Financial Responsibility Requirements for Commercial Motor Vehicles

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

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FOREWORD

The minimum levels of financial responsibility for commercial motor carriers were established by Congressional legislation in the early 1980's. The question today is whether these levels should be raised, weighing the benefits of improved compensation of crash victims, internalization of freight and passenger transportation costs, and reduction of truck- and bus-involved crashes, with costs imposed on commercial motor vehicle (CMV) operators, the insurance industry and other relevant considerations. Affected motor carriers are for-hire general freight and passenger carriers in interstate commerce and hazardous materials carriers.

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16. Abstract

Minimum liability insurance levels and related requirements for motor carriers to demonstrate financial responsibility in case of damages from crashes were established in the 1980's by Congressional legislation. These levels have not been changed since then. The question is whether these levels should be raised, weighing the benefits of improved compensation of injured third parties, internalization of freight and passenger transportation costs, reduction of truck- and bus-involved crashes, costs imposed on commercial motor vehicle (CMV) operators, and other relevant considerations. Affected motor carriers are for-hire general freight and passenger carriers in interstate commerce and hazardous materials carriers.

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SI* (MODERN METRIC) CONVERSION FACTORS

TABLE OF APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	Millimeters	mm
ft	feet	0.305	Meters	m
yd	yards	0.914	Meters	m
mi	miles	1.61	Kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	acres	0.405	Hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME	1000 L shall be shown in m^3	
fl oz	fluid ounces	29.57	Milliliters	mL
gal	gallons	3.785	Liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		MASS		
oz	ounces	28.35	Grams	g
lb	pounds	0.454	Kilograms	kg
T	short tons (2,000 lb)	0.907	mega grams (or “metric ton”)	Mg (or “t”)
		TEMPERATURE	Temperature is in exact degrees	
°F	Fahrenheit	5 × (F-32) ÷ 9 or (F-32) ÷ 1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	Lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		Force and Pressure or Stress		
lbf	poundforce	4.45	Newtons	N
lbf/in^2	poundforce per square inch	6.89	Kilopascals	kPa

TABLE OF APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
Mm	millimeters	0.039	inches	in
M	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or “t”)	mega grams (or “metric ton”)	1.103	short tons (2,000 lb)	T
		TEMPERATURE	Temperature is in exact degrees	
°C	Celsius	1.8C + 32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		Force & Pressure Or Stress		
N	Newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

* SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003, Section 508-accessible version September 2009).

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

Acronym	Definition
AHAS	Advocates for Highway and Auto Safety
AIS	Abbreviated injury scale
ATA	American Trucking Associations
ATRI	American Transportation Research Institute
BASICs	Behavior Analysis and Safety Improvement Categories
CBA	Cost-benefit analysis
CAB	Central Analysis Bureau, a private company providing underwriting data for subscriber insurance companies
CAIP	Commercial Automobile Insurance Procedure
CMV	Commercial motor vehicle, a truck or bus
CPI	Consumer price index
CPSC	Consumer Product Safety Commission
CSA	Compliance, Safety, Accountability
FARS	Fatal Accident Reporting System database
FMCSA	Federal Motor Carrier Safety Administration
FHWA	Federal Highway Administration
GES	General Estimates System crash frequency database
HHG	Household goods
HM	Hazardous materials
HMIS	Hazardous Materials Information System
HOS	Hours of service
ICC	Interstate Commerce Commission
IRC	Insurance Research Council
ISO	Insurance Services Office, a private company that provides aggregated claims data to members
KABCO	A scale of crash severity ranging from fatality to property damage only
L&I	Licensing and Insurance

LTCCS	Large Truck Crash Causation Study
MAIS	Maximum AIS, taking the highest among multiple injuries
MCMIS	Motor Carrier Management Information System
NEISS	National Electronic Injury Surveillance System
NHTSA	National Highway Traffic Safety Administration
OMB	U.S. Office of Management and Budget
OOIDA	Owner-Operator Independent Drivers Association
SIC	Standard Industrial Classification
SMS	Safety Measurement System
TBI	Traumatic brain injury
USDOT	U.S. Department of Transportation
VMT	Vehicle Miles of Travel
VSL	Value of statistical life

EXECUTIVE SUMMARY

The Federal government has long required motor carriers, brokers, and freight forwarders to maintain certain levels of financial responsibility, either through insurance, a bond or other financial security as a means to enhance highway safety and protect carriers and the traveling and shipping public against dishonest and financially unstable brokers and freight forwarders. The Motor Carrier Act of 1935 first directed the establishment of Federal rules and regulations for interstate motor carrier operations that govern "security for the protection of the public." Over time, both Congress and the Federal government have taken numerous actions to address the levels of financial responsibility, most recently with the recent enactment of MAP-21. The current minimum levels of financial responsibility for commercial motor carriers were established by Congressional legislation in the early 1980's. Recently, there has been interest in determining whether the current mandated levels continue to accomplish these goals and whether victims of truck- and bus-related crashes are adequately compensated.[1]

The Office of Management and Budget (OMB) does not mandate the procedures or analytic methods to be used, and leaves the details of conceptual formulation and the task of finding relevant data to the proposing agency. It is clear, however, that the expected response will be an application of microeconomic analysis in the form of cost-benefit analysis when the economic impacts of the regulation exceed $100 million per year. FMCSA has sponsored a study by the Volpe Center to evaluate the adequacy and effectiveness of the current minimum levels of financial responsibility and to provide policy alternatives. The study is intended to be a preliminary exploration and assessment of the issues which could serve as background for possible future cost-benefit analyses.

THE MARKET FAILURE IS COST EXPORTING

Cost exporting is the shifting of costs of a good or service to entities other than producers or consumers. If producers can avoid paying some of the costs they incur, they will produce more output than is socially desirable and undercut those producers who internalize all their costs. Exported costs in the form of uncompensated injuries unfairly impose damages on innocent third parties. Insurance is a means for internalizing the costs of rare but costly events. It cannot cover every possible outcome, but it can spread the costs of catastrophic events across producers.

Costs to be Compensated

Estimating the full and exact cost of a single crash, or any crash, is difficult. Claims may be understated or overstated, judgments by juries may be biased, and out-of-court settlements may be compromised. In addition, the data may be imprecise, erroneous, aggregated, or approximate. Any source of data pertaining to crash costs needs to be interpreted carefully.

Driver fatalities, and damage to truck and cargo, are covered by the carrier in supplemental insurance if they wish to carry the coverage, but are not subject to financial responsibility

[1] Pursuant to the Moving Ahead for Progress in the 21st Century Act (MAP-21 (P.L. 112-141), signed on July 6, 2012, the Secretary of Transportation shall, every 4 years, issue a report on the appropriateness of the current minimum financial responsibility requirements and the current bond and insurance requirements and submit the report issued to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives.

requirements. The purpose of the regulation is to protect the public from loss for which they are not at fault. Compensation for damage is only provided by the carrier if the carrier is at fault.[2]

Regulated Entities

Three distinct groups of carriers, only some of which are carriers engaged in interstate or for-hire carriage, are covered by Federal insurance liability laws. The types, their minimum liability requirement, the estimated number of carriers in each market segment, and the estimated number of crashes per year are shown in Table 1. The vast majority of the regulated carriers are general freight carriers in for-hire service across State lines, and these carriers have the lowest requirement for liability coverage (private carriers are not included). Hazardous materials (HM) carriers are regulated whether for-hire or private, interstate or not, and passenger carriers are regulated if they are for-hire.[3]

Table 1. Motor Carriers Subject to FMCSA Financial Responsibility Regulations (March 2012)

Regulated Carrier Category	Liability Minimum	Estimated Number of Carriers	Estimated Number of Crashes/Year
For-Hire Interstate General Freight Carriers	$750,000	246,260	49,819
For-Hire and Private Carriers of Oil and Certain Types of Hazardous Waste	$1,000,000	28,926	28,854
For-Hire and Private Carriers of Other Hazardous Substances	$5,000,000	3,111	14,707*
For-Hire Passenger Carriers (Seating Capacity ≤15)	$1,500,000	2,767	269
For-Hire Passenger Carriers (Seating Capacity >15)	$5,000,000	6,912	3,290
Total		**287,976**	**96,939**

*The disproportionately high number of crashes in relation to the number of carriers in this category is due to the fact that most hazardous material carriers are larger, on average, than those in other carrier categories. Also, carriers are classified as "HM" if they carry any hazardous material; thus, most of the crashes in this category do not involve hazardous material.

[2] The Large Truck Crash Causation Study (LTCCS) estimates an overall 45 percent crash fault rate to the truck, and 30 percent for fatal crashes, which are the rates used throughout this study. Several other estimates of the truck at-fault share are much less, as low as 25 percent (ATRI, 2005). Guidelines for the determination of accountability are currently undergoing revision.

[3] Motor Common Carriers of Household Goods (HHG), Motor Contract Carriers of HHG, and U.S.-based Enterprise Carriers of International HHG must maintain a minimum of $750,000 of bodily injury and property damage liability insurance regardless of the gross vehicle weight rating (GVWR) of the vehicles they operate.

In addition to bodily injury and property damage liability insurance coverage, Motor Common Carriers of Property, Motor Common Carriers of HHG, U.S.-based Enterprise Carriers of International Cargo, and U.S.-based Enterprise Carriers of International HHG must maintain minimum levels of cargo insurance (Form BMC-34 for cargo liability) in the amount of:

- o $5,000 for loss of or damage to property carried on any one motor vehicle.
- o $10,000 for loss of or damage to property occurring at any one time and place.

MAP-21 § 32918 requires brokers and FFs to file evidence of financial responsibility as a condition for receiving and maintaining registration. It raises minimum broker surety bond/trust fund required from $10,000 (brokers of general freight) and $25,000 (brokers of HHG) to $75,000 for all brokers and freight forwarders.

MAGNITUDE OF THE PROBLEM

The extent of cost exporting is difficult to assess because there are very few pertinent data on the number of catastrophic injuries due to commercial motor vehicle (CMV) crashes, the number of undercompensated CMV crashes, the full cost of catastrophic crashes (including long-term cost of injury and rehabilitation), and the full statistical distribution of CMV crashes, especially of outlier crashes—those exceeding the current minimum levels of financial responsibility. Overall, however, CMV crashes are declining while traffic volume generally tends to increase; thus, cost-exporting crashes are potentially becoming a smaller share of total crashes.

Data on claims, judgments, and settlements do not necessarily represent actual or total costs. These data are seldom available for either individual or average crashes, and when they are, the sources can seldom be matched to other data on carrier attributes. Additionally, the problem of cost exporting has a secondary or underlying aspect, which also happens to be difficult to assess, and that is equity. OMB recognizes the issue of "distributional fairness" of regulatory action in its guidance on regulatory evaluation, but does not specify nor recommend particular approaches or solutions.

The average dollar claim for crashes is relatively low (e.g., $18,000[4] for general freight) compared to the mandatory minimums, but the distribution of claims has a long tail with small numbers of large claims. A plausibly shaped distribution (as shown in Figure 2) can be fitted to aggregated data, and frequencies calculated from the fitted data function for values not specifically identified. The procedures for applying this methodology using data from the Insurance Services Organization (ISO) are demonstrated in Appendix B.

A highly skewed distribution such as this one is much different than a more symmetrical one, such as a normal distribution. Whether the cutoff is made at $1 million or $10 million, there are still a few crashes at even higher cost levels. Thus, regardless of how high the insurance minimum, there will always be some crashes above that level. There is no realistic dollar amount that will necessarily ensure that every possible crash victim is fully compensated.

Applying the modeling procedures described above to the sparse data (from several sources) pertaining to each of the CMV types listed in Table 1 allows for the generation of estimates of the number of truck- or bus-caused crashes per year and that exceed the applicable insurance minimum liability. The results, based on truck- or bus-involved crashes with at least one fatality, are shown in Table 2. The percentages shown are for the total number of crashes for the type of carrier (not necessarily limited to regulated carriers). They are based on fatal accidents, as a measure of the likelihood of a costly crash that would exceed the insurance coverage.[5] Many power units are much more heavily insured or otherwise covered by financial capacity.

[4] Insurance Services Organization (ISO) data.

[5] Serious injuries can also result in costs that exceed current insurance limits. Injury data, however, are difficult to analyze for reasons described in the section "High Cost Crashes: Severe Injuries." There are an estimated 74 crashes per year that exceed insurance limits.

Table 2. Summary of Alternative Crash Rate Estimates: Crashes Per Year That Cost More Than Financial Responsibility Minimums

Carrier Class	Data Source (Year)	Estimated Count [a] *	Estimated Percent of Total Crashes [b]
General Freight	ISO (2005–10)	20	0.06%
General Freight	TTT (2010–11)	28	0.08%
General Freight	MCMIS (2010)	59	0.17%
General Freight	GES (2009)	23	0.13%
Hazardous Materials (HM)	HMIS (1998–2009)	2	0.07%
Hazardous Materials	MCMIS (2010)	14	0.26%
Passenger Carriers	ISO (2005–10)	1	0.09%
Passenger Carriers	MCMIS (2010)	4	0.34%

Assumptions:
[a] Number of crashes per year that exceed the liability limits for which the truck or bus is at fault.
[b] Total crashes of the carrier type.
* ISO reports have upper bound classifications of $500,000 to $999,999 and $1 million plus.
ISO = Insurance Services Organization.
TTT = *Tractor Trailer Torts.*
MCMIS = Motor Carrier Management Information System.
GES = General Estimates System.
HMIS = Hazardous Material Information System.

As seen in Table 2, most of the estimates of the share of crashes that exceed insurance limits are around 0.10 percent of crashes. Given the weak precision of the data and uncertain representativeness, the consistency among the different sources is strong. Compared to the total crashes in each category shown in Table 1, the number of high-cost crashes that exceed minimum insurance coverage is indeed small (less than 1 percent).

APPROACHES TO ADDRESS THE PROBLEM

The problem of externalized risk costs can be addressed from several directions, including more aggressive enforcement to prevent crashes or the establishment of a victim compensation fund, such as the United States Coast Guard Oil Spill compensation fund. The strategy receiving the most attention in this report is that of raising the requirements for liability insurance.

Inflation Adjustment for Costs per Crash

Minimum required liability levels were implemented in 1982 for freight carriers and in 1984 for passenger carriers. No analysis or documentation of their safety record has been found regarding the basis for choosing the particular minimum levels shown in Table 1, but the intention expressed in the legislative language was that the requirements should be high enough to incentivize insurers to investigate carriers seeking liability coverage and charge them suitable rates or refuse coverage. This suggests the limits might be adjusted for inflation.

Because freight railroads and trucking had recently been deregulated, there was concern that a flood of inexperienced and undercapitalized carriers would enter the market and fail to maintain adequate safety standards or provide compensation to crash victims. Not only would they create risks for motorists, they would lack sufficient financial resources to compensate for damages they caused.

If the current liability limits are adjusted only for the typical compensable unit costs (general consumption goods and medical costs) of crashes, the equivalents in today's dollars are shown in the third and fourth columns of Table 3. These numbers apply just two of many possible consumer price indices (CPI)—Core and Medical—that might be taken as indicators of price changes.

Table 3: Legislated Insurance Liability Limits Adjusted for Inflation

Carrier Type	1982/1984 Liability Limit Required	2011 Inflation Adjusted Liability Limit Core CPI	2011 Inflation Adjusted Liability Limit Medical CPI
General Freight	$750,000	$1,717,500	$3,203,649
HM (Low)	$1,000,000	$2,290,000	$4,271,531
HM (High)	$5,000,000	$11,450,000	$21,357,657
Small Bus	$1,500,000	$3,195,000	$5,547,301
Large Bus	$5,000,000	$10,650,000	$18,491,003

Note: Passenger carrier regulations were enacted in 1984 while other regulations were enacted in 1982; therefore, HM (high) and large passenger (bus) categories are inflated by different amounts.

If the liability limits were adequate when the legislation was enacted, then the current equivalents would be two to four times the original levels. No analysis has been identified that explains the levels chosen, and evaluation of their appropriateness via hindsight is probably impossible, but it is plausible to believe that the liability levels chosen were expected to cover all but the rarest of crashes.

COST BENEFIT EVALUATION

For proposed regulations having an impact of more than $100 million per year, a regulatory evaluation, of which a cost-benefit analysis is a major tool, is required. Raising insurance limits would be a significant regulatory action.

An increase in mandatory insurance coverage will necessarily lead to a change in the cost of operating CMVs, which will cause changes in market behavior in the industry. The evaluation challenge is to trace these marginal changes through to the impacts that can be valued, such as a reduction in CMV-involved crashes. These impacts are generally of six kinds:

- Reduce the exporting of crash costs onto the general public. If the minimum levels of coverage increase, then crash victims will recover greater monetary compensation from at-fault motor carriers. For severe crashes, the motor carrier may not have enough assets

to compensate the other parties involved, in which case the insurance payout may be the only form of remuneration that the victims or their families receive.[6]

- Remove unsafe carriers from the industry. If high-risk behavior such as unsafe driving and poor maintenance are associated with financially unhealthy carriers, increasing the minimum insurance levels may remove marginally profitable unsafe carriers from the roads.
- Improve the behavior of motor carriers that continue to operate. Raising the financial responsibility requirements will create an additional economic cost for motor carriers in the form of higher insurance rates. Higher rates convert potential liabilities and risks into financial instruments (i.e., monetizing potential liabilities and risks). Because the financial cost of this monetization is dependent upon demonstrating safe behavior, motor carriers have a stronger incentive to ensure both safe results and safe behavior.
- Reduce industry-wide crash costs. Raising the financial responsibility levels may remove unsafe carriers from the industry and will encourage safer behavior among remaining carriers. Both impacts will reduce the frequency of crashes and their associated costs.
- Improve efficiency of the insurance market. Because the current prescribed minimum levels of insurance do not cover catastrophic risk, screening out carriers at risk for high-cost crashes will improve the ability of the industry to match cost to risk.
- Loss of beneficial service. A loss of beneficial service might occur if otherwise safe carriers are driven out of the industry by higher insurance rates. Some of those carrier resources will be absorbed by carriers who continue to exist, but there likely will be an overall net loss of service.

A regulatory evaluation attempts to estimate the impacts of a regulatory change, comparing what will occur with the change against what would have happened without the change. In this case, increased insurance requirements will force all carriers not already insured at the higher level to pay for higher coverage in order to enter the market or stay in business. This change in the cost of carrier operation will create incentives for changes in behavior on the part of carriers and insurers, as well as lenders and other participants in interstate commercial freight and passenger markets.

Role of the Insurance Industry

The 1980 legislation was explicit about its expectation that increased mandatory insurance requirements would lead insurers to be diligent in selecting carriers to insure and to monitor them for safe behavior. Insurers will do this if it is in their financial interest to do so, and most insurers monitor risk-related indicators and exercise care in offering coverage and setting insurance rates.

Whether this has happened can be argued, but at current rate levels for minimum liability insurance, insurers may lack much incentive to scrutinize them carefully. There is also the well-known problem of "reincarnated" carriers that accumulate numerous violations (e.g., traffic violations, poor compliance, crashes) and simply change their names to evade detection and

[6] Anecdotal evidence can be found in *Tractor Trailer Torts*, and also supported by the observations of several interviewees.

implication. There is no empirical evidence to link these specific situations to cost-exporting crashes, but there is a considerable difference in crash frequency between, say, carriers with few compliance violations versus those with clearer indicators of poor safety behavior. By investigating such characteristics as drivers' speeding violations and carrier vehicle maintenance, and appropriately adjusting insurance rates, the relative odds of future crashes are potentially reduced.

Equity Impacts

In addition to the net changes in costs and benefits, a regulatory change will also produce transfers—i.e., create gainers and losers—that do not alter the social costs and benefits of the regulatory action. These transfers shift the distribution of income in some way and are referred to as equity impacts.

The magnitudes of these impacts and how they are passed from one person or entity to another through economic markets and administrative procedures depend upon such characteristics as competitiveness of the markets and price elasticities. If markets are competitive and costs are internalized, the final consumer ultimately pays for any costs that are imposed on the industry by regulation.

In the present instance, an increase in compensation to crash victims will result in monetary gains for crash victims and higher costs for insurers. Insurers, in turn, will pass the costs on to carriers in the form of higher insurance rates. These being competitive markets, carriers will pass the costs on to shippers, subsequently reflected in higher prices for consumers of the goods shipped. Income will be transferred from consumers, who pay more for their goods, to crash victims who receive more compensation. Profits of insurers and carriers will be largely unchanged.

Although not the primary mission of the Federal Motor Carrier Safety Administration (FMCSA), equity impacts are a legitimate concern of regulatory evaluation. Whether innocent third-party victims of truck- or bus-caused crashes are adequately compensated is an empirical question with important implications. There is considerable anecdotal evidence of instances of full compensation denied because of insufficient insurance or legal obstacles.

It has also been argued, however, that claim amounts sometimes exceed actual costs, in the form of intentional fraud, exaggerated injuries, or a tendency to inflate losses, referred to by Cass Sunstein as "illusory losses," due to court underestimation of victims' hedonic adaptation.[7] Contingency fees for legal representation may benefit injured victims that lack resources to sustain litigation, but they also create a strong incentive to maximize claims and also divert a significant share of insurance payments away from victim compensation.

SUMMARY OF RESULTS

The findings overall provide preliminary justification in favor of increasing the current levels of financial responsibility:

[7] Cass R. Sunstein, "Illusory Losses," presented at the American Law & Economics Association Annual Meetings 2008, Berkeley Economic Press (2008). http://law.bepress.com/alea/18th/art36

- The source of market failure is cost exporting, i.e., imposing the risk of costly crashes on the public.
- At current levels, liability insurance does not appear to be functioning effectively as catastrophe coverage, as evidenced by the small but significant share of crashes that exceed the current limits.
- At higher liability levels, insurers would have more at stake and could be incentivized to make greater efforts to screen out unqualified carriers and adjust insurance rates accordingly.
- Larger general-freight carriers already voluntarily hold more insurance coverage than the minimum, but a large number of smaller carriers could be affected by higher insurance requirements above $1 million.
- Because the economic impacts of a regulatory change would be greater than $100 million per year, a full cost-benefit analysis will be required.
- Other mechanisms should be considered for addressing both the efficiency impacts of cost exporting and the equity impacts of under-compensation.

1. Review of Financial Responsibility Authority

The Federal government has long required motor carriers, brokers, and freight forwarders to maintain certain levels of financial responsibility, either through insurance, a bond or other financial security as a means to enhance highway safety and protect carriers and the traveling and shipping public against dishonest and financially unstable brokers and freight forwarders. The Motor Carrier Act of 1935 first directed the establishment of Federal rules and regulations for interstate motor carrier operations that govern "security for the protection of the public."[8] Over time, both Congress and the Federal government have taken numerous actions to address the levels of financial responsibility, most recently with the recent enactment of MAP-21.

Motor Carrier Act of 1935

The first major legislative directive regarding financial responsibility levels for the motor carrier industry is found in the Motor Carrier Act of 1935. This Act directed the Interstate Commerce Commission (ICC) to "prescribe reasonable rules and regulations" that included insuring financial responsibility as a condition for receiving an operating license for motor carriers and brokers. The ICC, following an investigation, implemented regulations requiring the following levels (Table 1) of liability protection for motor carriers beginning November 15, 1936:[9]

Table 3 a- ICC Motor Carrier Act of 1935- Motor Carriers- Bodily Injury Liability-Property Damage Liability

	Limit for bodily injuries to or death of one person	Limit for bodily injuries to or death of all persons injured or killed in any one accident *	Limit for loss or damage in any one accident to property or other**
Motorcoach (Seating capacity)			
7 passengers or less	$5,000	$15,000	$1,000
8 to 12 passengers inclusive	$5,000	$20,000	$1,000
13 to 21 passengers inclusive	$5,000	$30,000	$1,000
21 to 30 passengers inclusive	$5,000	$40,000	$1,000
31 passengers or more	$5,000	$50,000	$1,000
All motor carriers of property	$5,000	$10,000	$1,000

* Subject to a maximum of $5,000 for bodily injuries to or death of one person
**Excluding cargo

[8] Motor Carrier Act of 1935
[9] 1 Federal Register (FR) 1163, August 21, 1936

The ICC also decided a person seeking authority to operate as a broker must furnish "a bond or other security approved by the Commission, in an amount of not less than $5,000, and in such form as will insure the financial responsibility of such broker and the supplying of authorized transportation in accordance with the contracts, agreements, or arrangements therefor."[10] In 1977, the ICC increased (with the exceptions of household goods brokers) the required amount of bonding to $10,000.[11]

Motor Carrier Act of 1980

On July 1, 1980, the President signed the Motor Carrier Act of 1980, Pub. L. 96-296 (MCA), which greatly deregulated the motor carrier industry. Section 30 of the MCA set forth minimum levels of financial responsibility which must be maintained by motor carriers of property. The MCA also gave the Secretary the authority to reduce those levels, by regulation, for up to a 2-year "phase-in period" provided the reduced levels would not adversely affect public safety and would prevent a serious disruption in transportation service. The Secretary exercised this authority to delay the statutory minimums in implementing this section.[12]

The "permanent" minimum financial responsibility level set by the MCA is no less than $750,000 for motor carriers of property, $5 million for hazardous materials, and $1 million for any vehicle transporting any material, oil, substance, or waste other than bulk.[13] The "phase-in" levels were set at $500,000 for general commodities, $1 million for hazardous materials, and $500,000 in the case of any material, oil, substance, or waste other than bulk.

The purpose of section 30 is "to create additional incentives to carriers to maintain and operate their trucks in a safe manner as well as to assure that carriers maintain an appropriate level of financial responsibility."[14] The legislative history of section 30 indicates that setting higher levels of financial responsibility would address two concerns: First, the higher levels would inhibit from operating "truckers who might have little concern for the safe operation and maintenance of their vehicles, thereby posing a threat to those who share the highways with them."[15] Second, the higher levels would ease concerns that the largely deregulated industry would put pressure on safe operators to cut costs to meet the prices of its competitors, "some of which may cut costs by operating in violation of minimum safety standards."[16]

The legislative history does not provide a clear direction for why the levels were set at the stated amounts. However, the House Committee Report to MCA referenced a 1979 report by the National Transportation Policy Study Commission which recommended a level "sufficient to require 'on site' inspection by the insurance company, with minimums to be

[10] 1 FR 1161, August 21, 1936
[11] 42 FR 21783, April 29, 1977
[12] 46 FR 30983, June 11, 1981.
[13] Section 30 of the Motor Carrier Act of 1980 (P.L. 96-296)
[14] H. Comm. Rept. 96-1069, "Motor Carrier Act of 1980", p. 41.
[15] Ibid. p. 6.
[16] Ibid. p. 43

updated regularly."[17] In explaining the role of financial responsibility levels, the Commission provided evidence that the DOT did not have personnel or funds to enable it to effectively enforce the Federal motor carrier safety regulations.[18] Increased oversight by the private sector would be one method to improve safety oversight.

