



Mobility and Climate Change

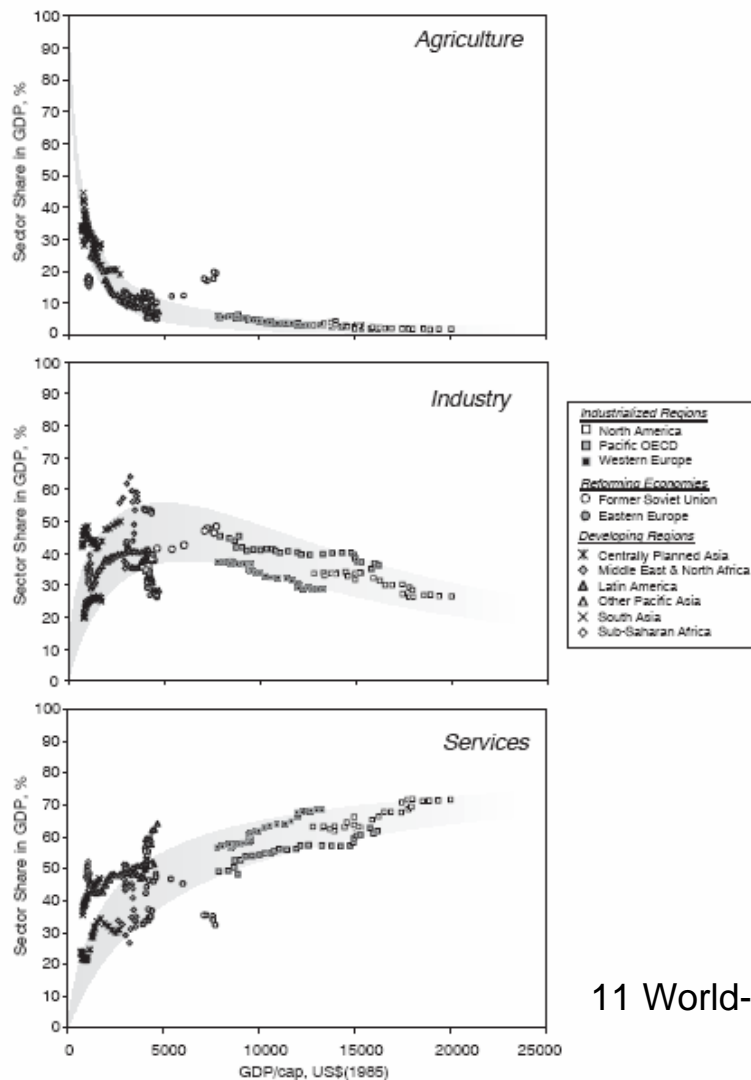
Andreas Schäfer

University of Cambridge

Geneva, 5-7 March 2008



Structural Change in the Economy ...

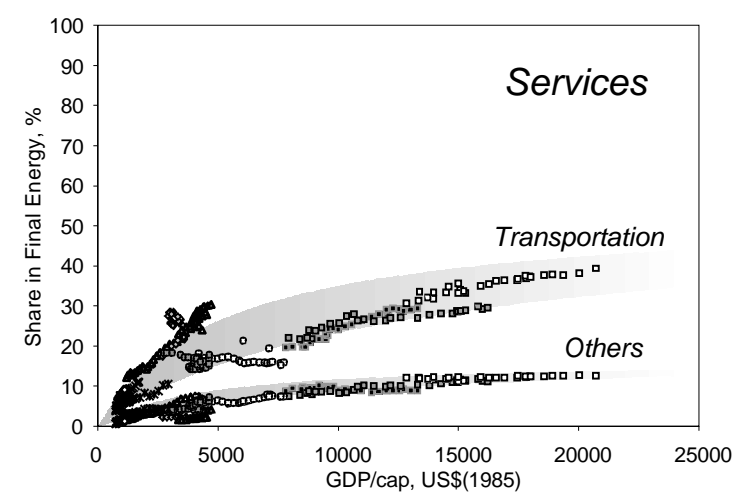
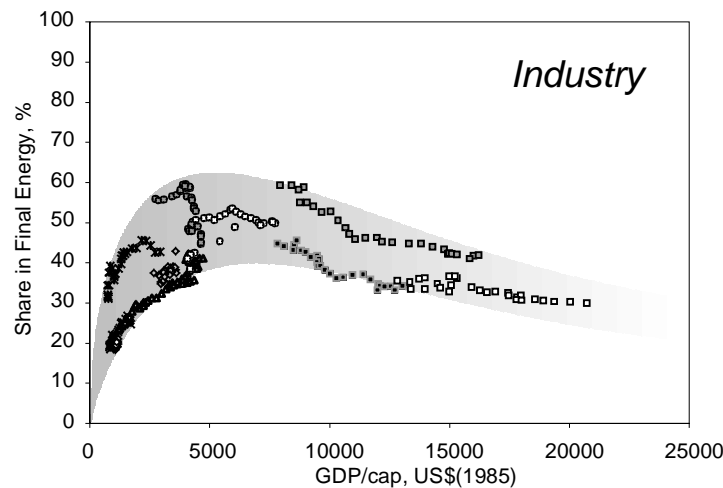
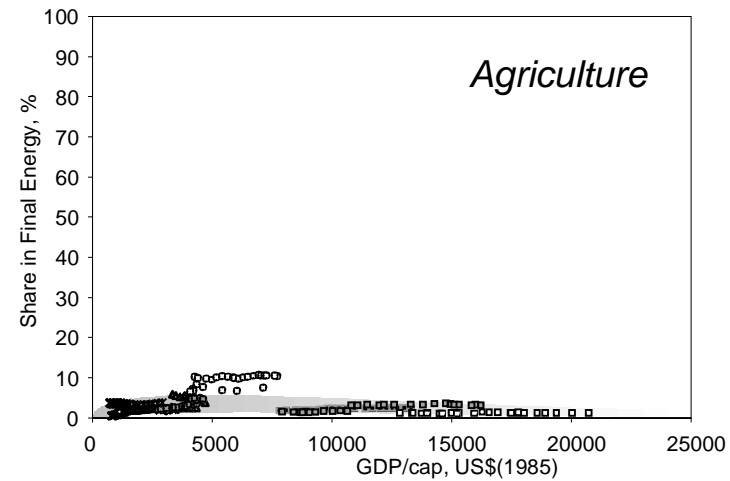
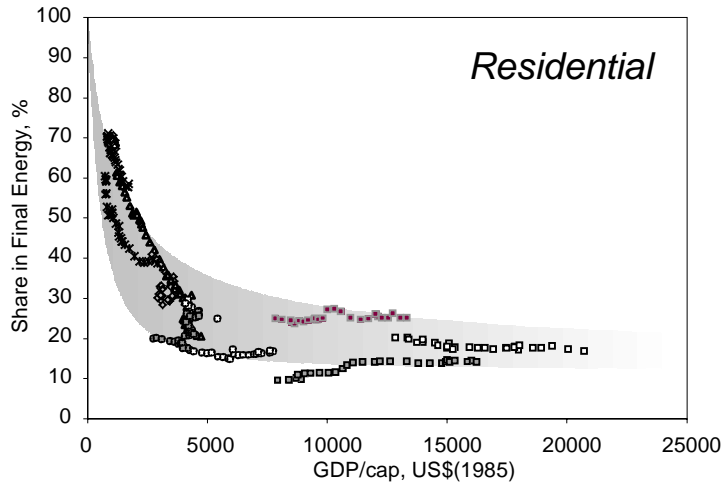


