Past Trends of Fuel Consumption and GHG Emissions from Heavy-Duty Trucking

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Energy Use and Policy in the U.S. Trucking Sector

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RESOURCES FOR THE FUTURE

Trucks are an important part of the U.S. economy

Trucking accounts for a large share of total value and ton-miles

- Figure 1 shows shares of value and ton-miles of freight by mode from the 2007 Commodity Flow Surveys

Trucking's importance has been growing over time

- Figure 2 plots growth in ton-miles for the largest modes from 1997-2007

Class 7-8 combination trucks account for a growing share of VMT and fuel consumption

- Figure 3 compares DOE estimates of VMT and fuel consumption for single-unit class 3-8 vs. combination class 7-8 trucks

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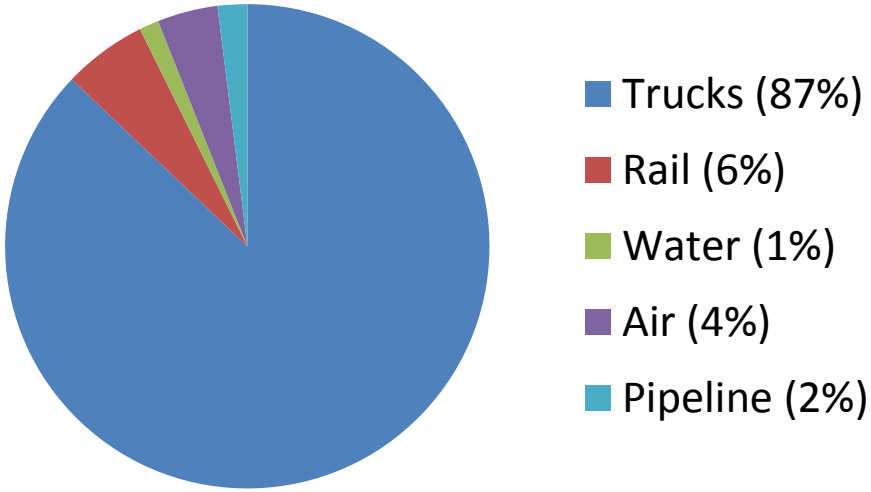
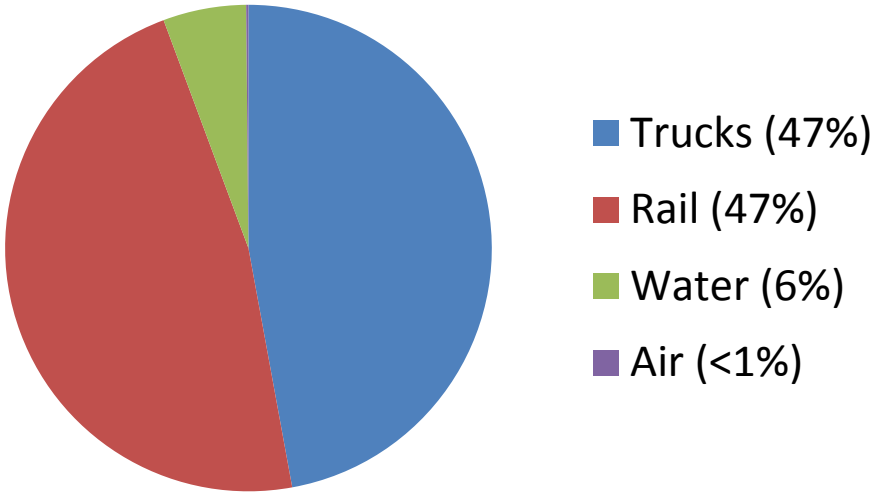
Figure 1: Share of value and ton-miles by mode in 2007

Share of Value by Shipment Mode (Total = $9.5 Trillion)



Share of Ton-Miles by Shipment Mode (Total = 1 Trillion)



Source: 2007 Commodity Flow Survey

Note: Figures include single-mode shipments only

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Figure 2: Growth in Ton-Miles (1997-2007, 1997 = 1)

