Short-Run Motor Gasoline Demand Model

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Price Elasticity

- Range of estimates
  - Most short-run estimates are between zero and -0.5
  - Most long-run estimates are between -0.5 and -1.5
- Decline in price responses
  - EIA short-run estimates:
    - 1977 to 1989: -0.05 to -0.08
    - 1994 to 2006: -0.02 to -0.04

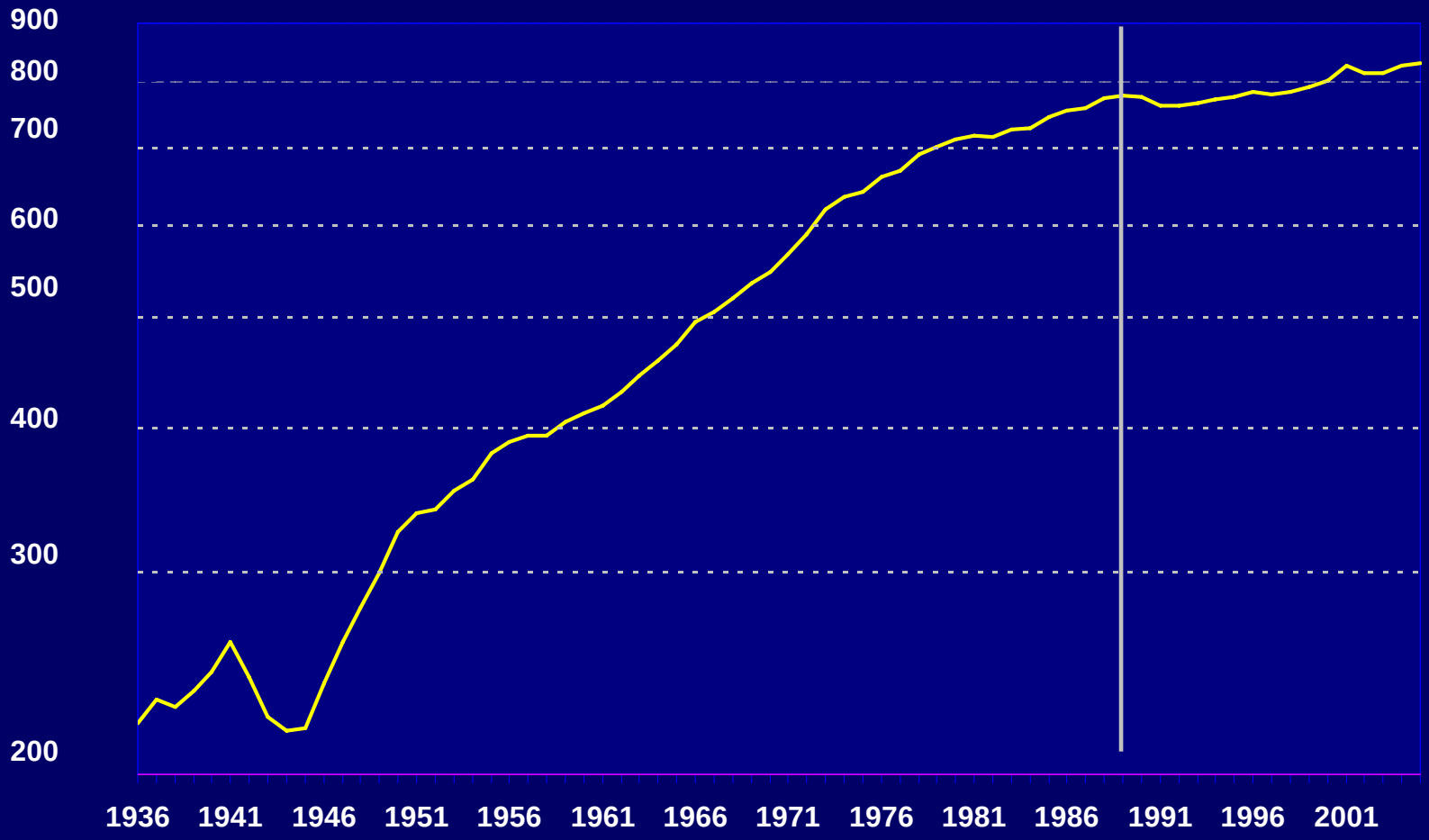
Income Elasticity

- Most estimates are between 0.2 and 1.5
- Estimates have declined over time
  - EIA:
    - 1977 to 1989: .85
    - 1994 to 2006: .50