Sector shifts due to:

1. Different income elasticities for goods and services produced by each of the three sectors
2. Competitive advantage for each of the sector's industries
3. Changing needs of society

11 World-Regional Data series: 1971 - 1998

... and in the Energy System



Source: Schäfer A., 2005, Structural Change in Energy Use, *Energy Policy*, 33(4): 429-437.

- o Identity of Greenhouse Gas Emissions (GGE):

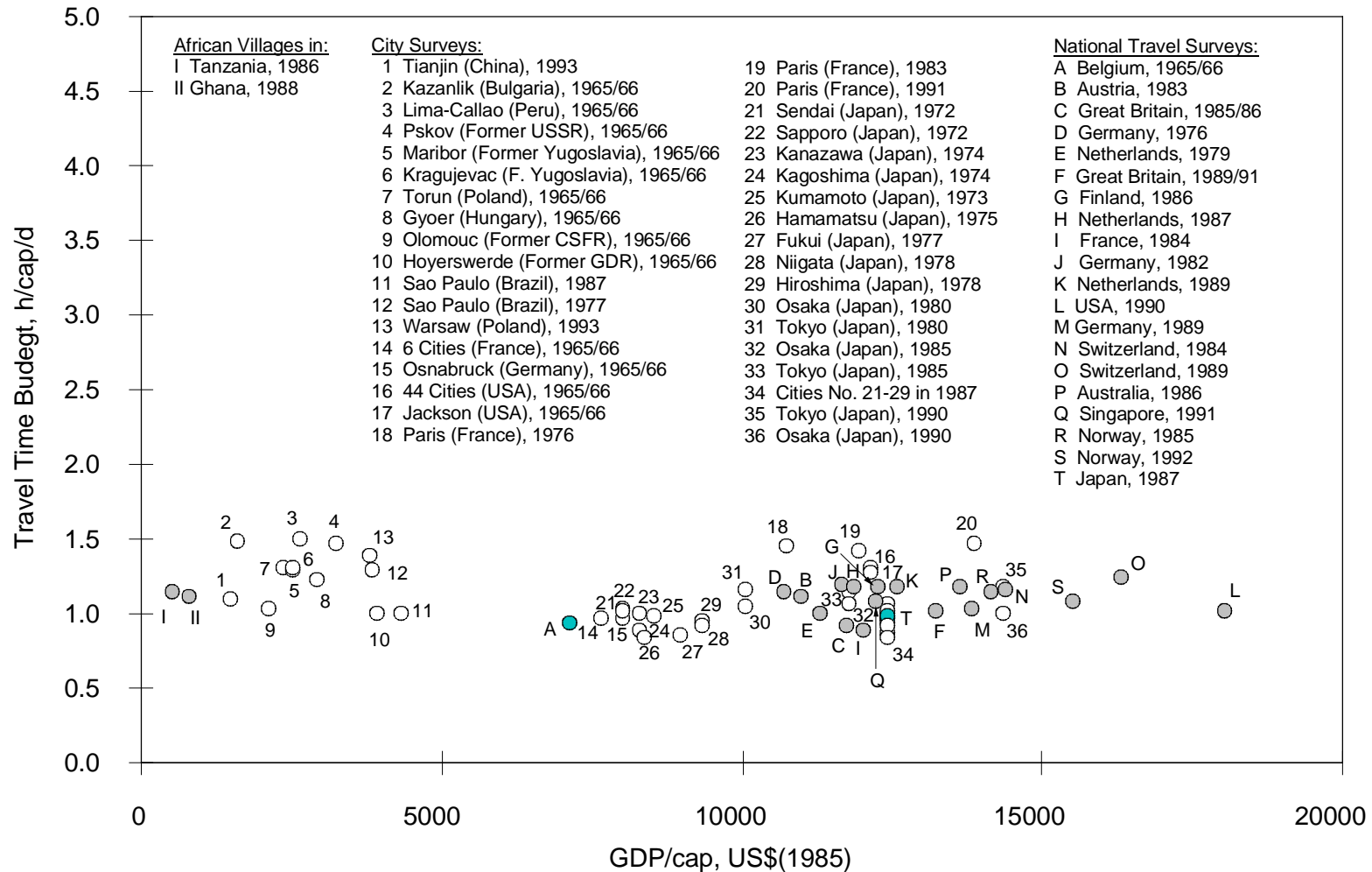
$$GGE = GGE/E * E/PKT * PKT$$

PKT: Passenger-km Traveled

E/PKT: Energy Intensity

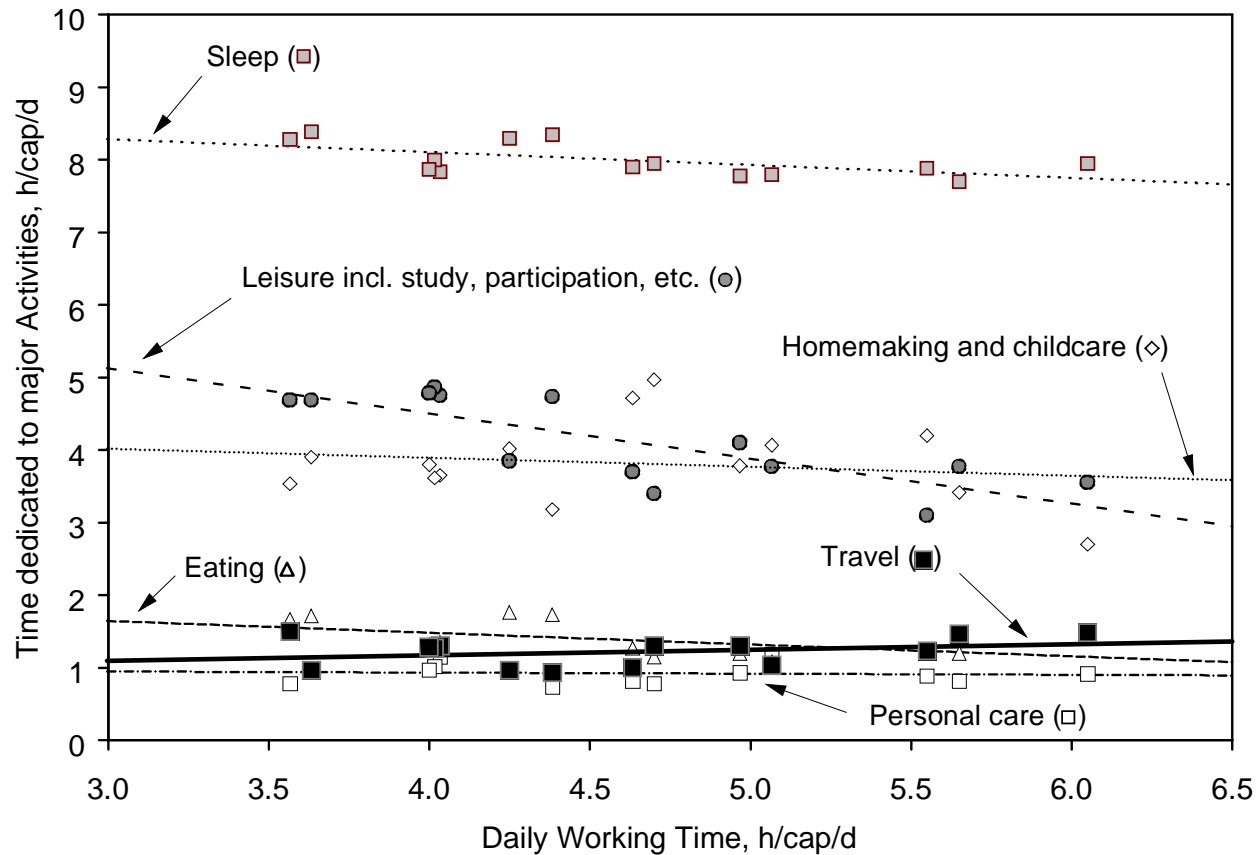
GGE/E: GHG Intensity of Fuel

Travel Time Budget



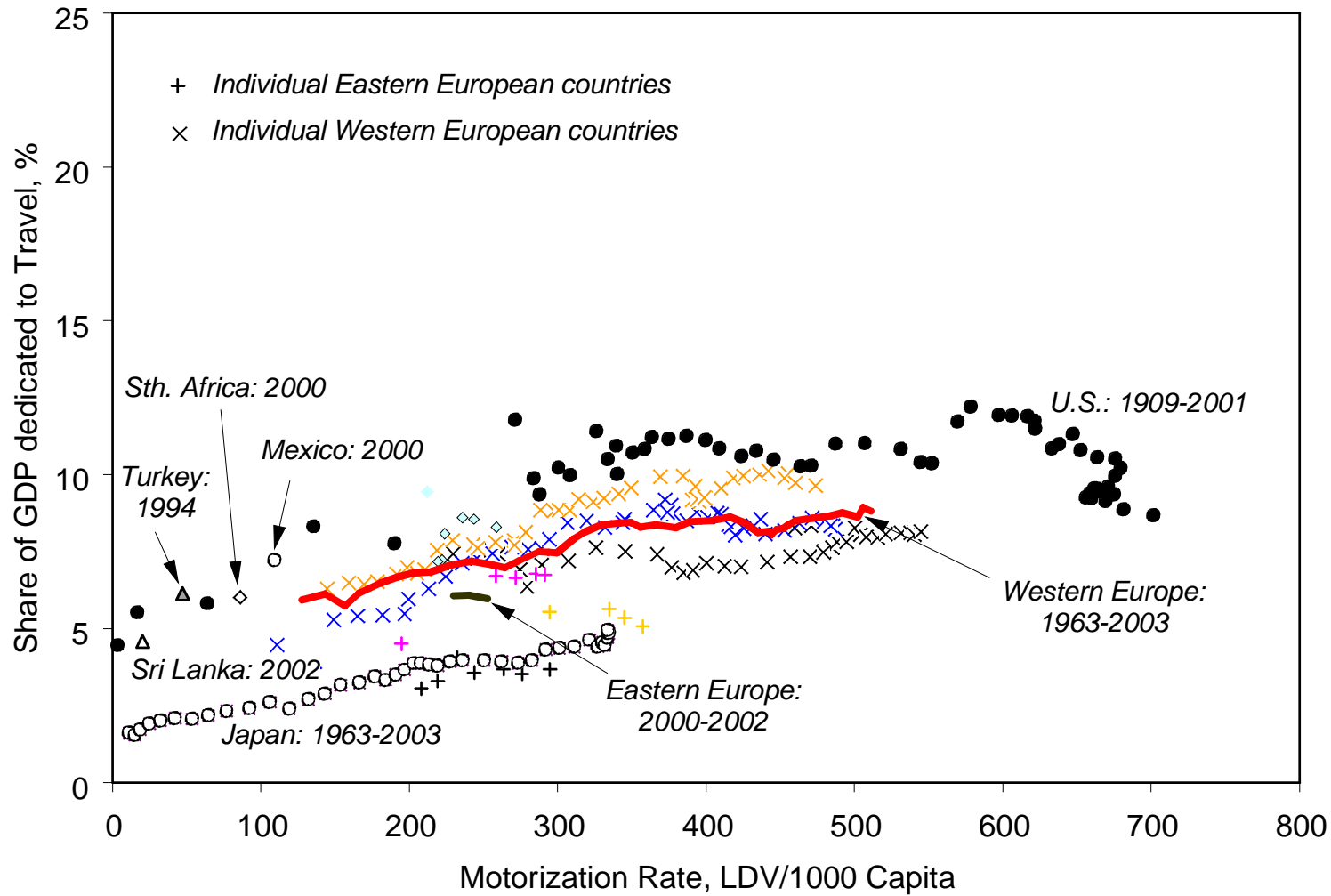
Source: Schäfer A. and D.G. Victor (2000) The Future Mobility of the World Population, *Transportation Research A*, 34(3): 171-205

