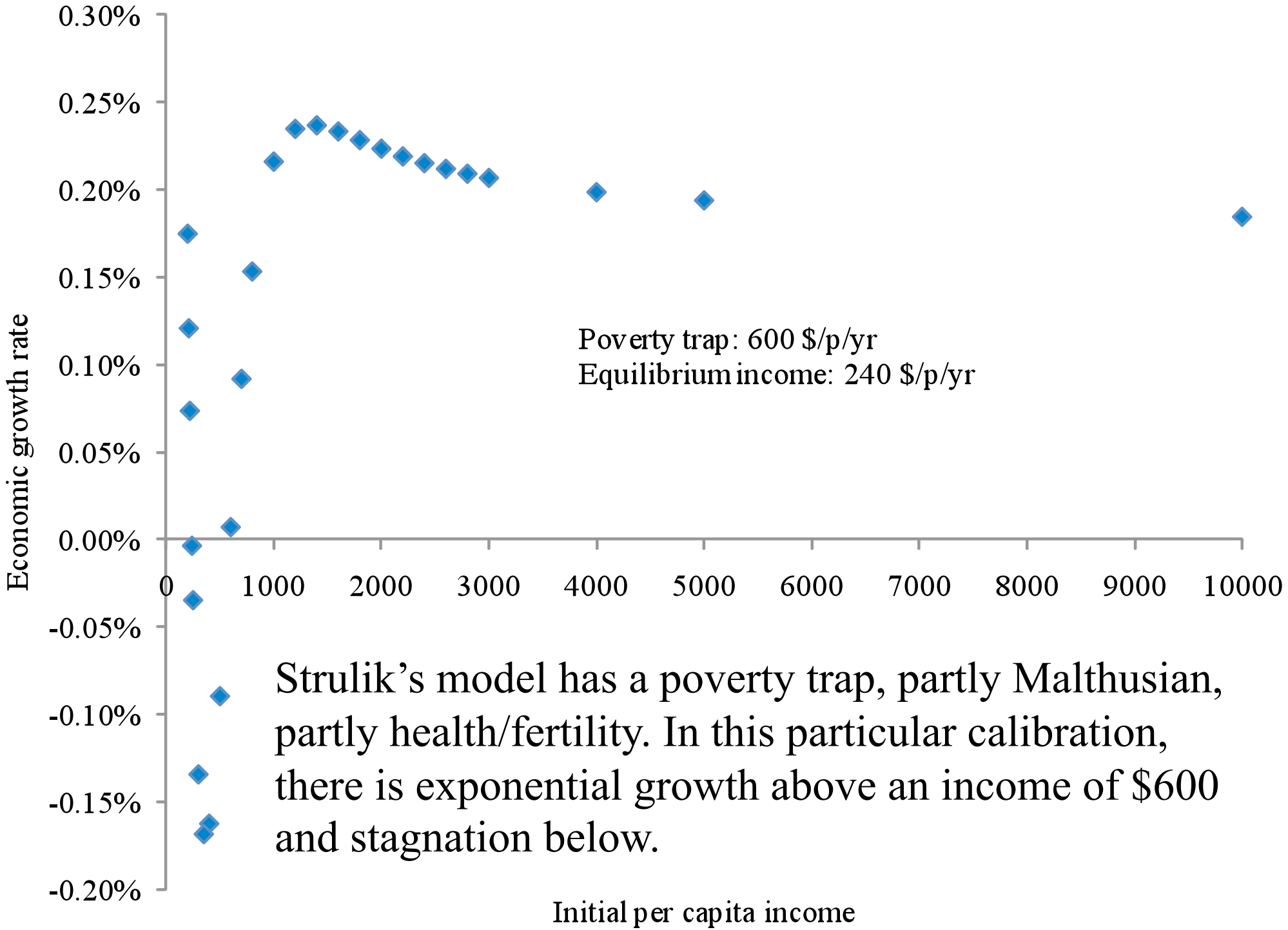
- Little to no literature
- A few studies on health – changed demand for health care due to changed disease patterns and increased demand for surveillance of new diseases

