For the direct rebound effect, the economic fundamentals are, well…fundamental.

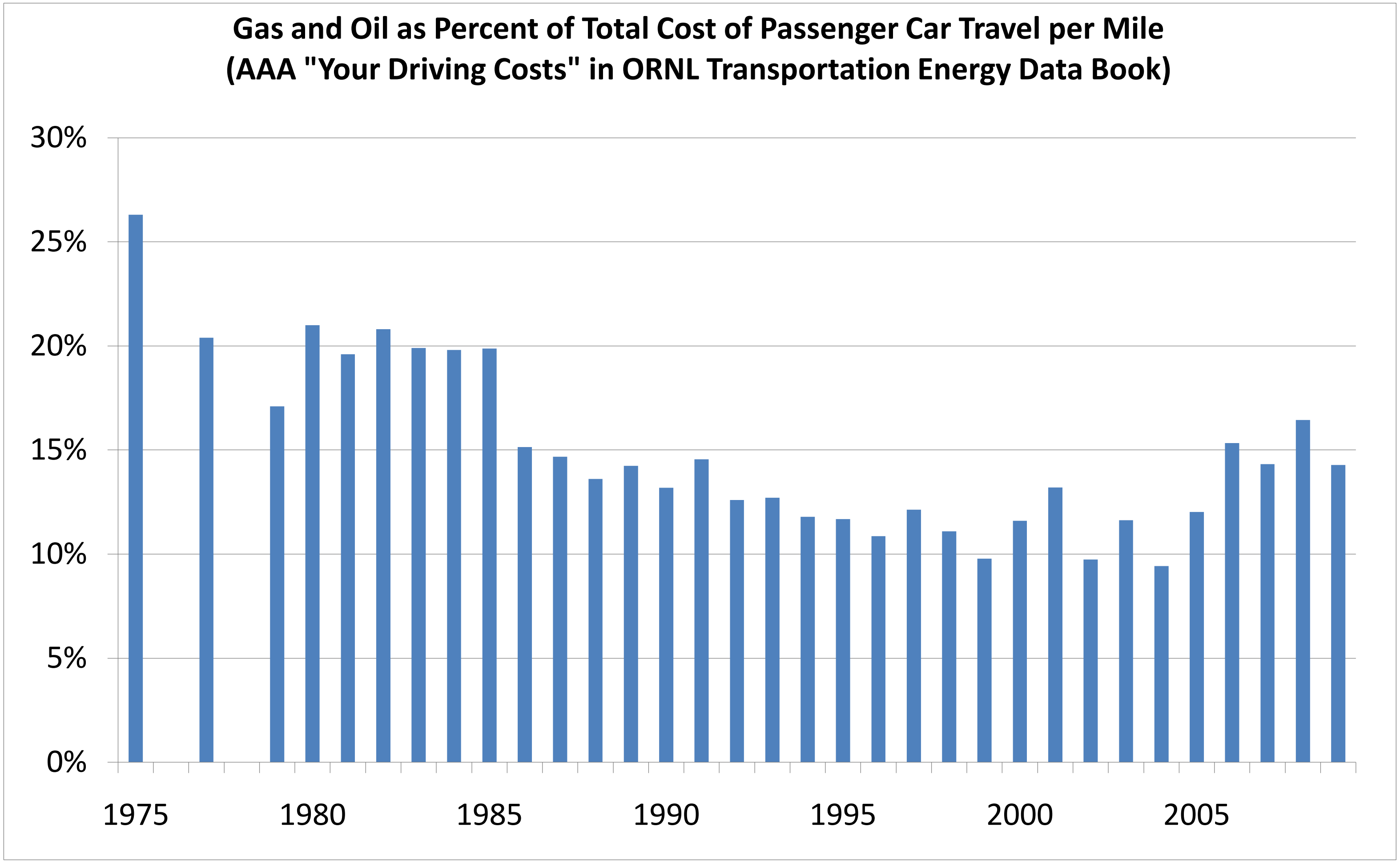
- Let T[c(ep,x),w] be the demand for travel as a function of the value of time, w, and the monetary cost of travel c(ep,x) which depends on fuel costs ep, where e is energy efficiency and p the price of fuel, and other costs, x.

$$\frac{dT}{de}\frac{e}{T} = \frac{dT}{dc}\frac{dc}{de}\frac{e}{T} = \frac{dT}{dc}\frac{c}{T}\left(\frac{ep}{c}\right) = -1\left(\frac{ep}{c}\right)$$

- If the elasticity of travel with respect to total monetary costs is about -1, then the direct rebound effect is the negative cost share of energy.

For passenger cars, the energy cost share declined from about 20% in the 1970s and early 80s to about 10% by 2000.

Today, the fuel cost share for air travel is about 35%, down from 15% in 2001. The cost share for heavy trucks is now about 30%.



It’s almost, but not quite, that simple.

- Higher energy costs increase the direct rebound effect and vice versa.
- Increased energy efficiency decreases the direct rebound effect and vice versa.
- The direct rebound effect varies directly with the price elasticity of travel.
- And inversely with the value of time.
- Indirect effects are (much) smaller than direct effects.
- The policy context matters.

What I think are the key remaining issues for energy policy.

- How does the RE vary with energy cost share and value of time?
- How do acquisition costs affect vehicle travel?
- Are efficiency and energy price effects symmetric (is there an efficiency RE)?
- What is the nature of the long-run adjustment to fuel cost per km and how big is it?
- What are the rebound effects for heavy trucks and air (more studies)?
- How big are the vehicle choice Res (very small)?