Travel Time Budget: Stability

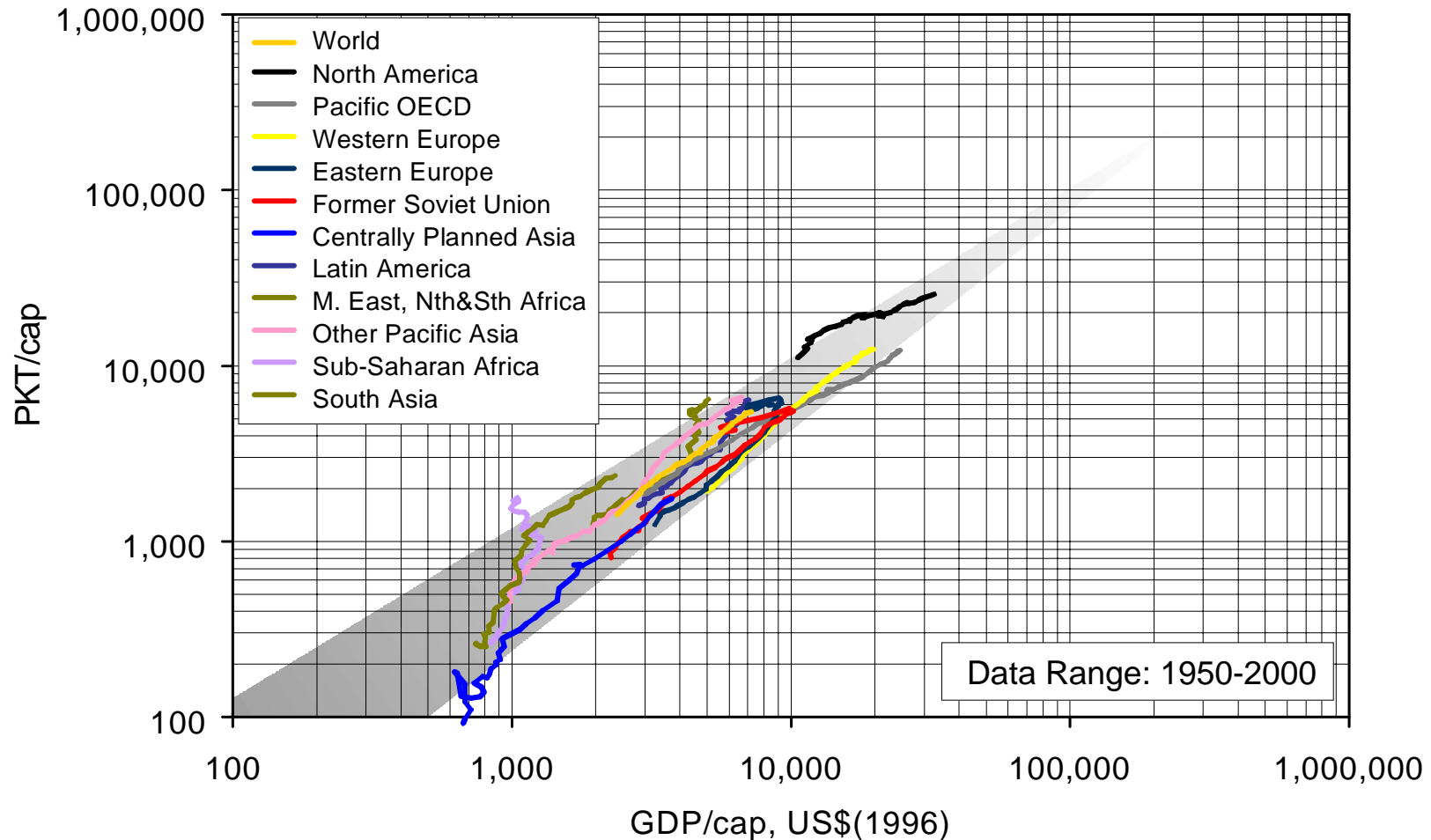


Data source: Szalai et al.(1972), data from 11 countries, pop. between 18 and 65 years of age.

Travel Money Budget



Global Mobility Trends

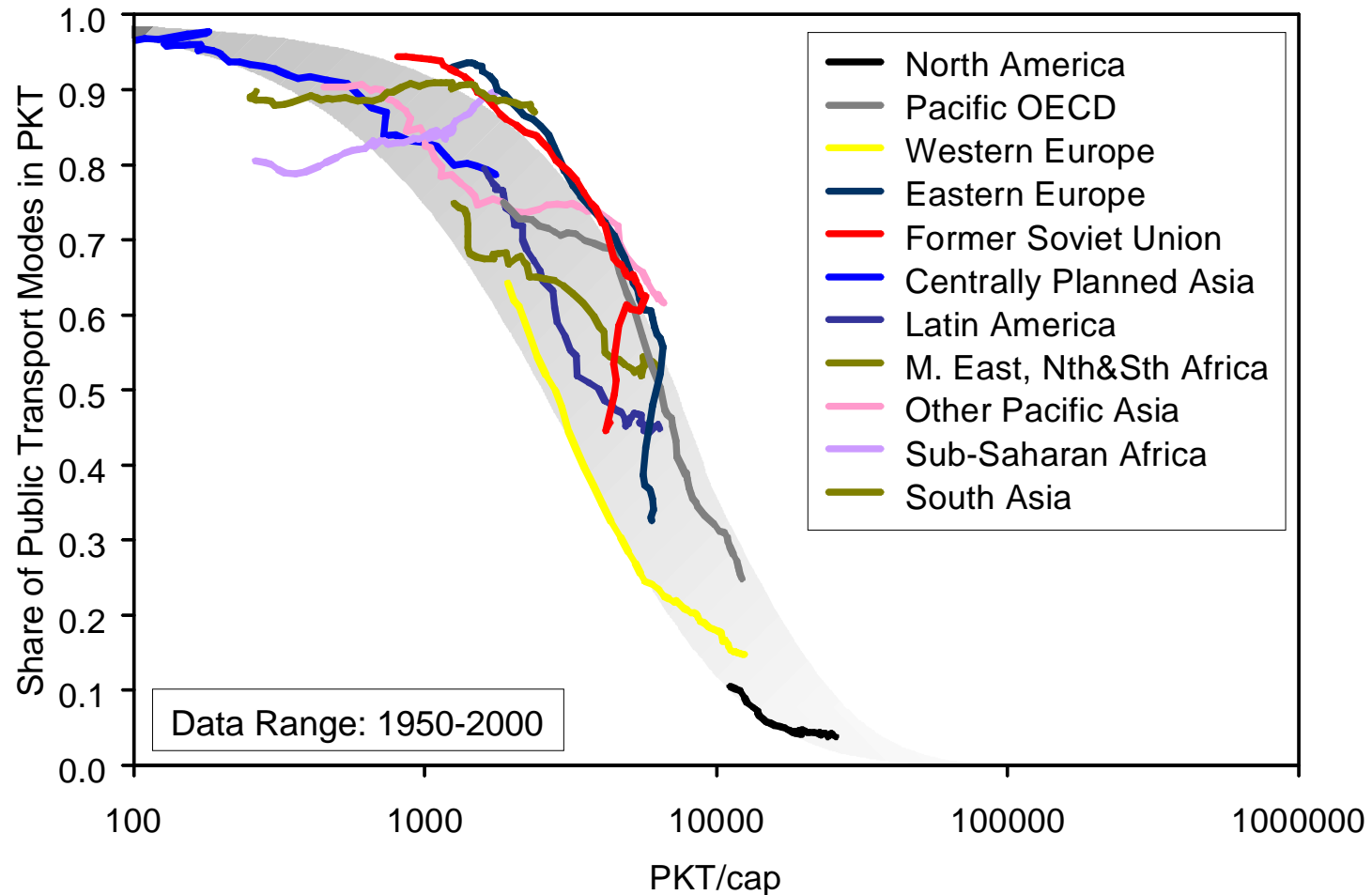


Source: A. Schäfer, Global Passenger Mobility Data Set, Version 1.0, University of Cambridge, Sept. 2005

The Fully Networked Car
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Declining Share of Public Transport