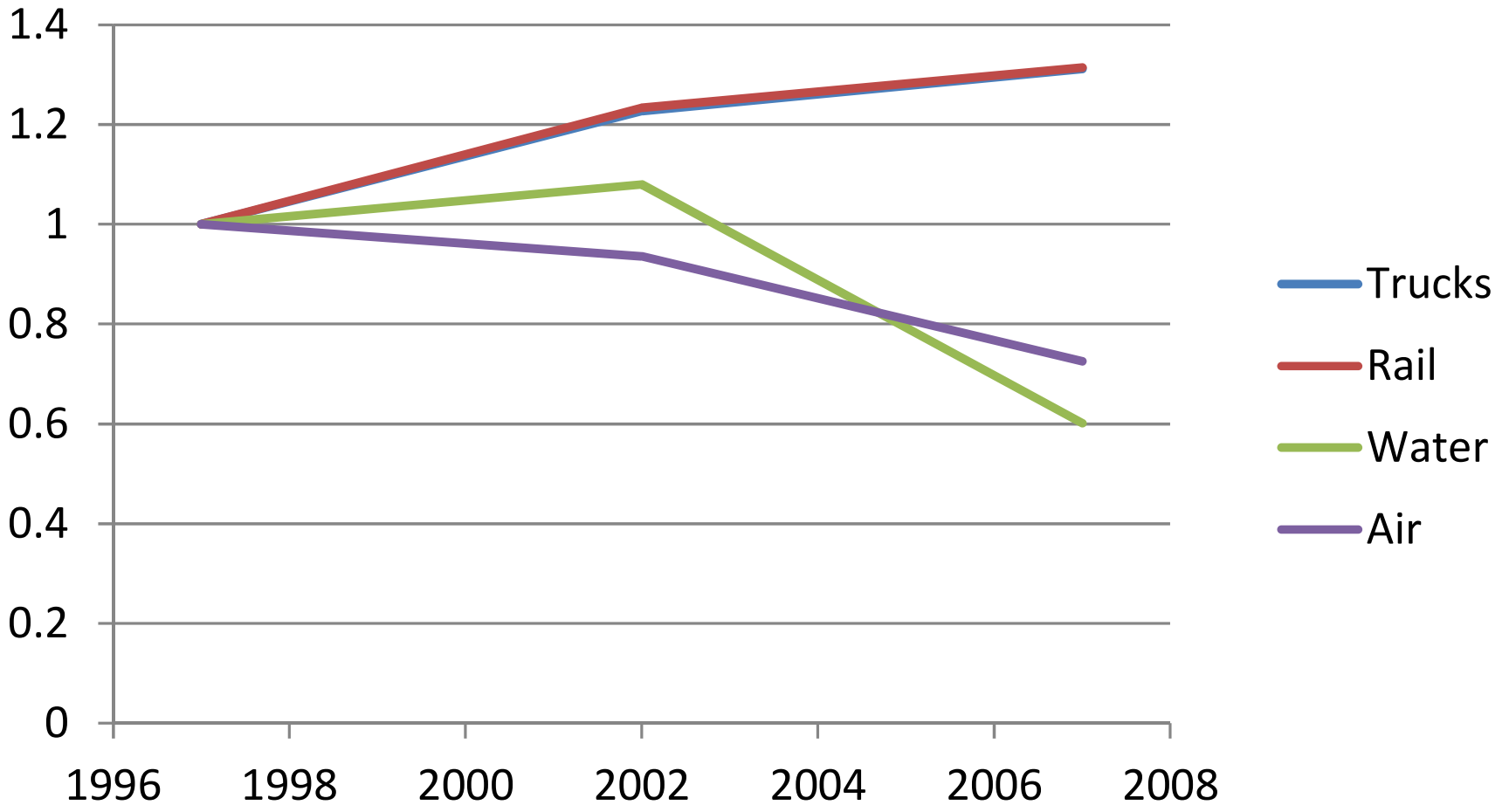
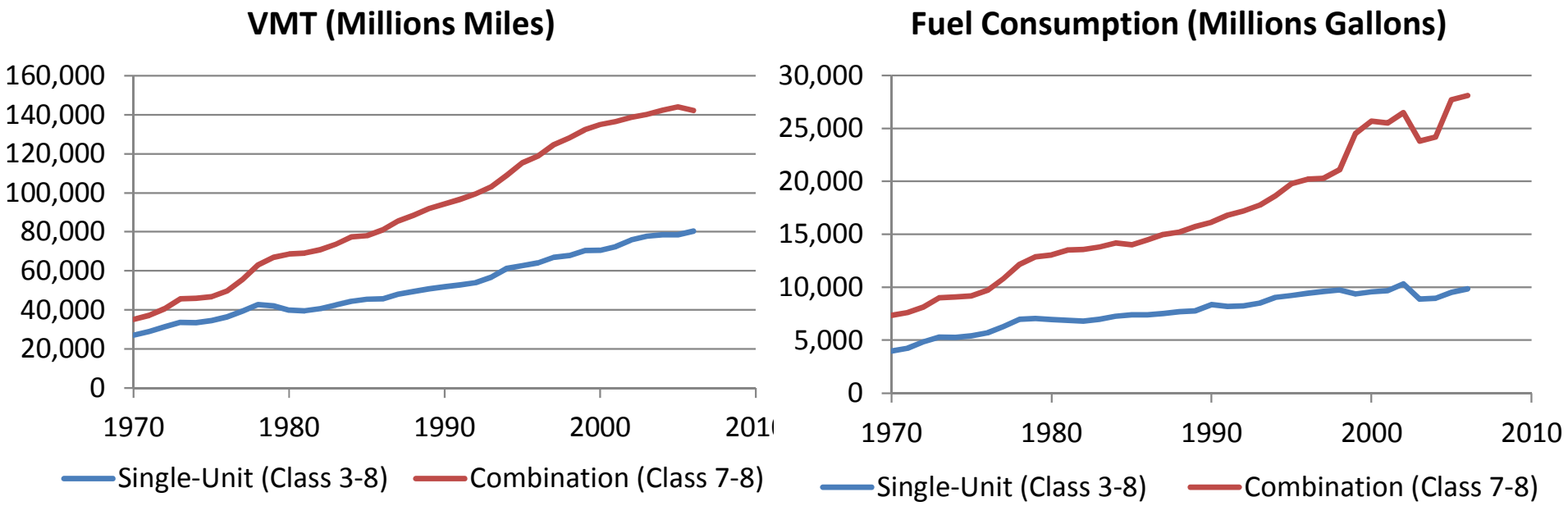


Figure 3: VMT and Fuel Consumption by Truck Type



Source: Transportation Energy Data Book

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Contribution of heavy-duty trucks to GHG emissions

Figure 4: medium and heavy duty trucks account for large share of GHG emissions

Table 1: GHG emissions by transportation mode

- Emissions from trucking have been growing more rapidly than other modes

Figure 5: Diesel and gasoline consumption over time

- Diesel fuel consumption has been growing more quickly than gasoline consumption
- High correlation between consumption and GDP

