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

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

Share of Value by Shipment Mode (Total = $9.5 Trillion)
- Trucks (87%)
- Rail (6%)
- Water (1%)
- Air (4%)
- Pipeline (2%)

Share of Ton-Miles by Shipment Mode (Total = 1 Trillion)
- Trucks (47%)
- Rail (47%)
- Water (6%)
- Air (<1%)

Source: 2007 Commodity Flow Survey
Note: Figures include single-mode shipments only
Figure 2: Growth in Ton-Miles (1997-2007, 1997 = 1)
Figure 3: VMT and Fuel Consumption by Truck Type

Source: Transportation Energy Data Book
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
Figure 4: GHG emissions by travel model

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<th>2000</th>
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Source: FHWA, Freight Facts and Figures 2011
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
Figure 6: Payload specific fuel consumption by vehicle type

Source: NAS (2010)

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?
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

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?