On January 6, 1983, the President signed into law the Surface Transportation Assistance Act of 1982, Pub. L. 97-424, which contained an amendment in Section 406 that partially responded to a recommendation by the Secretary to extend the allowable "phase-in period" from two years to three and a half years. The current minimum financial responsibility levels took effect on January 1, 1985.[19]

Bus Regulatory Reform Act of 1982

On September 20, 1982, the President signed the Bus Regulatory Reform Act of 1982, Pub. L. 97-261 (the Act). Section 18 of the Act establishes minimum levels of financial responsibility covering public liability and property damage for the transportation of passengers by for-hire motor vehicles in interstate or foreign commerce.

The Act establishes minimum levels of financial responsibility that must be met by affected persons as of November 19, 1983 unless the Secretary of Transportation issues regulations that require higher or lower levels. The Secretary may promulgate those regulations to require higher levels and the Secretary's authority to reduce these levels is limited. The statute precludes the Secretary from reducing the minimum levels below specified levels and provides that the authority to impose reduced levels applies only to a period of up to 2 years beginning either on: (1) The effective date of the rule provided that the rule is made effective by November 19, 1983, or (2) the 366th day after the effective date of Section 18 of the Act provided a rule is made effective 1 year after enactment or later.

The purpose of the financial responsibility provision of the Bus Regulatory Reform Act of 1982 is to create additional incentives to motor carriers to operate their buses in a safe manner and to assure that they maintain adequate levels of financial responsibility sufficient to satisfy claims covering public liability and property damage. The legislative history of Section 18 indicates a congressional belief that the establishment of minimum levels of financial responsibility to enhance safety will also ensure that adequate sources of compensation are available to compensate those who may be injured while traveling by bus. It is also believed, given the interstate nature of many motor carrier operations, a single Federal standard for financial responsibility coverage will be more efficient for carriers and more equitable and certain for consumers.

Interstate Commerce Commission Termination Act of 1995

[17] Ibid. p. 43

[18] National Transportation Policy Study Commission, "National Transportation Policies Through the Year 2000" Final Report, June 1979, p. 279

[19] Section 406 of the Highway Improvement Act of 1982, P.L. 97-424; 49 FR 27288 July 2, 1984.

On December 29, 1995, the President signed the Interstate Commerce Commission Termination Act of 1995, Pub. L. 104-88 (ICCTA). ICCTA transferred many of the authorities pertaining to the regulation of brokers and freight forwarders to the Secretary and re-codified the Interstate Commerce Act and related laws as subtitle IV of title 49, United States Code.

Moving Ahead for Progress in the 21st Century Act

On July 6, 2012, the President signed the Moving Ahead for Progress in the 21st Century Act, Pub. L. 112-141 (MAP-21). Section 32104 of MAP-21 directed the Secretary to issue a report on the appropriateness of (1) the current minimum financial responsibility requirements for motor carriers carrying property and carrying passengers; and (2) the current bond and insurance requirements for freight forwarders and brokers. This section also directed the Secretary to determine the appropriateness of these requirements every four years following the issuance of the first report.

Section 32918 also required each broker and freight forwarder to provide financial security of $75,000, an increase of the previous level of $10,000. This new financial security level will go into effect on October 1, 2013.

2. COST EXPORTING AND LIABILITY INSURANCE

A chief goal of the Federal Motor Carrier Safety Administration (FMCSA) is to reduce the costs associated with truck- and bus-related crashes by reducing both their frequency and severity, and to ensure that crash victims receive adequate compensation for damage and injuries.

Financial responsibility is demonstrated in the form of liability insurance coverage, the posting of bonds, letters of credit, and other demonstrations of financial reserves that could be applied to compensation of damages in case of a crash. The insurance liability minimums are the most common form of demonstrating financial responsibility, and it is these levels that are stated in FMCSA's regulations Part 387, and serve as the focus of attention here for assessing the adequacy of financial responsibility requirements.

2.1 HISTORY OF TRUCKING INSURANCE REGULATION

When trucking deregulation was enacted in 1980, barriers to entry into the industry were virtually eliminated, but insurance requirements have not been adjusted since then. Congress believed—as expressed in the legislative language—that financial responsibility requirements were needed to protect the public from undercapitalized or inexperienced carriers who might not be willing or able to pay the damages from crashes they caused.[20] The primary instrument of financial responsibility is the requirement to carry liability insurance at a level of $750,000 per occurrence for general freight carriers and higher amounts for hazardous materials (HM) and passenger carriers.

2.1.1 Changes Since Enactment

Medical costs and estimates of the value of a statistical life (VSL) have increased since 1980. Since the deregulation legislation that set the current limits, much has occurred:

- Unit costs of such components of crash costs as medical services and the VSL have increased substantially since 1980.
- Crash frequency has declined, but the cost of crashes has increased.
- Insurance rates for the same level of coverage have decreased in nominal dollars, and thus even more in real (inflation adjusted) dollars.
- The freight trucking insurance market seems to accept $1 million as the standard minimum coverage.

Other things have changed as well, including the effectiveness of emergency services and medical treatments and the financial capacity and interests of the insurance industry. Some

[20] U.S. Congress (1980), 49 USC 31139 - Sec. 31139.

factors suggest that current liability limits ought to be higher, but others seem to argue against higher limits. These topics are addressed below.

2.1.2 The Problem of Undercompensated Injuries

Compensation is an equity issue, while crash reduction is an economic efficiency objective. Crashes involving a commercial motor vehicle (CMV) may be caused by unsafe driver behavior or by unpredictable random events, but in any case it is desirable to avoid imposing costs on innocent third parties. The empirical problem is to determine the extent by which carriers are able to export costs by failing to adequately compensate victims, and the policy problem is to find ways to correct the under-compensation.

Evidence of a cost exporting (or externality) problem in the regulated commercial freight and passenger sectors is anecdotal, but statistically it is a very small share of carriers and crashes. Some cases, however, appear to greatly exceed the mandatory insurance levels, and even a single fatality generates a nominal social cost that is a multiple of the insurance level.[21] The number of crashes whose costs exceed the insurance maximum—where the truck is at fault and compensation beyond the insurance level is not paid—is unknown, but may be in the range of 30 to 100 crashes per year (this question is studied in more detail in Section 2).

2.1.3 Prevention Versus Compensation

Because changes in mandatory liability limits have both efficiency (e.g., changes in costs for carriers and insurers, and changes in carrier operating behavior) and equity implications, both crash prevention and adequacy of compensation must be addressed analytically.

While crash frequency is reducible, crash occurrence is inevitable. It is necessary, therefore, to be prepared to provide compensation to the extent feasible. Preventing crashes is an economic efficiency problem, subject to cost-benefit analysis (CBA), even though the quantitative estimates may be imprecise. Compensation, on the other hand, is largely an equity problem; there is no right answer, even in principle. Society sets a standard for fairness, and then it seeks the least-costly way to achieve it. Thus prevention and compensation must be pursued in tandem.

The underlying problems to be addressed are how to provide compensation for victims of CMV-at-fault crashes whose costs to the victims exceed mandatory insurance limits that the carrier is unwilling or unable to exceed, and how to reform or remove carriers from service due to detrimental safety behavior, before they have a serious crash.

Each of these has many aspects to be considered, but fundamentally they address compensation to crash victims and prevention of crashes.

[21] U.S. Department of Transportation (USDOT) policy, based on the value of a statistical life (VSL) stated in USDOT/Office of the Secretary of Transportation (OST) (2011).

2.2 ECONOMIC EFFICIENCY DISTINGUISHED FROM EQUITY IMPACTS

Raising liability requirements will have both economic efficiency impacts and equity impacts. Cost exporting, in the form of costs imposed unwillingly on innocent third parties, has negative consequences on two primary grounds:

- Efficiency: Misallocation of resources occurs if producers (carriers) do not take into account all of the costs they create in producing the service. In this case, the cost is the risk of injury to others. When the carrier can escape some of the costs of crashes by failing to provide compensation for injuries, the carrier may not exercise sufficient caution to avoid crashes. This might be reflected in inadequate safety training, lack of compliance with safety regulations, poor maintenance of the vehicle, driver fatigue, and other safety behavior factors. The inefficiency of cost exporting, in economic terms, is too much freight carried and too many vehicle miles driven with too little safety.
- Equity: In-kind income transfers occur between carriers and crash victims, in the form of injuries for which compensation is insufficient.

Efficiency impacts are investigated by applying the principles and methods of CBA, as discussed later. Inadequate compensation or overcompensation are studied in this section in the context of possible equity impacts.

Even if carriers are required to carry minimum levels of bodily injury insurance or other documentation of financial responsibility, victims of crashes may not be adequately compensated for their injuries. This can occur if actual injuries exceed liability limits and the carrier lacks or hides other cash or assets that might cover the victims' costs. Inadequate compensation may also occur if insurers fail to pay judgments for which they are responsible, if victims are deterred from making legitimate claims to which they are entitled, if jury awards are inadequate, or if carriers are declared to be not at fault when in fact they caused the crash. Costs may be ill-defined or difficult to measure objectively.

2.2.1 Equity Impacts of Cost Exporting

Equity is not directly subject to CBA, but can be incorporated into the CBA framework. The vast majority of CMV-caused crashes have relatively small cost consequences, and the costs are easily covered within the limits of mandatory liability insurance. A small share of crashes creates costs that exceed the mandatory insurance requirements. A portion of these costs are covered by other insurance policies or financial instruments carried by the carrier above the minimum required level, including borrowing and cash reserves. Another portion of these high cost crashes would be borne by insurance companies if the mandatory limits were to be raised. A final portion of high-cost crashes would fall outside existing compensation instruments even if the minimum liability were raised. It is the next to last of these—costs that are not currently compensated but would if limits were higher—that is of concern here.

There is no absolute standard of equity. A neutral equity impact occurs if there are no net transfers between any parties, an essentially impossible goal, and pointless: at least some change is intentional. A practical goal is to avoid actions that make the distribution of income more unequal. Undercompensated crash victims may have less income than those receiving

fuller compensation because those with more income have better means, but this cannot be confirmed empirically.

Sympathy is duly felt for victims maimed or killed by drunk drivers or truckers that fall asleep at the wheel. Thus it is desirable to improve the timeliness and accuracy with which compensation is provided, without adding unduly to transaction costs such as expensive court proceedings.

This is difficult for many reasons, including the difficulty of placing dollar values on debilitating injuries and other losses, disagreement about who is responsible and should pay, and what costs are compensable. In situations where damages are in-kind—as opposed to damages with clear market value—and also involuntary, there are likely to be legal proceedings that produce highly variable outcomes.

2.3 ORIGINAL LEGISLATIVE INTENT

The initial 1980 legislation that enabled trucking deregulation contained many expressions of expectations about what would occur in the trucking industry under the new rules. These expectations included:

- Because barriers to entry into the industry were being removed, a "flood" of new and probably small undercapitalized carriers was anticipated.
- The volume of new entrants would be too large for the responsible Government agency (in the absence of the Interstate Commerce Commission [ICC]) to monitor adequately.
- In addition to State enforcement and Federal regulatory programs, the Federal Government would need the assistance of insurance companies to screen and curtail unqualified carriers.
- There was at least an implicit expectation that the limits would be reviewed periodically and adjusted as necessary.[22]

Regulated carriers fall into three categories: for-hire general freight, HM, and passenger.

2.3.1 Regulated Entities

Three distinct groups of carriers—with two divided into subgroups—are covered by Federal insurance liability laws, not all of which are engaged in interstate or for-hire transportation. The types, their minimum liability requirements, and the estimated number of carriers in each market segment are shown in Table 4. The vast majority of the regulated carriers are general freight carriers in interstate for-hire service, and these carriers have the lowest requirement for liability coverage. HM carriers are regulated whether for-hire or private, interstate or intrastate, and passenger carriers are regulated if they are for-hire.

[22] Pursuant to the recently enacted legislation "Moving Ahead for Progress in the 21st Century Act'' (MAP–21), the Secretary of Transportation shall issue, every 4 years, a report on the appropriateness of the current minimum financial responsibility requirements.

Table 4. Carriers Subject to Financial Responsibility Regulations in the U.S. (March 2012)

Regulated Carrier Category	Liability Minimum	Estimated Number of Carriers	Estimated Number of Crashes/Year
For-Hire Interstate General Freight Carriers	$750,000	246,260	49,819
For-Hire and Private Carriers of Oil and Certain Types of Hazardous Waste	$1,000,000	28,926	28,854
For-Hire and Private Carriers of Other Hazardous Substances	$5,000,000	3,111	14,707
For-Hire Passenger Carriers (Seating Capacity ≤15)	$1,500,000	2,767	269
For-Hire Passenger Carriers (Seating Capacity >15)	$5,000,000	6,912	3,290
Total		**287,976**	**96,939**

Source: The numbers are based on a matchup of records from MCMIS and L&I. See Appendix F for details on methodology and limitations.

2.4 CARRIER INDUSTRY STRUCTURE

Trucking is a low profit margin business, and profitability can depend upon small cost savings. There are two broad categories of carriers: small/medium size carriers with little equity, and large carriers that are self-insured and relatively safe.[23] Smaller carriers seem to be especially sensitive to operating costs, including insurance and fuel. The motor carrier industry as a whole can be roughly divided into two groups, as described in Table 4. The upper tier carriers are and will likely be little affected by financial responsibility requirements and rarely engage in cost exporting.[24]

The lower tier carriers, in contrast, may not necessarily internalize safety costs and may need to be constrained through financial responsibility requirements. Studies have shown that safety measures and outcomes are correlated with the net worth of the carrier.[25]

[23] Motor carrier size classifications vary by source and context.
[24] Motor Carrier Management Information System (MCMIS) and Licensing and Insurance (L&I) (March 2012).
[25] Lepofsky et al. (2007).

Table 5. General Characteristics of Two Primary Carrier Subsectors

Lower Tier: Small and Medium Carriers	Upper Tier: Large Carriers
≤ 500 power units per carrier[a]	> 500 power units per carrier
≤ $100 million in revenues	> $100 million in revenues
Vast majority of all carriers	Vast majority of all power units
Somewhat higher crash rate per power unit	Lowest crash rate per power unit
Low or modest net worth	Highly valuable net worth
May rent, lease, or contract for assets[b]	Assets owned by carrier
Minimal to modest safety programs	Safety programs central to carrier business model
Meet only the minimum insurance requirements, do not carry umbrella or excess coverage, and exercise little risk management	Comprehensive integrated insurance coverage as part of detailed risk management plan

[a] Carriers of certain goods (mostly agricultural) are not required to name their insurance companies even though they are required to carry insurance, as declared by filing an MCS-90. Private carriers are not required to demonstrate financial responsibility, perhaps on the rationale that their owners will be responsible for injuries caused by their carriers.

[b] An exception would be independent owner-operators.

Carriers operating on narrow profit margins may be tempted to push safety bounds in order to augment revenues.

2.4.1 Overextended Carriers

Some carriers are marginally profitable, and manage from day to day meeting their operating and capital replacement needs but with little accumulation of cash or assets. If such a carrier has a costly crash, the impact could be immediately detrimental to their financial viability. Once the limits of the insurance are breached, there are no other sources of funds for resolving damage claims.

These carriers may be more risky than the average. They may incur risk for which they lack the capacity to compensate, should an adverse event occur. They may enter bankruptcy, further complicating any issues of restitution. In any event, claimants are denied because the carrier is insolvent, or would be made so if the claim were validated.

Even if quality improvements have occurred, the cost of a crash has increased since 1980.

2.4.2 Inflation in Crash Costs

Comparing a major crash in 2011 to the same crash occurring in 1980 (or 1984), today's crash is probably more costly in nominal dollars (i.e., there has been inflation in unit costs). Prices in general have increased, more than doubling on average.[26] An hour of a doctor's time is more expensive, the price of an ambulance, the cost of an operating room, etc., are more expensive today. This is probably true even if we hold quality constant. A doctor has broader and deeper training, has access to more equipment, has specialized assistants and colleagues, and can make diagnoses faster and more accurately, thus reducing cost. Although these

[26] The gross domestic product (GDP) implicit price deflator—the broadest and least volatile index of prices, increased from 1980 to 2010 by a factor of 2.3.

improvements in the quality of treatment are undoubtedly very large and substantially mitigate the consequences of injuries, they do not completely offset the higher price for the same amount of constant-quality care.

Another factor to control for is the severity of the damages. Large trucks and passenger vehicles are heavier than in 1980, and speeds on average are higher.[27] At the same time, vehicle design (brakes, comfort, stability) and safety features (air bags, seatbelts), and road design (expressways, medians, rumble strips) have mitigated the damages that occur when motor vehicles happen to collide, as well as reduced their frequency.

Despite these advances, the cost of a comparable crash is higher in 2011 nominal terms than in 1980 and the crashes are similarly destructive. At least for purposes of comparison, a translation of the original liability requirements into today's prices is of interest.

This translation is not unique or obvious. There are a large number of price indices, depending upon the particular goods and services of interest and the narrowness or broadness of their specificity. Consumer prices indices—of which there are many—provide a different perspective than producer price indices. Moreover, the composition of the cost of a crash (what shares are property damage, emergency services, medical treatment, etc.) varies considerably, and applicable data are scarce.[28]

2.4.3 Current Crash Costs

Costs per crash of fatal and catastrophic injury crashes exceed current insurance limits. Data on the costs of crashes are not routinely collected, and can only be estimated from special studies or by inference from crude indicators such as fatalities. An example of the former is shown in Table 6 for 2005. The costs are based on a broader social cost concept that includes traffic incident delay and the VSL of $5 million.[29] The estimated cost of an average fatal crash is high enough that it indicates that the upper range of costs is mostly likely in the millions of dollars. The population of crashes in Table 6 does not include for-hire passenger carriers.

Table 6. Estimated Minimum Cost of Heavy Truck Crashes for the Year 2005

Crash Type	Cost/Crash	Crashes in 2005	Total Cost
Fatal	$3,604,518	4,551	$16,404,161,418
Injury	$195,258	78,000	$15,230,124,000
Property Damage Only	$15,114	341,000	$5,153,874,000
Total			**$36,788,159,418**

Source: Zaloshnja and Miller, PIRE (2006) as reported in the American Transportation Research Institute (ATRI) (April 2011).

[27] Truck and bus length and width restrictions have been eased since 1980, although the weight effect is unclear (FHWA c. 2000); passenger vehicle weight was at a minimum in 1980 and has increased since (Environmental Protection Agency [EPA] 2008).

[28] An example of liability limits required by law to be periodically updated is in the Oil Pollution Act of 1990 (OPA-90) as amended (33CFR138). The instructions state that the CPI-U (Consumer Price Index—All Urban Consumers) should be used to update the bounds of liability for oil pollution incidents by vessels or deep-water ports, every three years or longer until the cumulative change is at least 3 percent. The rationale for selecting the CPI is not apparent, although high conceptual precision is not required for the purpose. The resulting liability limits are rounded to the nearest $100, leaving the values at arbitrary levels.

[29] The current DOT value is $6.2 million, but was $5 million in 2006.

Costs for injuries are lower on average than for fatalities, not surprisingly, although severe injuries can also generate costs in the millions of dollars.

2.4.4 Protecting the Public

The original legislative intent was that insurance would protect the public from risky carriers. Congressional language of the Motor Carrier Act of 1980 stated that insurance companies would screen carriers, and either refuse insurance to risky ones or charge a rate that would create a barrier to entry. Although not directly stated, it seems likely that the limits required in the 1980 legislation were intended to cover all but the most extreme crash costs.

The insurable costs of a crash include emergency services, towing, and repair, but would seem to be dominated by medical and related costs.[30] Two price indices can be used at least for illustration: the consumer price index (CPI) for core items, excluding food and energy, that represent a bundle of goods and services that are widely purchased on a frequent basis, and a medical services cost index. The results of applying these two price indices to the five categories of regulated carriers with respect to financial responsibility are shown in Table 3.

If the medical index is taken as the most suitable for crash costs, the limits could be raised by a factor of approximately four, for each carrier type.

Data do not allow for the observation of the share of crashes that currently exceed existing or proposed thresholds, or for the current levels when they were enacted, so neither the number of crashes over the limits nor their trend is observable. The best that can be done is to construct statistical models (see Section 2.6).

2.5 CATASTROPHIC CRASH COVERAGE

Shrinking real value of upper insurance limits has removed the catastrophe function of insurance. Although the legislative intent did not explicitly describe how the mandatory insurance liability limits were calculated, it is plausible and likely that the caps were intended to be high enough to cover all but the most extreme events. The fundamental purpose of insurance is to pool uncontrollable risk that would be unaffordable for any individual operating unit or carrier, so trucking liability insurance pools the risk of similarly situated asset owners for whom the potential cost of a bad crash is large compared to their net worth. Up to some level of cost, individuals and firms can absorb a loss without being economically threatened (e.g., bankrupt). Beyond that threshold, it is rational for entities to pool their risk and share the cost. Entities join with other entities having the same abilities and motivations to minimize the risk, and pay a small share of the cost (as an insurance rate) whether the rare adverse event happens to them or to someone else in the risk pool. The deductible is the amount up to which the entity is willing to self-insure, and the threshold is the level at which the cost becomes catastrophic.

[30] According to Michael Miller, director of regional marketing for Progressive Insurance, the reason rates will need to rise "is due to the burgeoning cost of claims ... due to the high medical costs ... but also because the cost to fix trucks is that much higher as well." quoted in Kilcarr, FleetOwner (2009). Costs of the at-fault carrier are not covered under liability insurance.

In practice, the catastrophic/worst case has to be finite for the shared cost to be calculable. To insure an infinite loss would require an infinite rate. Thus insurance coverage has an upper bound, high enough to be considered rare and unlikely. But what was considered unlikely at one point in time, however, may have become more likely if prices had risen due to inflation. When this happens, the purpose of insurance becomes compromised.

Costly crashes are rare compared to the amount of freight and passenger transportation (per vehicle mile of travel (VMT), ton miles, and passenger miles) provided by commercial motor carriers. Large-cost rare events, however, are exactly those for which insurance is most suitable, yet a significant share of costly crashes are excluded from the present CMV insurance market. CMV liability insurance has reached a stage where rare events occur dozens or a hundred times a year. The events are still rare relative to the overall activity level in the industry, but above-limit crashes now occur more often, due to increased costs in general, so as to fail to serve as an upper bound. If the purpose of liability coverage is to cover these rare events, then it needs to be raised to meet its purpose.

A specific case: The driver of a combination rig was fiddling with his radio and didn't notice the traffic had slowed down. The truck first struck a car, killing the driver, then another car, killing the driver and severely injuring its passenger (plaintiff), and then struck a bobtail tractor. The $8.4 million in claims were contested, and available insurance was $1 million. The estate of the first driver was awarded $350,000, and the plaintiff settled for $650,000 (death plus injuries) on the agreement that the trucking company would pay $1.235 million over time.

This case is unusual in several respects:

- Most cases settle before trial, therefore they do not appear in *Tractor Trailer Torts*.
- Cases that go through extensive litigation and trial do so because there are insurance and other assets to be drawn from; if there is too little insurance to pay the claims, there is little point in obtaining a judgment.

There are no systematic data on these outlier cases and very limited anecdotal data. Because of these data source limitations, the number and costs of large uncompensated crashes is practically impossible to obtain.[31]

2.6 CALCULATION OF INSURANCE RATES

2.6.1 Basic Insurance Concepts

Insurance rates are set based on the expected crash cost: crash frequency multiplied by crash cost. An insurance premium is simply the insurance rate multiplied by the number of power units. When a person or firm purchases insurance, it is effectively paying to join a risk pool to spread the cost of an adverse event over a larger base than just the assets of the individual or firm. The risk has an expected value, which is the probability of an adverse event times the cost of the event. To simplify somewhat, the equation is shown in Figure 1:

[31] *Tractor Trailer Torts* reports most of these outlier cases if they result in litigation, which typically takes place over several years.

$$EV = \sum_{\text{all events } i} A_i C_i$$

Figure 1. Equation. Formula to Calculate the Expected Value of Risk

where EV = expected value of risk, A_i = probability of adverse event i, and C_i = cost of adverse event i. A more complete version of this formula would specify a period of time over which the adverse events would be covered, an allowance for a time lag between the payment of rates and the payment of claims, and the adverse events might be grouped into types, such as property damage only. If EV represents rates paid, there would also be a cost component for administrative costs and profit for the insurer.

The distribution of event probabilities is L-shaped (e.g., see Figure 2); in that small-cost events are far more likely than costly ones, e.g., many fender-benders and few fatal crashes. For bodily injury liability, the events range from minor injuries to incapacitating injuries and multiple fatalities.

No analysis or documentation has been found regarding the basis for choosing the liability minimum levels shown in Table 4, but the intention expressed in the legislative language was that the requirements should be high enough to incentivize insurers to investigate carriers seeking liability coverage and charge them suitable rates.

2.6.2 Risk Update for Insurance Rates

Insurance rates adjusted for cost and risk have remained almost constant. If the current liability limits are adjusted for inflation in the compensable unit costs— general consumption goods and medical costs—of crashes, the equivalents in today's dollars of a hypothetical 1980 rate of $5,000 is more than $11,000 adjusted by the Core CPI or more than $21,000 based on the Medical CPI, as shown in Table 7. Alternatively, adjusted to today's dollars by only the reduction in crash frequency reduces the rate to near $2,000, while adjusting for both effects together yields almost $5,000 for the Core CPI index and more than $9,000 using the medical cost index.

Table 7. Insurance Rates Adjusted for Unit Cost Only and for Risk

	1980 Rate	Adjusted $/crash	Adjusted frequency	Adjusted for both
Core CPI	$5,000	$11,450	$2,170	$4,969
Medical CPI	$5,000	$21,358	$2,170	$9,269

The reduced frequency component is a major part of the explanation for why rates have not risen much in 30 years. The difference between $ 4,969 and $ 9,269, however, is possibly a measure of the amount of current claims unpaid.

Total amounts paid for insurance are insufficient to cover social costs of crashes. The average claim cost (or expected value) is about $18,000[32] for general freight carriers, and

[32] Insurance Services Office (ISO) data.

crashes that exceed $750,000 or $1 million are rare.[33] Total truck-involved fatalities have dropped by 44 percent since 1980 while VMT has risen by 180 percent and the number of registered trucks has increased by 30 percent, as shown in Table 8.

Table 8. Truck-Involved Fatalities (1980–2009)

Year	Total Truck Fatalities	VMT Combination Trucks	Registered Tractors	Fatalities per Tractor	Cost per PU ($)
1980	6,000	60,000	1,401,596	0.0043	26,541
2009	3,380	167,842	1,819,309	0.0019	11,519
	-44%	180%	30%	-57%	

Source: National Highway Traffic Safety Administration (NHTSA); Federal Highway Administration (FHWA), Highway Statistics.

Motor vehicle fatalities overall have dropped from more than 48,000 total per year in 1980 to less than 35,000 in 2009, while VMT increased from 1.52 trillion to 2.95 trillion. These data are based on the entire U.S. motor carrier population, including intrastate, private, and other carriers not subject to Federal financial responsibility regulation.

This population of trucks does not include single-unit trucks or buses, and does include many unregulated carriers, but it shows that for the dominant truck type (tractor-trailer combinations) safety has greatly improved. Crash loss can be measured by adjusting unit costs for risk, to obtain an expected value. From the data in Table 8, the fatalities from combination trucks can be calculated as 0.0043 per truck per year in 1980, dropping to 0.0019 in 2009. The fact that insurance rates have not doubled is an indirect indicator of potential cost exporting.

