Population and Climate Change: Relationships, Research, and Responses

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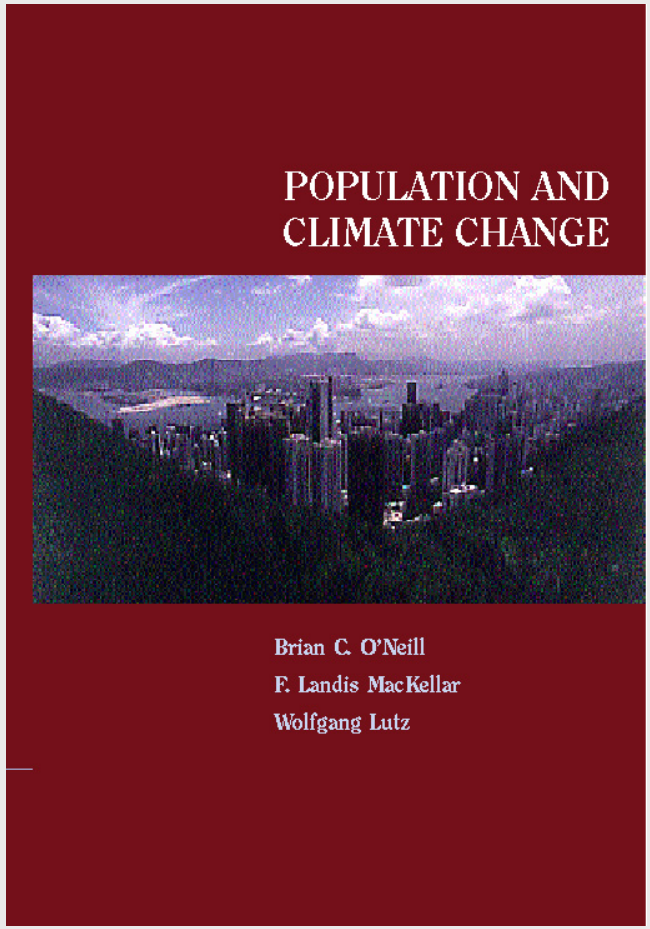
Population and the Climate Problem

- Slowing population growth would reduce greenhouse gas emissions significantly in the long term
- Lower fertility and slower population growth would ease adaptation to climate impacts
- Population-related policies can be considered “win-win” with respect to climate change



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Population and Emissions: Historical

- New statistical analyses support roughly proportional effect of population size on national emissions
- Also supports positive effect of urbanization level, and possibly of age structure

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Recent Econometric Results, Demography and National CO_2 Emissions

Study	Elasticity of CO2 Emissions			
	Pop. Size	% Urban	Household Size	% Working Age
Martinez-Zarzoso et al., 2007	+0.55 (EU)			
Fan et al., 2006	+	+		+
Cole & Neumayer, 2004	+0.98	+0.70	-0.50	Not Sig.
Rosa et al., 2004	+1.02			
York et al., 2003	+0.98	+0.62		Not Sig.
Shi, 2003	+1.43			+0.63
Dietz & Rosa, 1997	+1.15			

Studies based on 86-208 countries, mixture of cross-sectional and panel analyses, 1975-2000.

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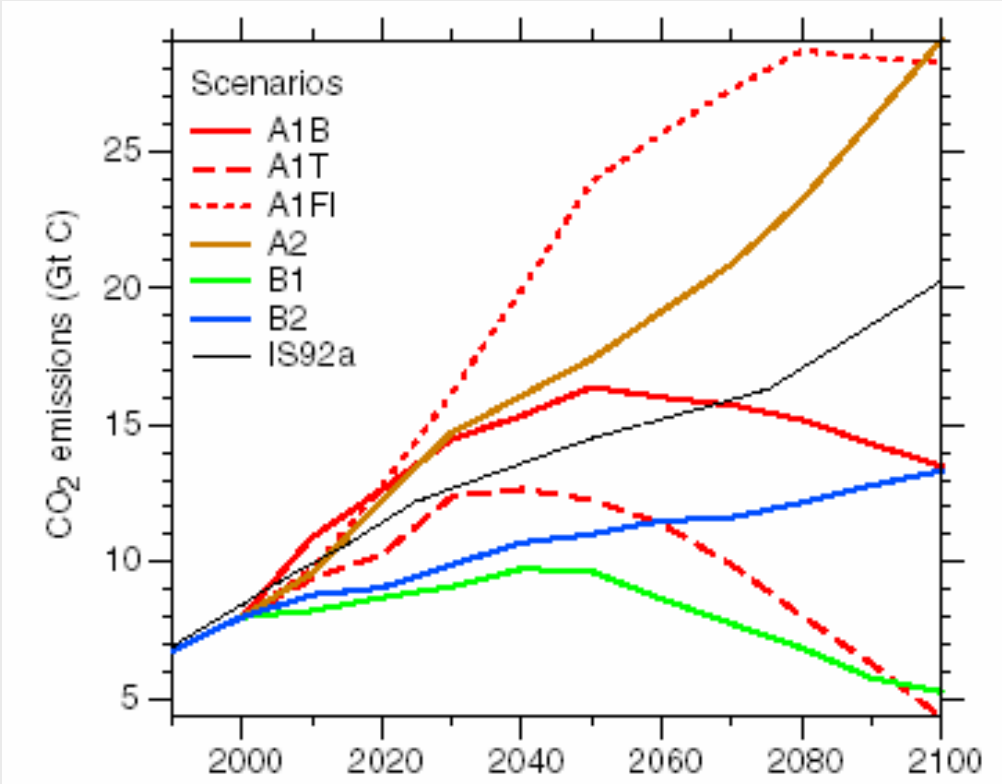
Population and Emissions: Future
The IPCC SRES Scenarios

