OFFSETTING OR ENHANCING BEHAVIOR: AN EMPIRICAL ANALYSIS OF MOTORCYCLE HELMET SAFETY LEGISLATION

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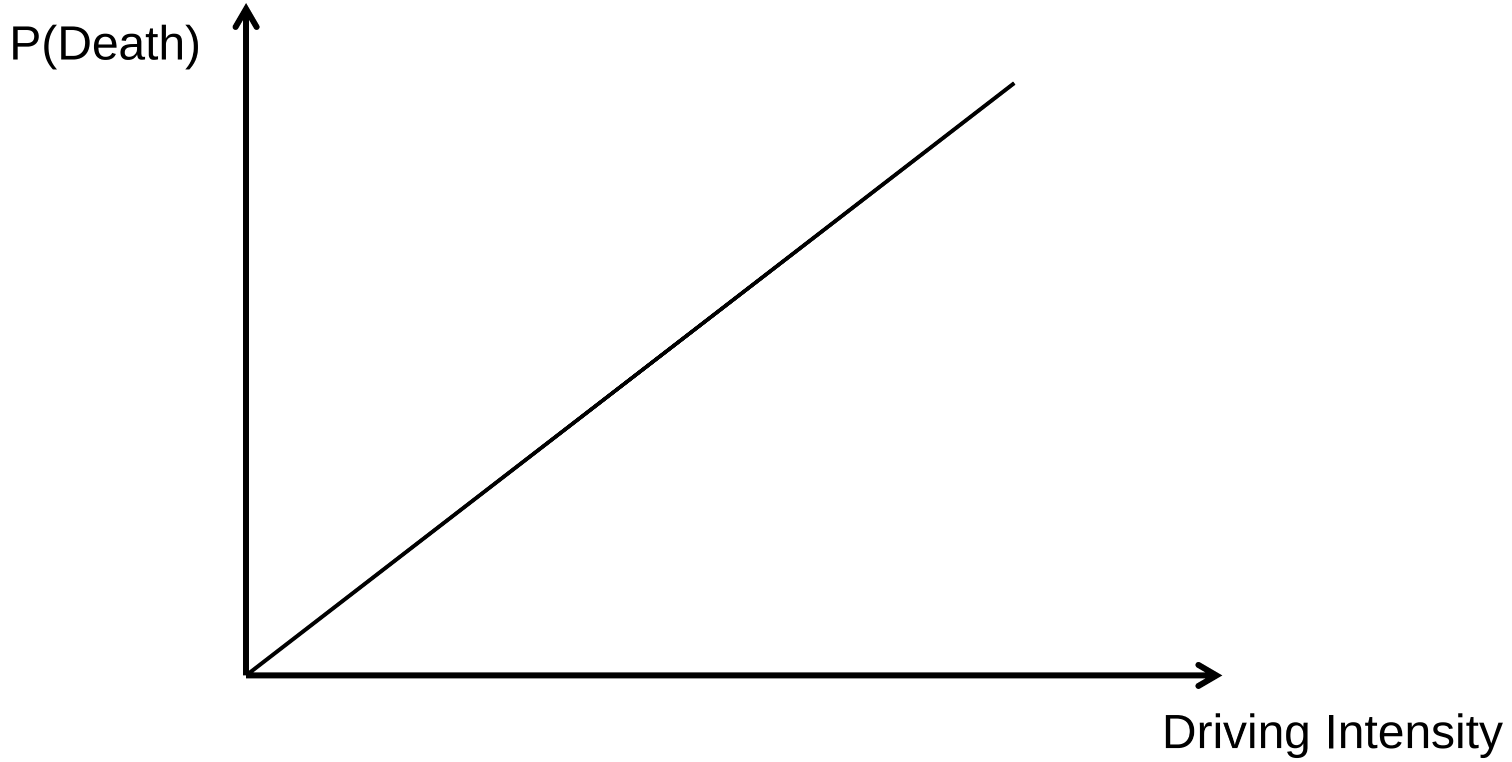
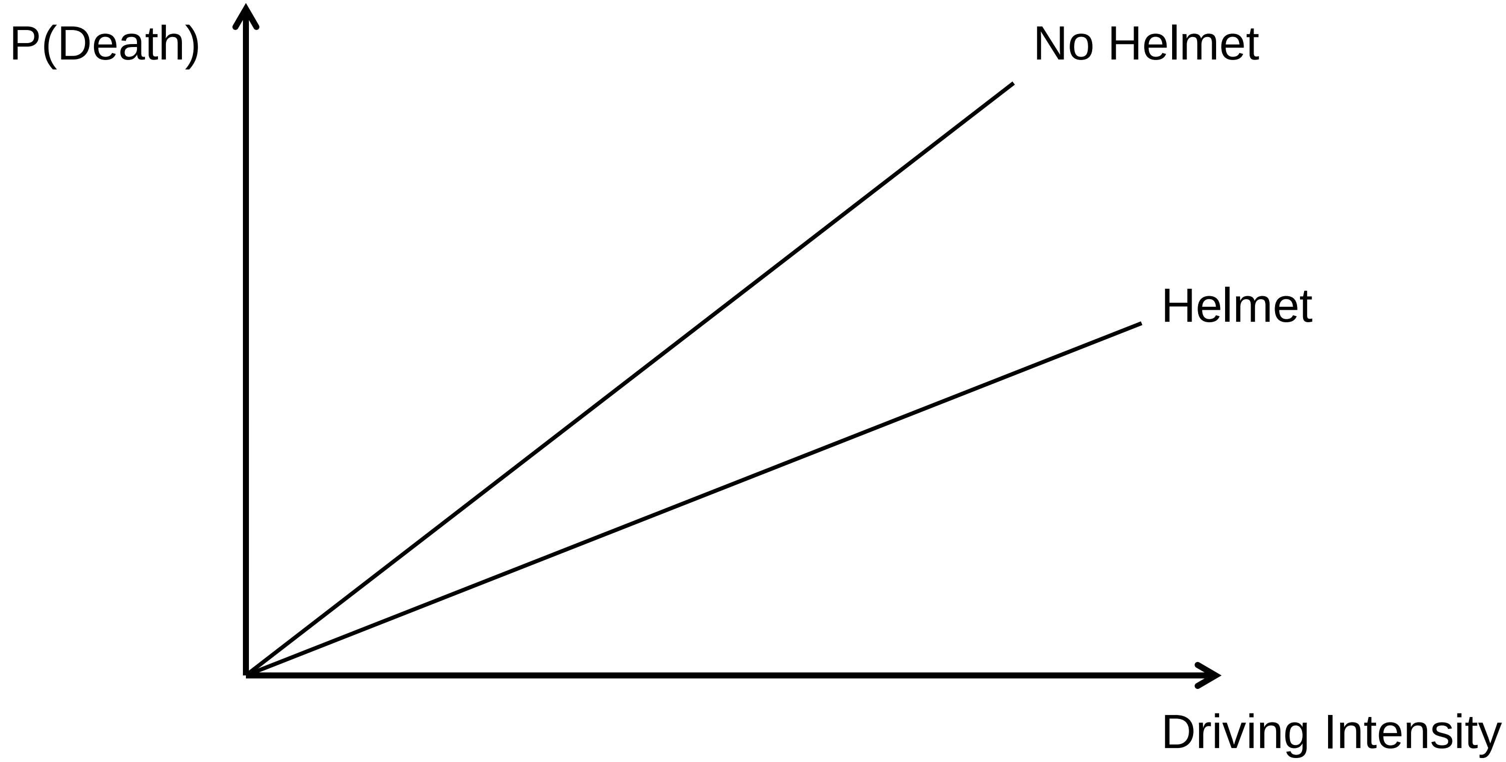
Theory of Offsetting Behavior