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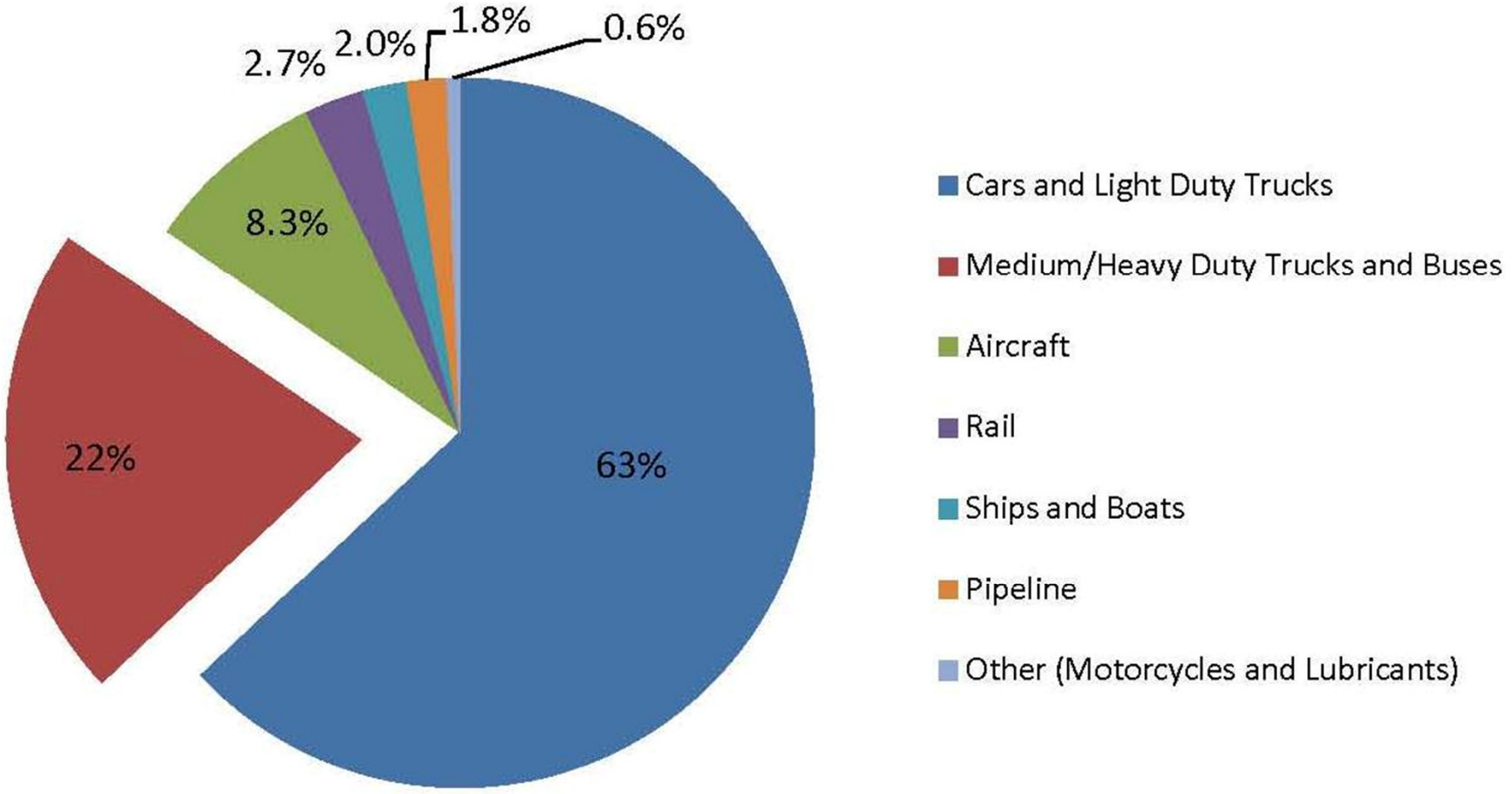
Figure 4: GHG emissions by travel model



Source: U.S. EPA, Inventory of Greenhouse Gas Emissions and Sinks: 1990-2008, published April, 2010

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Table 1: GHG Emissions (million metric tonnes CO2eq)

	1990	2000	2009	Percent Change
Trucks	231.1	354.5	365.6	58.2
Freight rail	34.5	42.8	37.2	7.8
Ships and other boats	30.6	48.3	13.5	-55.9
Freight total	356.0	510.5	467.9	31.4
Passenger total	1,145.7	1,391.8	1,326.1	15.7
Freight as % total transportation	23.0	26.4	25.8	12.2

