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Effects of Seatbelt Laws on Highway Fatalities

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1. INTRODUCTION

This report gives the results of five updates to the publication "Effects of Mandatory Seatbelt Use Laws on Highway Fatalities in 1985" (DOT-TSC-NHTSA-87-3) by Paul Hoxie and David Skinner of the Transportation Systems Center. The original work estimated the effects of seatbelt laws on highway fatalities through December 1985. At that time, nine states and the District of Columbia had implemented laws. The average reduction among law-covered fatalities was found to be 6.7 percent. This average reduction was found to be stronger (about 12 percent) in the first three months after implementation than in subsequent months.

As additional Fatal Accidents Reporting Systems (FARS) data became available for 1986 in three-month installments, four updates were done. Since then one update was done using the first nine months of 1987 FARS data. As more FARS data becomes available the estimated effect will again be updated. Each update is an attempt to track the effects of seatbelt laws on fatalities. This ongoing monitoring process is a way of detecting any trends in the effect which may be developing. Two types of econometric models are used in determining these seatbelt-law effects: (1) a national model; and (2) a group of individual state models for the larger seatbelt-law states. The results presented below discuss only the latest update.

2. RESULTS

Table 1 gives three effectiveness measures for all states implementing seatbelt laws from December 1984 through September 1987. The best estimate of the average fatality reduction among front-seat, passenger-vehicle, occupant fatalities in the 28 states and the District of Columbia in this period is 7.5 percent (as shown in the last row of the Average Effect column). That is, on average 7.5 percent of law-covered fatalities were prevented in states implementing a seatbelt law during this period. The standard error of this estimate is about 3.0 percent. The next column (Initial Effect) in Table 1 indicates that for the first three months after implementation the average reduction in any state is 11.9 percent. The average reduction thereafter is 6.3 percent (Continuing Effect). These two variables indicate that on average a state will experience a drop in seatbelt-law effectiveness of about one-half, three months after implementation. Table 1 also indicates that the nine months of additional data from the December 1986 update has caused an increase in the point estimates of the three effectiveness variables.

Table 2 shows that of the nine individual states modeled, only Texas has a statistically significant reduction in law-covered fatalities. In seven other states which have reductions, the effects of the seatbelt laws are not large enough relative to the natural variation in fatalities to be reliably measured by these statistical models.

The fact that only Texas among the larger seatbelt-law states has a statistically significant reduction has an important implication given the way the 7.5 percent national result is estimated. Larger states have more stable variations in their fatality counts than smaller ones and it is thus necessary to weigh the experience of Texas more in the estimation process. Thus, the 7.5 percent Average Effect is highly dependent on Texas. If Texas is removed from the estimation, the Average Effect in a state becomes 3.8 percent. This 3.8 percent effectiveness is statistically significant.

3. DATA AND METHODS

As mentioned above, two types of econometric models are used to produce estimates of the effects of seatbelt laws. A pooled cross-section, time-series model produces an estimate of the overall effect seatbelt laws have in reducing fatalities in the nation as a whole. This effectiveness is expressed as the average reduction (Average Effect) in a seatbelt-law state among fatalities generally covered by these laws. The second type of model is a series of time-series regressions for each of nine states. Nine states were chosen to be explicitly modeled because of their fatality size and because of their length of post-implementation fatality experience. The states are California, Illinois, Massachusetts, Michigan, Missouri, New Jersey, New York, North Carolina, and Texas.

Both types of models capture historical relationships among seatbelt-law-covered fatalities and control series. Deviations from these relationships are interpreted as seatbelt effectiveness (deviation from what would have happened without the law). Fatalities change for many reasons, not just because of seatbelt laws. Other sources of fatality variation are controlled for in these models. A full description of both types of econometric models is included in the report "Effects of Mandatory Seatbelt Use Laws on Highway Fatalities in 1985".

The national model gives an estimate of the overall effectiveness of seatbelt laws in quantitative terms. The state models give an indication of how the overall effectiveness may be distributed. Also, the fact that some states have a larger reduction in law-covered fatalities than others should create interest in the determinants of seatbelt law success. The models also indicate whether any effect is increasing, decreasing, or stable. In both the state and national models the seatbelt-law effect as measured by

the Average Effect variable is partitioned into a Initial Effect and a Continuing Effect. As shown in Tables 1 and 2, in the first three months after implementation of a seatbelt law, the reduction is much stronger than future months, indicating that effectiveness declines.