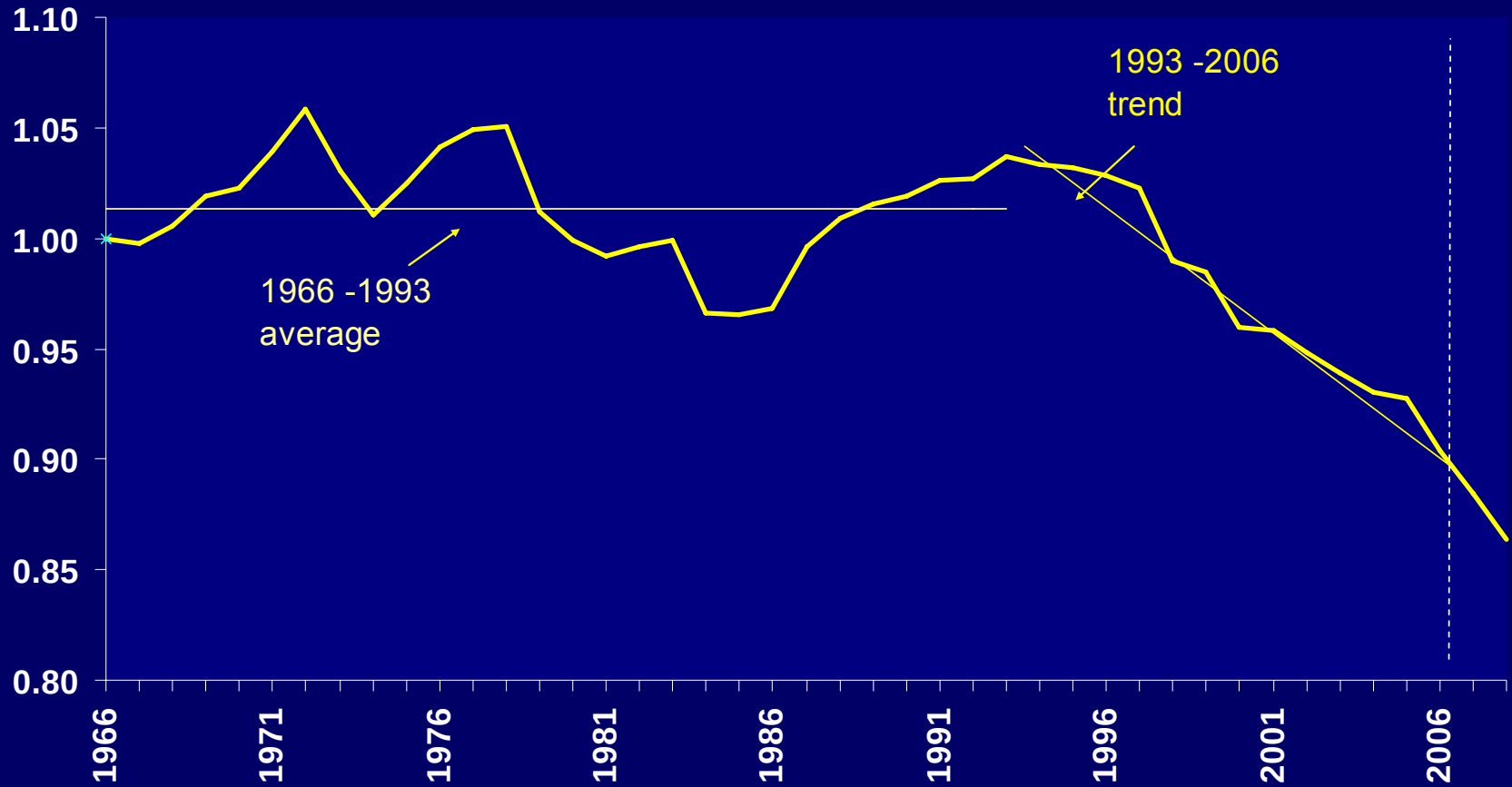
Possible Reasons for Elasticity Declines

- Motor vehicle travel is a mature product
- Fuel efficiencies have increased
- Real cost per mile is lower
- Gasoline's share of disposable income has declined