Source: FHWA, Freight Facts and Figures 2011

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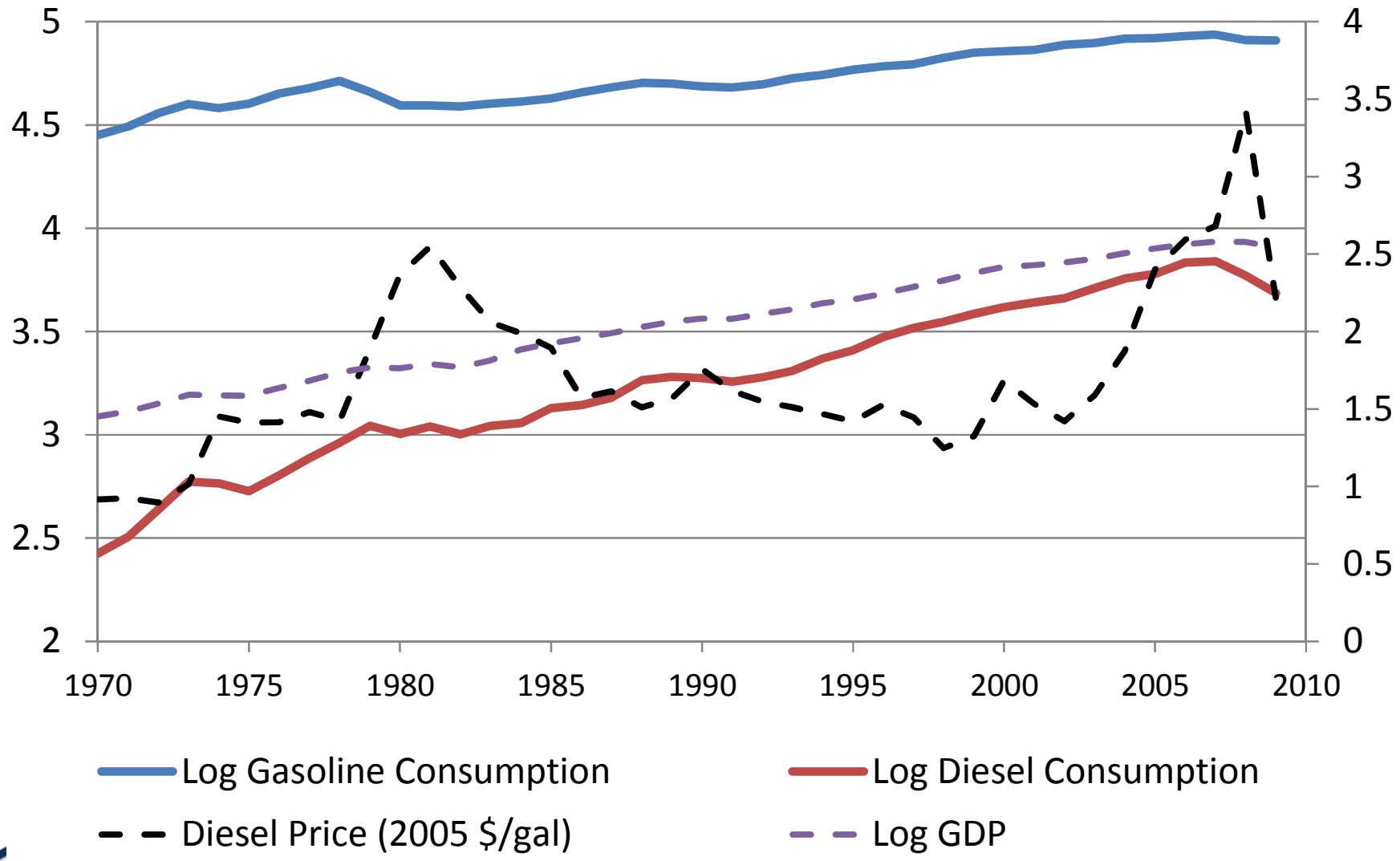
Figure 5: Fuel Consumption, GDP, and Fuel Prices



Sources: EIA State Energy Data System (Consumption and Fuel Price); BEA (GDP); BLS (CPI)

Accounting for the increasing GHG emissions

VMT and ton-miles have been increasing steadily

- 30 percent increase 1997-2007 (Figure 2)

Payload-specific fuel consumption (gallons per ton-mile) has decreased dramatically (Figure 6)

- PSFC has decreased much more for heavy-duty trucks than for passenger cars or light trucks
- But not as quickly as ton-miles have increased

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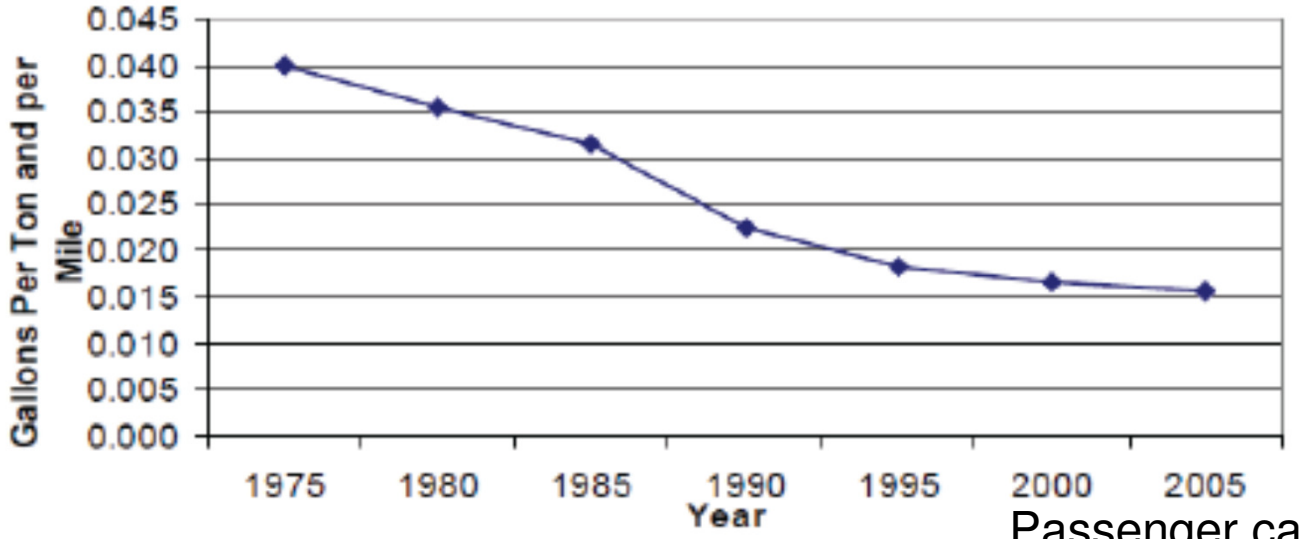
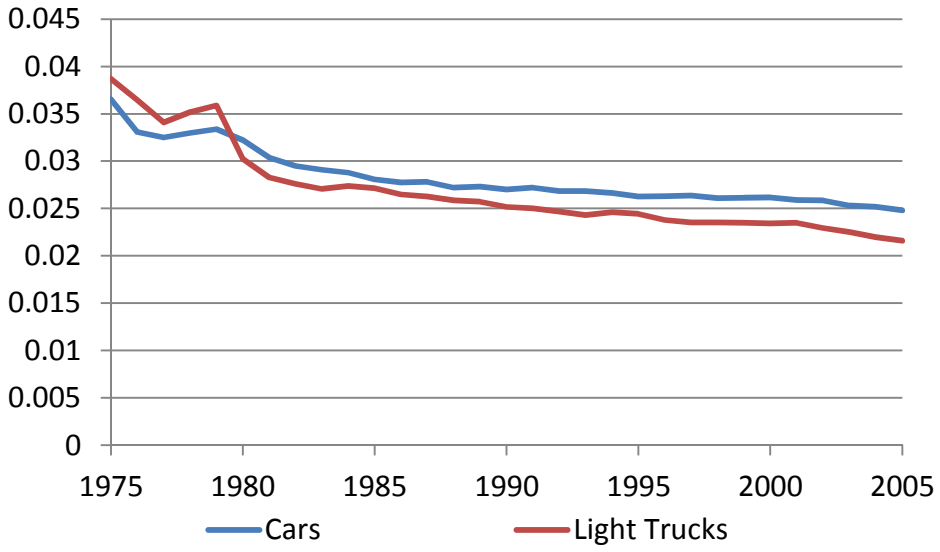
Figure 6: Payload specific fuel consumption by vehicle type