If fatalities are valued at the current VSL of $6.2 million,[34] then each power unit would have to pay more than $11,000 in insurance to cover the industry wide costs of fatalities only. If trucks pay only for the crashes for which they are at fault, then this number comes down to $5,759 (50 percent at fault) to $3,456 (30 percent at fault), more in line with evidence on actual rates (see Table 9 and Section 1.6.6).

2.6.3 Insurance Rates for Comparable Coverage

Insurance rates for the same level of coverage (e.g., $750,000 or $1 million) have declined slightly on average in nominal dollars over approximately 30 years, which means they have declined even more in real (inflation adjusted) dollars. A few examples of rates for $1 million in coverage from several points in time are shown in Table 9.

[33] ISO data and modeling are described in Section 2.6

[34] New guidance on treatment of the economic value of a statistical life in USDOT analyses establishes a value of $9.5 million for the years 2011 and 2012.

Table 9. Example: Average Insurance Rates* for $1 Million Liability Coverage

Year	1985	2003	2010
Average Rates ($1 Million Coverage)	$5,302	$4,877	$4,600

Source: Various industry sources.
*Average annual payments for rates per power unit not corrected for inflation.

Rates for higher coverage limits are higher than those for the basic minimum level, but the additional rate again depends on expected value, i.e., both the amount required for compensation and the probability of a higher-cost crash. Because of the decline in frequency with higher cost, the rate for an additional increment of insurance is less than the rate for the base coverage, per equal amounts of coverage (an additional $1 million in coverage will cost less than the first $1 million).

2.6.4 Decline in Crash Frequency and Insurance Rates

Declining crash frequencies and low costs of insurance may have deflected political pressure to take action. The average cost of a crash has increased in the past 30 years, but it has been more than offset by a reduction in crash frequency. Whether the decline is the result of effective scrutiny by insurers, FMCSA efforts to monitor and sanction the safety measures of carriers, both, or other factors, the net effect of higher cost crashes and declining crash rates has been insurance rates that have remained the same in nominal terms for 30 years and dropped in real terms.

Carriers are less inclined to complain with low insurance rates, and victim advocates gain less leverage with fewer major crashes, which tend to lighten the political pressure to take action with regard to insurance coverage. Safety improvements have been sufficiently effective that the problem of horrific crashes and associated under-compensation has become less evident.

If the required minimum levels are raised, it could be argued that insurers will apply more due diligence—even with small carriers—that will have the effect of increasing insurance rates, deterring undercapitalized carriers entirely or else moving them into the residual market (assigned risk pool) where they will be scrutinized and monitored more carefully.

2.6.5 Market Norm

Currently, the market norm for property liability insurance coverage seems to be $1 million, which only covers internal costs (those for which the trucker is liable and covered by insurance). At present, based on anecdotal but informed opinion and second-hand estimates, a liability level of $1 million per (truck) power unit seems to be accepted by the market as an appropriate indication of financial ability to provide compensation to third parties in the event of a crash. This level, for example, is accepted by lenders providing financial backing to general freight carriers.[35]

[35] An informal random sample of 10 insurance broker contracts turned up zero instances of any liability level other than $1 million.

One effect of the decrease in the real cost of insurance is that the mandatory limits established in 1980-84 are no longer binding for the majority of carriers. For purposes of internal risk (ignoring damage to the public), lenders and asset owners require $1 million or more to provide lending. For those purposes, mandatory liability regulation is no longer necessary. With respect to damage to the public via cost exporting, however, new limits may be appropriate.

Several interpretations can be given to the apparent emergence of $1 million as an industry standard. It shows the level of risk that lenders (to carriers) consider adequate to limit their own (e.g., banks) exposure, in the absence of specific regulation. Also, the $1 million amount could be a convenient rounding, representing the judgment that "about $1 million" is the right level, as opposed to $750,000, which is a more precise number. If the market chooses a standard higher than the mandatory level, then there is no need for regulation to enforce a higher level unless there is a market failure such as cost exporting. Raising the mandatory limit to $1 million would eliminate the option of $750,000 for those whose operating circumstances do not call for greater coverage.[36]

The market norm of $1 million coverage could force certain low-risk carriers to purchase more insurance than their situation dictates. If there is, or was, significant cost exporting, then the statutory limits were or are too low.

2.6.6 Rates for Higher Coverage

Higher liability coverage may increase insurance rates by 10 to 30 percent for safer carriers, up to perhaps a doubling of coverage. However, even if the amount of rate paid by a carrier for a given level of coverage were known, it is not possible to predict the rate that would be charged for a different level of coverage. Doubling the level of liability, for example, does not imply a doubling of the dollar value of the risk; it depends upon how frequently the higher cost events occur, relative to the frequency of the lower value.

For its baseline policy (for owner-operators with very good risk experience), the Owner-Operator Independent Driver Association (OOIDA) charges $5,050 per truck for $750,000 coverage, $5,550 for $1 million, and $6,600 for $2 million coverage.[37]

2.6.7 Insurers Sources of Revenue

For many years in the decades after about 1960, the business model for insurers was to collect rates from insured parties, invest the rates in the stock market and earn a healthy reliable rate of return, and make payouts as necessary. By 2000 or so, however, the stock market became more volatile and less rewarding, so insurers had to depend upon accurate risk assessments and rates that avoided cross-subsidies among the insured.

CMV liability insurers needed more expertise and more effort to correctly assess the risks of carriers they insured. Subsequent to the events of 9/11/2001, the number of insurers covering commercial motor carriers shrank, and subsequent mergers and acquisitions further reduced

[36] Examples might be local delivery trucks operating in a multi-State urban area, or farm vehicles that carry grain to terminals in another State a few times a year.

[37] Telephone interviews with the OOIDA staff.

the level of market competition. Despite the fluctuations in the number of insurers, the market remains more than sufficiently competitive to prevent monopoly profits, as indicated in Table 10.

Table 10: U.S. Insurance Industry Concentration

Commercial Insurers of Motor Carriers	2007	2008	2009	2010	2011
Total Number of Insurers	680	689	700	721	731
Insurers With > 1,000 CMV Carriers	26	26	28	31	31
Insurers With < 50 CMV Carriers	602	584	566	568	557
Herfindahl Index	4.4	4.2	4.5	4.5	3.9

Source: FMCSA L&I database.

Notes: The Herfindahl Index measures concentration in an industry; a value of zero indicates a perfectly competitive industry, while a value of 100 indicates a monopoly.

The direct cost of insurance to carriers has remained around 4 to 5 percent of operating costs. Insurance is not currently a big cost burden, but because insurance and risk costs are controllable they have a larger than proportional effect on behavior.

2.6.8 Insurance Cost to the Carrier

The cost of insurance as a share of operating cost seems to have fluctuated within a narrow range of 4 to 6 percent over the past 30 years. An increase of, say, 20 percent in the cost of insurance amounts to only a 1 percent increase in operating cost, not likely to be a make-or-break change. Given the competitive nature of the carrier industry, however, a small cost advantage or disadvantage can be telling. If low-risk carriers can shave their rate payments, other carriers incur higher costs or are unable to obtain coverage.

ROLE OF THE INSURANCE INDUSTRY

The 1980 legislation was explicit about expecting that mandatory insurance requirements would lead insurers to be more diligent in selecting carriers to insure and monitoring them for safe behavior. Insurers will do this if it is in their financial interest to do so, and most insurers keep track of risk-related indicators and exercise care in offering coverage and setting rates. Inevitably, however:

- Large motor carriers provide the bulk of premium revenues earned by insurers, and both parties work to ensure safe operation for the long term; but small motor carriers are differently situated and they generate less premium revenues individually than large carriers.
- Devoting considerable time to small motor carriers is thus potentially unproductive, and it is more effective to await evidence of unsafe behavior (violations and crashes) than to extract the information for predicting future crashes.
- Some insurers do not specialize in trucking liability and do not find it worthwhile to conduct a great deal of due diligence; if a small carrier has a crash or a violation (either traffic or FMCSA), the carrier may be dropped.

2.6.9 Safety Enforcement by Insurers

Trucking deregulation legislation forecasted that the insurance industry would scrutinize the characteristics of new entrants and decide whether and at what rate to insure individual carriers. Prospectively risky carriers (e.g., drivers with traffic violations) would have more difficulty obtaining insurance than carriers with good records. Thus the industry would serve as the gateway to the trucking market, screening out the weaker entrants before they did much damage.

Whether this happened is open to discussion, but at current rate levels the incentives for insurers to conduct rigorous onsite inspections of their insured carriers are small. Insurers can also deny coverage if they feel the risk is not worth the rate, sending the carrier to another firm or to the residual market. Insurers estimate carrier risk based on many factors, including those generated by FMCSA and made available to rating agencies.[38] It is likely, however, that the costs of investigating or inspecting each small carrier exceed the value of the rate earned.

2.6.10 Insurance Industry Underwriting Analysis

Raising the insurance limits might induce insurers to enhance their investigative efforts because the insurer would have more at stake. Although the cost of insurance is estimated to be around 4 percent of a carrier's operating costs, and occasionally as much as 6 percent,[39] it is a cost that could considerably increase if not properly controlled by demonstrating good safety practices. For marginal carriers, the cost of insurance can be a critical factor.

Although insurers undoubtedly evaluate the carriers they insure, the amount of direct information they collect and the factors they use to judge the riskiness of carriers is proprietary. Companies that provide bodily injury liability insurance to motor carriers do not publish data such as rates and actuarial experience, either for individual carriers or for the company as a whole. They, however, do share some information among themselves and with trade organizations that conduct research or may be willing to sell aggregated data that provide statistics that apply to their membership as a whole but do not reveal any characteristics about individual carriers or insurers.

An example of stated rating factors used by insurers is shown in Table 11. When determining the rate for a trucking company, the insurance company will consider factors which increase or decrease the probability that a loss will occur, and the potential size of the loss. The items listed are some key factors affecting a carrier's chance of having a loss and, therefore, the rate it will be expected to pay.

[38] The term "carrier" is used in the insurance industry to mean an entity that provides insurance coverage. In an effort to avoid confusion, the word carrier is used here only to refer to a firm that operates trucks or coaches.

[39] ATRI, An Analysis of the Operational Costs of Trucking: 2011 Update.

Table 11. Rating Factors—Example

Rating Factor
Driver Age
Years Driving Experience
Years Employed
Driving Record
Accidents
Years Operating in Name
Where You Drive
Property Hauled
Equipment Operated
Deductibles
USDOT Safety Record
Safety Program

Source: www.Truckinsurance.com.

2.6.11 The Optimal Liability Limit

Even if the answer to the question of price translation from 1980 to now could be rigorously determined, this does not reveal the correct level for current liability limits. For the inflation-adjusted limit to be the correct level it would be necessary to know that the original levels were correct and that nothing had taken place in the interim that was not captured in the price indices. Much has changed of course since enactment—average costs are up, crash frequency is down, rates are down, higher levels are normal, insurers seek actuarial soundness—and there is no realistic level that will guarantee with certainty that the limit will cover all crashes.

The more direct solution is to determine the correct level for liability limits based on today's conditions. The catastrophe coverage function is probably the strongest requirement in determining the share of the upper tail of the cost distribution that falls above the limits.

The cost of an individual crash varies across a spectrum whose upper tail is impossible to know but which can be modeled with a combination of data and assumptions about the form of the distribution. The distribution might be represented by a curve such as in Figure 2. Most crashes result in small costs; and the average is around $18,000 per crash, including very costly crashes. The reason the average is low is because there are relatively few costly crashes.

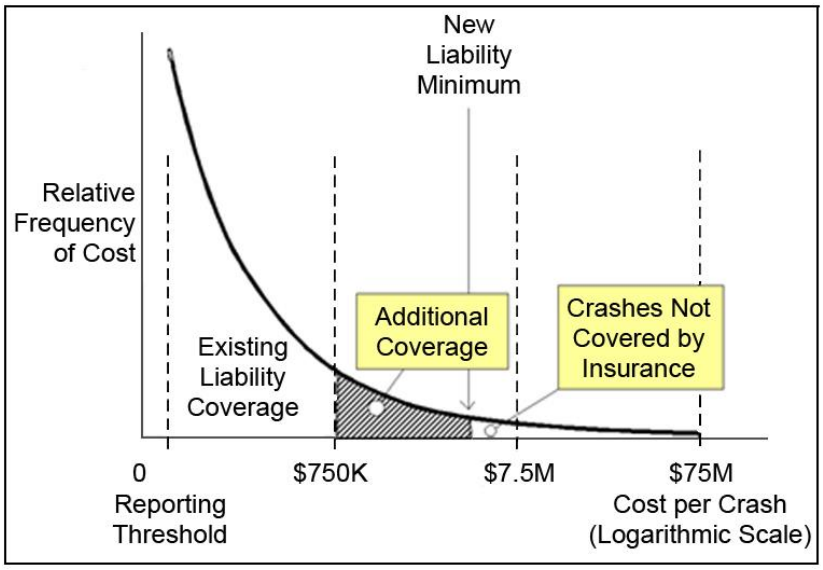

Figure 2. Histogram. Hypothetical Distribution of the Cost per Crash

The horizontal scale in Figure 2 is converted to a logarithmic scale, which compresses the scale (and its graphic representation) for larger numbers. Otherwise, the tail of the distribution would be stretched out to the point that the bulk of the frequency would appear as a very small lump at the left edge.

The optimal level is a tradeoff between two factors: the desire to cover as many as possible of the catastrophic crashes that will occur, and a reasonable cost of insurance to the buyer. A limit that is too low leaves too many crashes above the liability limits, while too high a level results in insurance that may be unaffordable. Raising the limit by some amount—up to the "new liability minimum"—provides additional coverage indicated by the diagonally shaded area, but leaves the area of the tail to the right of the new minimum uncovered by insurance.

Hence, the policy question is what share (percent) of crashes should be covered?

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3. THE EXTENT OF UNDERCOMPENSATION AND THE DISTRIBUTION OF COST PER CRASH

The purpose of this chapter is twofold: to estimate the magnitude of CMV crashes that exceed the limits of current liability insurance requirements, and to determine what limits would need to be implemented to raise the share of covered crashes to an acceptable level. These questions are fundamental, but cannot be answered with any precision due to both a lack of applicable data and the inherent subjectivity of determining a level of acceptability and placing dollar values on death and severe injury.

3.1 DATA REQUIREMENTS AND POSSIBLE SOURCES

There are many data sources, but little information of the costs or the cost distribution of crashes. The existence of costly crashes for which severely or critically injured victims are unable to obtain reasonable compensation can be verified anecdotally from news reports, but representative or comprehensive data are not available. A wide range of incomplete data and modeling strategies were pursued in this study in an effort to develop estimates of the total potential magnitude of compensation shortfalls.

The data that would be required include:

- A complete enumeration of individual CMV-involved crashes (or those above a certain cost magnitude).
- The claimed cost of each crash, the amount settled or adjudged, and the cost components of the settlement (medical treatment, lost income, emergency services, etc.) for bodily injury liability, and whether the carrier was determined to be at fault.
- The type(s) of service(s)—for-hire interstate general freight, HM, for-hire passenger—and average annual VMT per power unit in each type.
- The size (employees, power units) of the motor carrier, and whether the power units are owned or leased/rented.
- The types of insurance the motor carrier carries, and the depth (limits) of coverage, and names of insurers.
- The number of crashes and severity of each.
- The debt carried by the motor carrier, and to whom it is owed.

The several sources of such data investigated for the present study are described in Table 12. Not surprisingly, most of the data mentioned above are not available from the sources listed.

Table 12. Truck Crash Data Sources

Data Source	Description
Internet Search	A search can reveal anecdotal reports of high-cost or dramatic CMV crashes that led to notoriety or legal conflict.
Motor Carrier Management Information System (MCMIS)	This FMCSA database provides comprehensive data on the characteristics of active motor carrier firms engaged in any kind of Federally regulated service, plus many carriers that are no longer active or may be regulated only at the State level. Indicates the type of service (general freight, HM, or passenger) and regulated status (for-hire, private). Fatalities are included if they occur within 30 days after the crash. Fatal, injury, and towaway crashes are included in MCMIS for trucks and buses.
Licensing and Insurance (L&I)	An FMCSA database describing the insurance coverage for each carrier required to meet the minimum levels of financial responsibility.
Fatal Analysis Reporting System (FARS)	A comprehensive National Highway Traffic Safety Administration (NHTSA) database of passenger and freight vehicle crashes in which there was at least one fatality. Indicates the type of service (general freight, HM, or passenger) and regulated status (for-hire, interstate). Fatalities may be included if they occur within 30 days after the crash.
Trucks Involved in Fatal Accidents (TIFA)	Data extension of FARS results supplemented by interviews with first responders, hospital staff, and additional information received following the event.
Large Truck Crash Causation Study (LTCCS)	A highly detailed joint FMCSA/NHTSA study on a nationally representative sample of 2001–03 truck crashes, investigating crash risk and causal factors. Indicates the type of service (general freight, HM, or passenger) and regulated status (for-hire, private).
General Estimates System (GES)	A sample database generated by NHTSA that records highway crashes along with many attributes, including expansion factors that allow the sample data to represent national statistics. Indicates the type of service (general freight, HM, or passenger) and regulated status (for-hire, interstate).
Texas Closed Claim Database	The database, maintained by the Texas Department of Insurance, includes commercial liability closed claims involving bodily injury settled under Texas law for the following lines of insurance: General Liability, Medical Professional Liability, Other Professional Liability, Commercial Automobile Liability, and the Liability Portion of Commercial Multi-Peril Insurance. The database includes claims from several insurance companies and self-insurers. Claims included in the database have been settled or otherwise disposed of, and the insurer has made all indemnity and expense payments on the claim.
LexisNexis	Legal case law, litigation, and enforcement support service, providing State-by-State legal references and searches to identify fraud, unpaid transactions, etc., for private clients and public agencies. Fee for service. "The LexisNexis® Insurance Exchange is a collaborative insurance risk placement platform and insurance proposal software designed to improve the flow of application data and documents between agents, brokers, wholesalers and carriers"
Insurance Services Organization (ISO)	A property/casualty insurance industry supplier of statistical, actuarial, underwriting, and claims data. For commercial lines, that data represents 70 to 75 percent of the entire industry's premium volume.

Data Source	Description
Insurance Research Council (IRC)	The trade organization studies broad insurance industry problems such as fraud.
Insurance Institute for Highway Safety (IIHS)	A trade organization that conducts policy research pertaining to automobile crashes
Tractor Trailer Torts (Lewis Laska)	A somewhat systematic but anecdotal database of litigated crash claims is sifted and compiled from a range of public sources that can be analyzed with a modest level of manual effort in interpretation.
American Trucking Research Institute (ATRI)	The former research arm for the American Trucking Associations (ATA) has access to a substantial amount of carrier and insurance data, but the data cannot be released to other parties such as research centers or Government agencies. Using these data for policy analysis would require a partnership with ATRI in which they executed any data queries.
CODES	A NHTSA data collection and collaboration program that encourages States to collect and retain data on injuries from highway crashes.

3.2 TRUCK- AND BUS-RELATED CRASHES

The most fundamental uncertainty is whether crash occurrences are random or vary systematically with associated factors. Clearly simple exposure in miles or hours driven is a primary determinant of crashes, but other indicators such as violations have substantial impacts on crash rates. If crashes occur randomly, then insurance is about the only mitigation treatment: it allows the risk to be shared so that no unlucky individual is ruined by a single crash event. Alternatively, if crashes are systematically related to causal factors, then identifying the causal factors will lead to actions that either reduce the impact of the causal factor or remove the affected carriers from the industry. Effective regulatory actions should incentivize the industry toward safer behavior without compromising productivity.

One view is provided by Table 13, which shows crash rates by freight carrier size. Most carriers are very small, the largest category being a single truck, while most trucks are operated by large carriers. Half of all trucks belong to carriers with more than 50 power units. Comparing the share of power units in each size group with the group's share of crashes shows closely matching distributions. The crash rate per power unit is consistent (approximately 5.5) for the very small carriers (1–5 power units), then reaches a slightly higher level (5.7) for medium carriers (6–50 power units), then declines with larger carriers down to 3.68 (500+ power units).

Table 13. Size Distribution of General Freight Carriers (March 2012)

Carrier Size Power Units	Number of Carriers[a]	Power Units in Class	Share of Power Units	Crashes in Class[b]	Crashes per 100 Power Units	Share of Crashes
1	138,750	138,750	5%	7,720	5.56	6%
2–5	97,042	267,482	9%	14,796	5.53	11%
6–15	31,700	286,898	10%	16,512	5.76	12%
16–50	14,435	384,716	14%	22,056	5.73	16%
51–500	5,573	690,131	24%	35,439	5.14	26%
500+	477	1,064,551	38%	39,223	3.68	29%
TOTAL	**287,977**	**2,832,528**	**100%**	**135,746**	**4.79**	**100%**

While the data on annual VMT are less complete and less reliable than the count of power units, the VMT data available do not indicate any fall-off in annual VMT per power unit for larger carriers.

In a histogram by size group, it is shown that the lowest rate occurs in the 500+ power units category. If it is assumed that insurers pay closer attention to larger carriers because that is more cost-effective for safety purposes (economies of scale in monitoring conditions), then crashes could have been reduced by 11,775 (23 percent) if insurers had given equal attention to carriers up to 500 power units per carrier. Other factors, of course, affect crash rates per power unit, and FMCSA's monitoring and compliance measures also direct attention at larger carriers. Whatever the causes of variations in safety experience among carriers, greater size seems beneficial.

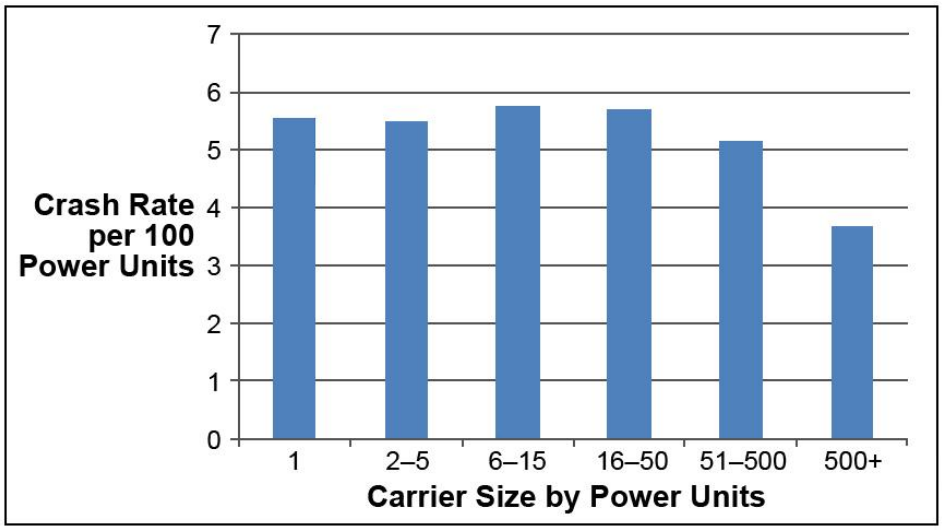

Figure 3. Bar Chart. Crash Rates per 100 Power Units by Fleet Size

3.3 EFFORT TO DOCUMENT UNDERCOMPENSATION

Evidence of the problem of cost exporting is anecdotal, but insurance is circumstantially deficient in providing catastrophe coverage. To detect the existence of cost exporting, a selection of Federal legal cases from the U.S. District Courts and the U.S. Courts of Appeals was examined. A LexisNexis search using "MCS-90" (the mandated endorsement for a motor carrier's public liability insurance policy) uncovered 153 potentially relevant results from 1985 to the present. Some of these cases, however, consist of multiple records from different stages of a single case.

Of these cases, 25 were studied for further relevance, and 7 were found to have damage claims or settlements above the $750,000 insurance limit. These were subjected to general internet searches for news or other coverage. Finally, four cases were found to meet the criteria of truck-at-fault crashes exceeding insurance limits and other carrier or insurer resources resulting in a significant shortfall between apparent damages and compensation received by victims.

Table 14. Example Court Cases Exhibiting Costs Exporting

Case	Date	Consequences
Net Trucking	2005	$15.1 million
Cox Cattle	2006	2 fatalities and 2 injuries
Virginia Hiway Express	1995	4 fatalities and 3 severe injuries
Transystems Inc.	1999	$2.5 million, train derailment

These examples, described in detail in Appendix A, illustrate some of the possible ways to escape paying damages. One of the carriers fraudulently transferred his company's assets and his home to his wife, who then opened three "chameleon" carriers using the former company's trucks. Other carriers declare bankruptcy and leave the claimants to divide up whatever insurance is available.

3.3.1 Two Broad Types of Carriers at Risk

Large motor carriers tend to have considerably more capital than smaller carriers which may suggest the need for higher screening of the latter group. OOIDA, however, indicates that independent owner-operators are at least as safety conscious and risk averse as larger carriers because the bulk of their primary savings are connected to the capital value of their truck(s). The organization provides basic insurance for its members at modest rates, screening the truck drivers it insures very thoroughly.

Trucking is a low profit margin business. Smaller carriers tend to be especially sensitive to operating costs, including insurance and fuel. The carrier industry as a whole can be roughly divided into two groups by size, as described in Table 15. The upper-tier carriers are not significantly impacted by increases in insurance requirements, and for all practical purposes are self-regulating. The lower-tier carriers, in contrast, typically lack the financial means to fully internalize safety costs and may need to be incentivized through financial responsibility requirements.

Table 15. Two Broad Carrier Groups

Lower Tier: Small and Medium Carriers	Upper Tier: Large Carriers
≤ 500 power units per carrier	> 500 power units per carrier
≤ $100 million in revenues	> $100 million in revenues
Vast majority of all carriers	Vast majority of all power units
Somewhat higher crash rate per power unit	Lowest crash rate per power unit
Low or modest net worth	Highly valuable net worth
Assets rented, leased, or contracted. Some are owned.	Assets are generally owned by carrier
Minimal to modest safety programs	Safety programs central to carrier business model
Meet only the minimum insurance requirements, do not carry umbrella or excess coverage, and exercise little risk management	Comprehensive integrated insurance coverage as part of detailed risk management plan

* Carriers of certain goods (mostly agriculture) are not required to name their insurance companies even though they are required to carry insurance, as declared by filing an MCS-90. Private carriers are not required to demonstrate financial responsibility.

Studies have shown that safety measures and outcomes are correlated with the net worth of the carrier.[40] This leaves a market segment of carriers with less than 500 trucks who may attempt to operate with insufficient capital and weak safety controls. As shown in Table 13, the largest number of carriers are small, the most numerous of all being single-truck firms. The largest share of power units, however, is with the largest carriers. If annual VMT per power unit and tons carried are approximately the same across size classes (as shown in Appendix D), then the largest share of freight is carried by larger carriers operating more than 500 power units.