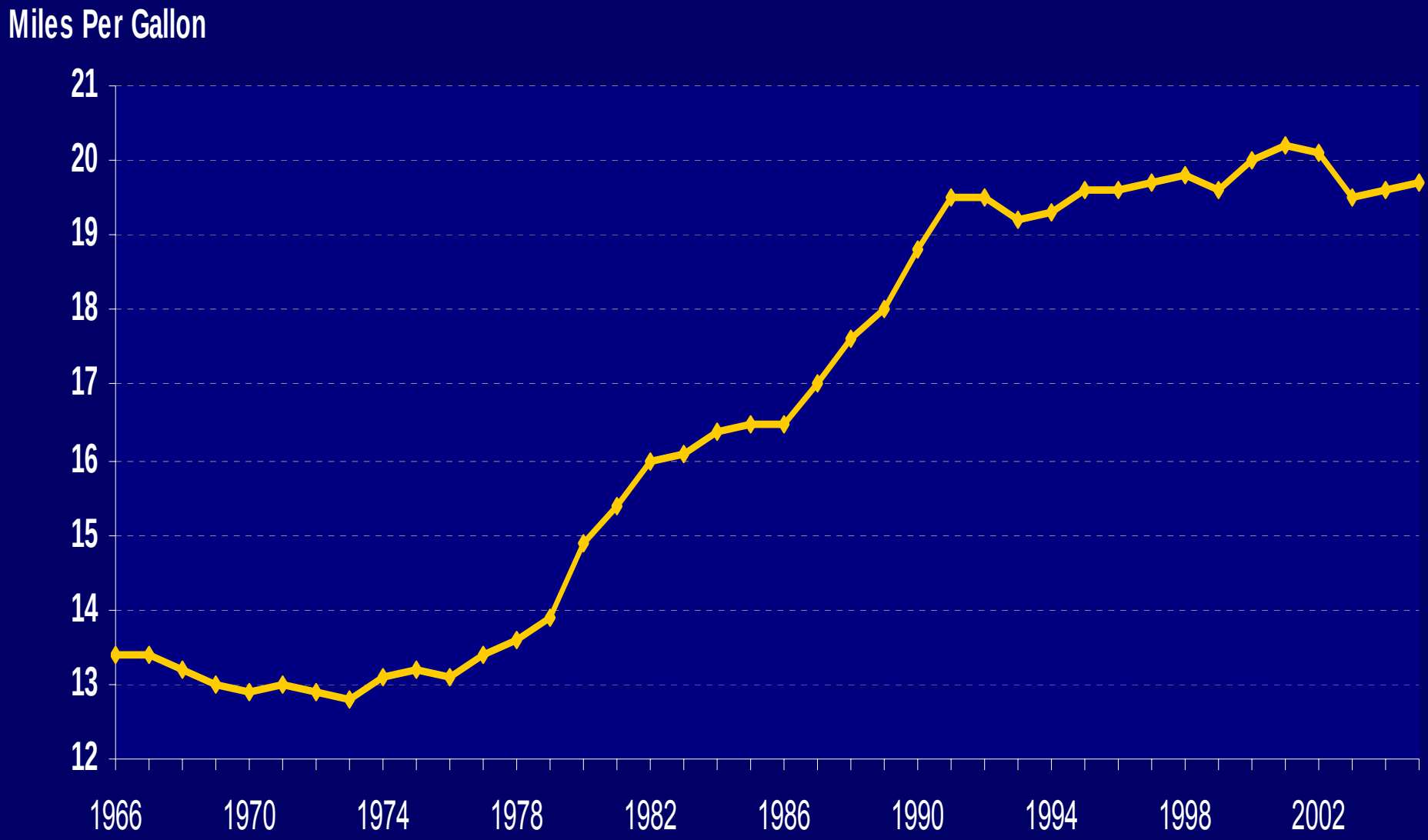
Growth in Vehicles per 1000 People Has Slowed Sharply



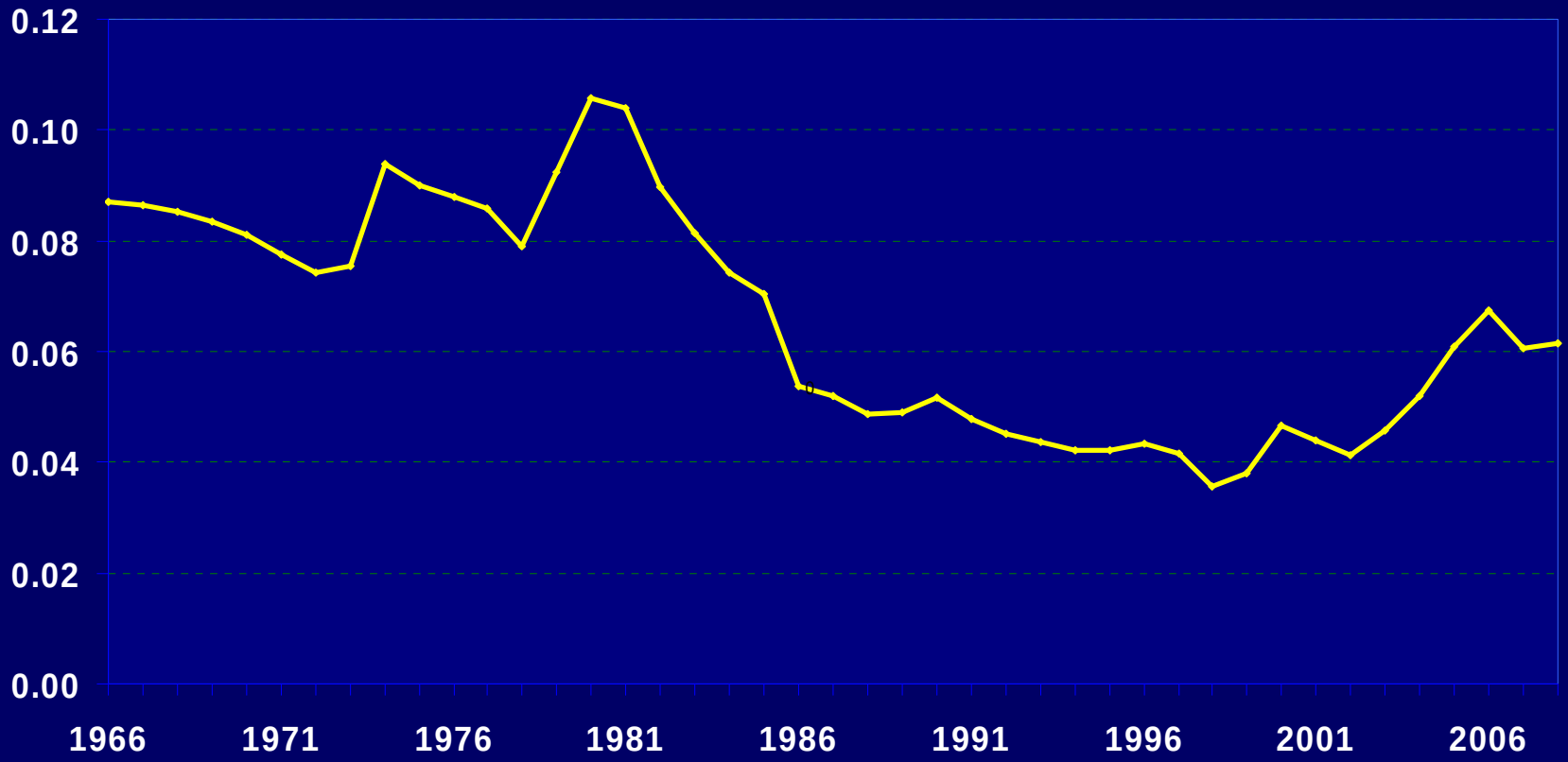
Ratio of Passenger VMT to Real Personal Disposable Income (1966=1)