Heavy-duty trucks



Source: NAS (2010)

Passenger cars and light trucks



Source: EPA (2012)

What could be behind the changes in GHG emissions?

Greater demand for trucking services

- Is demand proportional to economic activity?

Mode shifting

- Do fuel prices, regional trends in economic activity, or other factors affect choice of rail, air, or truck?

Innovation and technology adoption

- Are carriers using better technology? Fuel prices, industry structure, or something else?

Changing utilization patterns

- More efficient networks, e.g., hub-and-spoke and GPS?

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VIUS: a deeper look at utilization and fuel consumption

Focus on class 8 tractors in 1982, 1992, 2002

Compare distributions of age, GVWR, VMT, ton-miles, and gallons per ton-mile over time

Comparing 1982 and 2002, the average truck:

- Is slightly newer and considerably larger
- Travels 10% more miles
- Carries 15 % more ton-miles
- Has 13% lower payload-specific fuel consumption

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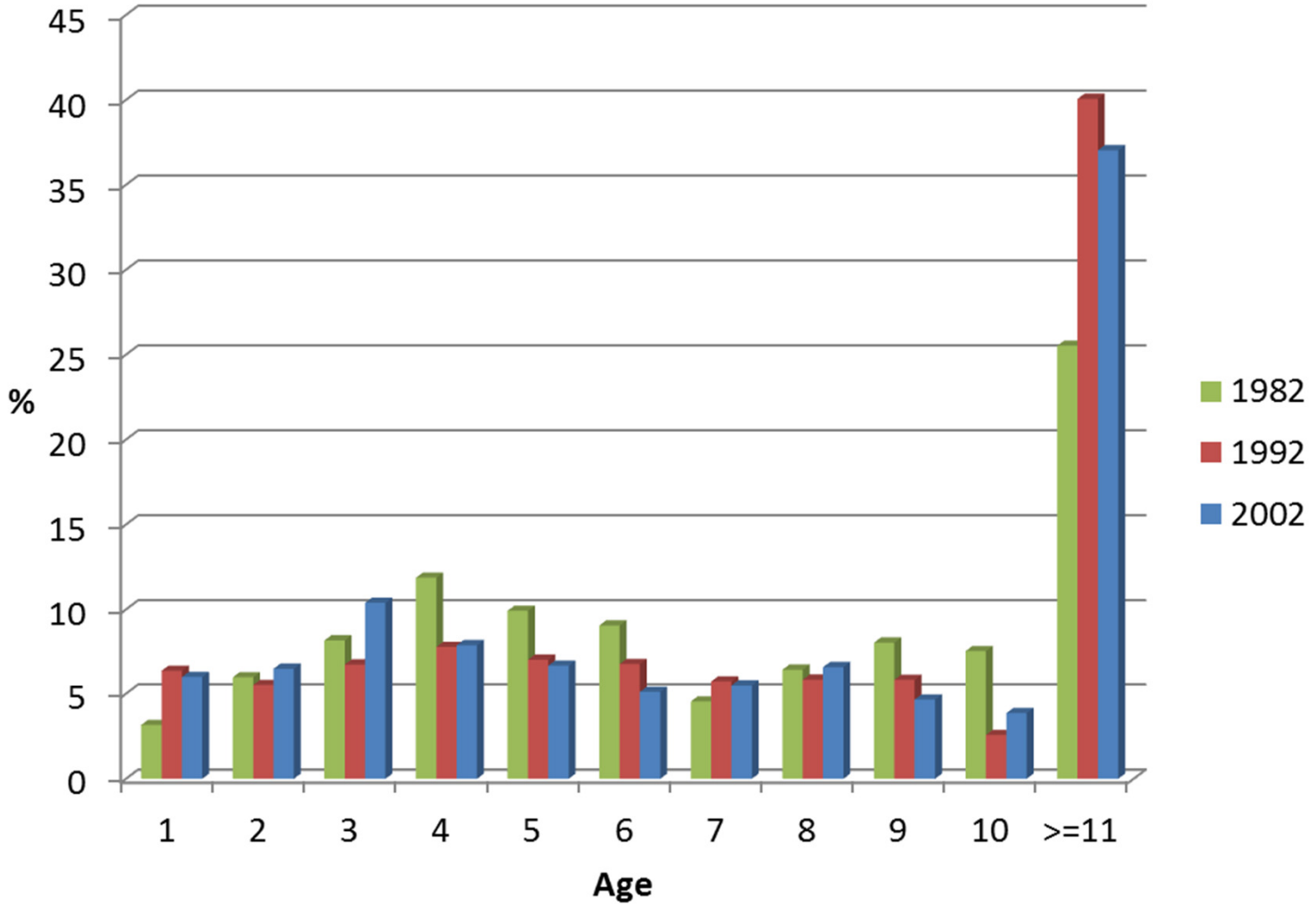
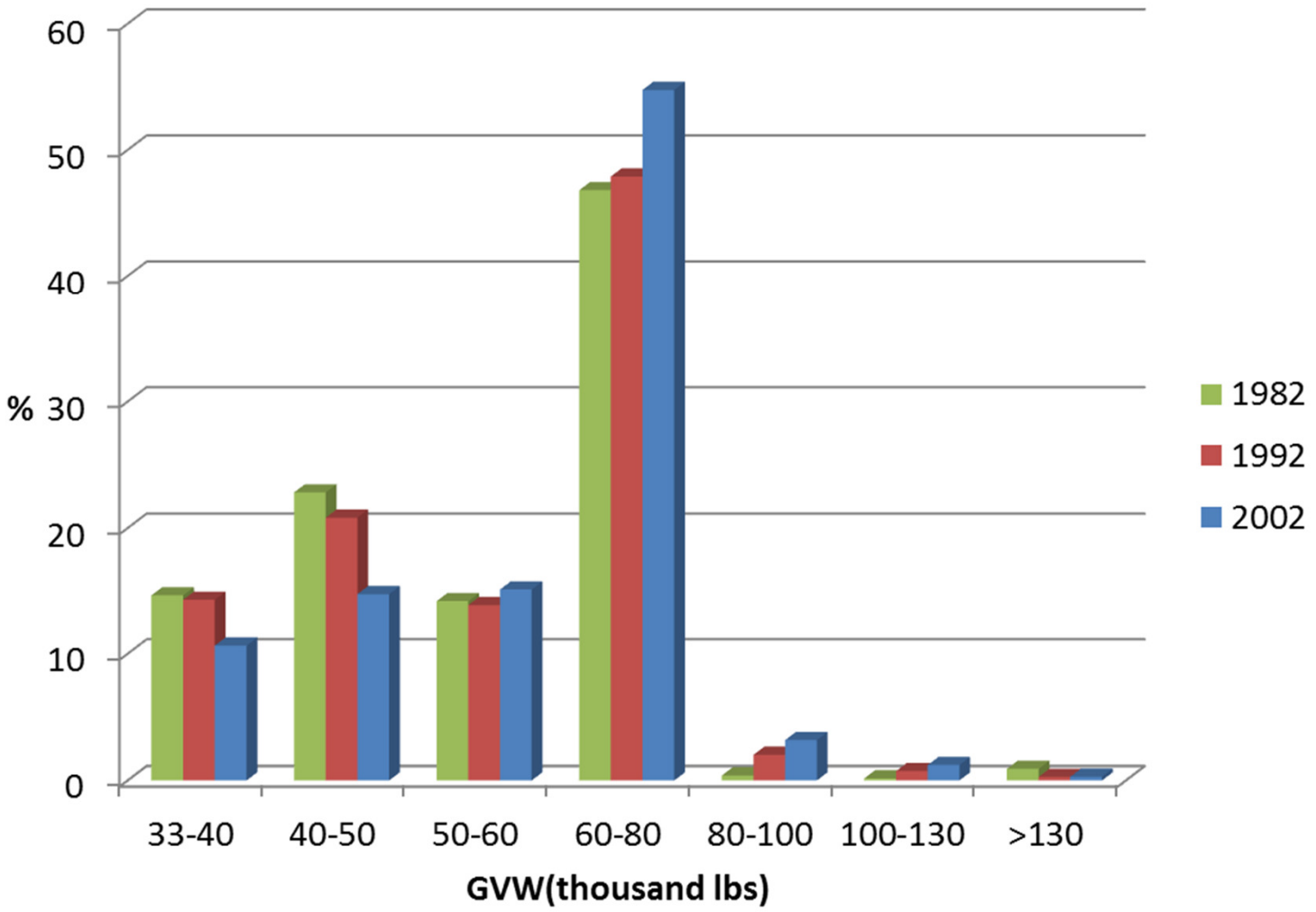
Source: VIUS, authors' calculations