Although the crash rates per truck tend to decline as carrier size increases, the overall probability of a single truck being in a crash is 0.0275 per year (average total crashes per power unit). This probability varies with carrier size as described above, but it is still a very small probability for any given truck (or bus). Small carriers tend to have worse safety records compared to larger carriers, and they may also be less able to meet their financial obligation for costly crashes.

Although the only data available for the characteristics of carriers more likely to export costs is size, a rough estimate can be gained by weighting estimates by size group, as shown in Table 16.

[40] Pritchard (2011); ICF (2010).

Table 16. A Hypothetical Representation of Cost Exporting

Power Unit Group	Share of Crashes	Hypothetical Share Exporting	Weighted Shares Exporting
1–5	10.2%	80%	8.2%
6–15	10.5%	60%	6.3%
16–50	15.8%	30%	4.7%
51–500	28.6%	5%	1.4%
500+	34.9%	0%	0.0%
Total	**100%**		**20.6%**

The middle columns, depicting the shares of crashes by carrier size, are calculated from Table 41. The next column is an estimate of the share of crashes by each size group that would be incompletely compensated if the carrier had a crash exceeding the mandatory coverage requirements. For the largest size group (500+ power units), it is assumed that all crashes are fully covered given insurance coverage, owned assets, and cash reserves. At the other end of the scale, smaller carriers are only slightly more likely to get into crashes, but if they cause a major crash they are less likely to be able to exceed the insurance liability. The resulting estimate is 20.6 percent, which is the share of crashes that would not be completely compensated if the cost exceeded the minimum insurance coverage level.

3.4 FMCSA SAFETY PROGRAMS

Compliance, Safety, Accountability (CSA) scores have significant predictive power for crashes, but do not cover the bulk of smaller carriers. Selected aspects of the safety behavior of carriers can be observed through FMCSA's programs to inspect carriers for safety actions and issue sanctions. Table 17 shows, for small general freight carriers that were active at the end of 2007, summary indicators of FMCSA's safety ratings at the time, compared to crashes by those same carriers in 2008–09. Alerts are warnings to the carrier of a safety deficiency, and Behavior Analysis and Safety Improvement Categories (BASICs) are relative ratings of individual carriers in areas such as traffic violations.[41] It is to be noted that the source of the crash counts in this table is the MCMIS database, which is a comprehensive source of motor carriers engaged in any type of Federally regulated service, plus carriers that are no longer active or may be regulated only at the State level. This source, and crash counts, is to be distinguished from those in Table 13, which are the outcome of the merging of MCMIS and L&I data. This has the effect of filtering out inactive carriers and those not subject to FMCSA's jurisdiction. Hence, the crash counts in Table 13 are smaller.

[41] FMCSA's Safety Measurement System (SMS) is organized into seven BASICs, which sort the carrier's safety information (violations from roadside inspections, reviews, and crashes) into specific categories. The carriers are then measured in those categories against similar carriers and assigned percentiles on a 0-100 scale with 0 being the best, and 100 the worst. Carriers above a predetermined threshold in the percentile are termed "Above the Threshold." These carriers are prioritized for interventions by FMCSA. An Alert is above the threshold.

Table 17. Safety Indicators and Subsequent Crashes

2007 For-Hire Interstate Small (1–5 Power Units) Carriers CSA Safety Indicator	2007 For-Hire Interstate Small (1–5 Power Units) Carriers Number	2008–09 Carriers With 1+ Injury or Fatal Crashes Number	2008–09 Carriers With 1+ Injury or Fatal Crashes Percent
2+ Alerts	3,178	506	15.9%
1 Alert	9,198	873	9.5%
0 Alerts, 1+ BASICS	6,525	497	7.6%
No BASICS	65,163	2,192	3.4%
Total	**84,064**		

Source: MCMIS.

Carriers with the worst safety scores (in the table) were four times more likely to have a crash than carriers for whom no sanctions had been issued or negative indicators reported. More than likely the carriers with "No BASIC scores" are those with no inspection or safety history. As with carrier size, the relationship between safety indicators as applied by FMCSA and carrier crash experience, is clearly systematic, shown as well in Figure 4.[42]

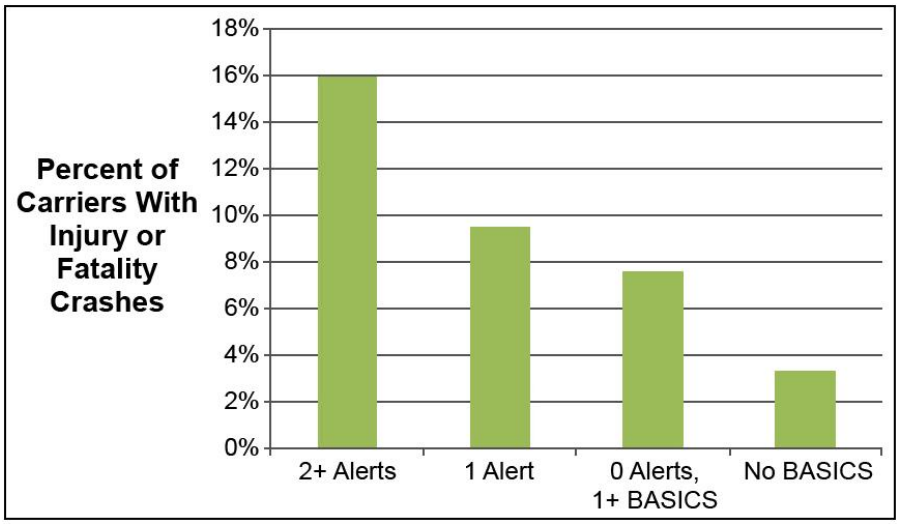

Figure 4. Bar Chart. Percent of Small Carriers with Crashes, by Safety Level

In summary:

- There is a great deal of variation among carriers in the frequency with which they have crashes.
- Larger carriers, representing larger fleets and greater net worth, have significantly fewer crashes, per truck, than smaller carriers.
- Carrier safety indicators can be used to predict the likelihood of a crash by the carrier, and remove a carrier from service if declared an imminent hazard.

[42] Criticism and defense of the CSA program is found in Miller (2012).

- These generalizations are strong, but they are only probabilistic; they do not identify the specific carrier (let alone vehicle) that will have a crash, or particularly, a costly crash.

3.5 COST PER CRASH

Assuming the unit of insurance is per person or per incident, then the optimal minimum level of financial responsibility should be high enough to cover all except possibly the rarest of events, but low enough that insurance can be offered at a reasonably affordable rate. At the present mandated limits, several crashes exceed the insurance requirements, meaning that the purpose of the insurance is weakened. Although the costs of the majority of crashes are much less than the limits, several "catastrophic" crashes are not covered.

There are no comprehensive data on the number of crashes, the true costs of individual crashes, cost of a crash to individual victims, nor the frequency with which insurance fails to cover the costs—the optimal level at which to set the upper bound is unknown. Estimating the optimal limit can be approached as the reconciliation of multiple rough approximations:

- Model the crash cost distribution using ISO and perhaps other aggregate data sources, and select a cutoff above which the annual frequency is reduced by an order of magnitude (e.g., from 100 per year to 10 per year).
- Apply Bayesian probability analysis that infers from anecdotal evidence the existence of an unobserved population.

These strategies may be supplemented by fine-tuning insurance instruments such as split limits, and incentives for insurers to do greater diligence/underwriting.

3.5.1 What is the Scope of the Costs?

The scope of costs is ambiguous and difficult to translate accurately into dollars. Insurance coverage allows compensation for some, but not all costs of crashes, and includes some payments that are not costs. Payments for fatalities are rarely as much as the $6.2 million value established by the USDOT as the VSL for use in regulatory evaluation and other cost-benefit analyses. Costs of medical treatment, property damage, spill cleanup, and other public services may be compensated, but operating costs and delay to vehicles affected by a crash incident are not compensated, nor are extra air pollutant emissions. Pain and suffering damages may be covered by insurance, but punitive damages are considered fines or penalty incentives for extreme negligence and are not actual costs.[43]

Before attempting to interpret the limited data, it is necessary to consider the nature of the costs potentially at stake in damages and compensation conflicts. The concept of a cost is not limited to bills paid or voluntary transactions between willing parties. Loss of quality of life may be a valid cost. Efforts to turn cost occurrences into dollars may have biases, distortions, omissions, imprecision, and other weaknesses and errors.

[43] Punitive damages are transfers between one person and another and do not constitute real resource costs to society.

The social costs of truck crashes have been enumerated in previous research documents (Zaloshnja and Miller, 2004; Hagemann et al., May 2011) and include loss of life, productivity, and medical costs of personal injury, property damage, emergency response services, productivity, and emissions costs from crash incident delay, and vehicle operating costs from crash incidents. These costs represent the social benefits from reducing the frequency and severity of truck-involved crashes, and constitute a primary basis for the evaluation of the trucking industry regulations.

Not all of these social costs are considered compensable from the standpoint of CMV crash liability. Costs of incident delay (delay time, excess fuel and other operating costs, and emissions of pollutants) are ignored, perhaps due to the transactions costs of identifying and valuing all of the vehicles caught in the traffic backup behind a crash. Perhaps, also, the cost is implicitly presumed as a risk of using public roads.

For regulatory evaluation cost-benefit purposes, the VSL is assumed to be constant for all fatalities. In the case of a specific crash, however, the characteristics of the specific individuals killed might be relevant, and the victims' life insurance coverage may reduce the amount paid to heirs for damage compensation.

Many competing definitions and measurements of cost have been used to date.

- Social costs, or all costs to society including pollution and incident delay.
- Public costs, those that are not incurred by the CMV driver or carrier.
- Reimbursable costs, which can be recovered by tort action if necessary, including pain and suffering.
- Financing costs, to the extent that compensation is not paid immediately.

An enumeration of social costs and whether they are compensable public costs is given in Table 18. Punitive damages are not regarded as costs, but are listed because they sometimes arise in torts. For economic efficiency, each person should pay the marginal social costs that arise from his or her actions. Thus, ideally, someone who causes a crash that results in traffic delay should pay that cost (or insure against it) so that they will be deterred from doing it again. This does not necessarily mean that the injured parties (vehicles caught in the backup) should receive compensation; if highway users have means to avoid the delays, they should not be indifferent about using them.

Table 18. Social Costs and Public Goods

Social Cost Component	Public Costs
Driver Fatality	Not compensated under liability
Passenger Fatality	Passengers not in the primary CMV
Other Fatality	Partial compensation under liability
Driver Injury	Not compensated under liability
Passenger or Other Injury	Full compensation
Property Damage to Truck and Cargo	Not compensated under liability
Emergency Services	Partial compensation under liability
Hazmat Damage and Environmental Mitigation	Partial compensation under liability
Delay Time and Costs to Other Vehicles	Not compensated
Emissions During Incident	Not compensated
Intangible Injuries to Others (Pain and Suffering, Lifestyle, etc.)	Compensable
Punitive Damages	Not awarded/transfer
Interest Lost Between Injury and Payment	Not compensated

[a] Public costs are those for which victims or other injured parties ("injured" in the sense of any kind of loss caused by the crash) could expect to receive compensation from insurance.

3.5.2 The Highway "User Contract"

Highway users implicitly accept some risk by venturing on the road; victims could also buy more insurance if they wanted to further pool their risk. From an equity standpoint, "innocent" third parties (members of the public) who have no control over the magnitude of their injury should, ideally, be held harmless. No one, however, is entirely blameless. When commuters leave for work during the peak period, they are aware of the congestion they are likely to suffer (as well as impose on others). Similarly, they are aware of the possibility of incidents that may cause them delay. In this sense, compensation is not desirable because the costs have already been internalized on the victim's side, and compensation would remove the incentive to avoid delay.

An analogous argument can be made for injury risk. As William Vickrey has pointed out, both of two vehicles that collide should be willing to bear the full costs of the crash, because if either one had not been on the road the crash would have been avoided.[44] For rare events for which the injured person is not at fault, significant compensation is desirable (so as not to deter beneficial road use), but the victim should still prefer to have avoided the crash and the costs should be shared through insurance. Hence, the social costs that are not fully compensated, as indicated in the right hand column of Table 18 are acceptable at some moderate level.

3.5.3 Pressures for Victims to Settle Low

Due to transaction costs (legal effort), urgency, and uncertainty about future awards, victims are reluctant to pass up early offers for settlement. In normal circumstances, most individuals are reluctant to incur the time, energy, and legal costs of pursuing claims for damages, except for those highly motivated by a sense of aggrievement. When individuals are physically and

[44] Automobile Accidents, Tort Law, Externalities and Insurance: An Economist's Critique, William Vickrey (1968).

psychically injured, they are likely to be even less aggressive, and are inclined to take whatever they can receive in the short run. Insurers are aware of this tendency and also recognize the costs of prolonging litigation, so they encourage resolution as soon as feasible. When the total claims for a crash clearly exceed the liability limits, insurers often offer the injured parties the maximum of the insurance to divide among themselves as they or the court sees fit.

Lawyers commonly take on personal injury cases, often by taking a percentage of any award as their fee. The U.S. depends upon the tort system to adjudicate the claims of parties believing they have been injured by actions of others. The system is imperfect in its outcomes, rewarding some excessively while denying fair recompense to others. Tort reform is a subject about which many people have strong opinions, but there are no simple changes that will result in greatly improved equity.

3.5.4 Delay in Payment of Claims

Another factor seldom explicitly acknowledged in the settlement of claims is the time value of resources, i.e., the time lag between injury and compensation payment is an additional cost to the victim that is not covered. The crash occurs at a moment in time, and the costs are incurred at that moment. If compensation is delayed, especially for a significant amount of time (e.g., 5 years), the cost will have escalated due to two effects:

- Inflation tends to increase the equivalent value of the injury over time due to the general change in price levels (the more that payment is delayed, the less medical care the same nominal dollars buy).
- The opportunity cost of resources increases the longer they are deferred in time (the "real" discount rate). The real discount rate for injured persons not receiving treatment until compensation is paid is very high.

These two cost factors are separate and independent of each other, and additive. No adjustment is made in most adjudicated or contested cases for the passage of time, the assumption being that the dollars valued at the time of the crash are the correct measure of damage. To arrive at the true value of compensation paid would require deflating the actual payments into constant dollars and then discounting the amounts in real dollars back to the time of the crash.

Because time is a cost, and litigation or other efforts to obtain compensation are real costs that may not be compensated, there is pressure exerted on victims to accept settlements that may be below the true cost of damages. Settlements prior to trial and judgments resulting from trial may be imprecise and biased measures of actual cost, even within those categories of social cost that are nominally compensated.

3.5.5 True Cost of Injuries

"True" costs are not conceptually measurable in dollar terms. Many of the data used to estimate the average cost of crashes are not precise enough for valuing an individual crash. In addition to the correct value for wrongful death, the actual medical costs of injuries can be estimated in several ways. Police reports record personal injuries on the KABCO scale, but whether these injuries are trivial, severe, or ultimately result in death is not generally known. KABCO is an observational scale, where K=Killed; A=Incapacitating Injury; B=Non-Incapacitating Injury;

C=Possible Injury; O=No Injury; and U=Injured, severity unknown. The recently implemented NHTSA program Crash Outcome Data Evaluation System (CODES) which matches police reports to medical records has been in operation long enough in some States to generate useful data on the actual costs of injuries, but these or similar data do not form the basis for compensation claims.[45]

The CODES data program could, ideally, provide data connecting police-reported severity with actual costs in hospital-treated injuries, but this possibility remains unfulfilled for many reasons. Few States participate in the system. States expend separate efforts, privacy restrictions, the need to aggregate data, sampling biases, bureaucratic requirements for access in each State, and no public access or publication of studies.[46]

3.6 STATISTICAL MODELING USING ISO DATA

The magnitude of the problem can be modeled with ISO data. The average dollar claim is relatively low (e.g., $18,000 for general freight carriers) compared to the mandatory minimums, but the distribution has a long tail with small numbers of large claims. A plausibly shaped distribution can be fitted to aggregated data (the histogram shown in Figure 5), and frequency calculated from the fitted function for values not specifically identified in the data.

A highly skewed distribution such as this one is much different from a more symmetrical one, such as the normal distribution. Consider that the average is less than $20,000, but there are a few crashes with costs $200,000 or even $2 million. Whether the cutoff is made at $750,000 or $1 million, there are still some crashes at even higher cost levels. The graph is truncated at $500,000 because the curved distribution (the smooth curve) is not separable visually from the zero-frequency line, although some space could be seen between the curve and zero if the picture were greatly enlarged.

Thus, regardless of how high the insurance minimum is, there will always be some crashes above that level. There is no dollar amount that will necessarily ensure that every possible crash victim is fully compensated.[47]

[45] http://www.nhtsa.gov/Data/State+Data+Program+&+CODES.

[46] Access to data collected by public agencies requires lengthy negotiation of agreements for use and disclosure, and assembling a useful comprehensive dataset would be costly and take many years.

[47] A 2011 tour bus crash killed 15 people and injured 10 more, constituting a total cost of something in the neighborhood of $100 million, at the current USDOT rate of $6.2 million per fatality.

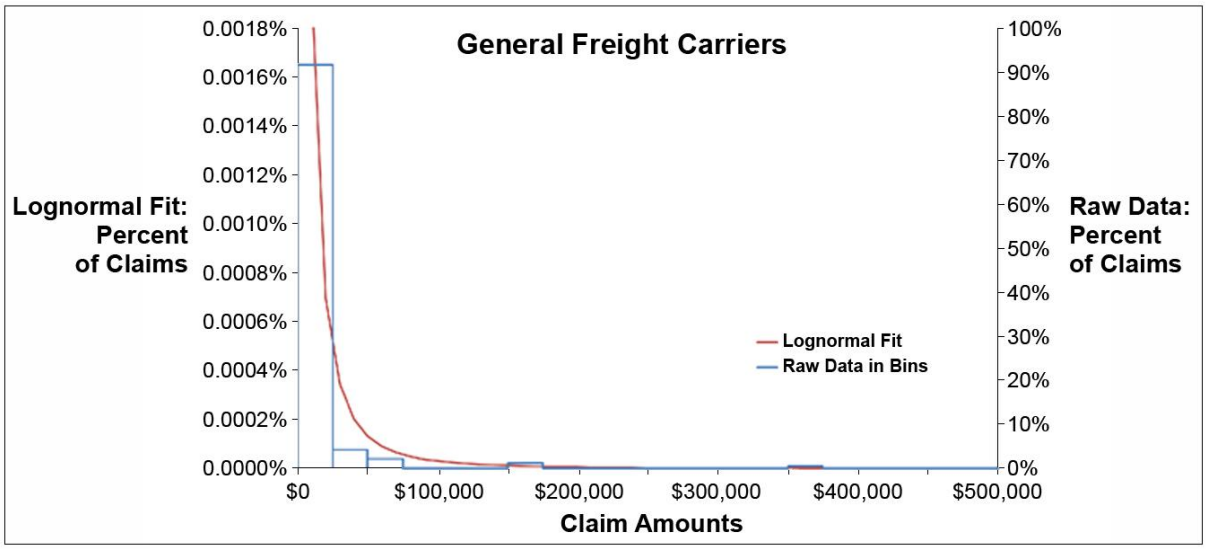

Figure 5. Histogram. Raw Histogram Data With Fitted Model Distribution

3.7 HIGH-COST CRASH FREQUENCY

There are 30 to 50 high-cost fatal crashes with truck at fault per year, depending upon sector. By applying the modeling procedures described above to the sparse data pertaining to each of the CMV types listed in Table 19 allows for the generation of estimates of the number of crashes per year that are caused by CMVs and exceed the applicable insurance minimum liability. The results, based on truck- or bus-involved crashes with at least one fatality, are shown in Table 20. The percentages are for the total number of crashes for the type of carrier. They are based on fatal crashes, as a measure of the likelihood of a costly crash that would exceed the insurance coverage (injuries can also exceed insurance liability limits but these are not as easily tabulated.

Most of the estimates of the share of crashes that exceed insurance limits are around 0.10 percent. Given the weak precision of the data and uncertain representativeness, the consistency among the different sources is strong. Compared to the total crashes in each group shown in Table 19, the number of high-cost crashes that exceed minimum insurance coverage is very small, and most power units are much more heavily insured or otherwise covered by financial capacity (e.g., large carriers).

Table 19. Motor Carriers Subject to FMCSA Financial Responsibility Regulations (March 2012)

Regulated Carrier Category	Liability Minimum	Estimated Number of Carriers	Estimated Number of Crashes/Year
For-Hire Interstate General Freight Carriers	$750,000	246,260	49,819
For-Hire and Private Carriers of Oil and Certain Types of Hazardous Waste	$1,000,000	28,926	28,854
For-Hire and Private Carriers of Other Hazardous Substances	$5,000,000	3,111	14,707*
For-Hire Passenger Carriers (Seating Capacity ≤ 15)	$1,500,000	2,767	269
For-Hire Passenger Carriers (Seating Capacity > 15)	$5,000,000	6,912	3,290
Total		**287,976**	**96,939**

*The disproportionately high number of crashes in this category, in comparison to the number of carriers, is due to the fact that most hazardous material carriers are larger, on average, than those in other carrier categories. Also, carriers are classified as "HM" if they carry any hazardous material; thus, most of the crashes in this category do not involve hazardous material.

Table 20. Summary of Alternative Crash Rate Estimates: Crashes Per Year That Cost More Than Financial Responsibility Minimums

Carrier Class	Data Source (Year)	Estimated Count [a] *	Estimated Percent of Total Crashes [b]
General Freight	ISO (2005–10)	20	0.06%
General Freight	TTT (2010–11)	28	0.08%
General Freight	MCMIS (2010)	59	0.17%
General Freight	GES (2009)	23	0.13%
HM	HMIS (1998–2009)	2	0.07%
HM	MCMIS (2010)	14	0.26%
Passenger Carriers	ISO (2005–10)	1	0.09%
Passenger Carriers	MCMIS (2010)	4	0.34%

Assumptions:

[a] Number of crashes per year that exceed the liability limits for which the truck or bus is at fault

[b] Total crashes of the carrier type

* ISO reports have upper bound classifications of $500,000 to $999,999 and $1 million plus.

ISO = Insurance Services Organization

TTT = *Tractor Trailer Torts*

MCMIS = Motor Carrier Management Information System

GES = General Estimates System

HMIS = Hazardous Material Information System

3.8 OTHER METHODS USING FATALITIES AS THE COST CRITERION

Other sources of limited data can be used to make guesses or test for order-of-magnitude consistency among estimates. The GES and MCMIS databases cannot distinguish fault in

multiple-vehicle accidents, and do not indicate whether the truck driver was killed in fatal crashes rather than a pedestrian or occupant of another vehicle (*Tractor Trailer Torts* and the Texas Closed Claim Data do show fault for a small unrepresentative sample). Because GES database depends upon police reports and the MCMIS database is constrained by reporting thresholds, both omit some share of crashes in which the damage was too minor to require a report.

3.8.1 FMCSA Motor Carrier Management Information System

MCMIS contains many records for carriers who have ceased operation but did not report that fact to the FMCSA, because they are not required to do so. Thus all queries in this report taken from MCMIS consider only carriers that have provided a "recent activity" indicator showing that they are in business.[48] MCMIS provides information on the type of carrier with respect to major cargo, and both interstate and for-hire status. Rates of fatal crashes for which the carrier is liable, as estimated from MCMIS and LTCCS, are shown in Table 21.

If 2.3 percent of general freight crashes result in at least 1 fatality, and 21 percent of the fatal crashes are by small carriers with less than 15 power units, then 0.47 percent of all crashes by regulated carriers are potentially cost exporting by this measure.

Applying this to the estimated number of crashes for which the truck was at fault, approximately 71 crashes per year in the general freight category are potentially cost exporting. Adding the other carrier types yields a total of 127 potentially cost-exporting crashes per year, assuming all fatal crashes exceed insurance thresholds and injury-only crashes do not. A test can be applied to this table by using the smaller merged MCMIS/L&I dataset, and comparing the results to Table 21. In Table 22, the merged data are expanded to yield the same crash total, so the number of crashes with one or two fatalities is expanded, rather than being raw data from a direct query.

[48] See "Characteristics of the MCMIS and L&I Databases" in Appendix F.

Table 21. Annual Fatal Crash Rates for Regulated Carriers

Carrier Category	Number of All Crashes	Carrier at Fault 30%	Number of Crashes With 1+ Fatalities[a]	Percent of Total Crashes With Fatalities[a]	Number of Crashes With 2+ Fatalities[a]	Percent of Total Crashes With 2+ Fatalities[a]	Low Net Worth[b] 0%	Potential Cost Exporting From Crashes
General Freight	49,819	14,946	1,135	2.3%	138	0.3%	0.47%	71
HM	43,561	13,068	862	2.0%	92	0.2%	0.41%	54
Passenger	3,559	1,068	44	1.2%	6	0.2%	0.26%	3
Totals	**96,939**	**29,082**	**2,041**		**236**			**127**

All Crashes" is taken from Table 1 (March 2012) using only MCMIS data; truck or bus at fault = 30 percent of the time, based on the LTCCS, for fatal crashes.

[a] Crashes with one or more fatalities includes crashes with 2 or more fatalities. Numbers are annual counts.

[b] Low Net Worth is share of crashes by small carriers with <15 power units.

Table 22. Annual Fatal Crash Rates for Regulated Carriers Using MCMIS and L&I

Carrier Category	All Crashes Total	Carrier at Fault 30%	Crashes With 1+ Fatalities[a] Number	Crashes With 1+ Fatalities[a] % of Total	Crashes With 2+ Fatalities[a] Number	Crashes With 2+ Fatalities[a] % of Total	Low Net Worth[b] 0%	Potential Cost Exporting from Crashes
General Freight	49,819	14,946	1,465	2.9%	175	0.4%	0.61%	91
HM	43,561	13,068	1,174	2.7%	108	0.2%	0.56%	73
Passenger	3,559	1,068	62	1.7%	11	0.3%	0.36%	4
Totals	**96,939**	**29,082**	**2,701**		**294**			**168**

Note: Same as Table 21, except fatality data are from the merged MCMIS and L&I database.

The actual numbers of crashes are consistently lower than those extrapolated from the combined database by significant amounts. The expanded data claim 82 percent of the 3,300 annual fatal truck crashes for the regulated sectors, but actual crashes are only 62 percent in the regulated sector. Carriers that match in both MCMIS and L&I may, for example, be larger than average.

3.8.2 General Estimate System (GES)

The GES is a sample database that is designed to be expanded to the population as a whole. Counting fatalities and serious injuries (KABCO "A"-level crashes), about 0.25 percent of crashes possibly exceed the $750,000 mandatory cap for general freight carriers. This is most certainly an overestimate because studies have concluded that only about 20 percent of injuries classified as "serious" on the KABCO scale by police officers are in fact serious.

3.8.3 Texas Closed Claim Database

The Texas database is the only State crash database readily accessible to the public, but there are severe limitations on what can be obtained from the data. The data coding does not allow for the separation of interstate from intrastate carriers, or the distinction of for-hire versus private carriers. Therefore, without knowing the magnitudes of those groups within the population, it is impossible to interpret whether any generalizations apply to the regulated portion or the unregulated portion.