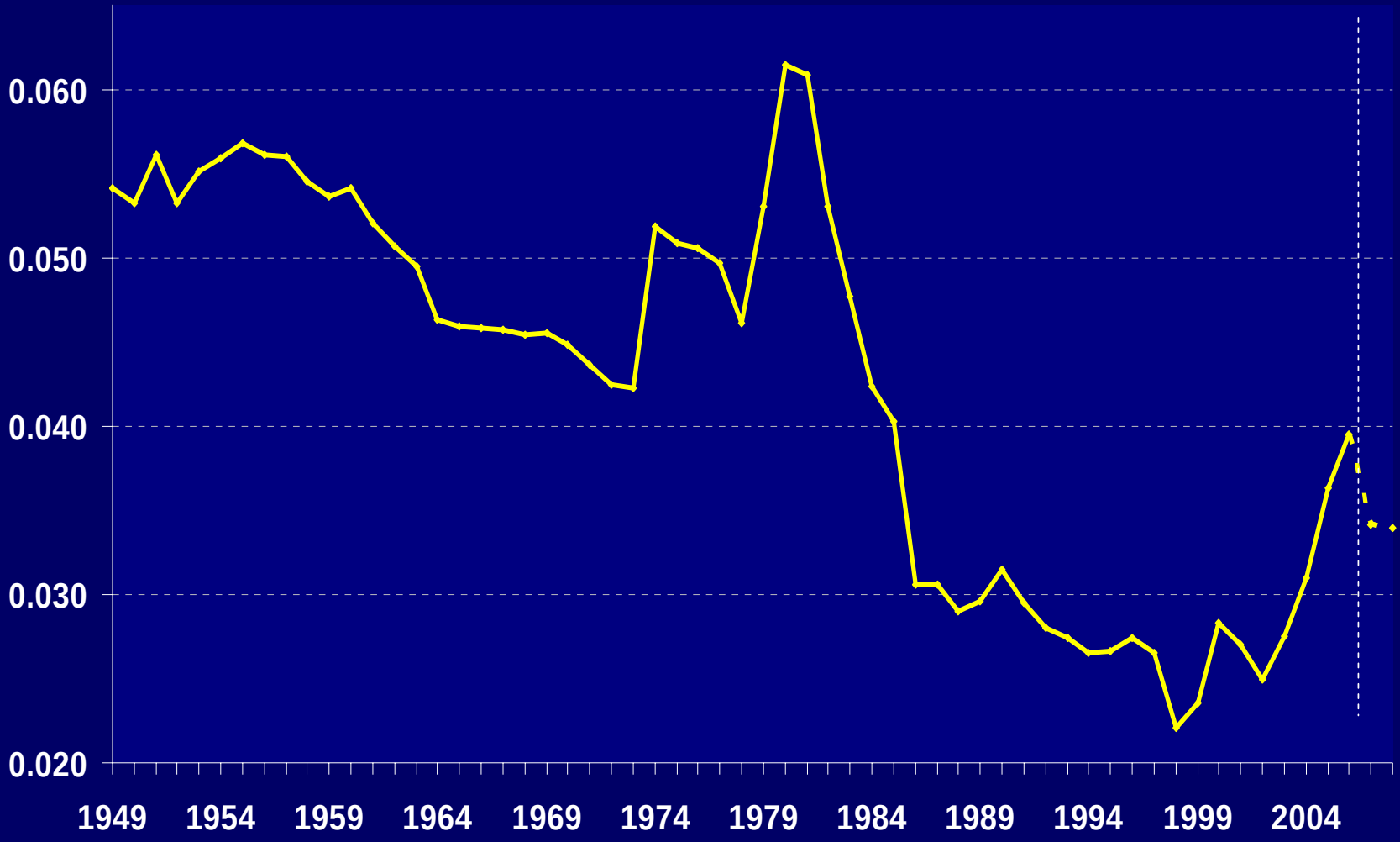
Motor Gasoline Vehicle Fuel Efficiency



Inflation-Adjusted Motor Gasoline Cost per Mile (1982-84 $)