- Peltzman (1975), Blomquist (1986)
  - Tradeoff between "driving intensity" and driver fatality risks



Theory of Offsetting Behavior

- Peltzman (1975), Blomquist (1986)
    - Technological safety improvements



Theory of Offsetting Behavior

- Peltzman (1975), Blomquist (1986)
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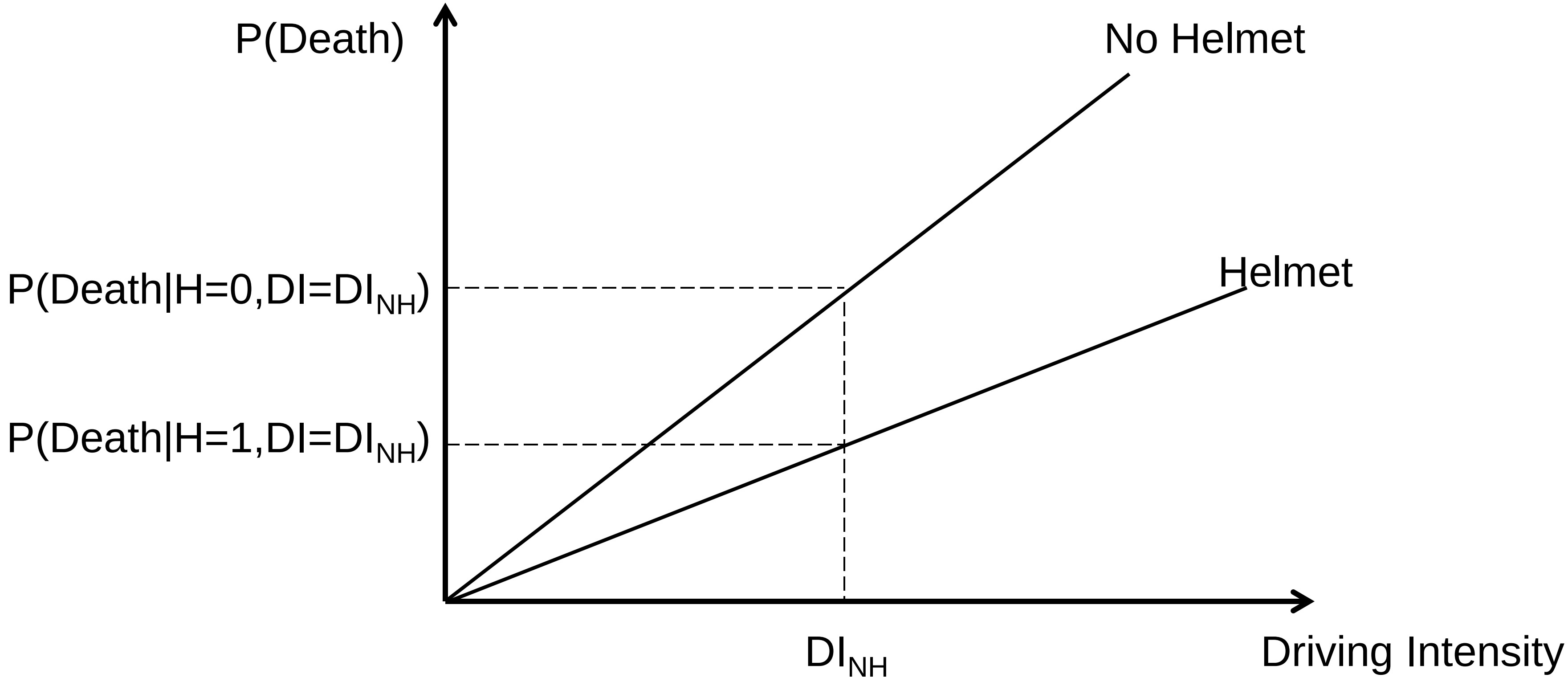
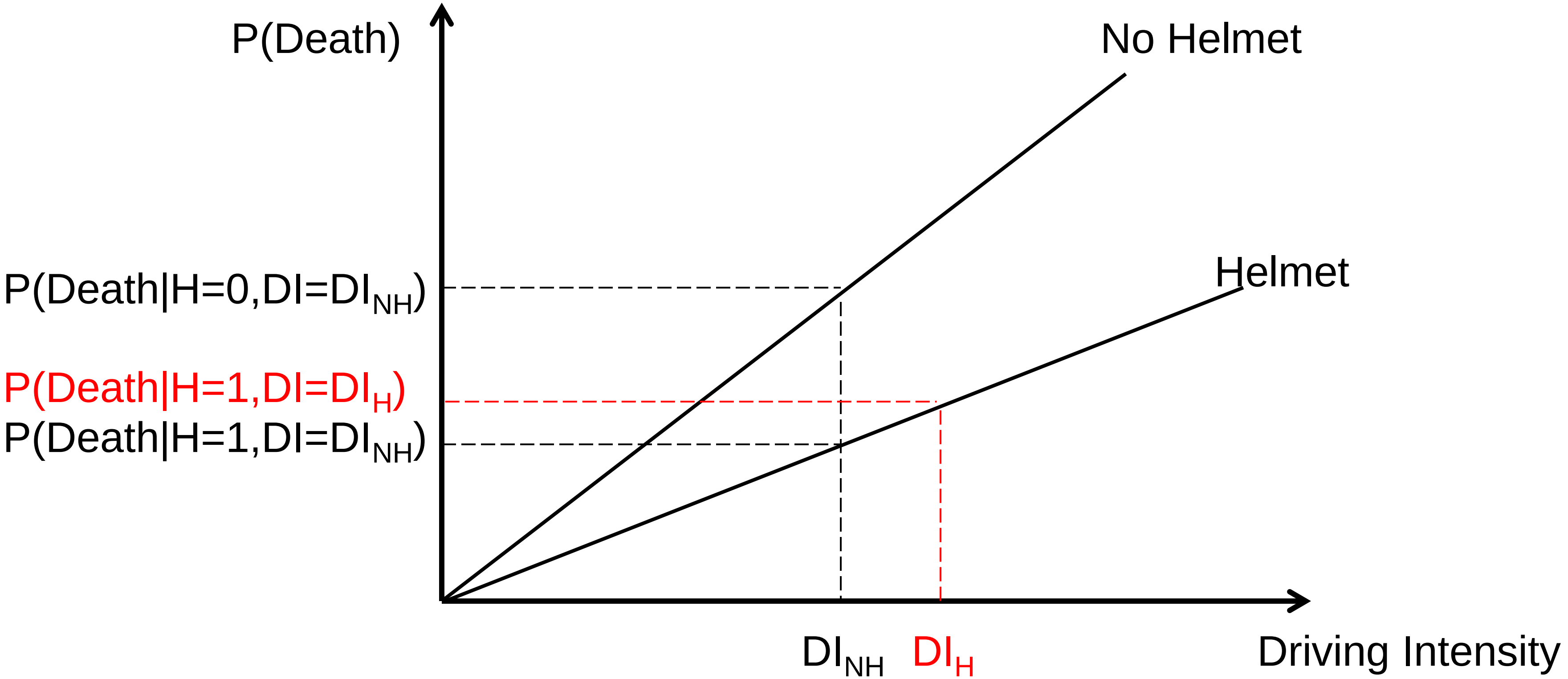