Figure 7: Age for Class 8 Commercial Trucks



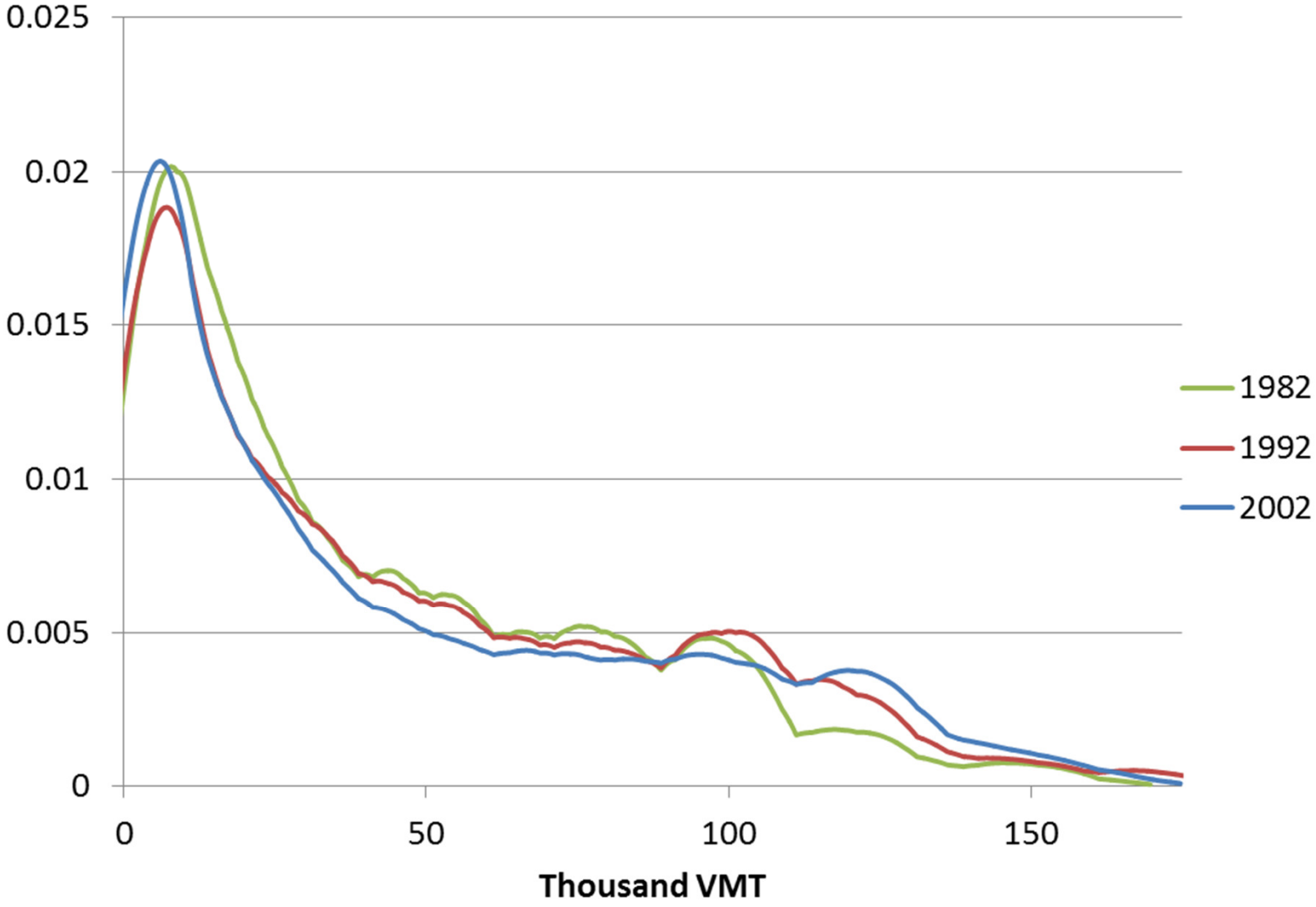
Source: VIUS, authors' calculations

Figure 8: GVWR for Class 8 Commercial Trucks



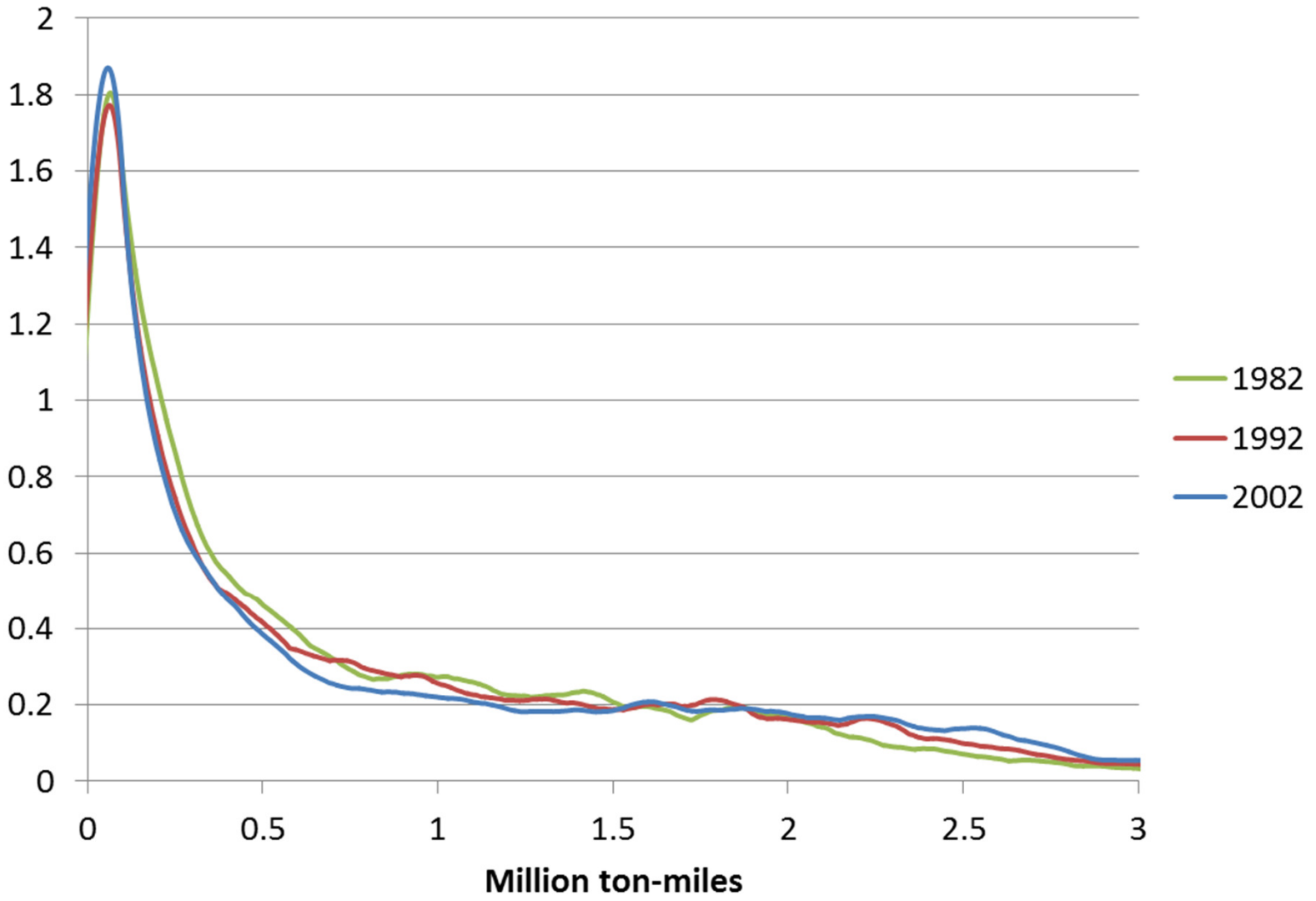
Source: VIUS, authors' calculations

Figure 9: VMT



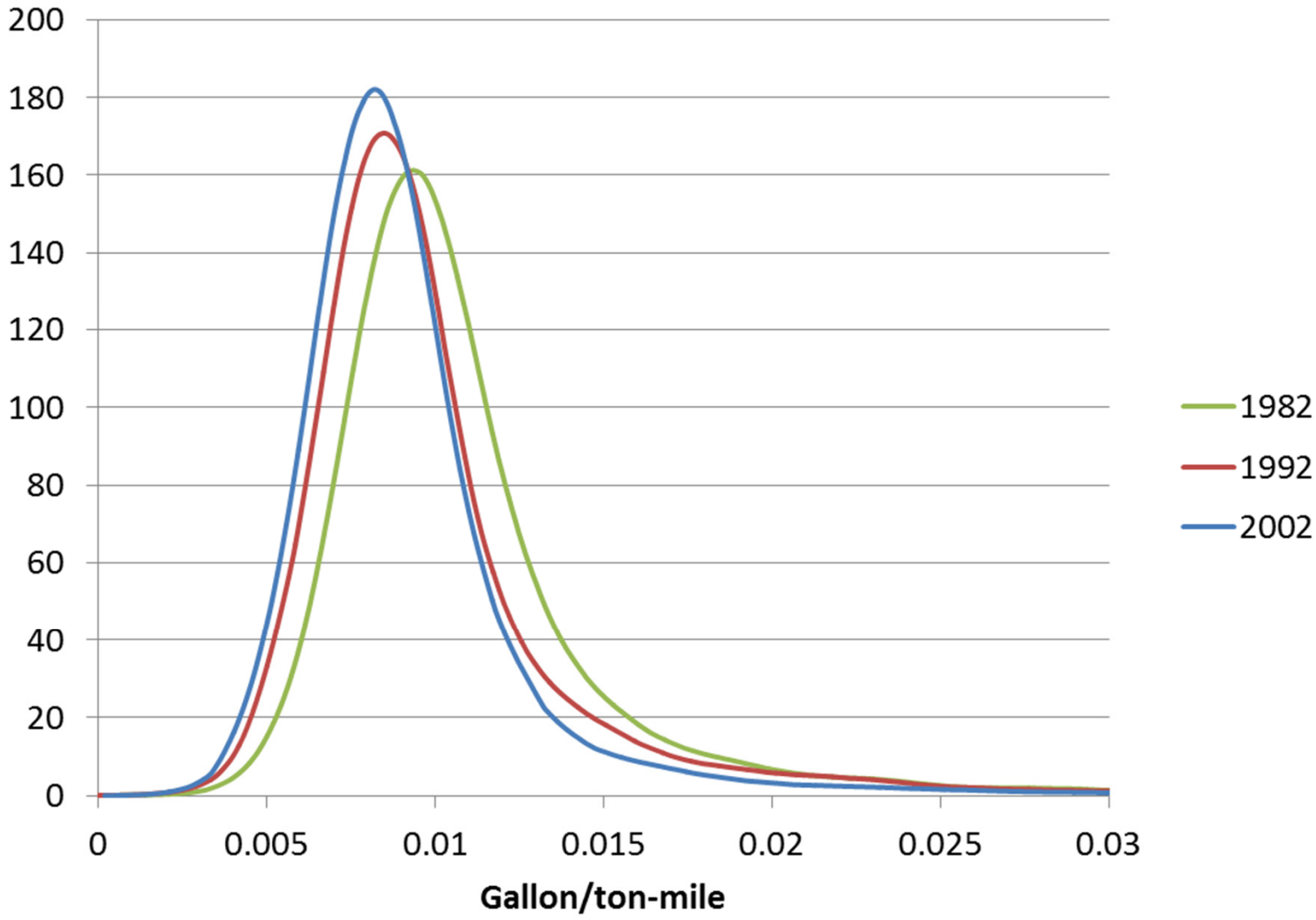
Source: VIUS, authors' calculations

Figure 10: Ton-Miles



Source: VIUS, authors' calculations

Figure 11: Gallons per Ton-Mile



Source: VIUS, authors' calculations

Summary and questions

Trucking plays a very important role in the economy, and fuel consumption and GHG emissions have been increasing

Greater ton-miles has been partially offset by lower payload specific fuel consumption

What is driving these trends?

- What are the main factors behind trucking demand?
- Why do carriers adopt better technology or change their utilization patterns?

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