In performing this evaluation only highway fatality data is used in the models. It is recognized that seatbelts also affect injuries. Hence the full benefit of seatbelts cannot be described by the estimated effect on fatalities alone.

Since New York implemented a seatbelt law on December 1, 1984, 27 other states and the District of Columbia also implemented laws through September 1987. Table 3 gives a list of these states. One of those states, Nebraska, repealed its law on November 30, 1986. Massachusetts also repealed its law (December 4, 1986), but extended its child restraint law on August 9, 1987.

Table 1: Implementing Seatbelt Laws -- Results of National Model

File Complete Through:	EFFECTS		
	Average	Initial	Continuing
12/85**	-6.7% (-2.19)*	-11.6% (-2.61)*	-2.4% (-0.57)
3/86	-5.7% (-2.27)*	-11.1% (-3.14)*	-1.4% (-0.43)
6/86	-5.8% (-2.61)*	-9.0% (-2.64)*	-4.2% (-1.61)
9/86	-7.1% (-3.59)*	-11.8% (-4.10)*	-4.5% (-1.99)*
12/86	-5.8% (-3.18)*	-9.6% (-3.41)*	-4.3% (-2.12)*
9/87	-7.5% (-5.46)*	-11.9% (-4.60)*	-6.3% (-4.21)*

t-statistics are in parentheses below values of coefficients

* t-statistic significant at the 95 percent level

** from: "Effects of Mandatory Seatbelt Use Laws on Highway Fatalities in 1985," (DOT-TSC-NHTSA-87-3) by Paul Hoxie and David Skinner

Table 2: Implementing Seatbelt Laws -- State Model Results

File Complete Through:		EFFECTS	
State	Average	Initial	Continuing
California			
Dec '86	-2.6%	-12.1%	-0.5%
	(-0.46)	(-1.77)	(-0.10)
Sep '87	3.1%	-12.7%	4.8%
	(0.55)	(-1.90)	(1.04)
Illinois			
Dec '85	-6.4%	-15.0%	2.1%
	(-0.94)	(-1.68)	(0.24)
Mar '86	-3.9%	-14.2%	1.7%
	(-0.61)	(-1.57)	(0.23)
Jun '86	-1.7%	-14.6%	3.9%
	(-0.27)	(-1.64)	(0.58)
Sep '86	-1.4%	-15.9%	4.6%
	(-0.21)	(-1.78)	(0.69)
Dec '86	-0.5%	-14.8%	5.1%
	(-0.08)	(-1.58)	(0.73)
Sep '87	-3.4%	-13.6%	0.01%
	(-0.48)	(-1.32)	(0.01)
Massachusetts			
Dec '86	-10.9%	-15.5%	-8.8%
	(-1.07)	(-1.08)	(-0.77)
Michigan			
Dec '85	-17.0%	-22.5%	-11.5%
	(-2.19)*	(-2.21)*	(-1.13)
Mar '86	-17.1%	-21.1%	-15.0%
	(-2.26)*	(-1.94)	(-1.72)
Jun '86	-13.8%	-22.2%	-10.2%
	(-1.86)	(-2.04)*	(-1.25)
Sep '86	-11.9%	-24.6%	-6.5%
	(-1.55)	(-2.23)*	(-0.78)
Dec '86	-11.6%	-25.4%	-6.0%
	(-1.52)	(-2.37)*	(-0.75)
Sep '87	-9.6%	-25.7%	-3.9%
	(-1.28)	(-2.43)*	(-0.50)

Table 2: (Con't)