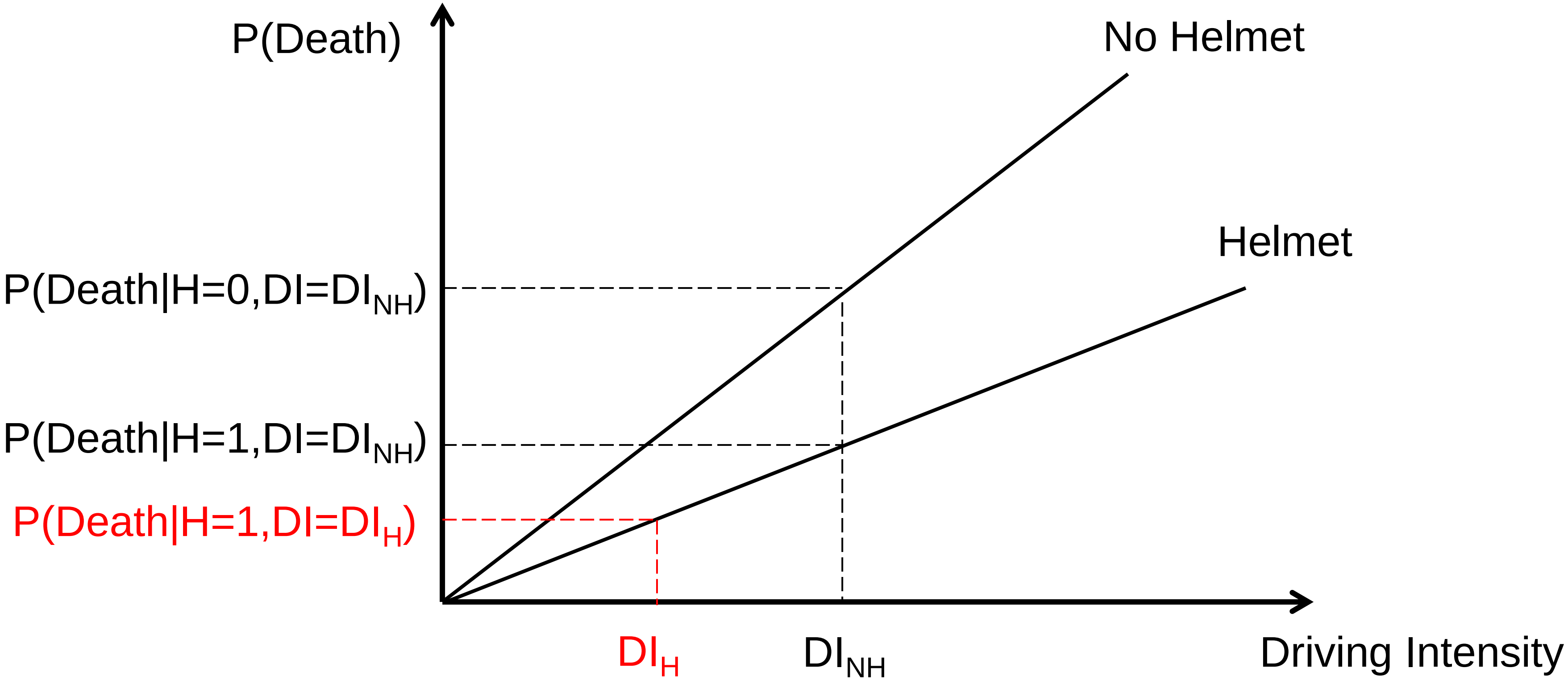
Theory of Offsetting Behavior

- Peltzman (1975), Blomquist (1986)
  - Increased driving intensity



Theory of Enhancing Behavior

- Thaler and Sunstein (2008)
  - Laws can “nudge” people. Alternatively individuals may have biases regarding risk probabilities.



Research Outline

- Test for increased (offset) or decreased (enhance) “driving intensity” post helmet law using two alternative datasets and estimation strategies.

I. State-level motorcycle crash data → Do motorcycle crash counts increase or decrease post mandatory helmet law?

II. Individual police accident report (PAR) crash data → Are motorcyclists in mandatory helmet law states more or less likely to engage in risky driving behavior?

Empirical Strategy

- Estimate the following:

$$lncrashes_{j,t} = \alpha + SC_{j,t} * \gamma + S_j + T_t + \beta * helmet\_law_{j,t} + \varepsilon_{j,t}$$

  - $lncrashes_{j,t}$ = natural log of motorcycle crash count in state j in year t
  - $SC_{j,t}$ = vector of all observable state characteristics including laws for *skills tests, rider education, education prior to licensing, daytime headlights, and maximum speed limits*. $SC_{j,t}$ also includes *temperature, precipitation, vmt, population, alcohol consumption and natural log of registered motorcycles*.
  - S_j = state specific fixed effects
  - T_t = year fixed effects

Empirical Strategy

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$$lncrashes_{j,t} = \alpha + SC_{j,t} * \gamma + S_j + T_t + \beta * helmet\_law_{j,t} + \varepsilon_{\ j,t}$$

  - $helmet\_law_{j,t}$ = 1 for states with a mandatory universal coverage motorcycle helmet law, and = 0 otherwise
  - $\varepsilon_{\ j,t}$ = random error term clustered at the state level.