Carbon emissions, 2000-2100,
6 (of 40) scenarios



4 Qualitative Storylines
(A1, A2, B1, B2;
no climate policy)

↓

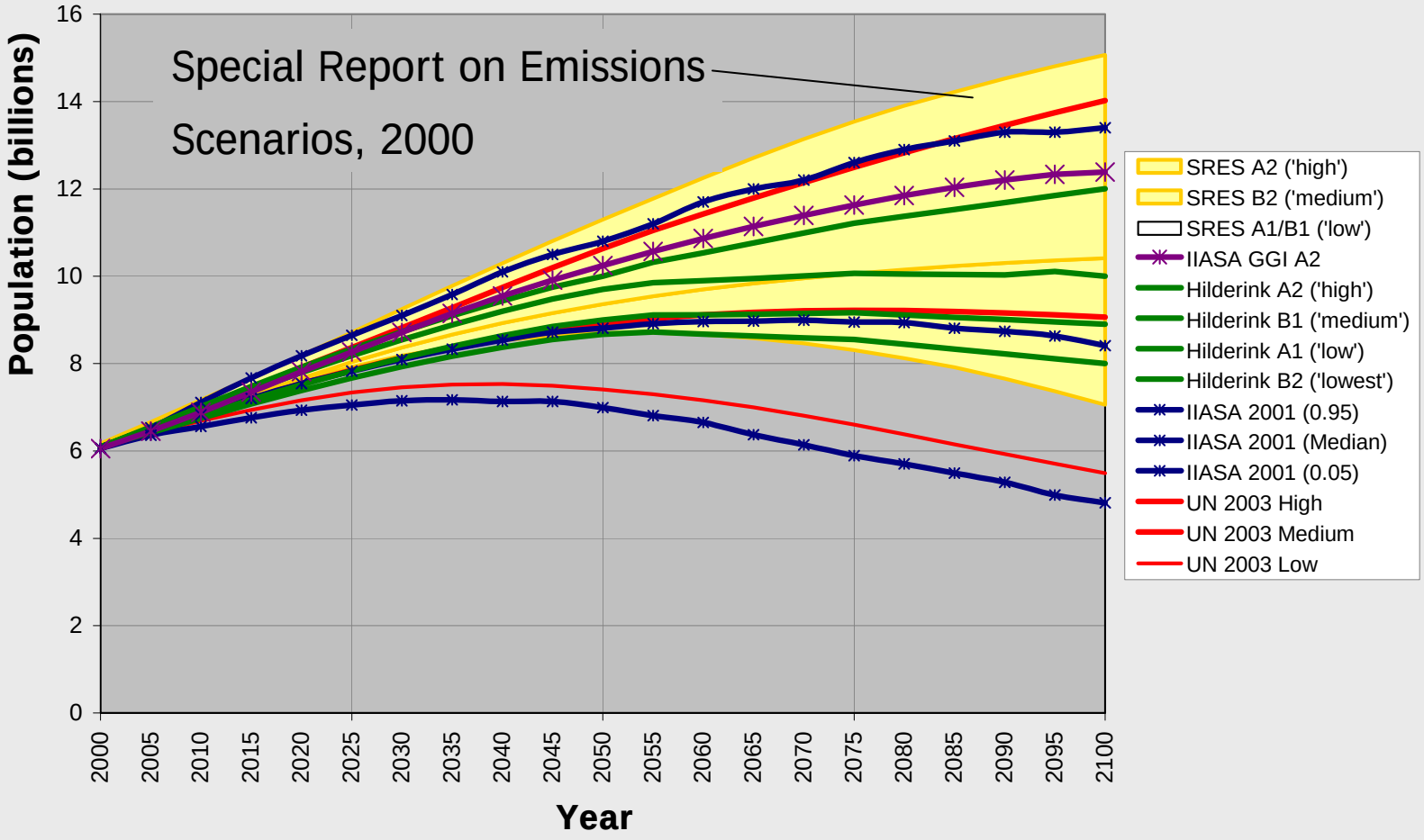
4 Combinations of
Driving Forces

↓

40 Quantitative
Scenarios

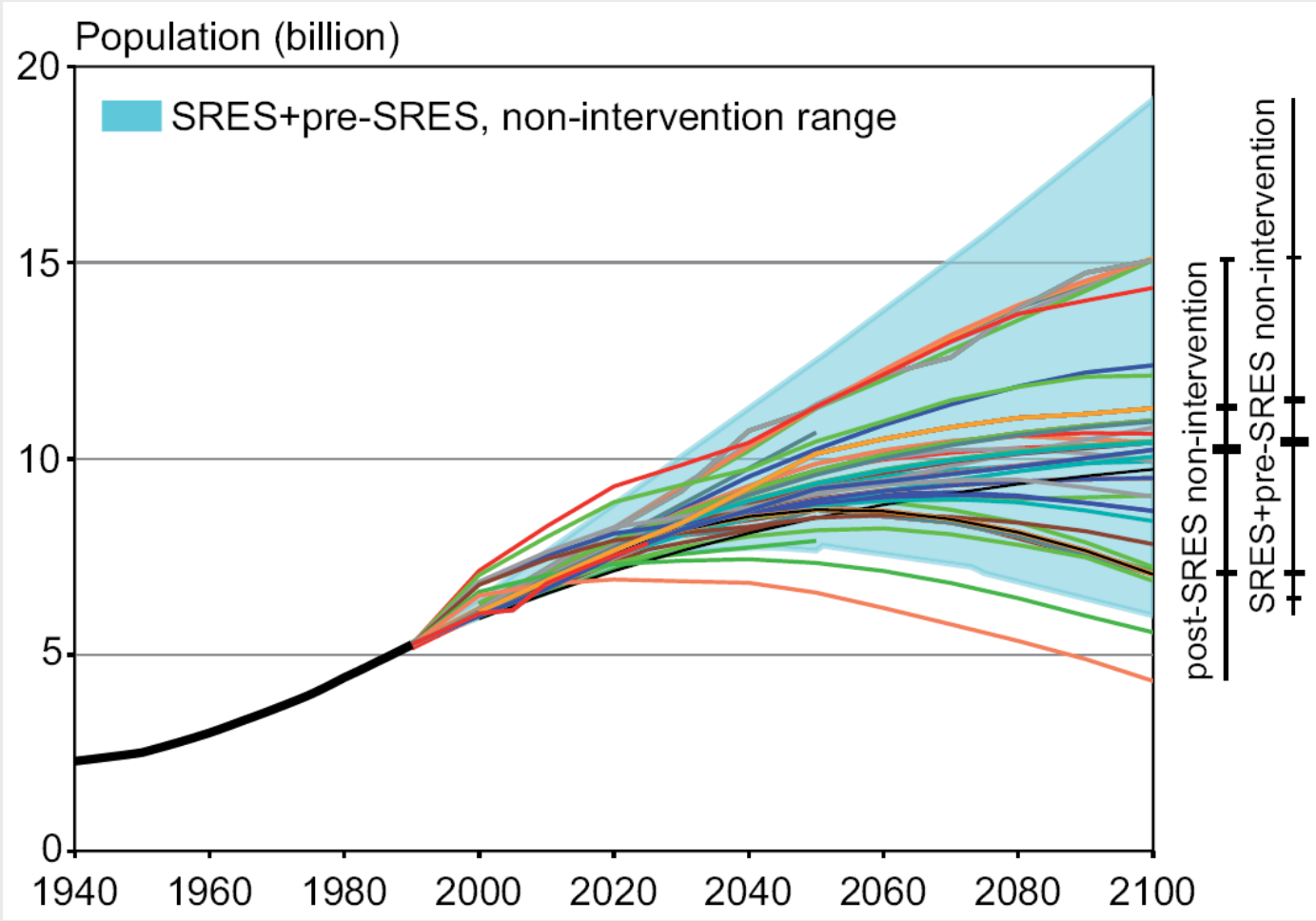
Source: IPCC SRES, 2000.