Motor Gasoline Expenditures as a Share of Personal Disposable Income



Short-Term Energy Outlook Motor Gasoline Model

Total motor gasoline demand =

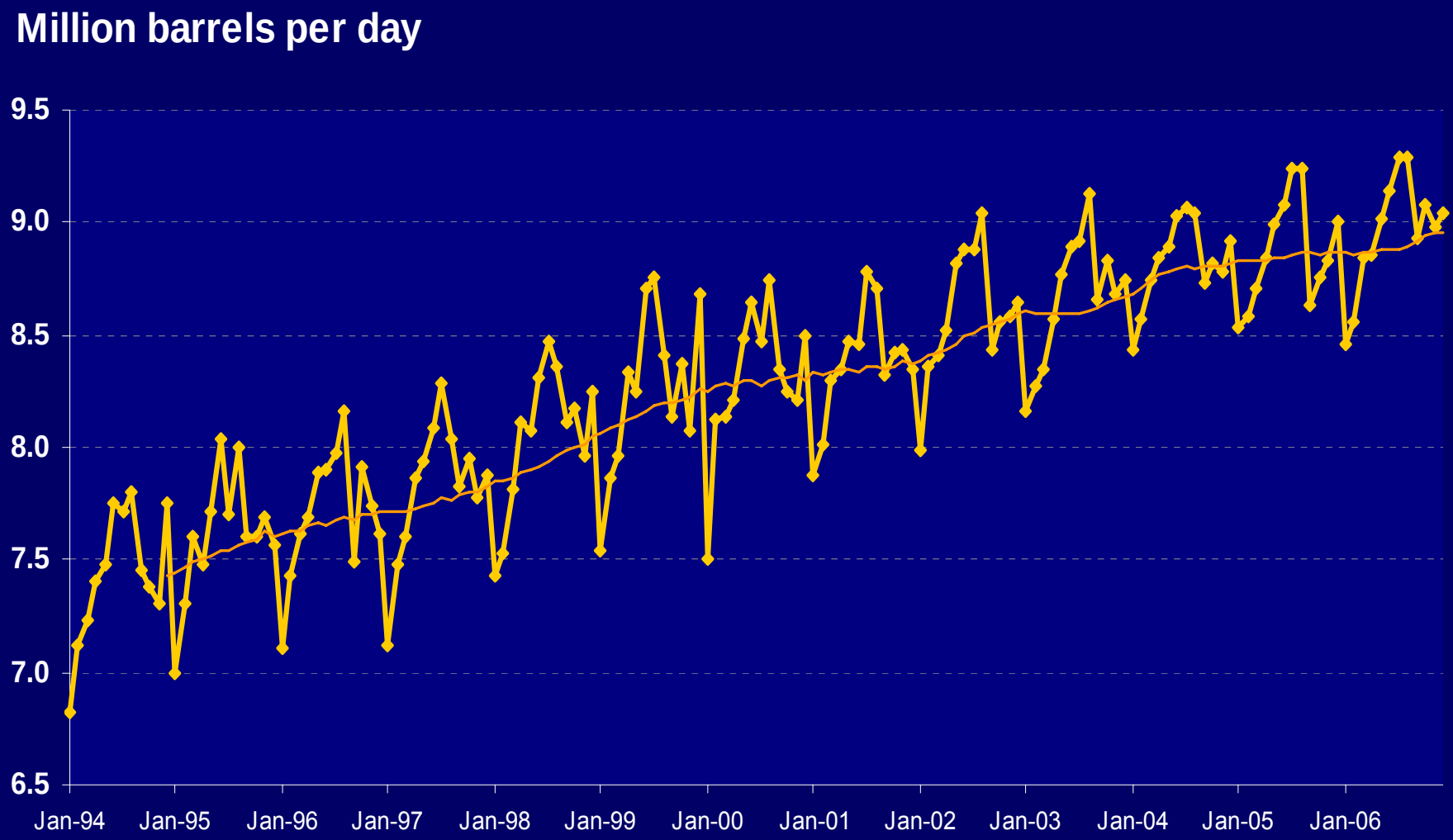
Highway demand + Non-highway demand

Highway demand accounts for 97 percent of total motor gasoline demand. It is derived from the following identity:

