The Energy Efficiency Paradox and Trucking

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October 10, 2012

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Economic rationale for fuel efficiency investment

- Buy if PDV of fuel savings > Investment Cost
  - PDV: i, lifetime of vehicle/investment
  - Fuel savings: Price of fuel($t_o \rightarrow T$), EE factor, quantity of fuel used ($t_o \rightarrow T$)
- Payback period: time where PDV fuel savings= Inv cost

- Complications
  - What i?
  - Uncertainty over vehicle/investment life, resale value
  - Uncertainty over future fuel prices, uncertainty about energy savings factor, miles driven over time, ancillary costs
  - Investment financing, maintenance costs

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What is the Energy Efficiency Paradox?

- Fuel saving investments “available” but not being used
- If true, particularly surprising since this is a for-profit sector.
- The conventional wisdom in the trucking industry is that investments in energy efficiency require a two-to-three year payback in fuel economy savings, and yet the investments will continue to generate fuel savings over a far longer period.

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Why do companies demand such a short payback period?

- Market failure:
  - ➔ government intervention justified
  - ➔ can count "full" PDV fuel savings as benefit
- Hidden costs:
  - ➔ no intervention
  - ➔ reduce benefits appropriately

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- Complications (green is hidden costs; red is market failure)
  - Uncertainty over future fuel prices, miles driven over time, ancillary costs
  - Uncertainty about energy savings factor

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Telling anecdote on hidden costs

"Reducing power to take loads up hills will induce drivers to go around rather than up the mountains, which can lead to increases in fuel use" (comment by steel supplier who has a fleet of trucks)

Treatment of energy efficiency in the Truck CAFE RIA

- Assumed market failure is the cause; therefore the "engineering" cost savings are real and should be counted.
- Also assumed a given technology penetration in a given fleet size and given rebound effect. But these depend on the actual/perceived costs
  - Could hold on to vehicles longer
  - Purchase less expensive or less regulated vehicles
    - E.g., LDA's to LDVs

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Table 7. Costs Reduced in 2050 from Heavy-Duty Vehicle Regulations, 2009 dollars

Cost measure	Class 7–8 combination tractors	Class 2b–8 vocational vehicles
Cost per vehicle (2020)	$6,004	$366
Cost per ton CO_2 reduced (2050, not including fuel savings)	$20	$30
Fuel savings per 2018 model year vehicle (lifetime) at 3% and 7% discount rate	$79,089 $64,376	$5,872 $4,646
Payback period at 3% discount rate	~7 months	~6 months
Cost per ton CO_2 reduced (2050, including fuel savings)	-$320	-$310

Source: U.S. EPA and NHTSA 2011.

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Table 8. Estimated Net Benefits of Heavy-Duty Vehicle Regulations

Category	Benefits averaged over 2014–2018 model years, millions of 2009 dollars (3% discount rate)
Technology costs	$1,620
Public good benefits	
Energy security	$540
Rebound externalities	-$300
CO_2 emission reductions (3% discount)	$1,140
Net Benefits (before private benefits)	-$240
Private benefits	
Refueling	$80
Fuel savings	$10,020
Net including private benefits	$9,860
Net including private benefits (7% discount rate)	$6,600

Source: U.S. EPA and NHTSA 2011.

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Conclude on RIA

- Although reasons for the standard are energy security and climate change, most benefits are from fuel savings, so treatment of EEP is critical to justifying rule.
- Fortunately, costs (and fuel economy gains) are modest *this time around*
  - *NRC: 50% improvement possible*
  - *7-24% required*
- So need to solve the EEP

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