IPCC Population Assumptions vs. More Recent Projections



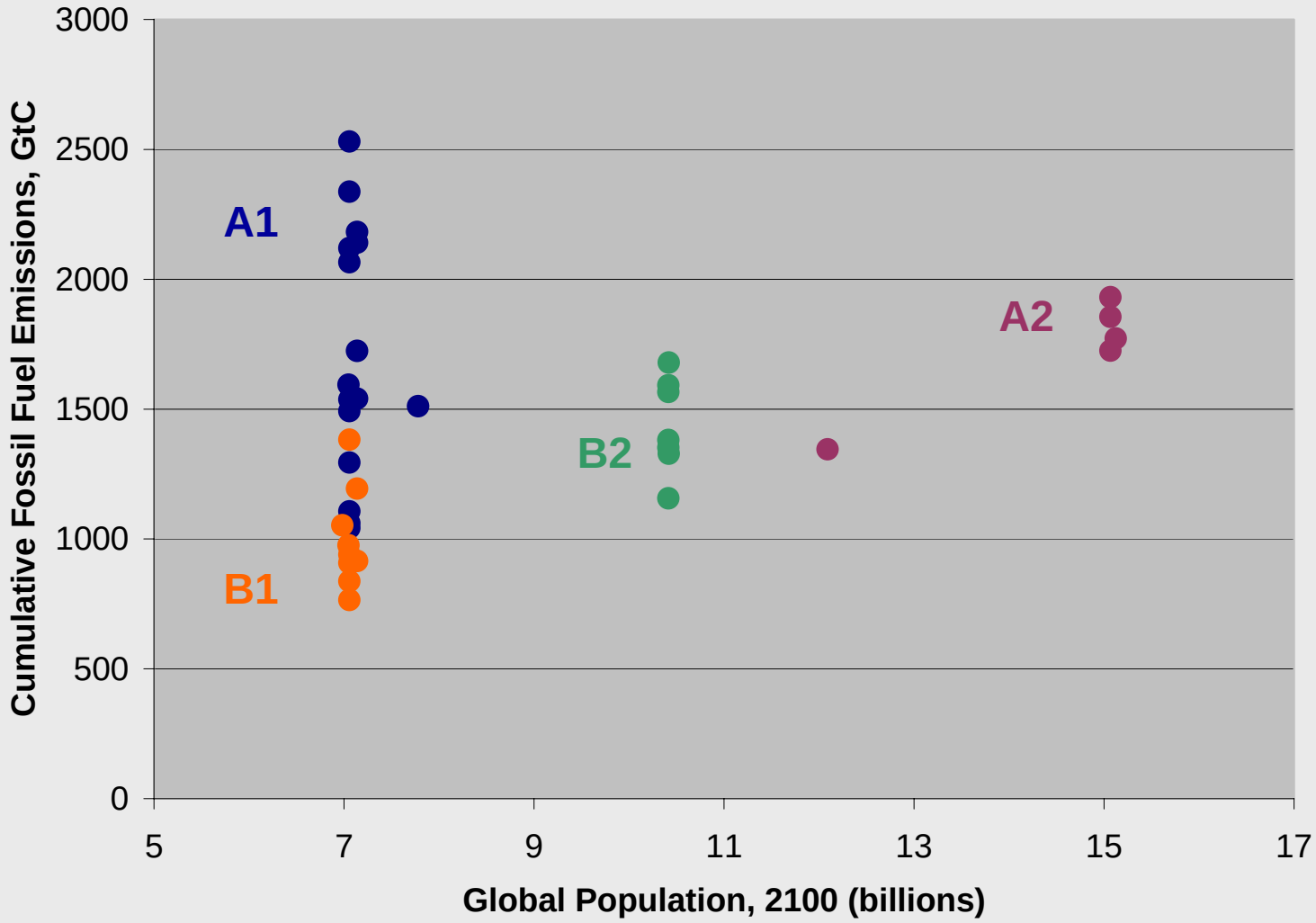
Source: O'Neill, 2004.

Population Assumptions in Recent Scenarios



Source: IPCC AR4, Mitigation Report, 2007.

Population-Emissions Relationship in SRES



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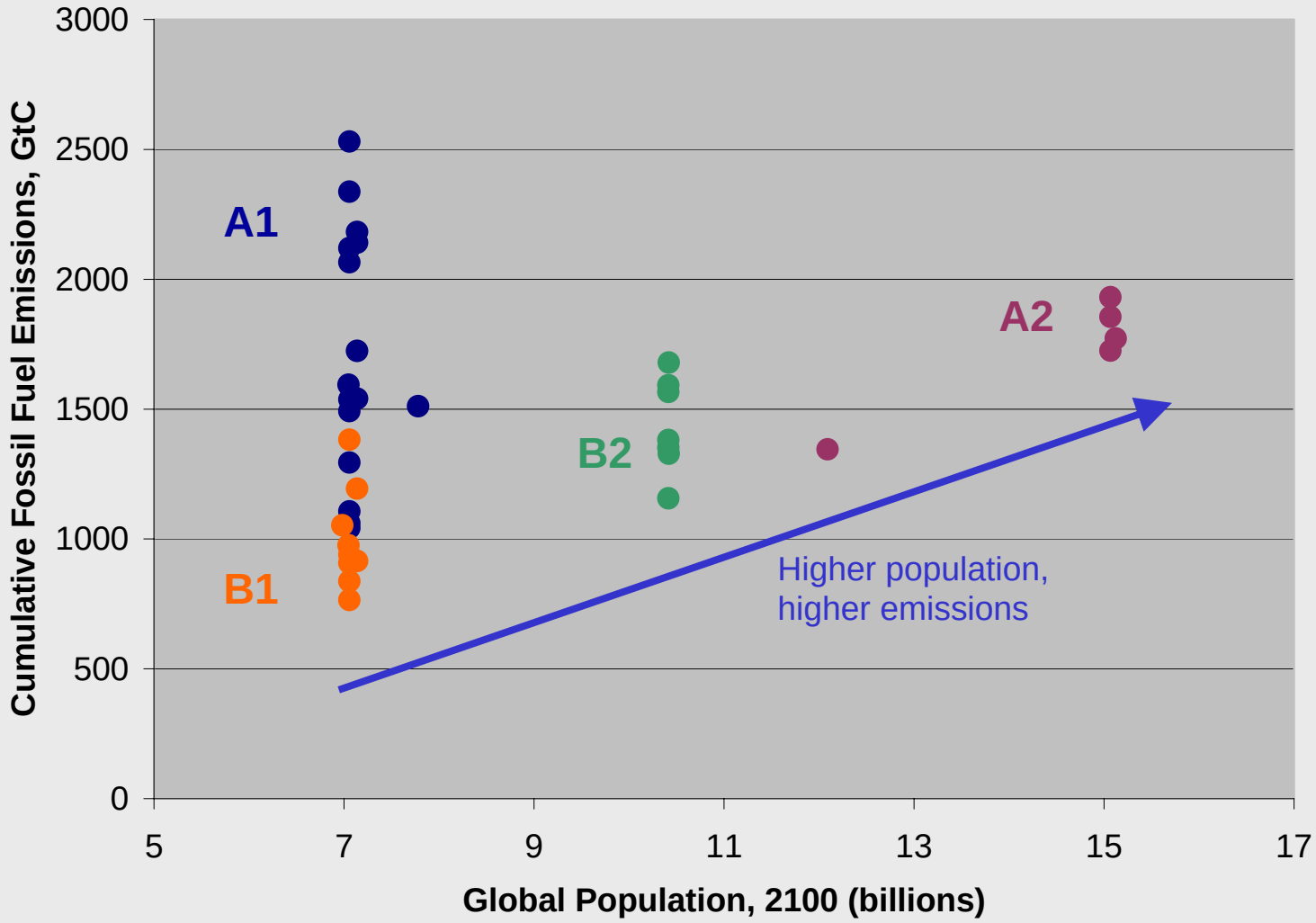
Population-Emissions Relationship in SRES