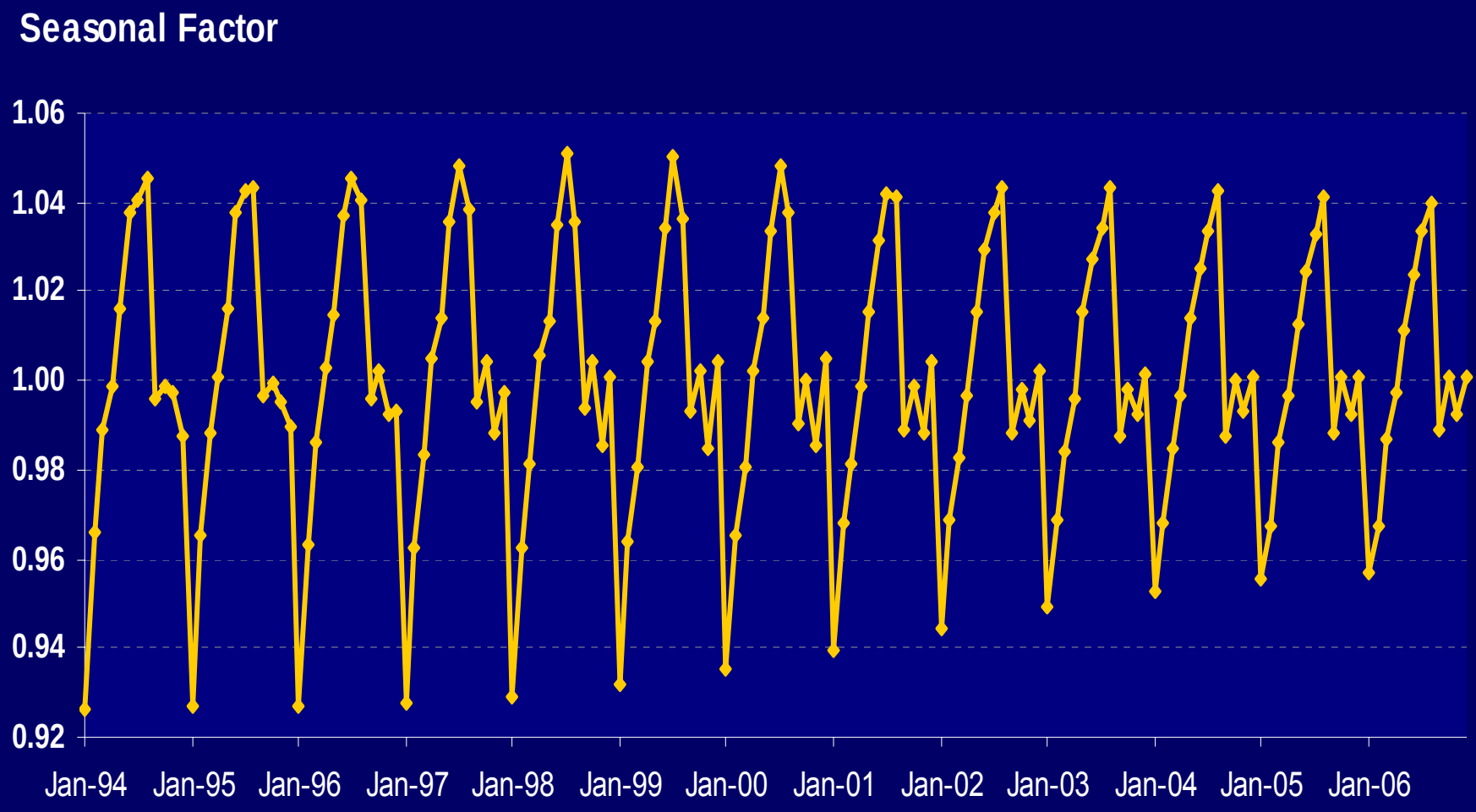
$$\text{Highway Demand} = \frac{\text{Highway Travel}}{\text{Fuel Efficiency}}$$

Each component is estimated separately.

Highway Motor Gasoline Demand is Highly Seasonal



Highway Motor Gasoline Demand Is Becoming Less Seasonal



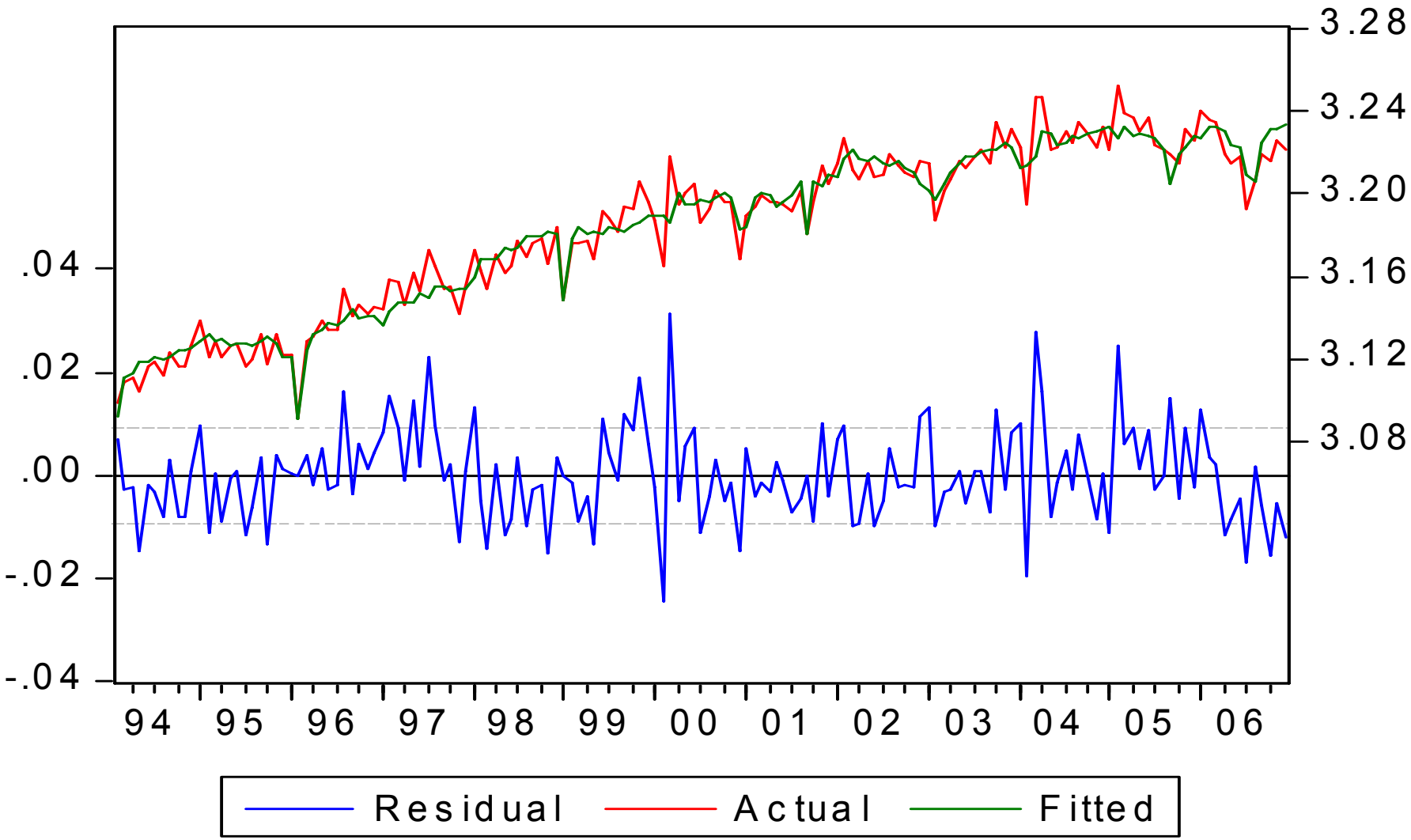
Seasonally-Adjusted Per-Capita Motor Gasoline-Related Vehicle Miles Traveled Per Day