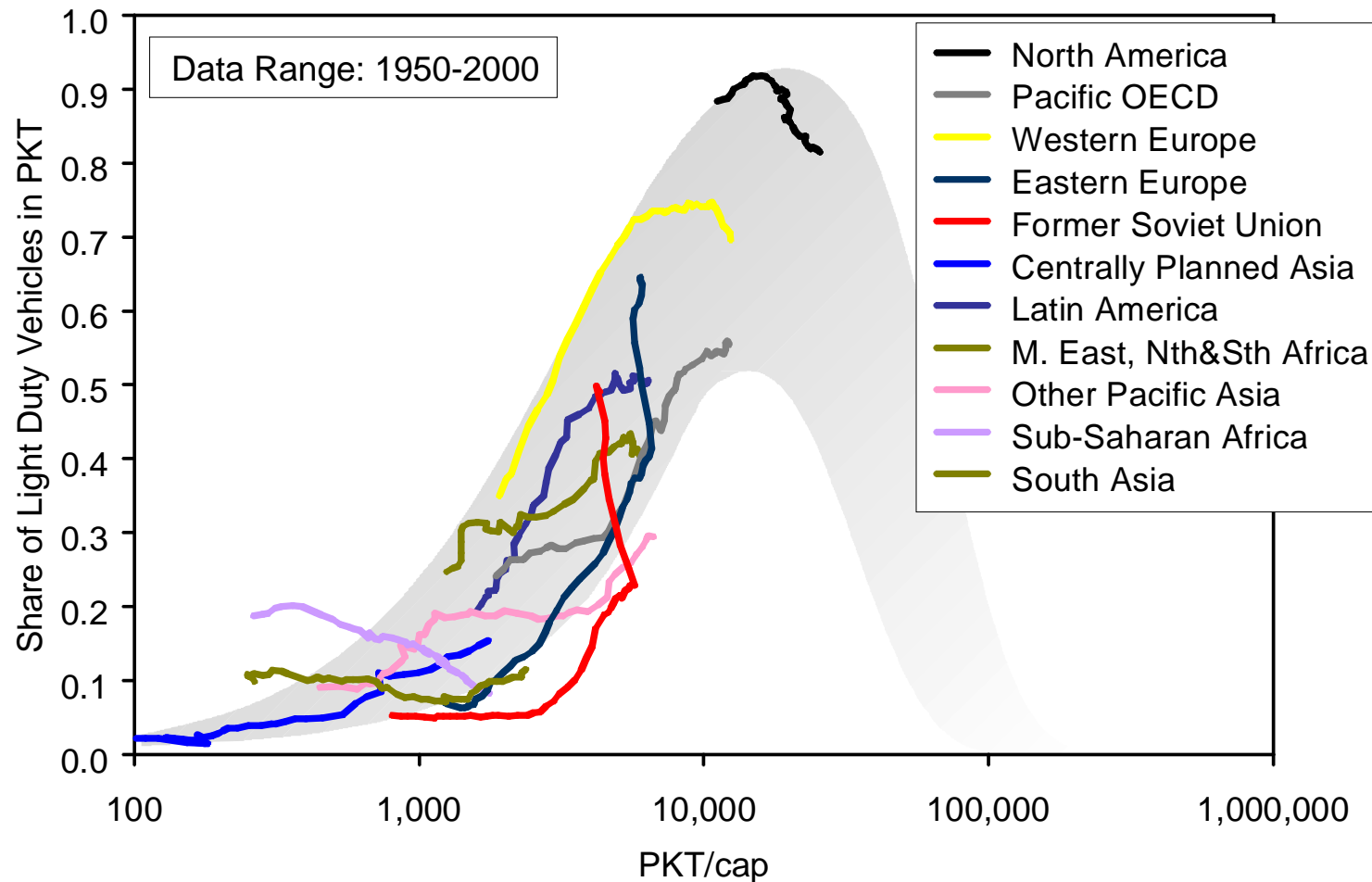


Source: A. Schäfer, Global Passenger Mobility Data Set, Version 1.0, University of Cambridge, Sept. 2005

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Changing relative Importance of the Automobile ¹⁰



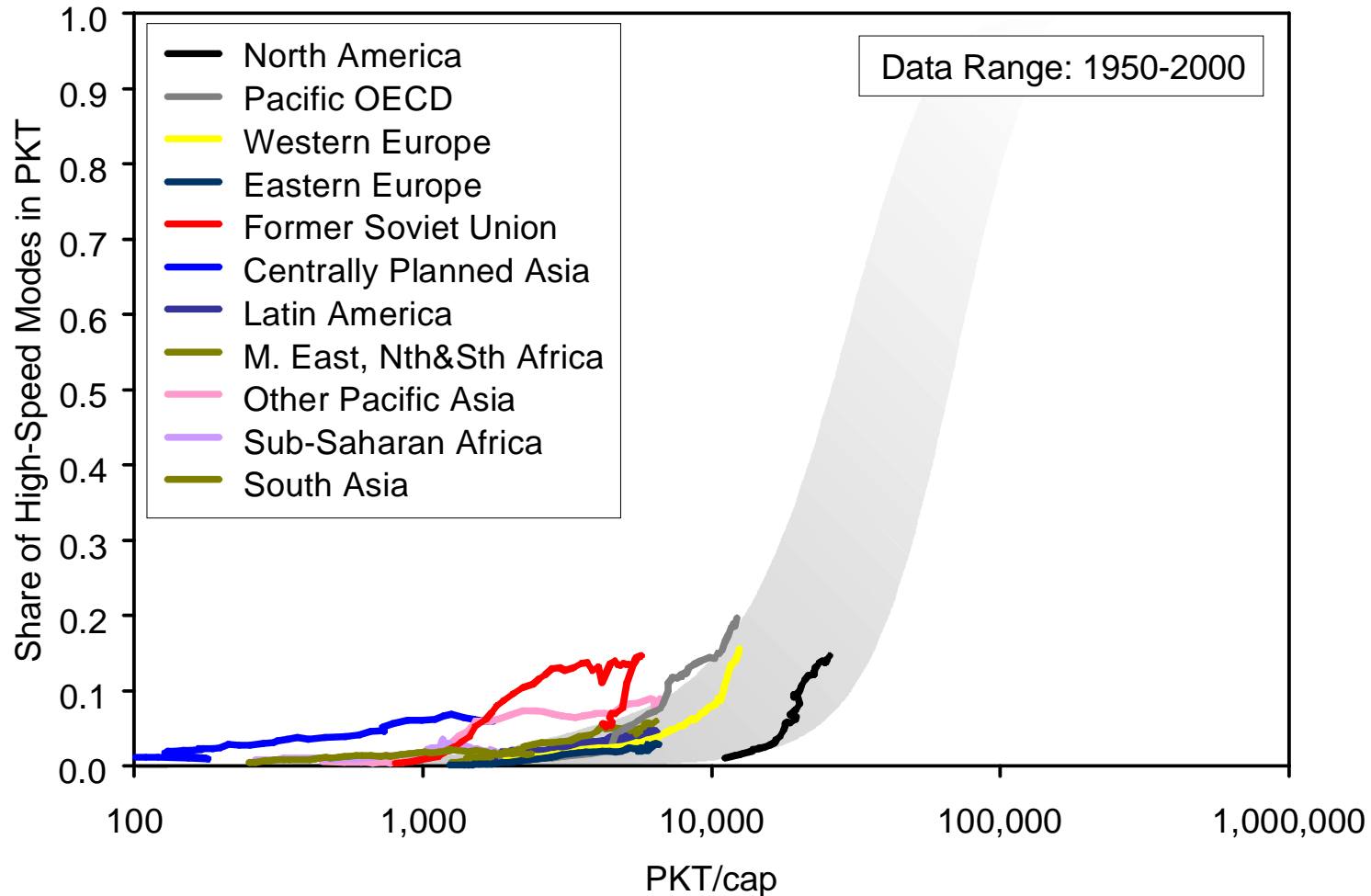
Source: A. Schäfer, Global Passenger Mobility Data Set, Version 1.0, University of Cambridge, Sept. 2005