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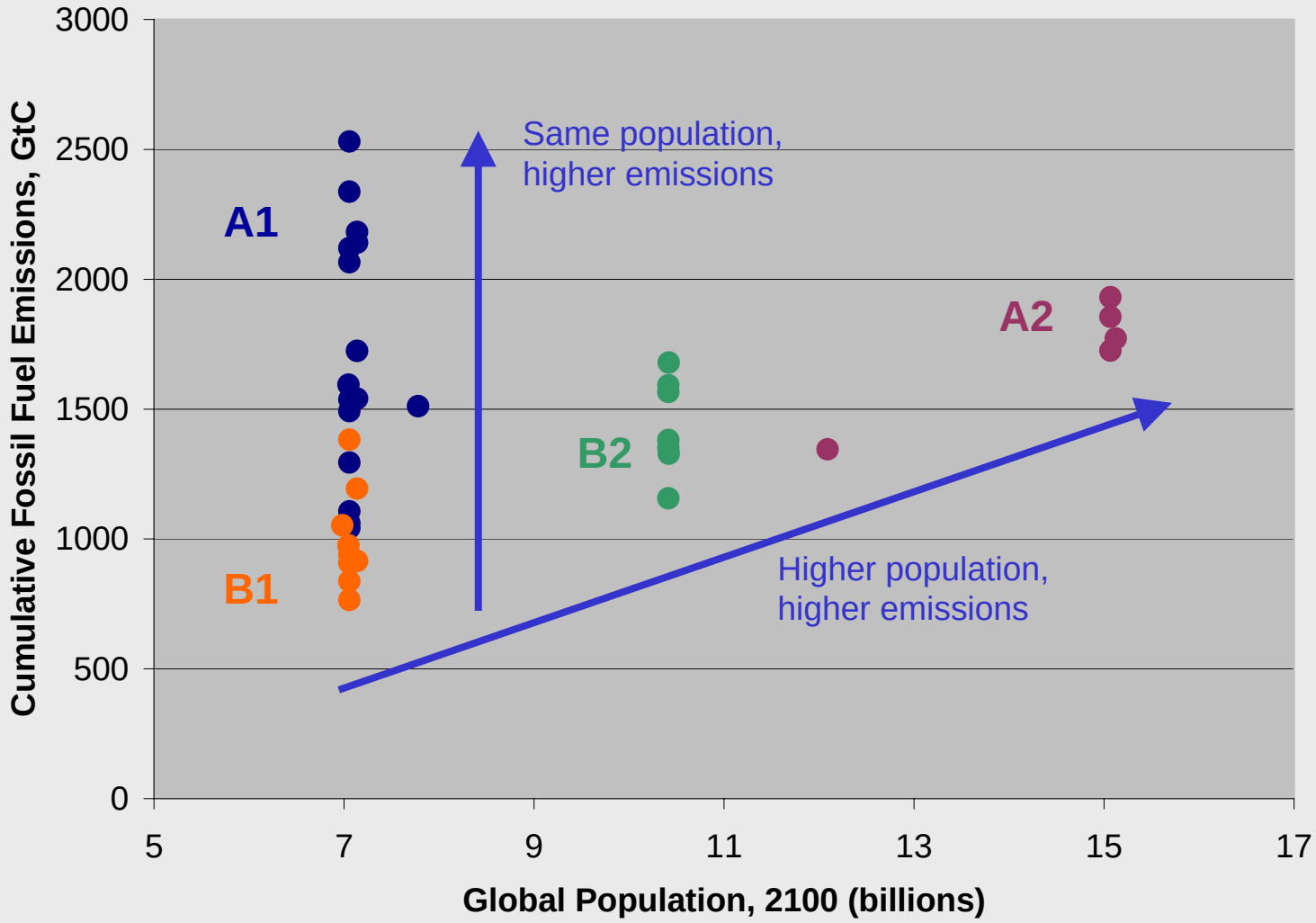
Population-Emissions Relationship in SRES