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- Estimate the following:

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Results

1975 - 2007 Natural log state motorcycle crashes is the dependent variable (n=1,239)		
Helmet Law	-0.211***	(-19.0%)
Skill Test	-0.027	
Rider Education	0.016	
Rider Education Licensing	-0.123***	(-11.6%)
Daytime Headlight	-0.121**	(-11.4%)
Temperature	0.018**	
Ln Alcohol Consumption	0.191	
Ln Registered Motorcycles	0.149**	
*,**,*** Denote significance at 10%, 5%, and 1% levels respectively		

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Empirical Strategy

- Estimate the following system of equations:

$$violation_{j,c} = \alpha + IC_{j,c} * \gamma + CC_c * \delta + \beta * helmet_{j,c} + \varepsilon_{\ j}$$
$$helmet_{j,c} = \alpha + IC_{j,c} * \gamma + CC_c * \delta + \beta * helmet\_law_c + \varepsilon_{\ j}$$

  - $violation_{j,c}$ = dummy variable equal to 1 if individual j received a traffic ticket for reckless driving (speeding, alcohol, failure to stop, etc.)
  - $IC_{j,c}$ = vector of all observable individual characteristics including motorcyclists' age, gender, and seating position
  - CC_c = vector of crash characteristics including manner of collision, and vehicles/objects involved in collision

Empirical Strategy

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  - $helmet_{j,c}$ = dummy variable equal to 1 if individual j was wearing a protective helmet at the time of crash
  - $helmet\_law_j$ = dummy variable equal to 1 if the crash occurred in a state with a mandatory motorcycle helmet law

Estimated Difference in Probability of Violation

2002-2008 Individual traffic citation is the dependent variable (n=13,610)			
	IV	Control function probit	Bivariate probit
Helmet	-0.048**	-0.043*	-0.042*
F-test/χ^2	1,029.97***	724.18***	724.59***
*,**,*** Denote significance at 10%, 5%, and 1% levels respectively			

Possible Explanations

- Omitted Variable / Simultaneity Bias
- Non-classical measurement error - All crashes are not observed. Only police accident reported crashes are observed
- Motorcyclists ride less frequently following helmet law adoption, and the number of registered motorcycles is an imperfect proxy for motorcycle utilization
- Helmets make riders more visible to other motorists
- Enhancing behavior - Helmet laws induce motorcyclists to take additional safety precautions

Future Research: Identifying Source of Enhancing Behavior

- Helmet laws encourage safety conscious behavior among motorcyclists
  - Sadiq & Graham (2014) – risk reducing measures and risk perception
  - AMA focuses considerable attention on alcohol use and rider conspicuity as contributing factors

- Motorcyclists' have biased opinions regarding helmet inefficacy
  - Cox (2014) and Freling et al. (2014) – confirmation bias and anecdotal bias
  - ABATE propagates belief that helmets are ineffective and may actually increase risk of serious neck injuries

- Motorcyclists' believe helmets increase crash propensity

Questions/Comments

Thank you!

Multinomial probit estimated difference in probability of fatality and injury

2002-2008 Injury Severity is the dependent variable				
	Control function probit		Bivariate probit	
	Injury	Fatality	Injury	Fatality
Helmet	-0.053**	-0.026***	-0.058**	-0.024***
χ^2	724.18***		724.59***	
*,**,*** Denote significance at 10%, 5%, and 1% levels respectively				

Table 9. Motorcycle Helmet Effectiveness Using Bivariate Multinomial Probit Specification.

	Number of obs.	**Predicted Mean Probability of Injury**	**Predicted Mean Probability of Death**
Panel A: Technological Effectiveness:			
Universal Helmet Use	13,610	0.788	0.020
No Helmet Use	13,610	0.846	0.044
Percentage change in mean predicted probabilities with helmet use		-6.88%	-53.91%
Panel B: Helmet Law Effectiveness:			
States with a Universal Helmet Law	6,099	0.790	0.024
States without Universal Helmet Laws	7,511	0.824	0.031
Percentage Change in Mean probabilities from Adopting a Universal Helmet Law		-4.12%	-21.30%
Panel C: 100% Compliance Helmet Law Effectiveness:			
Universal Helmet Use in Non-helmet Law States	7,511	0.793	0.019
States without Universal Helmet Laws	7,511	0.824	0.031
Percentage Change in Mean Probabilities from Adopting a Universal Helmet Law with 100% compliance		-3.84%	-38.34%

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