File Complete Through:	State	Average	Initial	Continuing
	Missouri			
Mar '86		17.7%	16.6%	105.4%
		(2.36)*	(2.03)*	(0.45)
Jun '86		17.7%	16.8%	100.7%
		(2.56)*	(2.29)*	(0.44)
Sep '86		15.7%	17.2%	14.9%
		(2.45)*	(1.80)	(2.00)*
Dec '86		15.6%	16.7%	15.1%
		(2.41)*	(1.78)	(2.10)*
Sep '87		15.6%	17.5%	14.9%
		(2.34)*	(1.74)	(2.07)*
	New Jersey			
Dec '85		-2.5%	-0.6%	-2.5%
		(-0.25)	(-0.05)	(-0.29)
Mar '86		-2.1%	-2.5%	-2.0%
		(-0.28)	(-0.23)	(-0.24)
Jun '86		-1.5%	-0.0%	-2.0%
		(-0.20)	(-0.00)	(-0.26)
Sep '86		-2.8%	-1.3%	-3.5%
		(-0.38)	(-0.12)	(-0.43)
Dec '86		-2.7%	-0.6%	-3.6%
		(-0.37)	(-0.06)	(-0.45)
Sep '87		-3.1%	-2.8%	-3.2%
		(-0.41)	(-0.27)	(-0.40)
	New York			
Dec '85		-12.9%	-15.0%	-12.0%
		(-2.01)*	(-1.64)	(-1.79)
Mar '86		-7.3%	-11.9%	-5.6%
		(-1.06)	(-1.26)	(-0.77)
Jun '86		-6.7%	-11.1%	-5.1%
		(-1.00)	(-1.19)	(-0.91)
Sep '86		-7.8%	-12.6%	-5.9%
		(-1.18)	(-1.38)	(-0.89)
Dec '86		-7.8%	-13.2%	-5.7%
		(-1.19)	(-1.47)	(-0.81)
Sep '87		-9.6%	-15.4%	-7.2%
		(-1.46)	(-1.70)	(-1.03)

Table 2: (Con't)

File Complete Through:	State	Average	Initial	Continuing
	North Carolina			
Dec '85		-15.3%	insufficient data	
		(-1.59)		
Mar '86		-8.5%	-14.0%	-1.9%
		(-1.07)	(-1.39)	(-0.18)
Jun '86		-5.3%	-14.2%	-0.9%
		(-0.74)	(-1.45)	(-0.10)
Sep '86		-7.7%	-14.2%	-4.2%
		(-1.14)	(-1.46)	(-0.54)
Dec '86		-7.7%	-14.5%	-4.4%
		(-1.14)	(-1.52)	(-0.59)
Sep '87		-4.4%	-13.2%	-1.1%
		(-0.66)	(-1.34)	(-0.15)
	Texas			
Dec '85		-19.1%	insufficient data	
		(-2.94)*		
Mar '86		-18.4%	-18.0%	-18.6%
		(-3.31)*	(-2.51)*	(-2.75)*
Jun '86		-17.6%	-18.0%	-18.7%
		(-3.44)*	(-2.51)*	(-2.75)*
Sep '86		-15.2%	-17.8%	-14.0%
		(-3.09)*	(-2.57)*	(-2.58)*
Dec '86		-14.8%	-16.1%	-14.0%
		(-3.00)*	(-2.50)*	(-2.90)*
Sep '87		-15.6%	-15.9%	-15.4%
		(-3.60)*	(-2.50)*	(-3.36)*

t-statistics are in parentheses below values of coefficients

* t-statistics significant at the 95 percent level

Table 3: States with Seatbelt Laws

States	Effective Date
New York	12/1/84
New Jersey	3/1/85
Illinois	7/1/85
Michigan	7/1/85
Texas	9/1/85
Nebraska	*9/6/85
Missouri	9/28/85
North Carolina	10/1/85
District of Columbia	12/12/85
Hawaii	12/16/85
California	1/1/86
Connecticut	1/1/86
Massachusetts	**1/1/86
New Mexico	1/1/86
Tennessee	4/21/86
Utah	4/28/86
Ohio	5/6/86
Washington	6/11/86
Florida	7/1/86
Idaho	7/1/86
Iowa	7/1/86
Kansas	7/1/86
Louisiana	7/1/86
Maryland	7/1/86
Minnesota	8/1/86
Oklahoma	2/1/87
Colorado	7/1/87
Indiana	7/1/87
Nevada	7/1/87

* Nebraska repealed law November 30, 1986

** Massachusetts repealed law December 4, 1986