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The Rise of High-Speed Transportation

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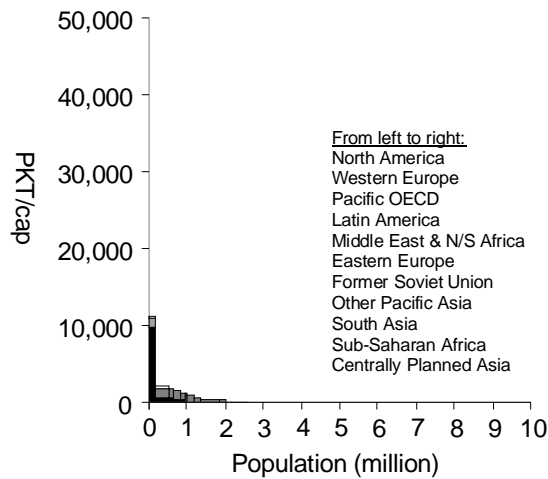
Source: A. Schäfer, Global Passenger Mobility Data Set, Version 1.0, University of Cambridge, Sept. 2005

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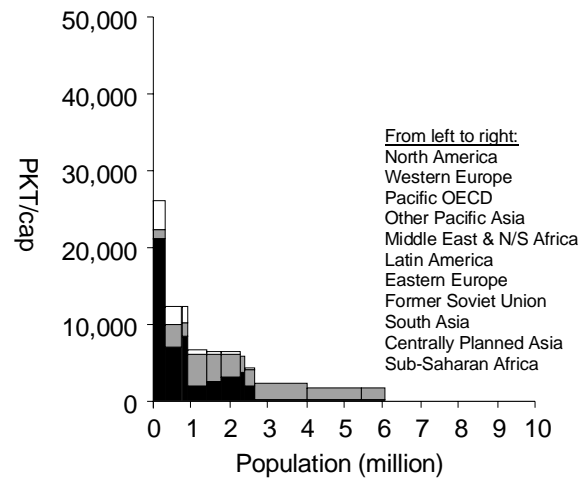


Evolution of Travel Demand: Past, Present, Future¹²

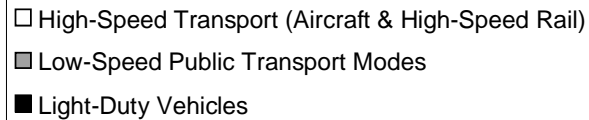
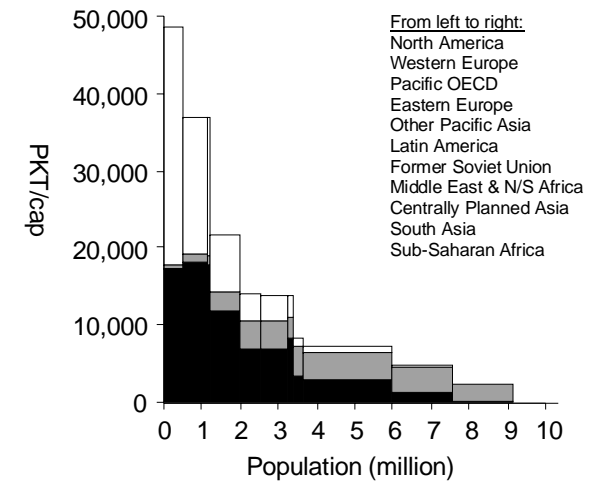
1950



2000



2050 (?)