Indirect impacts

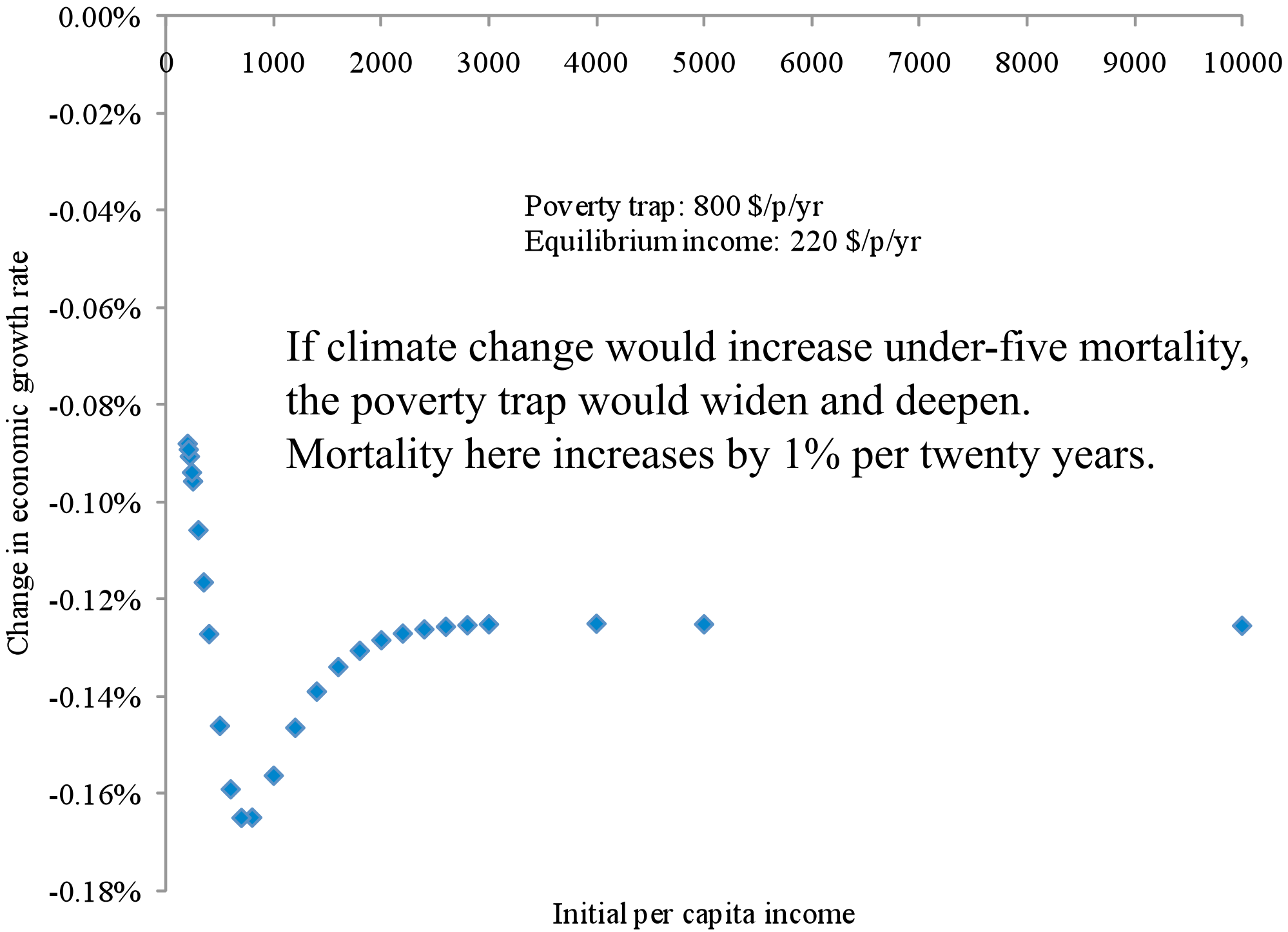
- Computable general equilibrium effects – spillovers from one market to the rest of the economy
- Mechanisms well-understood but illustrated by a one or two studies only, so little confidence in quantitative results
- Direct cost / partial equilibrium studies understate adaptation so overestimate impacts, but ignore impacts on other sectors / countries so underestimate impacts

Indirect impacts (2)

- Negative market impacts would slow down economic growth – dynamic impacts are a factor 2-10 of static impacts
- There may or may not be climate-related poverty traps, and climate change may or may not widen these traps
  - E.g., malaria -> infant mortality -> high fertility + low education -> poverty
  - If climate change would widen the poverty trap, this impact would dominate all other impacts



Strulik's model has a poverty trap, partly Malthusian, partly health/fertility. In this particular calibration, there is exponential growth above an income of $600 and stagnation below.


0.00%
-0.02%
-0.04%
-0.06%
-0.08%
-0.10%
-0.12%
-0.14%
-0.16%
-0.18%
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Change in economic growth rate
Initial per capita income
Poverty trap: 800 $/p/yr
Equilibrium income: 220 $/p/yr
If climate change would increase under-five mortality, the poverty trap would widen and deepen.
Mortality here increases by 1% per twenty years.

Summary and discussion

- Major issues of coordination
- Some sectors have a lot of detailed studies which are challenging to assess
- Some sectors have a few studies, so the message is clear but not robust
- Many sectors have no studies at all, perhaps because they're not vulnerable
- Contradictory literature on growth
- As it stands, the chapter is qualitative and will have a hard time competing with gray, quantitative material