- Dependent Variable: LOG(MVMGPUS_SA/POP)
- Estimation Interval 1994:01 to 2006:12

Variable	Coefficient	Std. Error	t-Statistic	
C	1.594	0.035	45.164	
LOG(YD87OUS/POP)	**0.500**	**0.012**	**40.440**	**(Per Capita RDI)**
LOG(CPMMG_SA)	**-0.018**	**0.006**	**-2.967**	**(Real Cost Per Mile)**
DGT250	-0.013	0.005	-2.587	(= 1 if Reg. Gr. $/gal > 2.50)
DGT275	-0.007	0.007	-1.052	(= 1 if Reg. Gr. $/gal > 2.75)
LOG(ZWHDDUS1/ZSAJQUS)	-0.003	0.001	-3.835	(Asymmetric Weather Var.)
D9401	-0.035	0.010	-3.401	(Severe Weather)
D9602	-0.042	0.010	-4.332	(Severe Weather)
D9901	-0.033	0.010	-3.409	(Severe Weather)
D0109	-0.030	0.010	-3.096	(9/11 Impact)

- **R-squared 0.948**
- **Durbin-Watson stat 1.617**

Seasonally-Adjusted Log Per-Capita Motor Gasoline-Related Vehicle Miles Traveled Per Day



Seasonally-Adjusted Per-Capita Motor Gasoline-Related Vehicle Miles Traveled Per Day

(Alternative estimation with lagged dependent variable)

- Dependent Variable: LOG(MVMGPUS_SA/POP)
- Estimation Interval: 1994:02 to 2006:12

Variable Name	Coefficient	Std. Error	t-Statistic	
C	1.229	0.107	11.516	
LOG(MVMGPUS_SA(-1)/POP(-1))	**0.231**	**0.064**	**3.630**	**(Lagged Dep. Var.)**
LOG(YD87OUS/POP)	**0.386**	**0.034**	**11.243**	**(Per Capita RDI)**
LOG(CPMMG_SA)	**-0.021**	**0.005**	**-3.758**	**(Real Cost per Mile)**
DGT275	-0.013	0.006	-2.199	(= 1 if Reg. Gr. $/Gal >2.75)
LOG(ZWHDDUS1/ZSAJQUS)	-0.003	0.001	-3.480	(Asymmetrical HDD Variable)
D9602	-0.040	0.009	-4.190	HDD Variable
D9901	-0.036	0.010	-3.761	HDD Variable
D0109	-0.028	0.009	-2.950	(9/11 Effect)

- **R-squared** **0.948**
- **Durbin-Watson stat** **2.089**

Results Using a Lagged-Dependent Variable in the VMT Equation

Partial Adjustment Hypothesis

$$\log (VMT/POP)_t - \log (VMT/POP)_{t-1} = \lambda (\log (VMT^*/POP)_t - \log (VMT/POP))_{t-1}$$

where $0 < \lambda < 1$ and VMT^* = desired (target) level of vehicle travel

$$\log (VMT/POP)_t = \lambda\acute{a} + (1 - \lambda) \log (VMT/POP)_{t-1} + \lambda\beta \log (Y/POP)_t + \lambda\gamma \log CPM_t$$

Adjustment Coefficient = λ = .769
Average lag = $\lambda / (1 - \lambda)$ = 3.32 months

Elasticity Estimates

	Income	Price
Short Run	$\lambda\beta$ (.386)	$\lambda\gamma$ (-0.021)
Long Run	β (.502)	γ (-0.027)