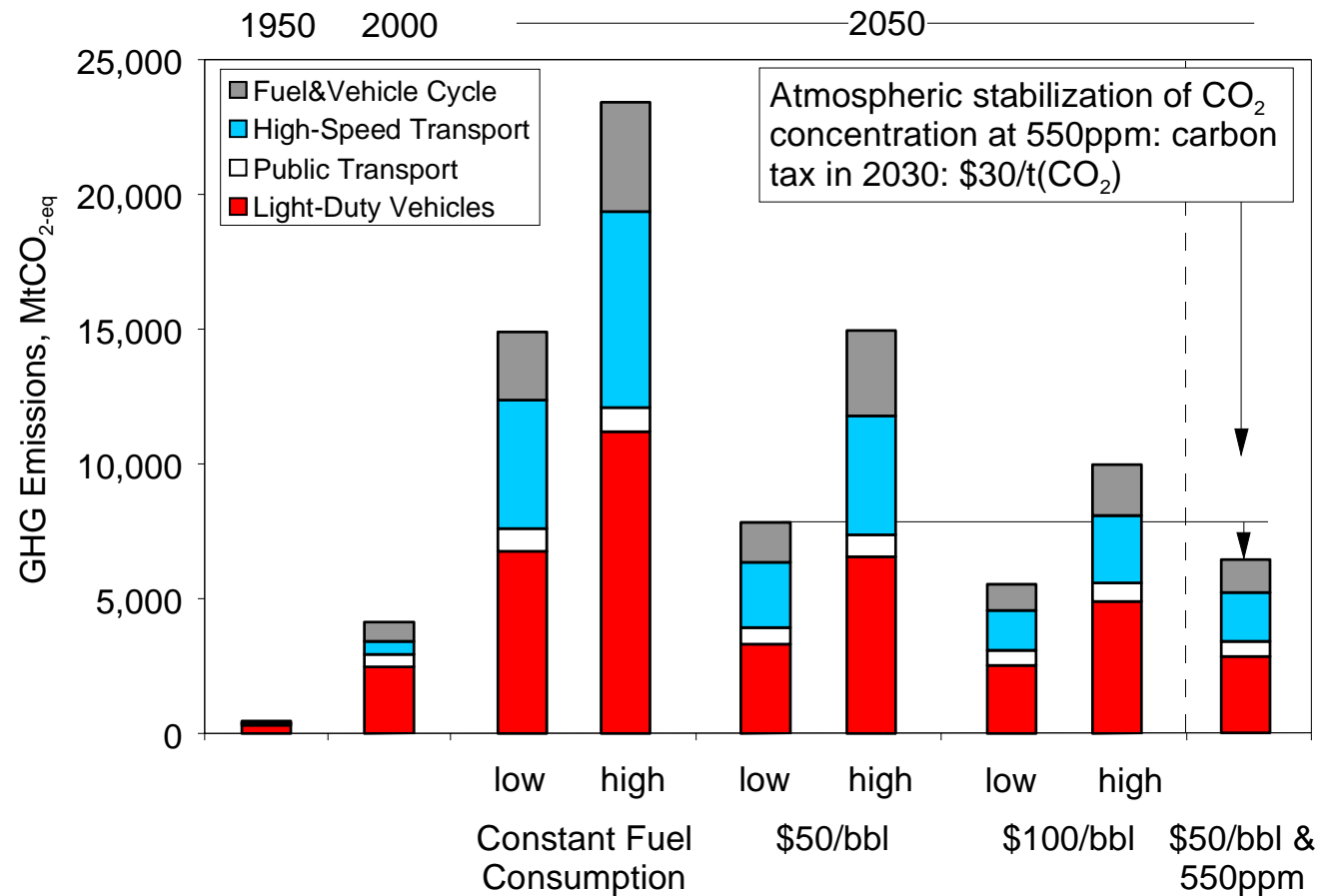
2050 travel demand > 3 X 2000 level at a roughly 3-fold GDP level

- Historical trend: initially increasing, then leveling off at roughly 2 MJ/pkm due to
 - *Increasing forces*: shift toward faster and more energy-intensive modes; shift toward larger and more powerful automobiles; declining automobile occupancy rates; etc.
 - *Mitigating forces*: strong fuel-efficiency improvements and increasing passenger load factors of aircraft; fuel efficiency improvements of light-duty vehicles within each size class

- Opportunities for reduction: significant (30-50%) over the next 20 years at current performance levels
 - Automobile/aircraft engines, others
 - Vehicle driving/flight resistances
- Challenges:
 - Extra costs of fuel-saving technology, consumer preferences, etc.
 - Thus policies required to push fuel-saving technologies into the market

- Historical trend: roughly constant (≈ 73 gCO₂/MJ for petroleum-based fuels)
- Opportunities for reduction: potentially significant but long-term
 - Current vs. second generation biofuels
 - Hydrogen and electricity
- Challenges for alternative fuels:
 - Energy density, convenience, costs, scale (amount and location of resources), environmental, etc.

World Passenger Mobility GHG Emissions



Prevailing 2050 automobile technologies:
\$50/bbl: gasoline-fueled mech drivetrain vehicle with reduced driving resistances
\$100/bbl: diesel-fueled mech drivetrain vehicle with strongly reduced driving resistances
\$50/bbl + C-tax: gasoline-fueled mech drivetrain vehicle with strongly reduced driving resistances

Projected low and high values differ by economic growth rate and thus PKT, mode share, and average E/PKT; and by the displacement of secondary bio-fuels for petroleum fuels. The travel demand underlying the low projections corresponds to the 2050 projection on slide 12

Some Conclusions

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- Global travel demand likely to continue to grow strongly; demand growth coupled with a rising relative importance of faster modes
- Large opportunities exist for reducing GHG emissions; but they are more than offset by strong demand growth. Thus, world GHG emission will continue to grow even under stringent GHG mitigation policies
- Policies that focus on GHG mitigation cause technology to change but are unlikely to significantly impact growth in travel demand