Approximately 2 percent of Texas truck crashes result in settlements greater than $750,000. Again, this statistic may be biased upward or downward by the inclusion of the unregulated categories.

3.8.4 Tractor Trailer Torts

When systematic comprehensive data are not available for generating quantitative estimates of important magnitudes, it is worthwhile to give attention to data that may only be symptomatic, but nonetheless suggest the existence or absence of a problem. One such source for truck crash costs is *Tractor Trailer Torts*, a newsletter published by an informal private data service that collects information on high-cost truck crashes. The newsletter seeks to document the occurrence and results of truck crashes whose costs are litigated or contested in court. The cases may last for years. The particulars such as carrier owner, carrier status as interstate or for-hire, claim amount, settlement or judgment amount, explanation of costs or injuries, and fault may not be included in the descriptions of the cases for various reasons.

Data covering the period from August 2010 to July 2011 were compiled. Descriptors of the cases were extracted manually by reviewing each one, and putting the results in a spreadsheet. Of 86 crashes with damages that appeared to be greater than $750,000 (most cases did not exceed this threshold), 37 could be linked to interstate carriers in MCMIS. Of these, 28 had evidence of insurance. A condensed example from *Tractor Trailer Torts* is included in Appendix A.

Not much can be generalized from this small sample representing an unknown population. There are anecdotal examples of claims or judgments above the carrier's insurance limits where the compensation accepted is the insurance maximum, and the description of the injuries seems to support the size of the claims, but the numbers of such cases are very small. One hypothesis considered was whether there was a relationship between size of carrier and frequency of severe

crashes, the question being whether small carriers with low net worth were overrepresented. The few data are shown in Table 23.

Table 23. Carrier Size Versus Crashes

Carrier Size	Number of Interstate Crashes > $750,000	Carrier Likely Started Since 2000	Inactive
Small (<10 Power Units)	1	2	0
Medium/Large (10+ Power Units)	27	26	0

Source: *Tractor Trailer Torts.*

The size distribution follows the broad pattern of Table 13, in which the most crashes occur in large carriers simply because they have the most trucks. A more unexpected result is that the large carriers were relatively recent entrants. None of the carriers had gone out of business after having a crash.

3.9 HIGH-COST CRASHES: SEVERE INJURIES

A share of CMV-involved crashes causes serious injury to occupants of other vehicles, who do not die from their injuries. The question, however, is whether there is a systematic tendency for injured victims to receive inadequate compensation to cover their true costs. Furthermore, can such a bias be corrected by changing mandatory liability insurance levels?

In addition to fatalities, crashes that result in debilitating injuries may result in costs that exceed insurance liability limits. Certain specific types of injuries, such as brain damage and pelvic crush may be much more severe and costly than other injuries. In addition, if a substantial number of settlements accepted by victims are too low to cover their costs this may exacerbate the extent to which victims are undercompensated.

KABCO data are very poor indicators of severe injuries, although they can be improved by converting to the Maximum Abbreviated Injury Scale (MAIS).

3.9.1 Severe Injury Frequency from GES

GES is the only source of data on a representative sample of all crashes, and the GES injury data are based on the KABCO scale. The level of injury is judged by the police officer filing the report, and he or she is generally not a medical expert. NHTSA has found that the reported "A" category of KABCO, in particular, is unreliable. In a review of 20 States, they found that "A" injuries actually ranged from 2 percent to 56 percent of all crashes, and that in many cases, the category included minor injuries.

MAIS provides more precise data on long-term injury costs and has been matched statistically to the KABCO scale by NHTSA, based on a sample. If this conversion is applied to the GES data, the result is shown in Table 24 (the methodology is explained Appendix C).

Table 24. Public Costs per Truck Crash Using GES-KABCO-MAIS Conversion

MAIS	Injuries	Percent of VSL	Costs per Crash	Number of Crashes	Truck at Fault	For-Hire Interstate
0	No Injury	0	$0	97,135	43,711	17,484
1	Minor	0.0028	$16,240	72,115	32,452	12,981
2	Moderate	0.0436	$252,880	11,129	5,008	2,003
3	Serious	0.0804	$466,320	4,658	2,096	838
4	Severe	0.1998	$1,158,840	1,093	492	197
5	Critical	0.6656	$3,860,480	412	185	74
Killed	Unsurvivable (Fatality)	1	$5,800,000	2,671	1,202	481

VSL = $5.8 million.
Truck at fault = 45 percent.
Share of crashes for-hire interstate or regulated.
Source: see "Conversion from KABCO to MAIS Scales," Appendix C.

3.9.2 Costs per Crash by Injury Severity

Assuming that insurance can cover all of the "public" costs and that the full public costs of crashes are represented by the NHTSA estimates given in Appendix C, at a VSL of $6.2 million, two of the MAIS categories of injury yield damages of more than $1 million: MAIS 4 (Severe) and MAIS 5 (Critical). Assuming further that the truck is at fault 30 percent of the time, and that roughly 40 percent of trucks involved in crashes are subject to FMCSA regulations (for-hire, interstate or HM carriers), then about 180 non-fatal crashes might be affected by higher liability requirements.

Because 53 percent of crashes involve trucks belonging to carriers owning more than 50 power units (Table 13)—those with enough assets to cover a larger crash—the number of cost-exporting (undercompensated) crashes might be around 74 per year, in addition to fatal crashes.[49]

3.9.3 Traumatic Injury by Type

A different approach to estimating crash costs can be taken by looking at particular categories of severe injuries that may be caused by CMV crashes but have other causes as well. Data pertaining to such injuries tend to be highly aggregated or difficult to place in context.

An example is traumatic brain injury (TBI). Two organizations—Brain and Spinal Cord Org, and Family Caregiver Alliance—cite the same figure ($48.3 billion) for the total cost of TBI in the United States, presumably based on the same 1992 study by the National Foundation for Brain Research, which updated a 1991 study in the *Journal of Head Trauma Rehabilitation*. That study used 1988 dollars, so it is unclear which dollars account for the $48.3 billion number.

[49] The virtue of tying the injury costs to VSL is that the injury cost estimates become out of date more slowly than if their dollar values have to be scaled up via an unknown mix of price indices that may differ from level to level. The bases for estimating VSL (willingness to pay to avoid risk) versus injuries (medical costs and lost productivity) are not the same as those determining compensation for insurance claims, which may result in higher or lower awards. The 9/11 compensation fund paid an average of more than $2 million to families of those killed, based on 1) income of the deceased, 2) a base for pain and suffering, and 3) minus collateral sources of income to the families, such as life insurance (CNNMoney, 2011). Not acknowledged in the table is the possibility of more than one injury from each crash.

The two organizations also assert that 28 percent of TBI arises from motor vehicle crashes, based on a 1996 study in *Brain Injury* that uses 1991 data. This share is estimated to rise to 49 percent for the most serious TBI, elsewhere estimated to be in the ratio of 8:1 mild to serious.

Taking these items at face value, they are used in Table 25 to calculate first the truck share of TBI costs by allocating them in the ratio of truck VMT to all VMT. This results in a total of about $2 billion for trucks.[50]

Table 25. Trucking Share of Traumatic Brain Injury Costs

Factor	Base or Rate	VMT
Total Annual Cost of TBI (in Billions)	$48.3	
Estimated Motor Vehicle Share	28%	2,953,501
Truck Share of VMT	10%	288,005
Truck Share of Total TBI Cost (in Billions)	$1.319	
Number of Registered Trucks	10,973,215	
TBI Cost per Truck per Year	$120	
Annual VMT per Power Unit + Combination Truck		26,246
Annual VMT per Heavy Truck		64,132
Heavy Truck Share for Serious TBI	49%	
Severity/Frequency Adjustment Factor	4.28	
Average Annual Cost per Heavy Truck	$514	
Truck At-Fault Share	45%	
Cost to Heavy Vehicle Insurers	$231	

Sources:
* Family Caregiver Alliance. http://www.caregiver.org/caregiver/jsp/content_node.jsp?nodeid=441).
* Brainandspinalcord.org (http://www.brainandspinalcord.org/).
Highway Statistics 2009 http://www.fhwa.dot.gov/policyinformation/statistics/2009/).

The second step is to allocate this truck share to individual trucks. The number of registered trucks of the 6-tire and up category is almost 11 million, so the average cost per vehicle is $120. This average is more representative of smaller trucks, so a heavy-truck estimate should be factored up to account for heavier weight per vehicle and more mileage per year. The 49 percent truck share for serious TBI divided by the 28 percent overall average takes account of the weight factor, and the ratio of heavy truck VMT per truck per year to average mileage reflects the utilization factor.

With these adjustments, the estimated TBI cost per heavy vehicle is about $514 per year. If 45 percent of the injuries are caused by trucks, the $231 cost is well below the approximately $5,000 insurance premium per truck, indicating that current payments to insurers easily cover the costs of TBI. Even if a large share of these costs is currently exported, overall premiums would not need to be significantly higher.

[50] Trucks in these statistics are two-axle, six-tire vehicles or heavier, including single-unit trucks in local or intrastate service and private trucks as well. Buses are presumably in the "motor vehicle share," but the Highway Statistics data include local transit buses that seldom cause TBI, so buses are ignored in the analysis.

3.9.4 Non-Profit and Advocacy Groups

Many groups have been formed to address advocacy needs across a wide range of spectra. All such groups have laudable goals and perform useful services, but most have not conducted the data collection themselves or the analysis that might help determine the desirable level of CMV liability coverage. Some of these organizations are listed in Table 26.

Table 26. Sources of Injury Information and Truck Safety Policy

Organization	Data or Positions
Centers for Disease Control and Prevention (CDC)	Injury Prevention and Control Center has a transportation research area focused on teens and children, but not trucking; CDC has many centers, programs, and databases.
Web-Based Injury Statistics Query and Reporting System (WISQARS)	A CDC database; medical cost of fatality is $9,594 on average, total cost $903,264 per fatality including work-related costs; national cost of motor vehicle occupants is $33 billion; for all crash-related deaths the total is $41billion (CDC cited as source in the *Chicago Tribune*).
Morbidity and Mortality Weekly Report (MMWR)	Newsletter from the CDC noting studies, events, etc., affecting mortality from disease, injury, genetic defects, etc.
National Hospital Discharge Survey (NHDS)	Number of patient discharges for specific diseases, includes injury but not motor vehicle or other trauma; detail by age and gender; no costs.
National Electronic Injury Surveillance System (NEISS)	A service of the Consumer Product Safety Commission (CPSC); includes motor vehicles; no cost data. NEISS estimates costs of medical treatment, work loss, pain and suffering, and product liability.
Trauma Foundation	Motor vehicle injuries are leading cause of death for population under 35; cost of "injury-attributable medical expenditures" given as $117 billion in 2000 citing CDC/MMWR.
American Academy of Orthopedic Surgeons (AAOS)	Counts on the number of emergency room visits for hip complaints; data source: Reason for Visits to Emergency Room - National Hospital Ambulatory Medical Care Survey 1998-2006. U.S. Department of Health and Human Services; CDC; National Center for Health Statistics; sports, home, and work-related reasons sometimes broken out, but transportation is not a category; neck injuries included but not brain; no cost data.
Orthopedic Trauma Association (OTA)	Conducts research and publishes papers on the treatment of various injuries, including pelvic and head, including motor vehicle in general; no costs or prevalence.
American College of Surgeons (ACS)	Posters/brochures on initial management of head injuries and pelvic injuries; no costs or prevalence.
Advocates for Highway and Auto Safety	Supported by insurance, health, medical, and police groups; opposed to larger, heavier, wider trucks or longer hours of service; 15 legislative recommendations do not include any for trucks.
Allstate Insurance Company	Favors national legislation (3/09) to harmonize State regulations supervise insurers, address fraud, and control systemic financial risk.
Truck Safety Coalition (TSC)	Combination of Citizens for Reliable and Safe Highways, and Parents Against Tired Truckers; advocacy across the board; favors increased insurance requirements as entry barrier to marginal carriers.

Few of the private and non-profit groups collect primary data. Primarily, they extract selected information from government or independent agencies such as the CDC. Conceivably, it would be possible to match injury costs to types of injuries if a common set of categories could be

found between truck crashes and cost tabulations, but no such set of categories exists. For example, the Consumer Product Safety Commission (CPSC) publishes the data presented in Table 27 (except for the last column, which is calculated). The CPSC operates the National Electronic Injury Surveillance System (NEISS) that collects sample data on consumer product-related injuries treated in emergency rooms.

Table 27. Average Cost per Injury to Persons Over 65 for Selected Products

Consumer Product Category	ER Injuries	Treated Injuries	Deaths	Total Costs	Costs per Case
Yard and Garden Equipment	41,780	108,710	51	1,917.6	$2,742
Ladders and Step Stools	28,510	76,890	79	2,286.7	$21,695
Sports	57,120	168,890	128	3,164.2	$14,000
Bathrooms	85,630	220,630	194	6,039.8	$19,721

Source: Consumer Product Safety Commission, "Emergency Room Injuries Adults 65 and Over," 2002 (injuries include all reported, not just ER).

The contexts for these injuries are unlikely to produce injuries as severe as those that can occur in CMV crashes, but the distribution of costs is unknown without accessing the raw data, and also cannot be related to similar injuries from CMV crashes in any event.

3.10 INTERVIEWS WITH INDUSTRY EXPERTS

A parallel effort to seeking objective data and attempting to extract trends and conclusions from various sources was carried out to identify key informants with insight from various vantage points into how the industry works and interview them. These included trade organizations, public officials, motor carriers, insurers, and scholars. Interviews with experts provided many insights, but few objective data or data sources. The individuals and their affiliations are listed in Table 28.

Table 28. Persons Interviewed for Financial Responsibility Study

Person Interviewed	Affiliation
John Kindelberger	NHTSA CODES
Joseph Ferreira	Massachusetts Institute of Technology, Massachusetts Insurance Regulation
Morgan Adams	AAJ Trucking Litigation Committee
Normal Little	American Bus Association
Robin Reissman	University of Massachusetts
Steve Piwowarsky	FMCSA
Thomas Weakley	OOIDA
Thomas Corsi	University of Maryland
Dan Murray	American Transportation Research Institute
John Lannen and Jeff Burns	Truck Safety Coalition
Ira Lipsius	Central Analysis Bureau (CAB)

General observations offered by persons interviewed for this study are summarized below. The observations represent personal perspectives of persons in various entities and organizations.

3.10.1 Transportation Industry

The transportation industry recognizes the role of regulation in protecting the public interest and ensuring equitable treatment of victims. Large motor carriers tend to favor, or at least not oppose, higher minimum levels of financial responsibility. They perceive such measures as complementary to their own safety programs and to their voluntary internalization of costs. They also see such measures as pro-competitive in that they level the playing field and eliminate cut-throat competitors. Large- and medium-sized carriers have a great deal to lose from crashes, and therefore generally maintain strong safety programs and have sufficient insurance policies or reserves to provide full compensation for crashes. With higher insurance requirements, safety will gradually improve through carrier selection, driver selection, and insurer scrutiny, which will reduce operating costs for safe carriers. These carriers tend to also favor more due diligence by insurers and aggressive safety enforcement by FMCSA. They view FMCSA's CSA measures as useful and appropriate.

Small carriers tend to oppose raising insurance liability requirements for cost reasons. The transportation industry is highly competitive, generating profits on the margin, of only 3 to 5 percent. Insurance costs to the passenger carrier segment are especially volatile compared to the other segments, with deductibles reaching up to $100,000 per policy and rates up to $2,500 per vehicle.

Industry observers acknowledge the existence of "bad apples" (carriers and insurers that are unscrupulous) but the size of these groups is small and their divergence from the norm is difficult to gauge. Marginal carriers and insurers may also exhibit less responsibility financially and safety-wise. Chameleon or reincarnated carriers are also recognized by the industry as a significant enforcement problem that must be addressed in order for other policies to work. Automatic devices that allow police to stop vehicles for cause are invaluable for enforcement productivity, while avoiding disruption to vehicles that are in full compliance.

3.10.2 Insurers

Insurers are of mixed opinions on the question of higher liability, tending to regard the short term disruption to established practices as costly while the longer term benefits as uncertain.

Large insurers have sufficient actuarial data and motivation to estimate carrier risk, and base rates on their own evidence of carrier behavior, whereas smaller insurers are less likely to be able to incur the expense of investigating and inspecting an individual motor carrier. Yet insurer organizations serve smaller insurers, providing pooled experience to compensate for lack of actuarial depth.

Insurers regard their knowledge of risk factors as proprietary, and do not share their data or rating factors with researchers or the public. Insurers manage the amount of risk they undertake by passing on shares of risk and rate revenues to reinsurers, some of whom are captive firms (owned by the primary insurer). Insurers sometimes do not know a carrier's operating authority has been revoked, and continue to provide insurance coverage. However, with data and information technology generally improving over time, insurers are able to make more accurate judgments about risks presented by individual carriers.

Some smaller or less profitable carriers protect their assets by leasing commercial vehicles and equipment and by engaging in short-term contracting with drivers. Costly crashes rarely put carriers out of business, since there is no point in suing them for compensation they are unable to provide.

Insurers recognize that, although crash damage cases may be settled quickly, serious injury cases may take years to settle and for full damages to be known, during which time the victim has been forced onto their own or public resources. Furthermore, insurers point out that most litigation is settled out of court. Damage estimation for injuries is challenging and imprecise, but must be defensible to motivate judges and juries. Histories of similar cases can be acquired from jury verdict research companies, but they do not lend themselves to quantitative analysis or statistical generalization.

3.10.3 Carriers

Carriers are also of mixed opinions on the question of higher liability, with larger ones tending to be in favor of it, or at least not opposed to it; while smaller ones tending to oppose it.

OOIDA serves both as a trade organization and an insurer for small owner-operator motor carriers. It is generally opposed to increasing insurance liability requirements on the grounds that it is unnecessary and would be detrimental.

Owner-operators are especially sensitive to additional operating costs due to the state of the economy and Environmental Protection Agency (EPA) regulations. They argue that higher insurance requirements will place many small carriers out of business, as well as put insurers that serve them at unease.

Insurance is only one of many operating costs incurred by motor carriers—which include vehicle registration, fuel and oil, repair and maintenance and leasing. OOIDA's base insurance fee is $5,050 per truck power unit for $750,000 coverage and $5,550 for $1 million. The vast majority

(96 percent) of OOIDA's members elect the higher coverage, with the exceptions being essentially shortest-haul operators. Insurance for passenger carriers is not available through OOIDA, at least for primary coverage. Owner-operators do not have the regulatory option, or the sufficient means, to self-insure.

With regard to umbrella insurance, small carriers concede that it may be suitable for medium and large carriers, which have complex organizations and operating relationships, but it is not suitable for small carriers.

OOIDA reports that from 1996 to 2012, 17 out of almost 7,000 claims (i.e., 0.24 percent) approached $1 million. The average liability claim is $3,600 (similar for property damage). It is argued that juries setting damage awards are not informed of the available levels of insurance, so specific knowledge of liability limits should not be affecting the magnitudes of such judgments.

3.11 IMPACTS OF HIGHER MINIMUMS

The primary proposed correction to the problem of adequacy or under-compensation is to raise the mandatory insurance levels for motor carriers in the regulated segments and perhaps for private carriers as well. The immediate questions are as follows:

- How many inadequately compensated claims would be covered by higher limits?
- How many carriers (or proportion of CMV travel) would be affected by the requirement?
- If liability minimums were raised, what is the best level to require, for each of the regulated segments of the industry?
- Are there other impacts that should be considered in raising mandatory liability coverage?

Given the data and analysis conducted above, the answer to the first question is that a small but unknown number of undercompensated damages would receive more compensation. Because the liability limits have some tendency to become self-fulfilling, there may also be some increase in over-compensation, objective measures of true costs being difficult to define. With the information at hand it is not possible to determine the extent of either.

An obvious consideration is how many CMVs would be affected by increased limits? It is difficult to determine with current data. Some crude measures are given in Table 29, comparing two groups of carriers required to carry $750,000 liability: one group reports $750,000 coverage and the other reports $1 million coverage. The reporting requirement is to document that the carrier meets the minimum, and anything above the minimum is voluntary. Thus the first group may have more coverage, in the same policy or in an additional policy. The carriers counted only include those that can be matched between the two databases.

Table 29. Comparison of Coverage for General Freight

Group	$750,000	$1,000
Average Number of Power Units	4.04	5.27
Number of Failed BASICs per Carrier	0.35	0.28
Percent High Risk	5.0%	3.4%
Crashes per Power Unit	7.82	6.26
Fatal or Injury Crashes per Power Unit	3.02	2.45
Percent Covered by Insurer Specializing in CMV	97%	93%
Percent Carriers Began Operating in Past 2 Years	20.5%	18.6%
Number of Carriers	63,368	63,183

Source: MCMIS, L&I (December 2010).

With this imperfect partition, at most half the carriers reporting the minimum coverage would need to upgrade, which at more than 63,000 is a large number but likely overstated. The higher reported insurance coverage is associated with slightly larger carriers on average, but most carriers are small. Those reporting $1 million coverage are safer in the measures FMCSA scores, and a smaller share is labeled "High Risk." Crash rates among the higher coverage group are fewer, both total and fatal or injury, and have slightly longer experience in the business. Slightly fewer, however, are insured by companies specializing in truckers' insurance.

A substantial number of carriers would need to purchase more insurance if $1 million were the minimum, but perhaps many fewer than 60,000. As mentioned earlier, the norm seems to be $1 million, based on comments from interviews and limited searches. Insurance companies may have an incentive to only file that they meet the minimum rather than the actual level of insurance coverage. The higher liability cap is associated with safer results, and higher net worth is associated with higher safety, but there is no causal relationship that can be inferred from the table.

3.12 CONCLUSIONS WITH RESPECT TO COST EXPORTING

Although cost exporting clearly takes place, its magnitude is elusive because of the relatively small number of such crashes and the dearth of pertinent data. Given the volume of freight moved by truck in the U.S. and the extent of intercity passenger carriage, it is inevitable that there will be at least some severe crashes. Not all of them can be fully covered by insurance. The evidence suggests, however, that liability insurance levels need to be raised to cover a larger share of costly crashes.

The problem of estimating the magnitude of cost-exporting crashes can be addressed by using a method of successive windowing in on smaller subsets. This approach is particularly applicable when the population of interest (crashes whose costs exceed insurance coverage, and other resources are not available) cannot be constructed from primary data. The process is shown in Table 30.

Table 30. Potential Cost Exporting Crashes Summary

	Carriers	Crashes	Fatal
All Motor Vehicle Crashes		10,700,000[a]	33,000
CMV-Involved Crashes	525,000	416,000[b]	3,800
Financially Responsible Regulated Carriers (Five Types) Crashes	288,000	97,000[c]	2,000[d]
CMV at Fault	86,400	29,100[e]	600[e]
Above-Limit Crash Factor		2%[f]	1.20[g]
Crashes That Exceed Liability Limits		582	720
Low Net Worth Carriers/Minimum Insurance		21%[h]	21%[i]
Insufficient Compensation		122	151

a. FMCSA Commercial Motor Vehicle Facts.
b. NHTSA's Traffic Safety Facts 2008.
c. Data presented in Table 1.
d. Data from MCMIS presented in Table 21.
e. Assumes that in 30 percent of fatal crashes the truck is at fault, according to the LTCCS.
f. Share of truck crashes (regulated and not) resulting in claims exceeding $750,000, from the Texas Closed Claim database.
g. Estimated factor on fatal crashes to include severe injuries (see Section 2.9 and Appendix C.
h. See Table 16.
i. Share of crashes by carriers with < 15 power units.

The numbers of carriers and crashes are large. Stored data only extend to the set of regulated carriers, and the associated crashes of that particular subset. To delve deeper requires applying parameters derived from samples that may be considerably different from the general context of national regulation. The truck share of fatal crashes is taken from the Large Truck Crash Causation Study, which shows a different at-fault rate for crashes as a whole than for fatal crashes. The share of all crashes that exceed insurance coverage (2 percent) is based on one State (Texas) whose data do not distinguish regulated carriers. Fatal crashes are reliably tabulated, but costly severe-injury crashes are not captured in any databases.

The rough estimates constructed in Table 30 are higher than the ones in Table 22, in part due to the inclusion of severe injury crashes in Table 30 and perhaps also due to the crudeness of the at-fault and excess cost factors, and the exporting share as well.

4. ARGUMENTS AGAINST HIGHER INSURANCE REQUIREMENTS

Although there appears to be a defensible rationale for raising the levels of liability insurance for freight, passenger, and HM motor carriers, there are several counter arguments that will be raised. If a policy recommendation to raise the minimum levels is proposed, these arguments will need to be addressed by the FMCSA.

4.13 SETTLEMENTS AT THE MAXIMUM INSURANCE LIABILITY

There is the argument that claim settlements at high cost levels tend to gravitate to the carrier's liability limits. This could be interpreted to mean that the true value of claims greatly exceeds the carrier's insurance liability, but that it is fruitless to assert them because the carrier does not have the means to pay more. The pattern could also be interpreted to mean that any amount up to the insurance limit is fairly easy to obtain for certain severe crashes and does not require strong evidence of exact economic damage. For the insurer, the effort expended to establish that an injured victim's damages should be valued at $500,000 when the insurance covers up to $2 million may not justify striving for the lower amount when the outcome is subject to the discretion of judges and juries.

If this tendency to gravitate to the insurance maximum for cases within a certain range implies an inability to accurately measure damages, then the insurance market contains an inefficiency of unknown magnitude or even direction. Raising the liability minimum requirement would result in more transfer of income to crash victims and higher insurance costs to the industry, but not necessarily improved equity or efficiency. In economics, this problem is referred to as asymmetric information, because the victim and the plaintiff's lawyer can better assess the true damages than the insurer or the court.

4.13.1 Response:

- Fine-tuning the insurance requirement may suppress some abuses. An example is split limits, in which the cap applies to two measures separately, e.g., $3 million per person and $5 million per crash.
- With larger amounts of money at stake, insurance companies could develop and promote standard principles for valuation of injuries and make efforts to promote them as objective and equitable.

4.14 BANKRUPTCY

Where just compensation is not provided, the cause may be that the carrier has exhausted its resources and has a negative net worth. Claims for damage are often not even filed because the carrier has insufficient insurance and no other assets that are available for liquidation. Hence demonstrably risky carriers may be allowed to continue operation simply because claims for damages would force them into bankruptcy without generating any compensation. For this reason, the data do not readily show a pattern of bankruptcy after fatal crashes, even though

insufficient payments are made on claims. Thus the threat of bankruptcy is an escape because it deters legal remedies, while leaving the possibly negligent carrier still in business.

4.15 INSURANCE REQUIREMENTS FAIL TO DETER RISKY CARRIERS

Insurers are not necessarily interested in caretaking their carriers; other financial considerations are more important than careful underwriting. Many strategies are in use now to monitor and sanction the safety behavior of carriers, and judging from the steady decline in crash frequency the strategies seem to be working. There is no certainty that higher liability requirements will cause insurers to be more diligent in evaluating carriers for insurance.

Whether undertaken by underwriters or the FMCSA, some predictive ability is required if insurers' evaluation or FMCSA actions are effective at reducing crashes. Although subject to discussion, evidence seems to support the improving capability of analysts to use historical experience to estimate future risk.