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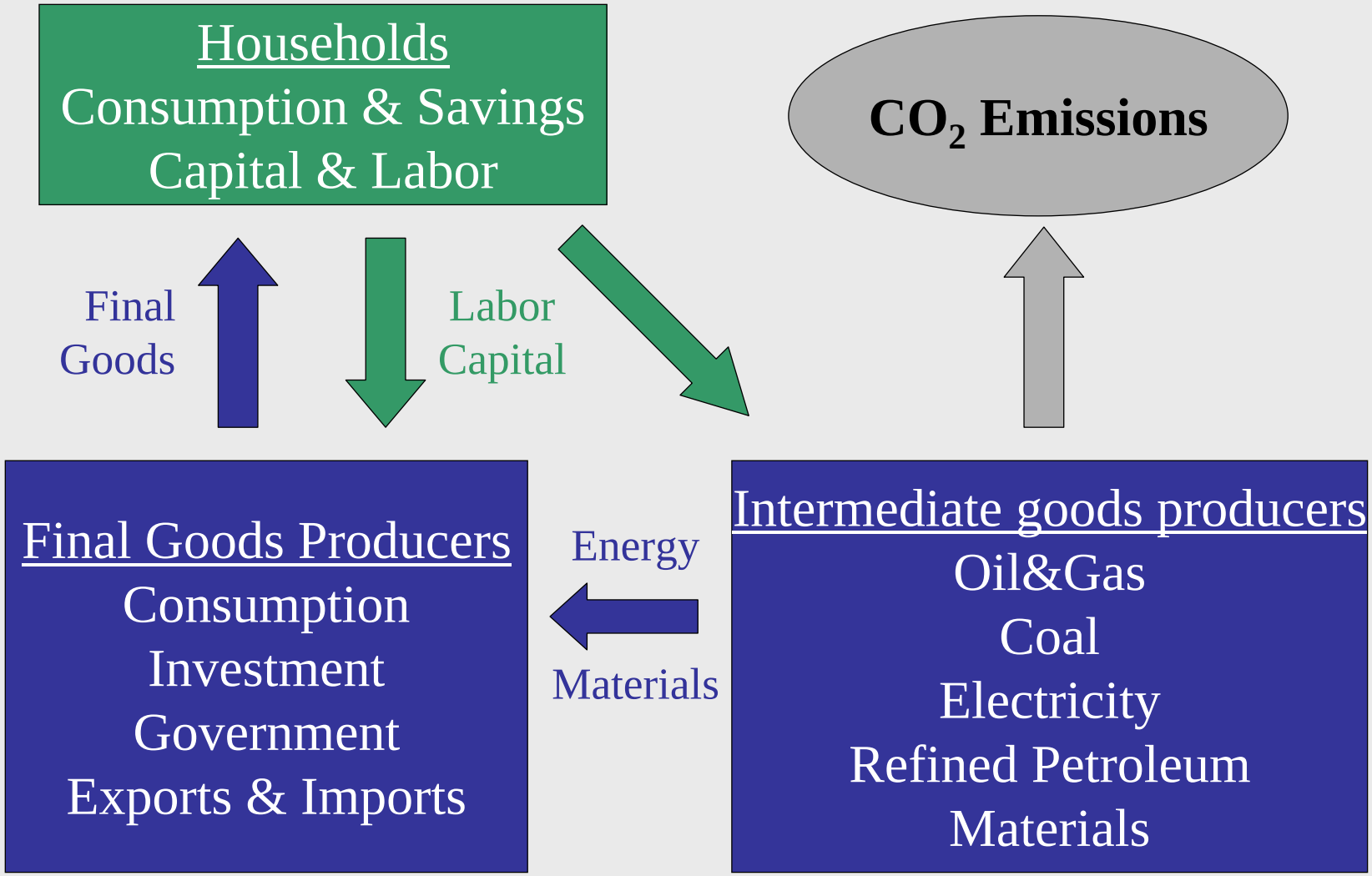
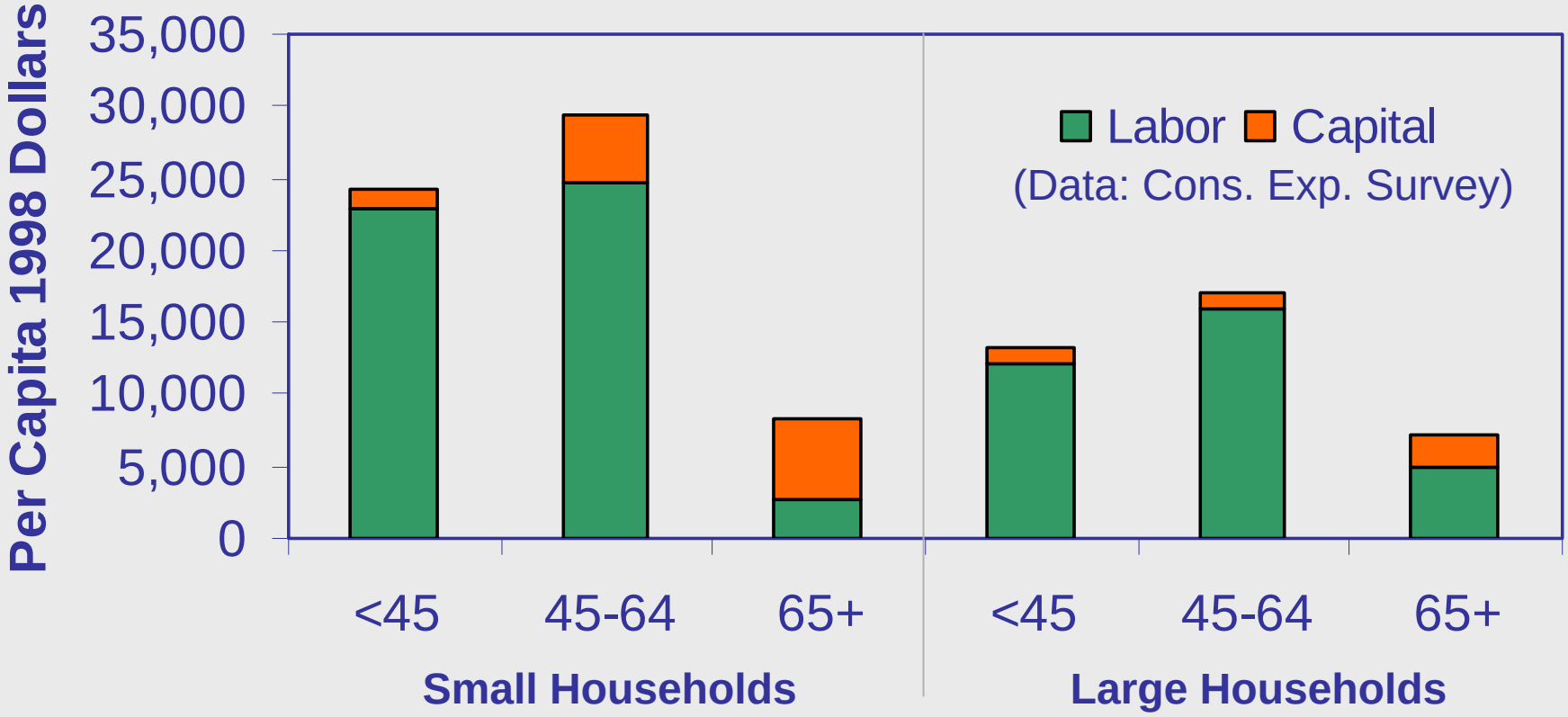
Population and Emissions: The PET Model



Source: Dalton et al., 2008; Dalton & Goulder, 1998.