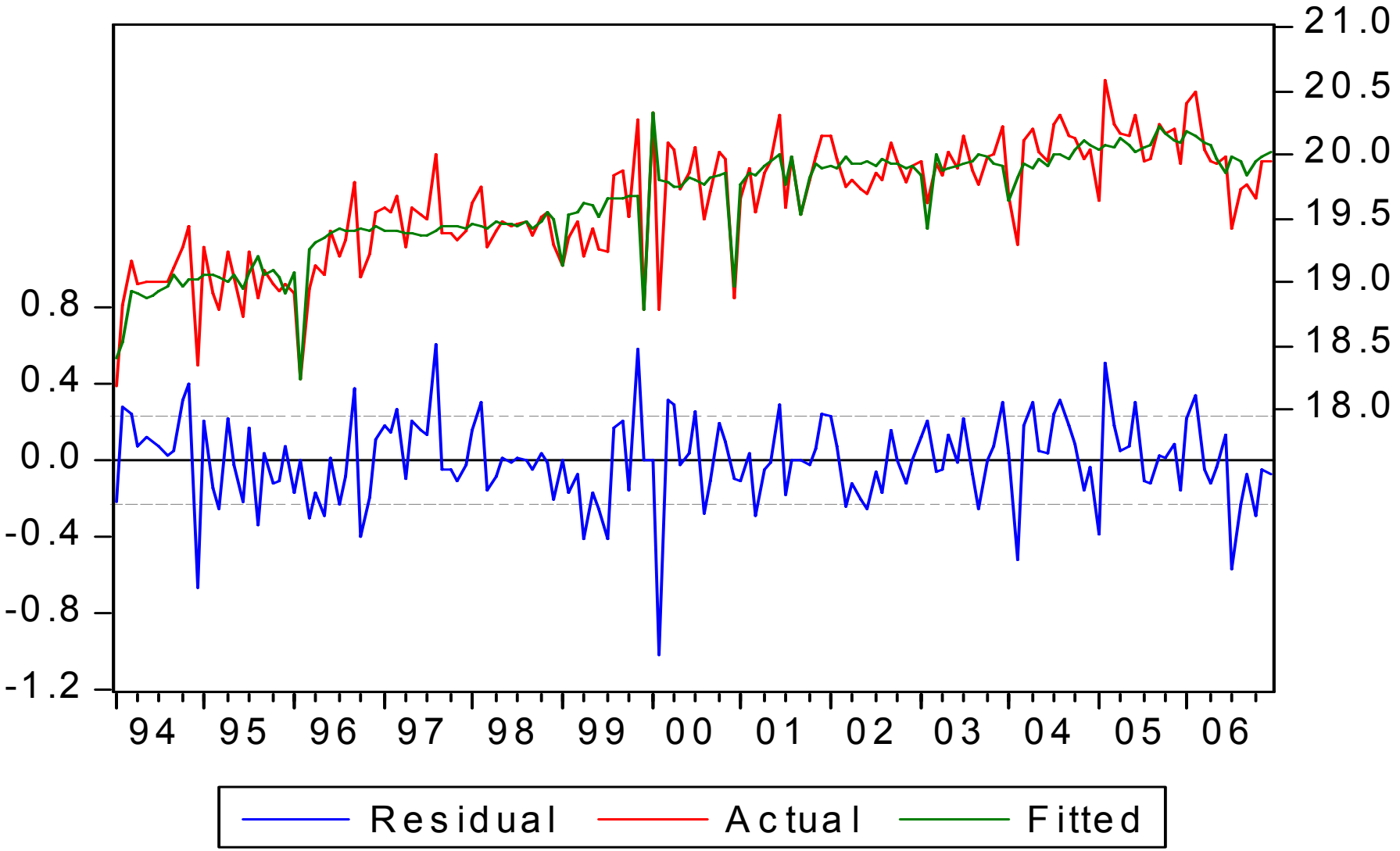
Seasonally-Adjusted Motor Gasoline-Related Fuel Efficiencies

- Dependent Variable: MPGMG_SA
- Estimation Interval 1994:01 to 2006:12

Variable	Coefficient	Std. Error	t-Statistic	
C	16.231	0.221	73.428	
TIME	0.012	0.001	14.756	(Time Trend)
MGRARUS_SA/CICPIUS	0.005	0.002	2.338	(Real Reg Gr. $/gal)
EOTCPUS_SA/MGTCPUS_SA	-34.264	6.000	-5.711	(Ethanol Share)
ZWHDDUS1/ZSAJQUS	-0.149	0.029	-5.232	(Asym. HDD Var.)
D9602	-0.961	0.234	-4.106	(Severe Weather)
D9901	-0.398	0.235	-1.693	(Severe Weather)
D9912	-0.940	0.234	-4.019	(Y2K Shift)
D0001	0.621	0.233	2.661	(Y2K Shift)
D0109	-0.388	0.234	-1.657	(9/11 Impact)

- **R-squared 0.769**
- **Durbin-Watson stat 2.011**

Seasonally-Adjusted Motor Gasoline-Related Fuel Efficiencies



Future Modeling Issues

- Asymmetrical Demand Reponses to Price Changes
- Price Shocks
- Seasonal Differences in Demand Behavior
- Co-integration Techniques

Thank You

Energy Information Administration

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