4.15.1 Response:

- Both carriers and insurers benefit from safe behavior, and their profits depend upon high safety performance.
- The safety culture seems to be improving.
- There is no guarantee that insurers will be more perceptive regarding whom they cover and how much they charge, but it is reasonable to assume that it is in their best interest to promote safety in their clients.

4.16 RESIDUAL MARKET

Dangerous carriers can escape the rigors of the voluntary insurance market by applying to the residual market for coverage. A residual market (also referred to as shared risk or assigned risk pool) exists for both private auto insurance and commercial vehicle liability insurance. The market, or "mechanism," provides insurance for carriers that have been rejected by the voluntary insurance market. Each State establishes its Commercial Automobile Insurance Procedure (CAIP) according to its own rules, but the State's facility is intended to be self-sustaining from rates charged to carriers (subsidies are assessed to the private insurers offering similar coverage in the State). This option might seem to offer a means for engaging in cost exporting.

If the CAIP serves as an insurer of last resort, allowing irresponsible carriers to continue in operation, then the following questions might be asked about loss experience in the residual market:

- What rates do CAIP typically charge, and how much to these vary depending upon the rating factors?
- What has been the loss experience of State CAIPs?
- What share of regulated carriers end up in a CAIP?

If the rates are reasonable, the losses commensurate with the rates, and the share of CAIP operators small relative to the voluntary market, then the CAIP is serving its purpose of serving the industry without endangering the public.

The residual market has its own trade organization, the Auto Insurance Plan Service Organization (AIPSO).[51] According to its Web site,

> *"AIPSO is a management organization and service provider for various insurance industry groups responsible for administering the residual market. Being a nonprofit organization, the revenues AIPSO receives from automobile insurers generally only cover its operating costs. These costs are shared among the insurers on a market share basis for each of 49 States (as well as District of Columbia) in which AIPSO provides services. Many AIPSO services are provided directly to or on behalf of Governing Committees representing residual market mechanisms in each State. Service components are frequently subject to the prior approval of the respective State insurance regulators."*

The CAIPs absorb those carriers who cannot get insurance in the voluntary market for whatever reasons but who can present themselves as potentially satisfactory risks, while those carriers with poor risk prospects leave the industry entirely.

- According to AIPSO, the residual market has been inexorably shrinking for the past 20 years, and has declined as a share of both personal and CMV insured operators.[52]
- The rates offered by CAIPs are supposed to be actuarially self-supporting, and they come close although most require modest subsidy from the insurance industry.
- AIPSO and the CAIPs consciously strive to keep the pool small and charge adequate rates.
- The insurance industry itself is regulated, and unsound insurers are unable to obtain the guarantees necessary to stay in business.

4.16.1 Inflated and Fraudulent Claims

Plaintiff claims do not necessarily represent an accurate (unbiased) estimate of true costs. Some plaintiffs may attempt to "game" the process of determining awards by inflating costs claimed. Insurance liability limits may become *de facto* upper bounds on claims because extracting further compensation from the carrier may be infeasible or unlikely.

The insurance industry as a whole is constantly working against fraud, which is the intent to obtain payment from an insurer that is greater than the injury the claimant has incurred. In automotive insurance, fraud ranges from inflation of legitimate claims by exaggeration and incurring unnecessary costs to deliberate efforts to cause minor crashes that can be expanded into serious claims. Many types of injury are difficult to verify objectively and depend upon the ostensibly injured person's descriptions of symptoms.

[51] Located at 302 Central Avenue in Johnston, Rhode Island, (888) 424-0026 nationally or (401) 429-1567 from Rhode Island.

[52] According to the AIPSO 2011 Annual Report, residual market rate was 9 percent of total auto rate in 1989 but dropped to 0.7 percent by 2009. This includes personal automobile liability, but commercial insurance has followed the same pattern.

The Insurance Research Council (IRC), an organization supported by automobile insurers and underwriters, conducts studies estimating the causes and extent of fraud in the motor vehicle sector. A 2008 study based on 42,000 closed-claim cases from insurers representing 58 percent of the industry estimates $4.8 to $6.8 billion in excess payments to auto injury claims, or 13 to 18 percent of total payments made.[53] This is an increase from a previous study estimating excess payments at 11 to 15 percent of payments.

Excess payments are classified in two ways, intentional or "difficult" fraud versus opportunistic or "soft" fraud, with the latter—referred to as "buildup"—being the dominant share. Because it is costly to investigate, costs are extrapolated from sample case investigations. Apparent fraud is "more likely than other claims to involve sprain and strain injuries and periods of disability." In addition, the study found that claimants in apparent fraud and buildup claims were more likely than other claimants to receive treatment from physical therapists, chiropractors, and other alternative medical providers. The claims are primarily bodily injury liability.

In another study, the IRC observed that while the number of claims filed decreased by 19 percent from 2000 to 2006, the cost per claim went up by 22 percent.[54] This they attribute to increases in vehicle repair and medical costs, some of the latter coming as a result of hospitals shifting unrecoverable Medicare and Medicaid costs to auto injury insurance claims.[55]

Thus, there are many ways in which claims may be inflated above true crash costs, and the excess payments are substantial although difficult to estimate. While the types of fraud tend to be toward the smaller end of severity, internal injuries with long periods of disability are subject to cost buildup for insurance purposes.

4.17 INSURANCE RATE VOLATILITY

When insurers relied on returns from equity markets for profits, the revenues were relatively stable and there was little need to adjust rates for year-to-year variations in risk experience. With less reliance on appreciation of financial investments, insurance rates may go through unpredictable fluctuations as insurers attempt to forecast risk when limits are raised.

This is a problem with medical malpractice insurance, for example. Injury claims grew dramatically in the 1970s, due in part to a desire for assigning blame when adverse outcomes occur, to growth in non-economic damages (pain and suffering), to punitive damages (gross negligence), to jury sympathy for injured plaintiffs, and to the large volume of litigation that was costly even when the claims were without merit. Legislative reforms have suppressed some of the excessive claims, but insurance rates remain high for practicing doctors.

These conditions apply much less to the transportation industry and some not at all. The facts in highway crashes are somewhat easier to establish than in medicine, deterring frivolous lawsuits. The frequency of high-damage crashes is lower, and perhaps most significantly, very large claims are not covered. There is often little to be gained by piling on pain and suffering and

[53] IRC (November 2008).
[54] IRC (April 2008).
[55] IRC (February 2010).

punitive damages when the limits of the insurance are already exceeded by direct economic damages.

Insurers of mortgage securities and other financial instruments have been heavily damaged by the sudden revelation that the risks in their portfolios were much higher than previously assumed and also very difficult to value because derivatives and the securitization of assets have made extracting the toxic portions almost impossible. Some insurance companies failed because they could not obtain credit to cover their losses; the withdrawal of credit occurred because the magnitude of the liability could not be estimated. The possibility of a system wide failure had not previously been anticipated.

Assets of bankrupt transportation companies are easily unwound, and readily liquidated. Uncertainty over very costly crashes is small. Costs of one crash are not inextricably intertwined with the values of other liabilities, as opposed to the valuation of subprime mortgages. The conditions for a credit default in transportation insurance do not appear likely.

4.18 LOSS OF BENEFICIAL SERVICE

Some of the effects of raising minimum liability requirements are less clear. Studies show what is obvious, namely, that the variation among carriers in their choices of insurance coverage is wide. Raising the requirement will lift some share of carriers from where they are to a higher level, but most larger carriers will be unaffected, having chosen for their own reasons to already insure at higher levels than the minimum.

Some carriers, however, will not be able to afford the rates or bonds needed to increase their coverage, and will cease or fail to initiate operations. The social cost of restricting entry to the carriers industry needs to be weighed against the improved safety of the carriers that do operate. It is this segment of carriers that needs to be evaluated. Because the carriers that get into costly crashes is a small segment of all carriers, it may be that a substantial amount of socially beneficial service will be terminated in the process of screening out a few vulnerable carriers. If the insurance requirements are set at too high a level, the value of the freight service lost will exceed the value of the crashes avoided.

4.19 REINCARNATED CARRIERS

“Chameleon” or reincarnated carriers (and perhaps insurers as well) are carriers who avoid a negative reputation (traffic violations, poor compliance, crashes) by simply changing their name. There is no empirical evidence to link these specific situations to cost-exporting crashes, but there is a considerable difference in crash frequency between, say, carriers with low compliance violations versus those with indicators of poor safety behavior.

Carriers having poor safety performance may attempt to suppress this information by changing the name of the carrier and re-registering ownership and vehicles as a different entity. Insurers have an incentive to detect this kind of fraud, and draw upon agencies such as the Central Analysis Bureau (CAB) to detect carriers using the ploy. It is unknown how much this practice will increase in response to potential increases in insurance rates.

4.19.1 Response:

- The insurance industry has available means of detecting potential reincarnated carriers. For example, CAB developed algorithms and databases that detect attempts by sanctioned carriers to reincarnate and provides this as one of the services they sell to insurance companies.

5. EVALUATION OF REGULATORY IMPACTS

For proposed regulations having an impact of more than $100 million per year, a regulatory evaluation, of which a cost-benefit analysis is a major tool. A set of administrative review procedures have been set in place at the Federal level to ensure that the proposed regulations meet certain standards for effectiveness and social benefit. A proper regulatory analysis should include the following three basic elements: 1) a statement of the need for the proposed action, 2) an examination of alternative approaches, and 3) an evaluation of the benefits and costs—quantitative and qualitative—of the proposed action and the main alternatives identified by the analysis.

The newly enacted MAP 21 legislation does not specify the type, scope, or complexity of the mandated periodic examination of the appropriateness of the minimum levels of financial responsibility. If a CBA is conducted, it would follow the framework described next.

5.1 COST-BENEFIT FRAMEWORK

In general, Federal regulations are expected to lead to benefits to society that exceed their costs. The burden of argument in justifying whether to raise liability requirements for regulated carriers depends upon generating the following information:

- Current equivalents of the original liability levels set in the 1980 law, adjusted for inflation in unit costs.
- The existence of catastrophe insurance coverage, meaning in practice that very few crashes exceed the maximum liability.
- The effectiveness of mandatory insurance coverage and the underwriting efforts of insurers in screening out or altering the behavior of carriers that otherwise might cause costly crashes.
- Equity consequences for crash victims, as observed in the adequacy of compensation for damages.
- Costs and benefits in terms of compliance costs imposed on the industry, reduced crashes, and other impacts of raising financial responsibility requirements.
- Consideration of other strategies besides insurance regulation that would accomplish the same safety and equity objectives.

Evaluation of the desirability of higher liability minimums requires analysis and interpretation of theory and empirical evidence, and would be challenging even if comprehensive and exhaustive data were available. In practice, the data are incomplete at best, and the conclusions are derived more from economic principles than empirical evidence.

The possible benefits to society from higher liability requirements could be:

- Reduction in truck-involved crashes.
- More equitable compensation for victims (or heirs or estates) of crashes, whether the injury is fatal, non-fatal, or property damage only.
- Internalization of crash costs by carriers.
- Increased underwriting focus by insurers.

Crash reduction can potentially be accomplished via:

- Changing carrier and driver behavior to be safer.
- Removing risky carriers from the industry before they cause crashes.

Changing carrier and driver behavior is accomplished via sanctions and incentives. CMV operators have an incentive to drive safely in order to protect their own health and life, to protect their livelihood as operators by maintaining a clean record, to protect the value of the truck asset for themselves or their employer, and to prevent injury to others. These incentives can be strong or muted depending upon a wide range of related factors.

Aside from personal injury, incentives can be adjusted financially. Increasing financial responsibility requirements requires that the carriers have more capital, in the sense of upfront investment in the operation. If the driver has more at stake (e.g., if the operator is also an owner), then he or she may drive more conservatively to avoid risking the investment. If the driver is not the owner, then the latter may be induced to take actions in the way of training and a safety culture to protect the investment.

Obviously these effects occur at the margin, and are not detectable for any given carrier.

5.1.1 Financial Deterrence to Risky Carriers

Carriers with weak financial means may be deterred from going into business or staying in business by the increased rates or bonding requirements. In some cases, the additional burden of providing rates or credit may be sufficient to discourage entry. The crashes these operators would have had if the liability requirements had remained at present levels is a benefit of the regulatory change.

5.1.2 Costs of Increased Financial Responsibility Requirements

The social cost of raising financial requirements on carriers is the loss of service the deterred carriers would have provided. The majority of deterred carriers would have had no crashes or would have paid all claims against them for damage.

In proper, well-functioning markets, the costs to carriers will result in an increase in prices for the delivered goods because the costs are passed along to the consumers. Some jobs may be lost in the trucking industry if not all of the freight movement of deterred carriers is picked up by other carriers, but higher shipping prices will inevitably cause a reduction on total goods

movement. Insurers will incur increased cost to manage the additional underwriting effort but may save if safety is improved.

Some of the lost service will be picked up by other carriers, but not all. The assets of discouraged carriers will be used for some other purpose or sold to carriers who can bear the additional financial burden.

5.1.3 Additional Cost to the Carrier

The additional rates paid by the carrier for increased insurance are a transfer (not a cost to society), but because it changes the price of a market good it has an efficiency impact.

The additional cost to the carrier is partly represented by the rate, but this cost is partially offset by the shift of some amount of risk (between the current minimum and the revised minimum). The cost of this risk is presumably less than the additional rate, because otherwise the carrier would have purchased the higher insurance before the requirement was imposed. The self-insurance cost can be objectively represented as the probability of a crash incident times the cost of the incident, summed over the range of possible incident severities (it is possible, of course, that the carrier did not do this calculation, or did it incorrectly, which adds more randomness to the outcome).

To know the incentive, then, from the carrier's perspective, it is necessary to have information on:

- The cost of rates for the incremental insurance, which will vary with the carrier and even with the insurer.
- The imputed value of the carrier's self-insurance on the incremental risk.
- The profitability of the carrier, as to whether the additional cost will reduce the carrier's return on investment below what it needs to stay in operation.

5.1.4 Transportation Market Competitiveness

If the regulatory action deters some carriers from offering service and that reduced service is not offset by some other action that stimulates service, the total amount of service offered in the market will decrease. Most of the freight that would have been moved by the deterred carriers will be transferred to other carriers, but some will not because the market price (shipping rates) will increase (slightly). The supply curve is shifted inward (less quantity offered at the same price), leading to a higher equilibrium price and lower quantity (ton miles).

Under imperfect competition, the individual firm may face a downward-sloping demand curve. This allows the firm to have some effect on quantity by the prices it sets. If the reduction in the market size has the effect of reducing competition, then actual prices will increase more than they would in a competitive market, further reducing quantity.

Under deregulation, most segments of the for-hire interstate trucking market are highly competitive and most operators are small. Thus the increase in industry concentration resulting from the elimination of marginal carriers should be small.

5.1.5 Internalization of Costs

In ideal (competitive) economic markets, efficiency (net social benefits) are maximized to the extent that producers internalize their costs and consumers are able to capture the full benefits. For trucking markets, benefits to shippers from good transportation are passed on to consumers in the form of prices of goods. Costs are similarly passed on to consumers if carriers if forced to internalize their costs. An important cost is the risk of crashes. If carriers are able to escape paying compensation for crashes they cause, costs are exported and the market is less efficient. Specifically, prices are too low and freight volumes too high compared to an efficient market.

Carriers might be able to export costs in several ways:

- Taking risks for which they lack sufficient financial responsibility, and find ways (e.g., bankruptcy) to avoid the liability should an adverse event occur.
- Exploiting weaknesses in the insurance market by taking advantage of adverse selection in entering risk pools.
- Moral hazard, which encourages operators to engage in inefficiently unsafe behavior because they do not bear the costs.

5.1.6 Regulation Causes Price Change

The first step is to translate the regulation into a price increase to carriers. Some carriers will not be impacted directly because they already purchase insurance at a level above the (new) mandatory requirement (e.g., $2 million).

- What share of the industry is already covered?
- Does coverage include supplemental/excess/umbrella coverage?

Carriers/operators above the current level but below the new minimum will need to purchase more insurance. The types of carriers may be several, but at least two can be distinguished:

- “Safe” carriers that show an absence of violations and crashes and other evidence of good behavior.
- “Risky” carriers who have higher odds of being involved in future crashes.

5.1.7 Magnitudes of Rates

Each of these carrier categories will face higher costs for insurance. The questions then to be answered, by insurance companies, are:

- What factors do you use to measure (future) risk?
- Approximately what magnitude of rates do you charge now, and how much more will it cost for the higher coverage?
- How accurately can you distinguish between safe and risky carriers, and do the rates you charge reflect the risk difference?

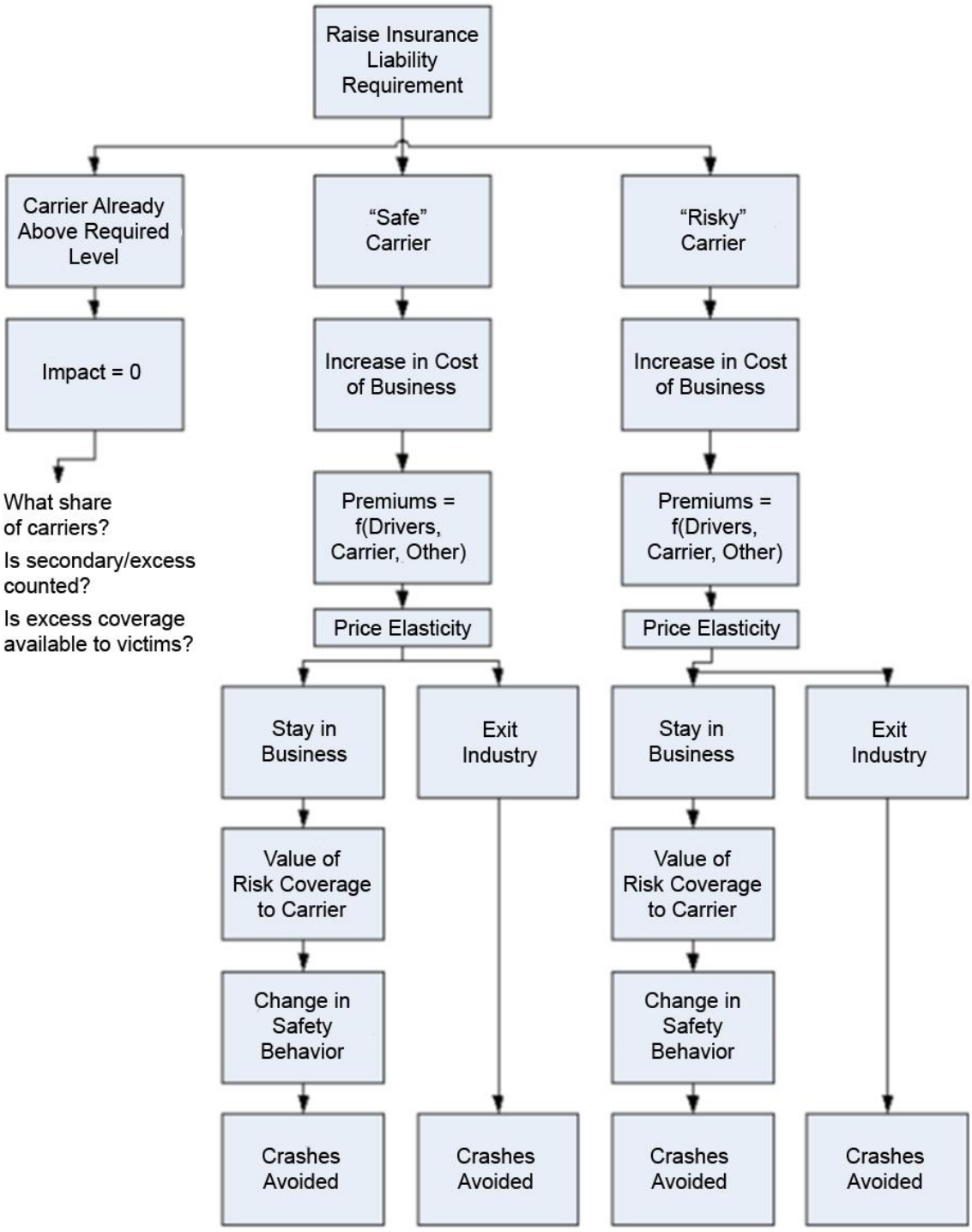

Figure 6. Flow Chart. Impact Linkages from Regulatory Action to Costs and Benefits

5.1.8 Compliance Costs

In addition to the changes in economic markets that occur as a consequence of regulation—some intended and some not—there are transaction costs in implementing the regulation. These can

include paperwork, time and effort enforcement, and costs of corruption and fraud. In addition, special attention is paid to impacts on small businesses.

The carriers affected by an increase in financial responsibility requirements already purchase insurance, so the additional paperwork costs of purchasing a different (higher) level would be small. Carriers would have to recalculate their risk exposure, receive quotes from insurers, and make a decision under new conditions, but any business needs to be cognizant of changes in its cost and operating environment and make adjustments accordingly.

5.1.9 Impacts on Small Business

As well as weighing costs and benefits to the industry and society, the Regulatory Flexibility Act requires that agencies evaluate their regulations with respect to whether they have a substantial economic impact on a substantial number of small entities, known as a SEISNOSE determination. It is clear from the analysis of the carriers most likely to change their behavior or otherwise be affected by a change in the financial responsibility requirements are almost exclusively small businesses. Thus the proposed change definitely has a SEISNOSE impact, but the transaction costs are nonetheless quite small.

When a SEISNOSE is estimated to occur, the agency has a responsibility to try and mitigate the burden on small businesses. The compliance costs for an increase in the financial responsibility requirements falls within the normal range of activities that a small business engages in routinely in its operation.

5.1.10 Equity Impacts

Although CBA is primarily directed at efficiency impacts that change prices and outputs in the relevant markets, Federal guidelines also urge that significant impacts on the distribution of income be considered, and mitigated if adverse. Sometimes the equity consequences of a regulation can be partially ameliorated through exemptions and in-kind transfers, but major equity impacts usually require cash transfer payments or the like to neutralize undesirable equity consequences.

Additional compensation for fatalities and severe injuries may help offset tendencies toward under-compensation, but there is little assurance that equity will be improved. In general, it is probably more efficient as well as more equitable to prevent the crashes than to award damages after the fact

6. POLICY ALTERNATIVES

A list of possible strategies is provided in Table 31 that could be used to reduce the costs or frequency of CMV crashes, and or improve the extent to which injuries to victims are compensated. The strategies can be considered complementary, and the choice among them is how much of each would be worthwhile. Some combinations may be synergistic, in that the combined effect is enhanced, but ultimately increased combinations will necessarily exhibit diminishing marginal returns as crashes approach their irreducible minimum. Some strategies—such as better data collection to monitor frequency and causes of under-compensation—should yield high incremental benefits because the strategy is presently comparatively underutilized.

Table 31. Broad Array of Policy Alternatives Affecting Public Crash Costs

Policy Strategy	Purpose
Mandatory Liability Requirement	
Minimum Level	Catastrophe coverage and underwriting incentive
Split Limits	Balance between catastrophe coverage and insurable risk magnitude
Periodic Updates	Adjusts limits if price index changes
Exemptions	Special categories for whom requirements do not apply
Extend to Private Carriers	Scope of regulatory coverage
Complementary Insurance Layers	
Umbrella or Excess Layers	Umbrella is for carriers with multiple types of risk; excess adds more protection
Compliance and Enforcement	
CSA	Information for insurers, out-of-service and compliance sanctions
Hour of Service (HOS) and Electronic Onboard Recorders (EOBR)	Fatigue
Speeding Restrictions and Enforcement	Major factor in frequency and especially severity
Safe Operation	
Driver Training	Safe driving habits
New Entrant Requirements	Inexperience
CDL Fraud	Unqualified potentially dangerous operators
Drug/Alcohol/Medical Prescriptions	Driver control
Equitable Compensation	
Compensation Fund	Focus exclusively on equity
Crash Cost Mitigation	
Incident Response Management	Earlier and faster treatment for victims
Bus Design and Construction	Bus body and window structure integrity
Improved Trauma Treatment	Higher survival with less permanent injury
Data for Decision-making and Analysis	
Database for High-Cost Crashes	Supplement existing data in areas of potentially cost-exporting crashes; monitor trends, track causal factors

FMCSA is credited with achieving greater safety, through drug testing, CDL requirements, creating databases of relevant crash and driver violations experience, compliance reviews (CRs),

removal of operating authority, and roadside inspections (forms of focused enforcement). These are complements to increased financial responsibility. Regulatory evaluation should include the design and consideration of alternative policies or strategies that can contribute to solving the same overall safety problem, through reduction in frequency and severity of crashes, internalization of crash costs, and better victim compensation.

6.1 RAISING LIABILITY COVERAGE LEVELS

The baseline for any recommended policy is the set of current policies including $750,000 mandatory insurance requirement for general freight carriers. The action alternative or alternatives could be, for practical or statistical purposes, $1 million, and/or $2 million or $3 million for basic interstate trucking operations and correspondingly higher levels for HM and passenger carriers.

Other features or variations on this strategy include setting the limits in several dimensions (split limits), extending the set of carriers subject to the regulation (exemptions and private carriers), and enacting a policy for periodic updates in the specific levels on the basis of inflation.[56] This overall strategy is the action alternative that has been studied in the present report.

6.1.1 Split Limits

The maximum compensation for an insurance policy can be stated as a single upper bound or as the envelope of several upper or outer bounds. The most familiar form of multiple or "split" limits for CMV insurance is one limit per person and another limit per crash or incident. Split limits are not encompassed within the current regulations.

The insurance limits set by the ICC in 1936, incidentally, were split limit. The limits were split as follows:

- Limits for bodily injuries to or death of one person.
- Limit for bodily injuries to or death of all persons injured or killed in any one crash (subject to a maximum of $5,000 for bodily injuries to or death of one person).
- Limit for loss or damage in any one crash to property of others (excluding cargo).[57]

The split limit option is a modification or variation on the mandatory liability strategy. It allows for a multiplicity of injuries without creating an open-ended total liability that would be difficult to offer because of the actuarial uncertainty.

Incidentally, Title 14 (Aeronautics and Space) Part 205 pertaining to Aircraft Accident Liability Insurance provides for a split-limit compensation structure. It requires that any carrier providing air transportation for passengers shall, in addition to other coverage required, maintain aircraft accident liability insurance coverage for bodily injury to or death of aircraft passengers, with minimum limits of $300,000 for any one passenger, and a total per involved aircraft for each

[56] This option could be pursued in fulfillment of the MAP 21 mandate, or independently as a precursor to a proposed rulemaking.
[57] Reference: Federal Register, Thursday, August 20, 1936.

occurrence of $300,000 times 75 percent of the number of passenger seats installed in the aircraft.

6.1.2 Expanding Coverage to Private Carriers

The structure of the analysis would be similar to the first policy option above, but even fewer national data are available. The categories of costs and benefits would be the same.