U.S. Per Capita Household Income



- **Level and composition of per capita income varies by age and size of the household**

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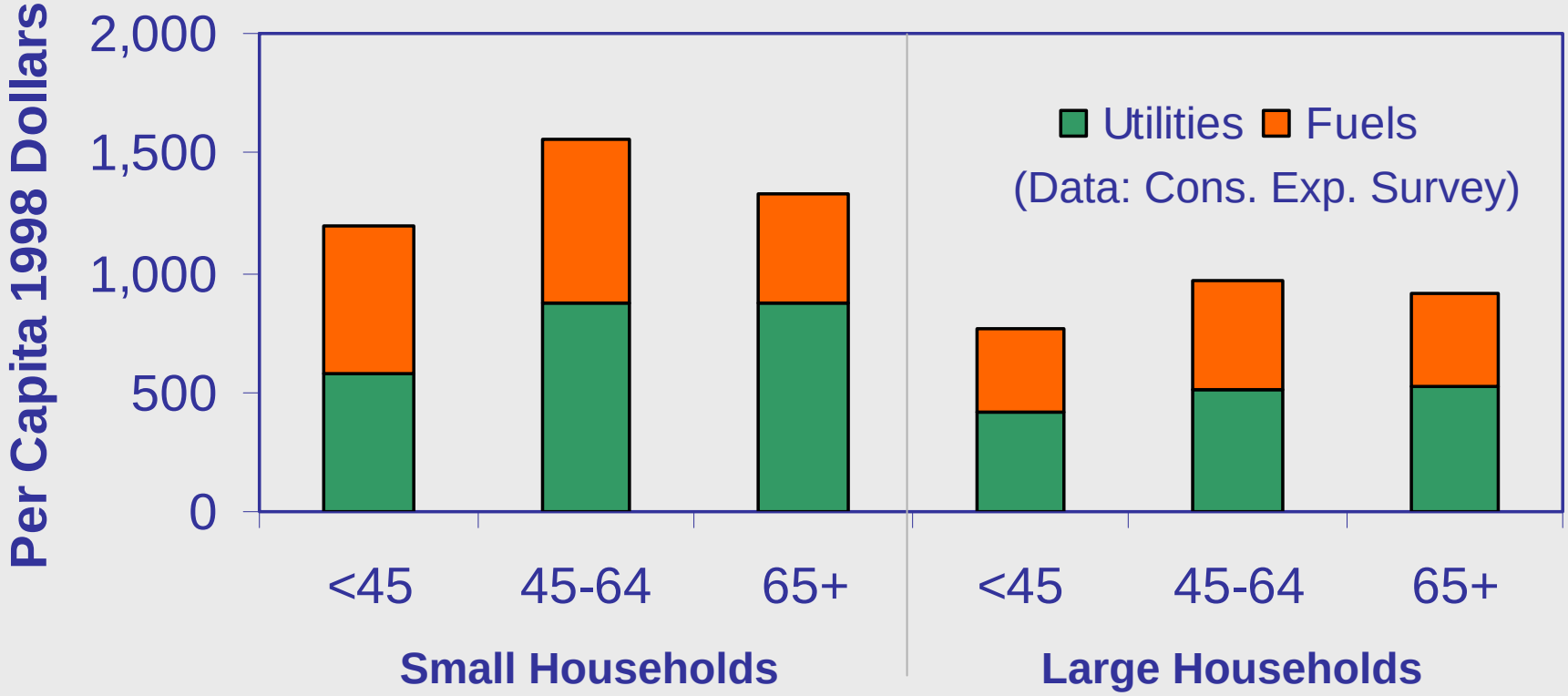
CO_2-Intensive U.S. Household Expenditures



- **Expenditure levels and patterns vary by household age and size, affecting direct and indirect energy use**