6.2 COMPLEMENTARY INSURANCE LAYERS

6.2.1 Umbrella Insurance

FMMCSA could require carriers to obtain additional insurance coverage over and above the existing required minimum levels. This additional insurance for commercial vehicles, commonly referred to as umbrella or excess insurance, typically ranges from $1 million to $5 million. Example rates are given in Table 32. This regulatory option still would not cover 100 percent of all crashes, but it would provide additional relief to crash victims.

Table 32. Umbrella or Excess Insurance Quotes*

Coverage	Insurance Rate
From $750,000 to $1 Million	$200 per power unit
An Additional $1 Million	$1,000–$2,000 (if fleet consists of one power unit or a small fleet) and quoting "in-house," otherwise, a lesser rate through an excess insurance company
	$500–$700 per power unit, if a large fleet (or a small fleet through excess insurance company)
From $1 Million to $5 Million	$8,000 per power unit, if fleet consists of one power unit
	$4,000 per power unit, if a large fleet

* The source (insurance company) requested not to be quoted.

6.3 FOCUSED COMPLIANCE ENFORCEMENT

If it is possible to statistically identify the relatively small pool of carriers at risk for high-cost crashes, then FMCSA could take corrective actions to either improve carrier safety behavior or remove them from service. The methods for identifying risky carriers are the measures included in the CSA program, supplemented with notices of insurance cancellation.

The empirical question here is the effectiveness of selective enforcement and the costs of that activity. If the pool of potentially risky carriers can be easily narrowed and the process of treating them reasonably inexpensive, then the net benefits of this strategy could conceivably be higher than the mandatory insurance strategy. The success of the enforcement strategy depends upon the ability to identify, and focus on, that share of risky carriers.

6.3.1 Speeding Enforcement

According to FARS, the number one most often coded factor for truck drivers involved in fatal crashes is speeding, with failure to keep in proper lane and inattention tied for second. Additional roadside enforcement or policies to reduce reckless driving could provide strong safety benefits.

These benefits of additional speeding enforcement would be determined by future reduction in speeding-related crashes. The quantitative estimate of the benefits would be entirely dependent on the number, cost, and frequency of crashes prevented.

6.3.2 Hours-of-Service Enforcement

Other things being equal, a fatigue-caused crash is likely to be more destructive because the operator may have taken little or no corrective action immediately before the impact. Increased levels of hours-of-service (HOS) monitoring and verification aimed at the carriers most at risk for high-cost crashes could be a productive regulatory strategy.

Costs and benefits would be similar to the focused enforcement policy option above. The benefits would be determined largely by the effectiveness of HOS enforcement as a means for improving operator behavior or taking carriers out of service. As with other CBAs, the number and cost of crashes prevented multiplied by the average cost per crash of the relevant type would form the core of the quantitative estimation.

6.4 ALTERNATIVE CORRECTION OF EQUITY PROBLEMS

Where equity outcomes are regarded as unacceptable or at least deficient, but the market functions well enough in other respects, treatments may be devised to compensate disadvantaged parties without disturbing the overall efficiency of the market. If inefficiencies have been corrected but the result is still deemed inadequate from an equity standpoint, there are various strategies that might be taken:

- Reduce the number of crashes.
- Reduce the number of victims who are inadequately compensated.
- Increase the pace of justice where there are conflicting claims.
- Reduce the erratic results and uncertainty in compensation negotiation.
- Reduce the magnitude and share of the costs in the compensation process that do not go to victims.
- Reduce the rate of increase in the cost per crash.
- Reduce the number of unqualified or unsafe carriers.
- Increase the scrutiny of carriers by insurance companies.

6.4.1 Victim Compensation Fund

FMCSA could establish a fund for the compensation of damages sustained by victims of catastrophic CMV crashes over and above the mandated limits of financial responsibility. The fund could be strictly administered by FMCSA or by a consortium of entities including FMCSA. The concept of a recovery fund is common in both the public and private sectors. Examples include the Oil Spill Liability Trust Fund of the United States Coast Guard and the Federal Deposit Insurance Corporation of the Federal Reserve. Other recovery funds, of a retrospective nature, are the 9/11 Victim Compensation Fund and the British Petroleum Oil Spill Fund.

This option would clearly be the most complex of all the options. FMCSA has not calculated the minimum amount of such a fund nor its impact (or obligation) per entity. Aside from the legal considerations, there are practical and monetary issues as well, including fund contribution criteria, daily administration, Agency resources, distribution of funds, and dispute resolution.

Given the relative rarity of large undercompensated claims, the magnitude of the fund need not be a deterrent to its establishment. The primary concern regarding a compensation fund would be the moral hazard incentives created by the availability of a possible means for escaping responsibility for unsafe behavior.

The most effective way to generate revenue for the fund, in avoiding undesirable incentives, would be an annual Congressional appropriation not tied to any measure of the CMV industry. A more common method for generating revenue for a pooled fund is some form of tax on the industry as a whole, such as a diesel fuel tax or a surcharge on annual registration fees.

To reduce moral hazard, crashes for which the carrier is at fault would be presumed a priority and to be the responsibility of the carrier and its insurers. Thus, the fund would be aimed at truck-fault crashes for which all compensation mechanisms had been exhausted and the carrier's net worth had been reduced to zero (with no possibility for reincarnation).

The Agency could establish a new fee or draw upon an existing fee(s) to meet the deficiency of compensation to victims of catastrophic crashes. This option is similar to the option of a fund, except that the source of funding is already pre-prescribed, in the case of an existing fee(s). The collected monies would be placed in an escrow account, administered by FMCSA. This option is subject to many of the same difficulties arising from the fund option, described above.

6.4.2 Other Prevention Measures

Compared to raising insurance requirements—which burden the entire industry or a large share of it, the majority of which operate safely—the effectiveness of other strategies for reducing crashes may be greater at a lower cost. The contribution of prevention measures (HOS, size/weight, training, CDL fraud, compliance, drunk/drugged driving, vehicle design, teenagers, etc.) toward reducing the need for compensation needs to be estimated.[58] FMCSA has had a substantial hand in reducing crash frequency, through its CSA program and other enforcement and safety efforts.

[58] The laundry list also includes fewer exemptions from length and weight limits; stronger bus construction; fewer exemptions of agriculture trucks from HOS; bigger fines for overweight trucks or falsifying HOS logbooks; underride protection (IIHS); fatigue (HOS, EOBR); driver compensation (per-mile rates result in excessive speed and too many hours, John Lannen, TSC);

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APPENDIX A: COMPENSATION DATA AND PREVIOUS STUDIES

If the minimum levels of insurance coverage are increased, victims of severe crashes will be able to recover greater monetary compensation from at-fault motor carriers. Hence, the market failure of cost exporting will be reduced. If the carrier's commercial vehicle is no longer operable following the crash, the carrier may not possess any other means of compensating the victim or their family. If that is the case, then the insurance payout presents the maximum amount of compensation that the family will receive. Furthermore, in cases that go to trial, that amount may have to be split among several plaintiffs. This section presents evidence that supports the existence of such cost exporting, but finds that its extent is limited in frequency.

CASE STUDIES

To illustrate the nature of cost exporting, a selection of Federal legal cases from the U.S. District Courts and the U.S. Courts of Appeals was examined. A LexisNexis search using "MCS-90" (the mandated endorsement for a motor carrier's public liability insurance policy) uncovered 153 potentially relevant results from 1985 to the present. Some of these cases, however, are multiple records from different stages of a single case.

An initial review of approximately 25 cases yielded 7 results in which the damages or settlement amount were greater than the $750,000 minimum liability requirements for property carriers. After identifying each legal case, a search for news articles was performed to gather additional detailed information. The four cases described below are the result of this initial review and provide detailed accounts of the aftermath of a severe motor carrier crash.

In some of the cases the defendants are insurance companies, in others they are motor carriers. But in all cases, there was an initial settlement amount determined in a prior civil suit. It is likely that a large number of civil suits exist, and the cases found in U.S. District Courts or Appeals Courts may not be a representative sample—many smaller and less contentious cases settle before going to trial. Therefore, these four cases provide a snapshot of the worst offenders or more unusual cases.

Net Trucking

On August 21, 2005, a truck driver from Illinois-based Net Trucking, Inc., rear-ended an automobile stopped in a construction zone on the Indiana Toll Road. This collision set off a chain reaction that resulted in four fatalities, seven injuries, and property damage. At the time of the incident, Net Trucking was insured with Carolina Casualty Insurance Company under a policy with a maximum liability of $1 million per crash.

In December 2010, after 5 years of litigation, a Federal judge in the United States District Court in Karpov v. Net Trucking (2010 U.S. Dist. LEXIS 129130) awarded damages of $15.1 million to the plaintiffs ($6.7 million compensatory damages for wrongful death, $2.1 million in compensatory damages for personal injury claim, and $6.4 in punitive damages). According to the case, the carrier had fraudulently conveyed its assets to other business entities. The president

transferred title of his house to his wife, and his wife subsequently started Net Trans Inc., Foxline Transportation, Inc., and Blue Line Equipment, LLC.

In a related case, Carolina Casualty Insurance Company v. Karpov (559 F.3d 621; 2009 U.S. App. LEXIS 6106) the plaintiff sought a declaration that its liability was limited to $1 million for the entire crash. This was in response to the Karpov's argument that the minimum level of financial responsibility applies on a per-person basis. In that case, the court affirmed prior district court decisions and concluded that "whatever amount was to be paid would not exceed the amount of the security that had been established by statute or motor carrier's liability policy" and that the minimum level of financial responsibility applies on a per-accident basis, not a per-person basis. The significance of this case is that it indicates that although the insurance policy liability cannot be greater than the policy limit, the actual liability of a motor carrier may be much higher.

Sources/Additional Information:
http://blog.cleveland.com/metro/2010/12/mayfield_heights_family_gets_ 1.html
http://www.journalgazette.net/article/20101208/LOCAL03/312089972
http://indianalawblog.com/documents/karpov%2012-8-10.pdf

Cox Cattle

On July 20, 2006, a Cox Cattle driver crashed into the back of a U.S. military Humvee traveling along Highway 98 near Camp Shelby, Mississippi. The impact of the crash sent the vehicle off the road, killing two of the occupants and injuring the two others. After the incident, a number of lawsuits were filed by the injured and the estates of the deceased seeking damages in excess of $750,000. The details of this litigation do not appear to be available.

Although no direct relationship can be verified based on known facts about the incident, the court proceedings are suggestive. Canal v. Dauma states that on October 28, 2008, Cox Cattle filed for bankruptcy protection in the United States Bankruptcy Court for the Eastern District of Texas, Tyler Division. It is possible that the incident and subsequent litigation may have contributed to the bankruptcy. This case is significant because, like the Net Trucking example, it indicates the potential inability for a carrier to cover damages above the liability coverage. The cases also illustrate the limited reach of the coverage in an incident that results in high damages. The courts acknowledge this assertion in Armstrong v. United States Fire Insurance Company, a case related to a crash that resulted in the four fatalities (including two minors, and a serious injury), stating "the tort plaintiffs have a total of $1.4 million of insurance coverage available to them. And, while that amount is clearly insufficient to adequately and completely compensate the tort plaintiffs for their losses in this case, the amount nevertheless exceeds the minimum Federal requirement" (606 F. Supp. 2d 794, 2009 at 825).

Sources/Additional Information: http://www.sitnews.us/0706news/072406/072406_guards.html
http://www.kinyradio.com/juneaunews/archives/week_of_07-17-06/juneau_ news_07-21-06.html.

Canal Indemnity Co. v. Tammy L. Dauma (2009 U.S. App. LEXIS 104463) Armstrong v. United States Fire Insurance Company (606 F. Supp. 2d 794, 2009).

Virginia Hiway Express

On July 8, 1995 a Virginia Hiway Express truck collided with a vehicle on I-85 near Salisbury, North Carolina, and knocked the vehicle onto the shoulder. The Virginia Hiway Express truck then collided with another vehicle forcing it to collide with yet another vehicle. These events resulted in four fatalities and three severe injuries. Two civil actions were filed in U.S. District Court for the recovery of damages. After receiving a judgment in the amount of the $1 million, the plaintiffs sought to increase available funds and determine whether the defendant's potential liability exceeded the stated policy limits of $1 million. The plaintiffs filed a "declaratory judgment action, contending that Federal law and regulations modified the liability policy to provide sufficient liability insurance," Hamm v. Canal Insurance Company (10 F. Supp. 2d 539; 1998). In Hamm, the Federal judge affirmed that the maximum liability is for damages arising out of a single accident, not each damage claim.

Transystems Inc.

On April 8, 1999, a Transystems Inc. semi-tractor trailer failed to yield and collided with a ConRail freight train at the railway intersection of State Route 13 in Moxahala in Perry County, Ohio. The incident led to a derailment, a coal spill from 25 rail cars, and a diesel fuel leak. The truck was carrying 16,000 pounds of glass jars that were broken and scattered at the accident site. The incident resulted in four injuries, an environmental clean-up, and property damage expenses in excess of $2.5 million.

A settlement for the personal injury action was reached, but the parties went to court over a dispute about the availability of additional coverage for the cost of the environmental clean-up expenses at costs. In Stevens v. Fireman's Fund Insurance Co. the Court affirmed that the limit for damages and covered pollution cost or expense combined, resulting from any single accident is $1,000,000. The significance of this case is that it is one of a number of legal cases in which the liability limit was insufficient to cover the damage and one of the parties is seeking additional compensation that aligns more closely with the particular costs of the incident. The judgment affirms Federal legal precedent, which states that the limits in 49 CFR Sec. 13906 apply to each accident regardless of the particular circumstances of the incident.

Sources/Additional Information: http://www.thepost.ohiou.edu/archives2/040999/501.html.

Stevens v. Fireman's Fund Insurance Co. (2002 U.S. Dist. LEXIS 28156) Associated Press, April 9, 1999.

EMPIRICAL EVIDENCE

The estimated frequency of crashes resulting in cost exporting from a carrier to the public is presented in this subsection. The key challenge in developing such an estimate largely stems from sparse data. To overcome that problem, this study combined two separate databases in an innovative fashion.

The first database, MCMIS provided annual nationwide information on the motor carrier industry. The most useful portion in the MCMIS was the so-called "crash file," which provided detailed data regarding the date and severity of large truck crashes. MCMIS also provided

detailed information about the identity and characteristics of all motor carriers subject to FMCSA regulation. To isolate the subsample of interest, certain variables within MCMIS identified those carriers that would potentially be subject to minimum insurance regulations (e.g., interstate for-hire carriers).

Another source of information, the L&I database provided a limited amount of detail regarding carriers' minimum liability insurance levels and the insurance levels selected by those carriers. In addition, the L&I database included an important set of variables that noted the exact date on which certain carriers lost their operating authority. This key variable was determined to be the best available indication of if and when a motor carrier permanently exited the industry.

Using unique identifiers in each dataset (i.e., the USDOT number), it was possible to merge the databases. This combined dataset provided an estimate of the number of motor carriers that were involved in an accident resulting in a fatality or injury. That subsample represents the vast majority of crashes that may have resulted in damages exceeding the minimum insurance level required for most interstate for-hire carriers of non-hazardous materials ($750,000).

The combined database was used to identify a smaller subset of carriers that were involved in a severe crash and subsequently exited the industry. It was found that 24,835 carriers with operating authority as of December 2007 exited the industry by December 2010. Of those 24,835 carriers, 1,187 had been involved in some type of crash, 513 had been involved in an injury-causing crash, and 57 carriers were involved in a fatal crash (fault notwithstanding). Note that some industry attrition would arise due to other factors besides the presence of a crash, so the figures presented above represent an upper bound of the count of industry exits. Also note that a legal settlement exceeding the mandated insurance level does not imply that an at-fault carrier is unable to remunerate victims of a crash, only that the insurance payout itself was not sufficient.

Nevertheless, the preliminary evidence can be analyzed and interpreted. The most striking finding is the relatively small number of carriers who potentially exported costs onto crash victims. The combined database yielded only 570 fatal or injury accidents in 2007 that were followed by the loss of operating authority by the carrier. In order to interpret these occurrences as a measure of the extent of cost exporting, the following series of assumptions needs to be accepted.

A few anecdotal references are also presented as examples of this sort of costly crash. These details are presented in Table 33.

Table 33. Anecdotal Costly Crash Details

No	Source	State	Carrier	Description
1	http://www.truckinginfo.com/news/news-detail.asp?news_id=75355	Maryland	Gunthers Transport LLC	August 2011 Fatal Crash.
2	*Tractor Trailer Torts* Newsletter 97 (January 2012)	Illinois	Dorlan Crane	$27.67 million verdict for paraplegia victim from big-rig crash.
3	*Tractor Trailer Torts* Newsletter 99 (March 2012)	Virginia	Purdy Bros	Driver distracted by cell phone clips the car. Following an airlift to treat serious injuries, settled for $2.5 million.
4	*Tractor Trailer Torts* Newsletter 99 (March 2012)	Idaho	Cedar Point Construction Co.	Truck driver runs stop sign and crashes with motorcycle. Jury verdict of $1.826 million for injuries.
5	*Tractor Trailer Torts* Newsletter 99 (March 2012)	New Jersey	Atack Trucking Co.	Refrigerated truck hits car, killing the driver. $1.5 million settlement ($750,000 each from trucking firm and shipper).

Necessary Assumptions

- The 1,757 cases identified above represent carriers who lost their operating authority due to crash-caused exit from the industry.
- Only firms who exited the industry (perhaps through bankruptcy) exported costs onto the crash victims. There may, however, be carriers involved in an accident who export costs but do not exit the industry. It is assumed that those firms were able to compensate the victims through other means (e.g., by liquidating assets).
- Civil court cases are resolved in less than 3 years. It is acknowledged that some legal cases may take significantly longer than 3 years (the time frame under consideration) to resolve and the carrier may still operate in the meantime.
- Defendants sue for the full extent of their damages. In reality, some injured parties may not seek restitution beyond the insurance level due to non-trivial court costs.
- Carriers who export costs onto the public cannot maintain their original operating authority (although they may become so-called "chameleon carriers"). If violations of this assumption are numerous, however, it would suggest broader underlying problems with the justice system and motor carrier regulation.

Although the assumptions listed above may not hold in some instances, it is reasonable to think that they typically are valid for most fatal accidents. Further work can be conducted to empirically test these assumptions.

Example from *Tractor Trailer Torts*

Defendant's driver was proceeding west on I-55 when he checked his XM satellite radio above his head. By the time the driver looked back at the road, traffic had slowed. The driver could not stop in time and the rig struck one car, killing the driver, then struck a second car, occupied by plaintiffs, before striking a bobtail trailer. Three other cars were involved in the incident, and the expressway was closed for 5 hours. The 45-year-old driver of the second car, an internal medicine physician in Puerto Rico, was airlifted to a hospital where he died of his injuries. His nephew sustained fractured vertebrae. Police investigation found a brake defect on the second axle of the trailer.

Plaintiffs sued the driver, Cardinal Transport, the tractor owner, and the trailer owner. Cardinal's policy had a limit of $1 million. The insurer paid $350,000 to settle wrongful death claims asserted on behalf of the driver of the first car, paid $10,000 to settle the claims of another injured party. Both the tractor owner and the trailer owner denied liability on the ground that the driver had no time to apply the brakes. Immediately prior to closing arguments, plaintiffs settled their claims for the $650,000 of available insurance, along with Cardinal's agreement to pay $1.235 million over time.

The jury returned a verdict which exonerated the owners of the tractor and trailer. Cardinal was found liable for $8.4 million. Plaintiffs agreed not to execute on the judgment so long as Cardinal remained current in its payments. (Condensed from *Tractor Trailer Torts*, No. 81, May 13, 2011.)

APPENDIX B: MODELED DISTRIBUTIONS OF CRASH COSTS

EMPIRICAL MEASUREMENT OF COSTS AND UNCOMPENSATED CLAIMS

The answer to underlying question of how big is the problem depends the Share of Crash Victims Are Inadequately Compensated and the Distribution of Costs per Crash. In a study by ICF, they estimate that 80 percent of costs are currently covered by insurance, based on Texas State data but using perhaps weak methodology.[59] No national data have been discovered that offer useful information on the distribution of actual crash costs, in particular, the prevalence of costly crashes for which cost exporting (inadequacy) is most likely.

There is no absolute standard for equity, including adequacy as defined here. Moreover, there is no feasible level of insurance liability that will with confidence cover 100 percent of all crashes. A form of catastrophe insurance may be achieved by raising the liability limits.

Cost Distribution by Magnitude of Cost

The information needed to answer the question of how many crashes lie above existing liability limits and other cost levels that might be considered for mandated limits of coverage is a the distribution of costs of individual crashes over a year for the particular sector of the trucking industry subject to regulation.

If this distribution of costs per crash were known, the frequency of crashes at each level of cost could be shown in a graph such as that in Figure 7 for the annual volume of crashes involving a given segment of regulated trucking (e.g., for-hire interstate, non-HM, general freight carriers). Ideally, the data would pertain to only those crashes for which the truck is at fault; other crashes would be the responsibility of other parties deemed at fault, or a broader form of compensation.

The general shape of the distribution tends to follow the pattern of a large number of small-cost crashes and diminishingly fewer crashes at higher costs. The lower bound is zero, or the reporting threshold or deductible level in more practical terms. The upper bound is unknown, but possibly very large with a probability of less than one crash per year of that magnitude.

Many carriers carry more than the minimum, and may also or instead be bonded or otherwise self-insured above the minimum requirement. Many social costs of crashes are difficult to quantify objectively, and the tort process may be both biased and inaccurate in its conclusions. Thus the number of crashes whose costs exceed insurance levels is difficult to determine.

[59] IRC (2007)

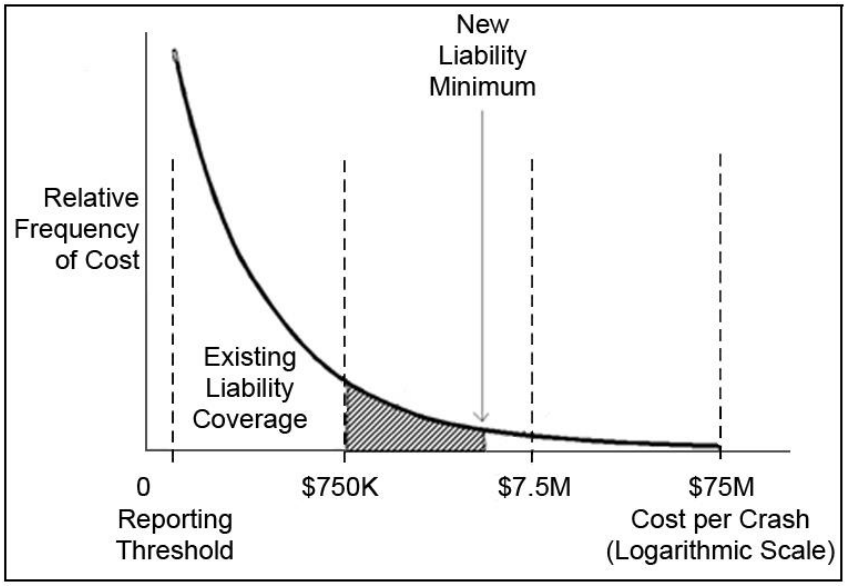

Figure 7. Line Chart. Hypothetical Frequency Distribution of Cost per Truck Crash

HIGH-COST CRASHES: FATALITIES

Without accurate comprehensive data on the costs of crashes, the presence or absence of a fatality as a consequence of the crash was taken as a proxy for high-cost crashes. Although fatalities are not always compensated or are compensated at less than the estimated VSL upon which the USDOT conducts cost-benefit evaluations of safety and other policies, the average social cost is declared to be approximately $5 million per fatality and, therefore, a factor that would imply that any fatal crash will exceed mandatory insurance levels for most types of regulated carriers. The likelihood that injury crashes may also exceed the insurance threshold is studied below in the section "High Cost Crashes: Severe Injuries."

By applying the modeling procedures described below to the sparse data, from several sources, pertaining to each of the CMV types listed in Table 4 allows for the generation of estimates of the number of crashes per year that are truck-caused and exceed the applicable insurance minimum liability. The results are shown in Table 34. The percentages are for the total number of crashes for the type of carrier. They are based on fatal accidents, as a measure of the likelihood of a costly crash that would exceed the insurance coverage.

Most of the estimates of the share of accidents that exceed insurance limits are around 0.10 percent. Given the weak precision of the data and uncertain representativeness, the consistency among the different sources is strong. Compared to the total crashes in each group shown in Table 4, the number of high-cost crashes that exceed minimum insurance coverage is very small, and most power units are much more heavily insured or otherwise covered by financial capacity (e.g., large carriers).

Table 34. Summary of Alternative Crash Rate Estimates

Estimated Number of Crashes Per Year That Cost More Than Financially Responsible Minimums [a]			
Carrier Class	**Data Source (Year)**	**Estimated Count**	**Estimated Percent of Total Crashes [b]**
General Freight	ISO (2005-10)	20	0.06%
General Freight	TTT (2010-11)	28	0.08%
General Freight	MCMIS (2010)	59	0.17%
General Freight	GES (2009)	43	0.13%
HM	HMIS (1998-2009)	2	0.07%
HM	MCMIS (2010)	14	0.26%
Passenger Carriers	ISO (2005-10)	1	0.09%
Passenger Carriers	MCMIS (2010)	4	0.34%

[a] Truck-involved crashes with at least 1 fatality.
[b] Total crashes of the freight carrier type.
ISO = Insurance Services Organization.
TTT-*Tractor Trailer Torts.*
MCMIS = Motor Carrier Management Information System.
GES - General Estimates System.
HMIS = Hazardous Material Information System.

STATISTICAL MODELING USING ISO DATA

The method of maximum likelihood (ML) can be used to fit a probability distribution to categorical data (histogram data) describing counts falling into arbitrarily defined bins. The ML procedure uses raw data points to generate a continuous function that can then be used to estimate the number crashes that would be covered by alternate levels of mandated liability insurance. The procedure requires the analyst to select an underlying probability distribution to fit to the data. The Weibull, Gamma, and Lognormal distributions are possible candidate functional forms because they each have the following properties:

- In their most general form, they do not permit non-positive values.
- They have "fat tails," which allow for small numbers of high-value (high-cost) observations that describe rare events such as catastrophic crashes.
- They have analytically tractable probability and cumulative density functions.

Each of the three distributions was fitted to the histogram data. Based upon visual inspection and the results of associated measures of goodness-of-fit, it was determined that the lognormal provided the best fit. The likelihood function of a log-normally distributed random variable *chi*, with parameters *mu* and *sigma* is:

$$\ln L = \prod_i \frac{1}{\sqrt{x\sigma 2\pi}} e^{-(\ln x-\mu)^2}$$

Figure 8. Equation. Likelihood Function of a Log-normally Distributed Random Variable *Chi*

where *i* indexes over all observations.

The properties of the lognormal distribution result in easily-calculated parameter estimators:

$$\hat{\mu} = \frac{\Sigma_i \ln x_i}{n} \quad \text{and} \quad \hat{\sigma} = \frac{\Sigma_i (\ln x_i - \hat{\mu})}{n}$$

Figure 9. Equation. Parameter Estimators for *Mu* and *Sigma*

where *n* is the number of observations.