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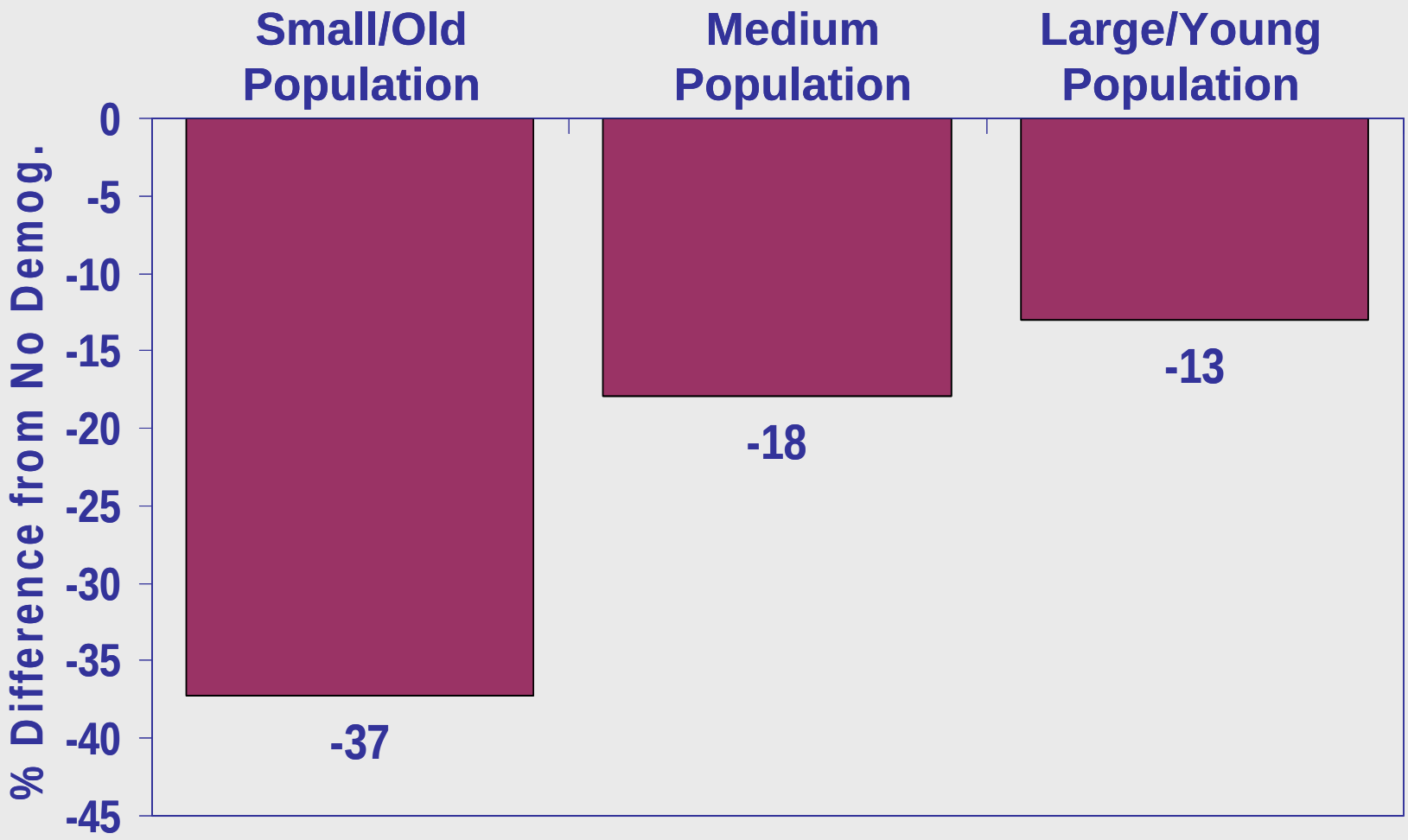
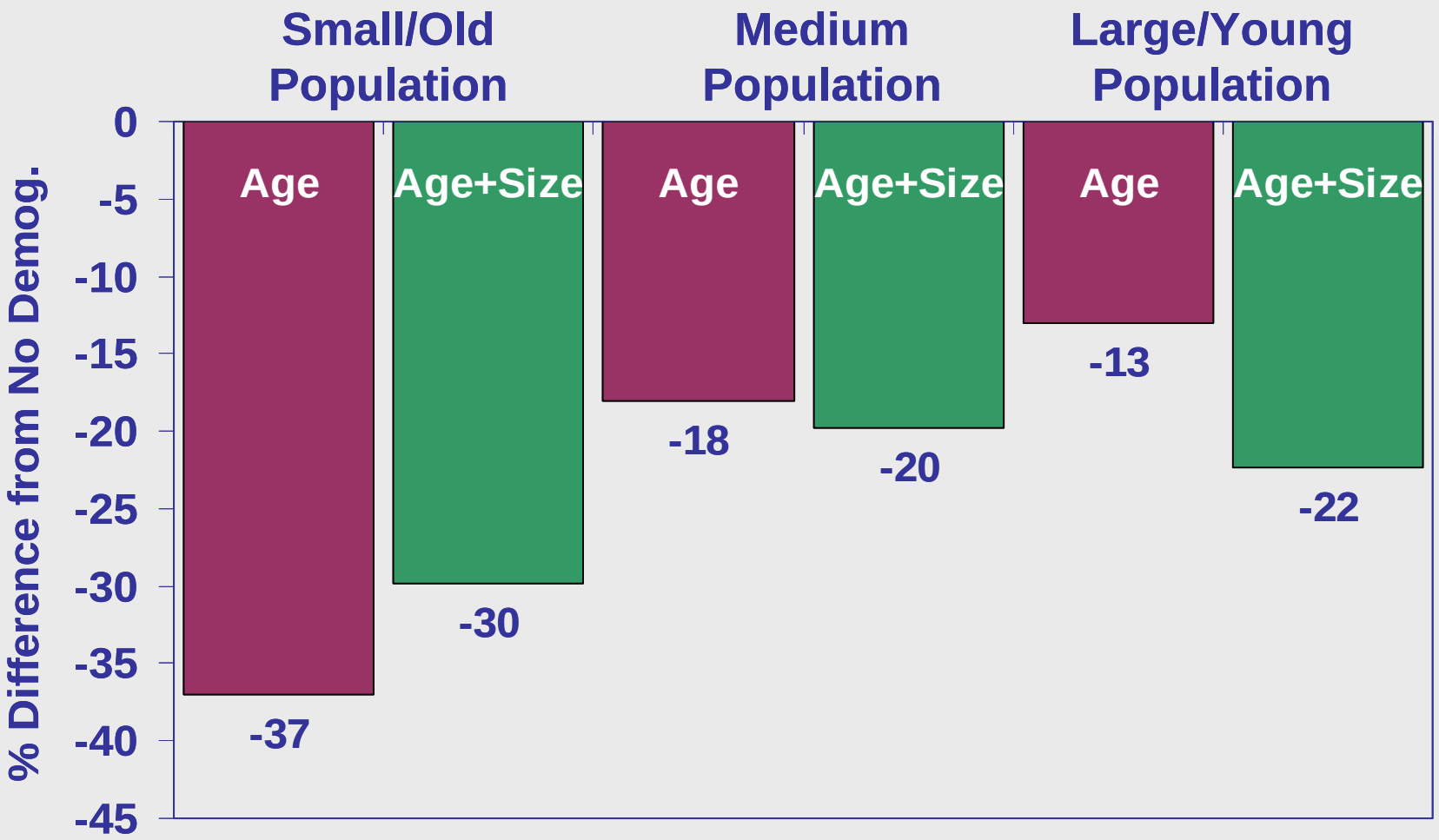
Effects of Aging on U.S. CO2 Emissions in 2100



All emissions differences relative to case with no age or size changes.
No technological progress in this scenario.

Source: Dalton et al., 2008.

Effects of Aging and HH Size Changes on U.S. CO_2 Emissions in 2100



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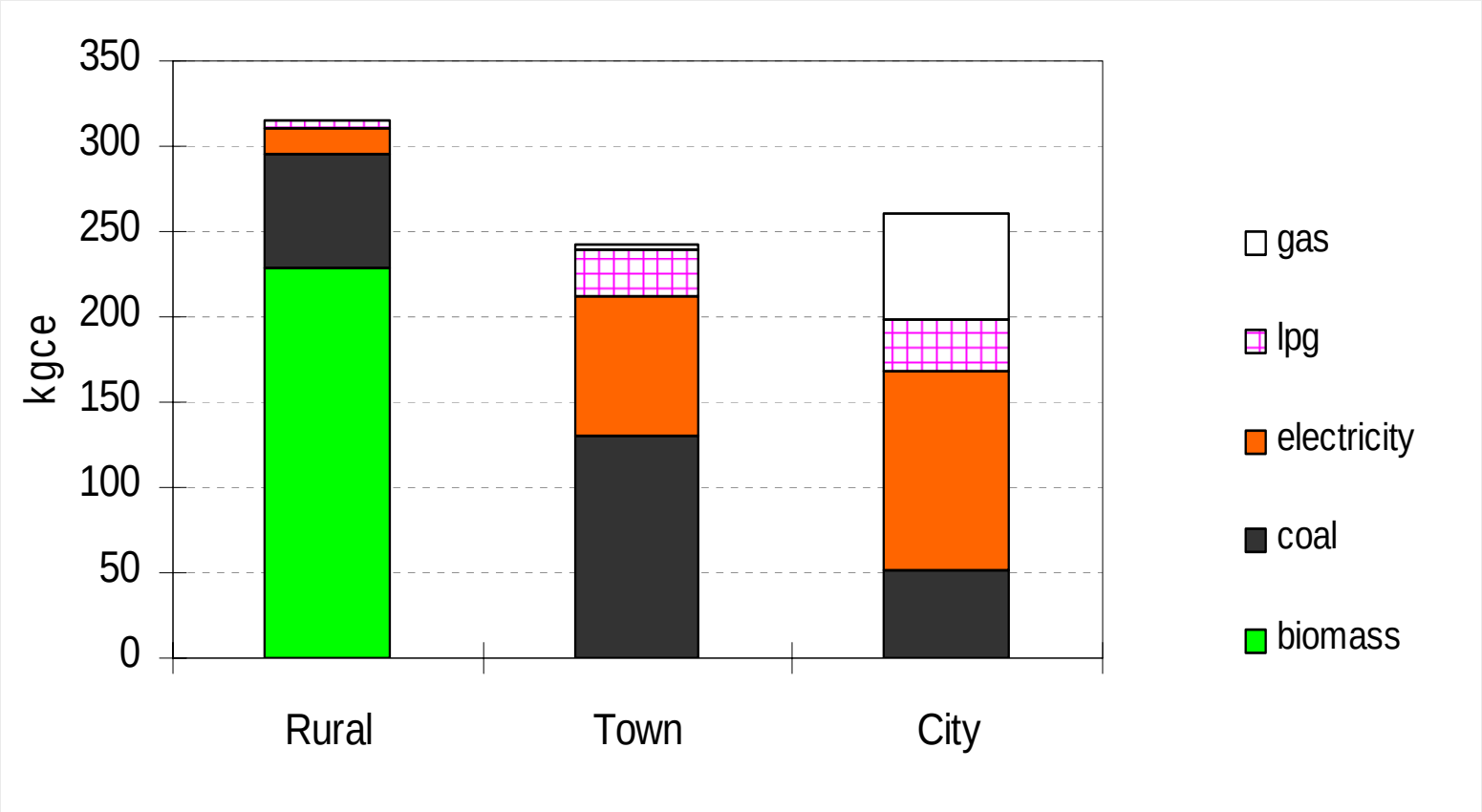
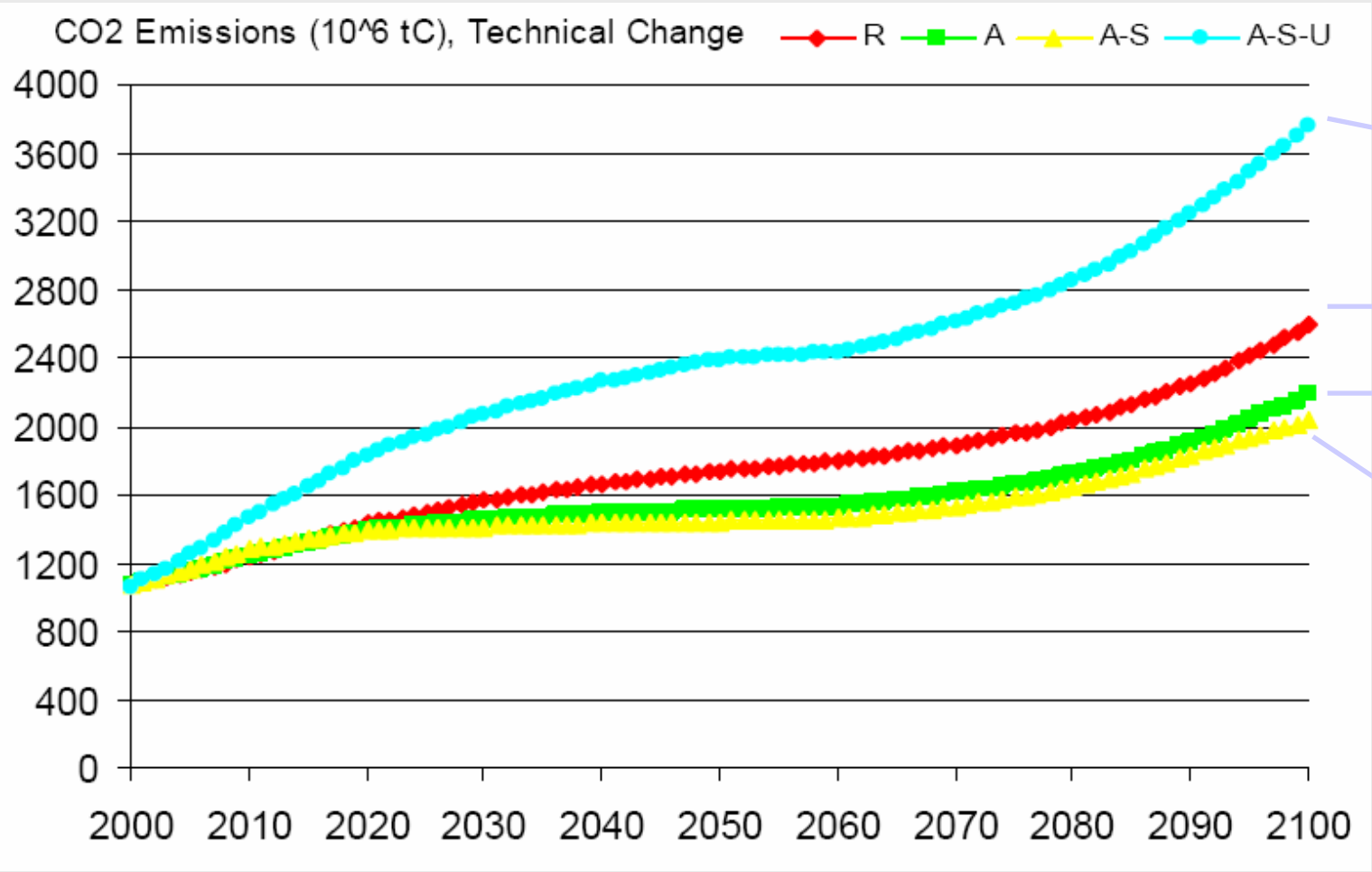
Per Capita HH Energy Use, China 1999



Effects of Aging and Urbanization on Chinese CO2 Emissions, B2 Scenario



Urb. + Aging + Size

No demography

Aging + size

Aging

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Population and Emissions: Conclusions

- Recent analyses of historical data support a roughly proportional direct effect of population size on emissions
- Scenarios of future emissions have not explicitly investigated implications of slower population growth
- Preliminary work indicates that effects of aging and urbanization may significantly affect outlook for future emissions

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Future Work

- Modeling analysis of implications of lower population growth for global emissions
  - Include effects of aging, urbanization where relevant
- How many “wedges” of emissions reductions could population-related policies provide?
- How much less costly would long term climate change goals be assuming lower population scenario?

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