Using these estimates and the expression for the lognormal cumulative density function, the estimate of the percentage of crashes above some threshold *z* is:

$$1 - \Phi\left(\frac{\ln z - \hat{\mu}}{\hat{\sigma}}\right)$$

Figure 10. Equation. Normal Cumulative Distribution Function Residual

where phi is the standard normal cumulative density function.

Similar procedures are used to fit distributions for the general freight, hazardous material, and passenger carrier data provided in summarized aggregated form from ISO.

HIGH-COST (FATAL) CRASH FREQUENCY

General Freight Carriers

The average dollar claim is relatively low (e.g., $18,000)[60] compared to the mandatory minimums, but the distribution has a long tail with small numbers of large claims. A plausibly shaped distribution (functional form) can be fitted to aggregated data (the histogram shown in Figure 11), and frequency calculated from the fitted function for values not specifically identified in the data.

A highly skewed distribution such as this one is much different from a more symmetrical one, such as the Normal distribution. Consider that the average is less than $20,000, but there are a few crashes with costs of $200,000 or even $2 million. Whether the cutoff is made at $750,000 or $1 million, there are still a few crashes at even higher cost levels. The graph is truncated at $500,000 because the curved distribution (the smooth curve) is not separable visually from the zero-frequency line, although some space could be seen between the curve and zero if the picture were greatly enlarged.

[60] ISO data.

Thus no matter how high the insurance minimum, there will always some crashes above that level. There is no dollar number that will necessarily ensure that every possible crash victim is fully compensated.[61]

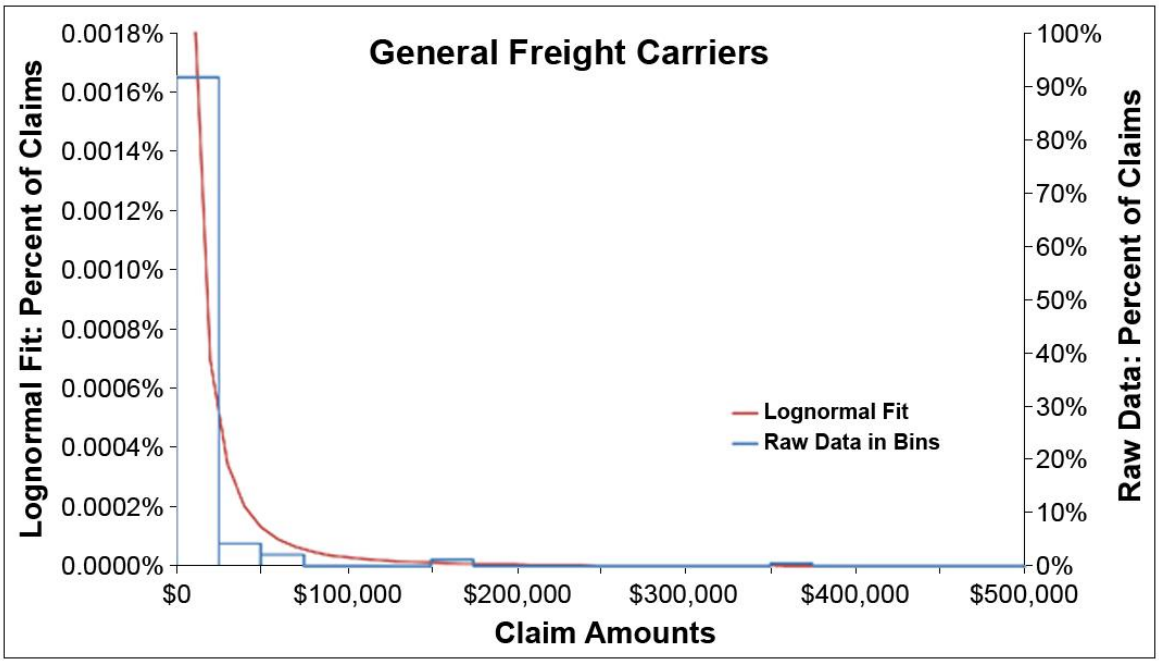

Figure 11. Histogram. Raw Histogram Data with Fitted Model Distribution

Several data sources have been combined to generate a glimpse of the general freight segment. The time period for these data is 2005–10.

- The average crash claim was $18,360, according to data collected by the ISO.
- The average annual number of crashes is 49,819, as tabulated from MCMIS (see Table 21).
- The estimated percent of crashes covered by the $750,000 level is 99.4, using the ISO data (the fitted model is shown in Figure 11).
- The estimated number of crashes at or above the $750,000 level is around 20 annually.
- The number of carriers/power units regulated is 287,977/2,832,528 from MCMIS (Table 13).

Modeling results for a range of higher liability limits on general freight carriers are shown in Table 35. The tail of the distribution is so thin at this high level that the crash probabilities are barely detectable, but there is no coverage level that will guarantee to cover every possible crash.

These estimates assume that all carriers are statistically in the same pool, and are affected randomly by crash risk. The evidence shows significant variation among carriers in their safety

[61] A 2011 tour bus crash killed 15 people and injured 10 more, constituting a total cost of something in the neighborhood of $100 million, at the USDOT rate of $5 million/fatality.

behavior, but nothing as extreme as would lead outlier carriers into systematically causing multimillion-dollar crashes. Evidence from the passenger carrier sector suggests that such high-risk carriers fail many FMCSA safety indicators that can warrant their removal from service, once detected.

Table 35. Estimated Share of GF Crashes Above Alternative Liability Levels

Insurance Level	% Crashes Covered
$1,000,000	99.97%
$1,250,000	99.98%
$1,500,000	99.99%
$2,000,000	99.99%

Source: ISO data, Volpe model.

Hazardous Materials Carriers

Two categories of HM carriers are regulated with respect to minimum liability requirements, one at $1 million and the other at $5 million. The higher level is for carrying explosive and other highly dangerous cargo, and constitutes a very small share of the total number of carriers.

The time period for the data is 1998 to 2009, taken from the HMIS database regarding HM spills. According to HMIS

- The average cost of a (truck-involved) crash is $123,300.
- The annual number of crashes with an HM spill is 305.
- The estimated percent of crashes covered by the $5 million level is 99.27.
- The estimated number of crashes annually at or above $5 million limit is about 2.
- The estimated share of crashes falling within the lower $1 million liability group is?
- The estimated number of crashes at or above the $1 million level is?

The estimated share of crashes covered by higher liability requirements is shown for several levels above the basic level in Table 36. Similar percentages apply for the lower HM liability requirement.

Table 36. Estimated Percent of HM Crashes Above Alternative Liability Levels

Insurance Level	Percent of Crashes Covered
$7,500,000	99.59%
$10,000,000	99.74%
$12,500,000	99.82%
$15,000,000	99.86%

Source: HMIS Database 1998–-2008.

Passenger Carriers

For-hire passenger carriers are regulated whether interstate or not, but segmented by the number of passengers per vehicle. The time period for the data is 2005–10.

- The average crash claim based on ISO data is $13,306 per crash.
- The number of carriers/vehicles in the regulated sector is 4,396/158,300, according to MCMIS.
- The annual number of crashes among regulated passenger carriers using vehicles that carry 15 or more passengers is 2,300, according to MCMIS.
- The estimated percent of crashes covered by the higher liability requirement for 15-passenger vehicle carriers is 99.99, based on a special ISO tabulation.
- The estimated number of crashes exceeding the $5 million liability limit is about one per year.

The data and the fitted distribution are shown in Figure 12. Crashes are those with one or more fatalities, 55 percent of which are assumed to be caused by the bus.[62] The left hand scale (relative frequency) applies to the smooth fitted continuous curve, while the right hand scale (histogram data) applies to the blocks in the histogram. The two scales are normalized so that the areas underneath the curve and the histogram are the same (equal to 1.0 in principle).

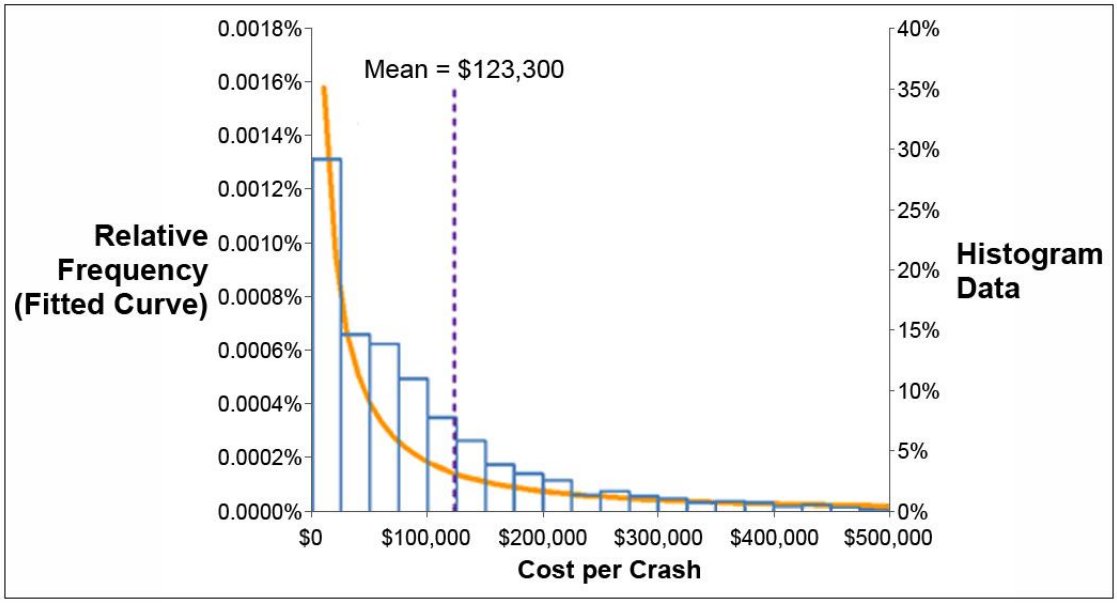

Figure 12. Histogram. Data and Model for Passenger Carrier Crash Cost Distribution

[62] One Web site for trucks claimed that 80 percent of truck-involved crashes are caused by other vehicles.

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APPENDIX C: CONVERSION FROM KABCO TO MAIS SCALES

FREQUENCY OF SEVERE INJURY CRASHES

GES is the only source of data on a representative sample of all crashes, and the GES injury data is based on the KABCO-category scale. The current KABCO scale is shown in Table 37. The level of injury is judged by the police officer filing the report, and he or she is generally not a medical expert. Reporting officers have little time to assess injuries, may be under pressure to make many urgent decisions, and do not follow-up after filing the report. Thus the police determined injury levels may not be accurate.

Table 37. KABCO Scale Definition

Severity Level	Description
K	Fatality
A	Incapacitating injury
B	Moderate injury
C	Minor injury
O	No injury; property damage only
IUS	Probable injury, severity unknown
U	Unknown if injury or not

Using the GES sample and its associated sampling weights, there are approximately 20,000 "A" level crashes per year (i.e., crashes in which at least one person is assessed as having an incapacitating injury), of which one-third to one-half are interstate for-hire carriers.[63] Generally, the truck driver is assumed to be at fault approximately half the time, so a direct estimate of "A" level injuries caused by regulated trucks is in the 3,300 to 5,000 per year range.\

Flaws in the KABCO Data

NHTSA has found that the "A" category of KABCO, in particular, is unreliable; in a review of 20 States, they found that "A" injuries ranged from 2 percent to 56 percent of all crashes, and that in many cases the category included minor injuries. The current definition is

> *An incapacitating injury is any injury, other than a fatal injury, which prevents the injured person from walking, driving or normally continuing the activities the person was capable of performing before the injury occurred.*

[63] Citation is needed for one-third to one-half share of carriers in the GES database being subject to FMCSA insurance liability regulations.

As a replacement, NHTSA is considering the definition:

> Suspected Serious Injury: The determination of the suspected severity of the injury is made at the time the injured person leaves the crash scene. A suspected serious injury is an injury other than fatal which results in one or more of the following:
>
> – Severe laceration resulting in exposure of underlying tissues/muscle/organ or resulting in significant loss of blood.
> – Broken or distorted extremity.
> – Full or partial amputations other than an amputation of a single finger or toe.
> – Crush injuries to the body.
> – Skull, chest, or abdominal injury other than bruises or minor lacerations.
> – Unconscious when taken from the crash scene.
> – Paralysis.

There is no mention *per se* of traumatic brain injury, but it is implied in the "crush injuries" description. These data collection improvements are not yet in use by agencies.

THE MAIS SCALE

In an effort to improve the quality of the KABCO data for statistical and research purposes, another scale was developed in conjunction with physicians to construct more precise functional boundaries between severity levels. The updated scale is known as the Abbreviated Injury Scale (AIS), and has been applied to a sample of individuals injured in motor vehicle accidents.

In many accidents, individuals will often have multiple injuries, so the worst injury or primary injury is used to characterize the severity of the crash. This scale is called the Maximum Abbreviated Injury Scale (MAIS), and is shown in Table 38.

Table 38. MAIS Scale Definitions

MAIS Level	Severity	Fraction of VSL	Share of all Crashes
0	No Injury	0	0.513362
1	Minor	0.003	0.381131
2	Moderate	0.047	0.058817
3	Serious	0.105	0.024619
4	Severe	0.266	0.005775
5	Critical	0.593	0.002178
6	Unsurvivable (Fatality)	1.000	0.014119
		Total	1.0

Source: NHTSA.

KABCO-MAIS Conversion

As the MAIS provides more detail regarding crash injuries, it serves as a better basis for estimating medical and other costs. So, in order to use the GES sample of data, it is necessary to convert the KABCO measures into MAIS categories. This conversion was also developed by physicians working with the safety experts, using detailed case data. The conversion is shown in Table 39.[64]

Each column shows the distribution of crash severity for crashes in the stated KABCO category, so the columns sum to 1.0. The distribution of crashes across KABCO categories in the GES database for truck-involved crashes is shown in the relative frequency row, with the estimated number of annual crashes immediately below.

The conversion from KABCO to MAIS includes serious crashes (MAIS 4 and 5) that are misclassified into other categories, and filters out the minor injuries misclassified as "A" in police reports. Using the existing definition, as indicated by Table 39, most supposedly incapacitating injuries are actually minor injuries.

[64] Reported in Timothy, Darren, "Measuring Safety Benefits," presented at: Benefit/Cost Analysis for Transportation Infrastructure: A Practitioner's Workshop, Washington D.C. (May 17, 2010).

Table 39. KABCO-to-MAIS Conversion Table: Police Reported Injury Severity System

MAIS	O No Injury	C Possible Injury	B Non-Incapacitating	A Incapacitating	K Fatality	U Injured, Severity Unknown	Unknown
0	0.92458	0.23203	0.06995	0.03341	0	0.22274	0.42883
1	0.07329	0.69145	0.78039	0.55819	0	0.61725	0.41108
2	0.00201	0.06413	0.11026	0.20748	0	0.10289	0.08667
3	0.00009	0.01061	0.0308	0.1407	0	0.04072	0.04748
4	0	0.00148	0.0063	0.03859	0	0.00418	0.00609
5	0.00003	0.00012	0.0009	0.01702	0	0.01174	0.00277
Killed	0	0.00018	0.0014	0.00461	1	0.00048	0.01708
Total	1	1	1	1	1	1	1
Relative Frequency	0.474338	0.1729321	0.190097932	0.105230613	0.012679	0.006400194	0.0383219
Number of Crashes	89,751	37,721	35,969	19,911	2,399	1,211	7,251
						Total	**189,213**

Source: NHTSA, GES.

APPENDIX D: ANNUAL VMT PER POWER UNIT BY CARRIER SIZE

Data from MCMIS describing VMT are not verified by FMCSA and may be reported (if reported at all) in round numbers or rough approximations. Such as they are, however, the data tend to support the thesis that truck utilization (annual VMT per power unit) is not related to carrier size (as measured in number of power units). Therefore, the reduction in crashes per power unit as carrier size goes up can be interpreted as an indicator of better safety performance on the part of larger carriers.

Data for all active carriers in the MCMIS database are shown in Table 40. General freight carriers, HM carriers, and passenger carriers are included, some of which are for-hire but not necessarily interstate. Utilization seems to be slightly less for smaller carriers, strengthening the positive relationship between size and safety. The weakest experience appears to be the 6–15 vehicle carriers, with the very smallest size group showing a slightly better record.

Table 40. Utilization and Crash Rates by Carrier Size for All Active Carriers

Power Unit Group	Carriers With VMT[a]	Total Group VMT	Total Group Power Units	Number of Crashes	Utilization VMT per Power Unit	Average Crash Rates Crashes per Million VMT	Average Crash Rates Crashes per 100 Power Units
1 to 5	154,579	11,752,447,913	291,815	15,675	40,274	1.33	5.37
6 to 15	30,678	10,502,721,029	271,343	15,163	38,706	1.44	5.59
16 to 50	14,338	17,236,477,488	377,795	20,406	45,624	1.18	5.40
51 to 500	5,776	36,346,707,946	728,212	35,055	49,912	0.96	4.81
500+	517	51,963,441,768	1,139,525	39,484	45,601	0.76	3.46

[a] Carriers reporting VMT; carriers are omitted if they claimed less than 100 or more than 200,000 annual VMT per power unit.
Data are from a March 2012 MCMIS snapshot.

If attention is restricted to regulated carriers (as shown in Table 1 or Table 4), the pattern is displayed in Table 41. Utilization is uneven, without an apparent trend, but at a distinctly higher level; this reflects the omission of non-interstate carriers in the general freight category. Crashes per VMT are slightly worse for the second smallest category, but crashes per power unit decline consistently with increasing carrier size.

Thus the annual mileage for power units is approximately uniform across size groups (although clearly not for type of service (interstate versus local), and the largest carriers have a significantly better safety record.

Table 41. Utilization and Crash Rates by Carrier Size for Regulated Carriers

Power Unit Group	Carriers With VMT[a]	Total Group VMT	Total Group Power Units	Number of Crashes	Utilization VMT per Power Unit	Average Crash Rates Crashes per Million VMT	Average Crash Rates Crashes per 100 Power Units
1 to 5	154,579	11,752,447,913	291,815	15,675	40,274	1.33	5.37
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[a] Carriers reporting VMT; carriers are omitted if they claimed less than 100 or more than 200,000 annual VMT per power unit.
Data are from a March 2012 MCMIS snapshot.

APPENDIX E: INSURANCE SHARE OF OPERATING COSTS

Data on insurance as a share of costs of trucking operations has been collected sporadically by both Government agencies and private companies. The methods, scope, and concepts differ among these sources, so it is difficult to extract patterns or trends. Considering trends in the share of costs taken up by insurance, the evidence is shown in Table 42. The first two surveys are two versions of the same U.S. Census data collection program focused on selected Standard Industrial Classification (SIC) codes. The definitions and data are consistent, showing a gradual downward trend of insurance expense as a share of annual cost through the 1990s. Insurance is also a small share of expenses, less than 4 percent. The Service Annual Survey is a continuation of the same Census effort, organized around the North American Industrial Classification System (NAICS) that replaced the SIC in 1997. The more recent data show higher costs, but similar trends and insurance shares.

The gap from 1998 through 2003 is a data void, but a study commissioned by the Federal Highway Administration (FHWA) to look at motor carrier policy issues offer some glimmers. Based on the opinions of industry experts and an American Trucking Associations (ATA) survey claiming rapid increases in insurance prices, identified rising insurance costs as the most important problem affecting the trucking industry. The source of the increase was twofold:

- Poor performance and volatility in equities and investment markets.
- Higher payouts and risk rates due in part to the disruptive events of 9/11/2001.

Sudden changes in the perception of risk frequently lead to overreaction. Medical malpractice insurance went through a similar process of large jury awards and open-ended risk causing insurance rates to escalate. In the case of trucking, either the cost trend leveled off or the declining frequency of crashes offset the larger awards, but subsequent to the alarm in the early 2000's the rates settled back to historical shares of costs (albeit at higher overall cost levels). Both the Census data and the ATRI study seem to bear this out, although the commercial estimate from FRI.com is higher.

Displaying the insurance share of costs on a graph over time, as is done in Figure 13, emphasizes the generally stable pattern of insurance expense remaining in the 3- to 4-percent range except for the temporary disruption of the early 2000s.

Some observers speculate that more self-insurance and less coverage are likely responses to higher rates, and it is unclear to what degree these are captured in the surveys. ICF/Edwards also mentions that carriers can deal with high rates by forming "risk retention groups," which they have done. The data may or may not capture the full costs of ownership and operation, and also may not reflect the several ways of demonstrating financial responsibility.

Table 42. Selected Data on Trucking Operating Expense

Motor Freight Transportation and Warehousing Survey 1994 Trucking, Except Local (SIC 4213)			
Year	Operating Expense per Year per Truck	Insurance Cost per Year per Truck	Share
1990	$70,965	$2,808	4.0%
1991	$70,828	$2,834	4.0%
1992	$75,061	$2,819	3.8%
1993	$78,716	$2,945	3.7%
1994	$87,078	$3,251	3.7%
Transportation Annual Survey 1997 Trucking, Except Local (SIC 4213)			
Year	Operating Expense per Year per Truck	Insurance Cost per Year per Truck	Share
1993	$77,568	$2,932	3.8%
1994	$84,682	$3,214	3.8%
1995	$88,061	$3,286	3.7%
1996	94,390	$3,465	3.7%
1997	$98,570	$3,278	3.3%
ICF/Edwards Study (2003)			
Year	Operating Expense per Year per Truck	Insurance Cost per Year per Truck	Share
2000	$106,482	$4,081	4.1%
2001	$109,672	$6,744	6.0%
Service Annual Survey Trucking (NAICS)			
Year	Operating Expense per Year per Truck	Insurance Cost per Year per Truck	Share
2004	$164,907	$7,226	4.4%
2005	$188,206	$6,688	3.6%
2006	$201,617	$7,207	3.6%
2007	$208,773	$7,242	3.5%
2008	$212,844	$6,778	3.2%
2009	$169,161	$5,789	3.4%
ATRI Update (2011)			
Year	Cost Per Hour	Insurance Premiums	Share
2008	$2.45	$2.22	3.3%
2009	$58.00	$2.15	3.7%
2010	$59.60	$2.06	3.5%
Freight Rate Index			
Year	Cost per Hour	Insurance Premiums	Share
2012	$2.45	$0.12	4.8%

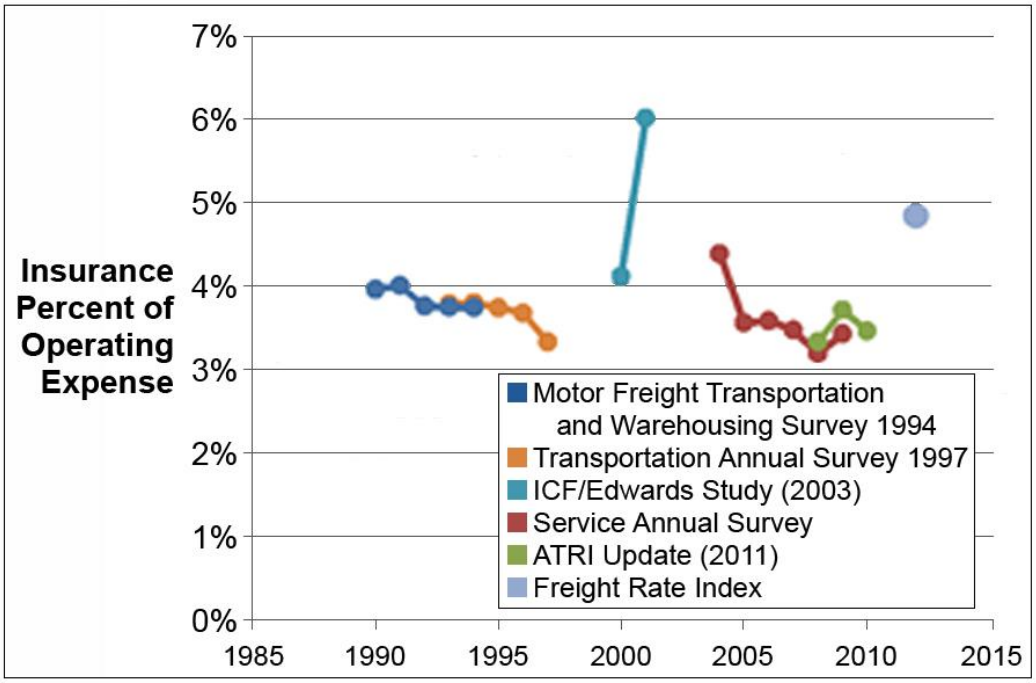

Figure 13. Line Chart. Insurance Expense as a Share of Annual Cost

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APPENDIX F: CHARACTERISTICS OF THE MCMIS AND L&I DATABASES

The set of motor carriers subject to minimum financial regulation are those which are interstate for-hire freight and passenger carriers and HM carriers, [49 C.F.R. §387.9 (1985)]. Motor carriers which self-identify via the MCS-150 form as one, or more, of those classifications were identified in MCMIS. To further identify the relevant subset of this population, these carriers are additionally limited to those with known activity within the past 3 years. This process identifies approximately 288,000 carriers based on a March 2012 MCMIS snapshot.

Carriers which meet these requirements are also required to file evidence of minimum insurance via the MCS-90 form with FMCSA. Note that this process only requires evidence of minimum financial responsibility, so these figures only reflect a floor on any given carrier's actual insurance level. These filings are tracked in the L&I database. This database was matched to MCMIS by USDOT number to identify carriers with insurance that meet the regulatory limits. Approximately 154,000 of the 288,000 carriers mentioned above have current insurance on file at or above the $750,000 level. At least these 154,000 carriers are subject to the regulation, as few carriers would needlessly incur the cost of insurance and file with FMCSA.

While it is unclear which estimate is superior, the true number of carriers subject to financial limits is likely to fall in between. Several factors may explain the 134,000 carrier gap between these two estimates. First, some of the 134,000 carriers may not be presently active. These carriers might have ceased operation without informing FMCSA, at which point there would be no reason to pay for insurance. These carriers may also be seasonal operators who are out of season. It is reasonable for firms to let their insurance lapse when they are not operating, but they would remain subject to financial regulation when they return to the industry.

Second, some of these carriers may have filed status incorrectly on the MCS-150 form, which would erroneously identify them in the MCMIS estimate. Inaccuracies in self-reporting on the MCS-150 form are relatively common, so this proportion is likely significant.

Third, L&I only reflect insurance as of a specific point in time; the March 2012 snapshot. If a motor carrier's insurance lapses, they are allowed several-month grace period to update their insurance before their operating authority is revoked. This is relatively common, and could explain a significant proportion of the gap.

Fourth, some small carriers may simply be unfamiliar with insurance regulations, and may be operating without purchasing insurance or filing the require proof. Taken together, these caveats suggest that the true population of regulated carriers is somewhere between these estimates. For the purposes of this paper the larger estimate will be assumed, as MCMIS provides the majority of necessary data for these carriers (crashes, power units, safety history). For analysis requiring L&I, the data will be expanded proportionally from the 154,000 to match the 288,000 carrier population under the assumption that the 154,000 are representative.

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