

In the Name of God



Allameh Tabataba'i University
E.C.O. College of Insurance

**The Effect of Traffic Density on the Accident Externality from Driving
The Case Study of Tehran**

Master of Science
In the subject of
Actuarial Science

Supervisor: Dr. Atousa Goodarzi

Advisor: Dr. Reza Ofoghi

By:

Razieh Esfandiari

Tehran-Iran

February-2013

To My Dear Mehdi

ACKNOWLEDGEMENTS

I would like to thank all those who gave me valuable help to complete my thesis. Dr. Atousa Goodarzi patiently supervised the thesis to go ahead. She not only supported the thesis as a supervisor, but she always motivated me to go further. I would also like to present my sincere gratitude for her supports. I would like to express my deeply gratitude to Dr. Reza Ofoghi for his valuable advises and considerable helps in writing and completing my thesis.

Most of all, I would like to thank my family for their understanding and love. They always supported me to reach the current situation and always helped me to go ahead in everything that I do. Furthermore, I also like to thank my friends especially Mrs. Shima Doodman, for their unsparing and kindness helps.

Finally, my gratitude, as always, to my husband, Mr. Mehdi Asad Nejad, that kindly and mentally supported me and is my incentive in life and also for all the wonderful moments that we've had.

Abstract:

Due to the growth of the automobile industry worldwide and increasing human demand for this vehicle, every day we see many accidents, around the world and especially in Iran. Based on experts research, Accidents cost includes a significant part of GDP, so that according to the most recent comprehensive study on the cost of traffic accidents, the cost amounts is about 7 percent of our gross national product whereas, in developed countries the economic value lost as a result of road accidents is about 1 to 2 percent of GDP. Hence accidents topic is very important in Iran.

In this study we showed that high-traffic density intersections have larger externality, and increase in traffic density leads to increase in accident frequency.

We chose and analyzed the number of accidents in 30 intersections over 24 month since 1389 to 1390 as dependent variable. This study estimated linear and quadratic models, to ordinary least squares (OLS) estimation with using panel data model. We found that high traffic density intersections have more accidents and large negative externality by using quadratic model. Also we found that the number of 3-vehicle accidents is decreased in high traffic intersections.

Keywords: *insurance, auto accidents, externality, panel data method.*

Table Of Contents

ACKNOWLEDGEMENTS I

Abstract:.....II

CHAPTER 1: INTRODUCTION 1

1.1 *Introduction*:.....2

1.2 *Importance of the thesis subject*:3

1.3 *Main hypothesis of the thesis*:.....4

1.4 *Methodology*:.....4

1.5 *Data requirements*:5

CHAPTER 2: LITERATURE REVIEW6

2.1 *Effect of Average Speed and Volume on Motor-Vehicle Accidents on Two-Lane Tangents*7

2.2 *Automobile Accidents, Tort Law, Externalities, and Insurance*:7

2.3 *Per-Mile Premiums for Auto Insurance*8

2.4 *The Accident Externality from Driving*:8

2.5 *Traffic Congestion and Accident Externality*:.....9

2.6 *Reexamining the Accident Externality from Driving Using Individual Data*:10

2.7 *Calculate premiums based on mileage*:.....11

2.8 *Pay-As-You-Drive Insurance*12

CHAPTER 3: THEORETICAL FOUNDATION.....14

3.1 *Introduction*:.....15

3.2 *Theoretical foundation*:15

3.3 *The Proxy Data*:19

3.4 *Model specification*:.....20

 3.4.1 *Accident Externality*.....21

3.5 *Methodology*:.....22

 3.5.1 *Basic Framework of Panel Data Model*.....23

3.5.1.1	<i>The Pooled OLS Estimator</i>	23
3.5.1.2	Fixed Effect Estimation.....	24
3.5.1.3	Random Effect Estimation.....	26
3.5.2	The Hausman Specification Test:	27
	CHAPTER 4: EMPIRICAL WORK	29
4.1	<i>Introduction</i>	30
4.2	<i>The Data</i>	30
4.3	<i>Univariate Results</i>	30
	Table 4.3.1:	31
4.4	<i>Estimation of the Economic Model</i>	31
4.5	<i>Most Appropriate Model</i>	32
4.5.1	Most Appropriate Model for Linear Model.....	32
4.5.1.1	Selection between Pool & Panel	32
4.5.1.2	Redundant Fixed Effect Test.....	33
4.5.1.3	Correlated Random Effects- Hausman Test.....	34
4.5.2	Most Appropriate Model for Quadratic Model	36
4.5.2.1	Selection between Pool and Panel for Quadratic Model.....	36
4.5.2.2	Redundant Fixed Effect Test for Quadratic Model.....	36
4.5.2.3	Correlated Random Effects- Hausman Test.....	38
4.6	<i>Model Estimation</i>	38
4.7	<i>Accident Externality</i>	41
4.7.1	Accident Externality for Linear Model.....	41
4.7.2	Accident Externality for Quadratic Model	41
	CHAPTER 5: SUMMARY & CONCLUSION	31
5.1	<i>Summary</i>	46
5.2	<i>Conclusion</i>	46
5-3	<i>Suggestion</i>	47
	REFERENCES	49

<i>Appendix A</i>	53
<i>Appendix B</i>	54
<i>Appendix C</i>	566
<i>Appendix D</i>	57
<i>Appendix E</i>	59
<i>Appendix F</i>	61
<i>Appendix G</i>	62
<i>Appendix H</i>	64
<i>Appendix I</i>	65
<i>Appendix J</i>	67

CHAPTER 1:

INTRODUCTION

1.1 Introduction:

Externalities mean costs that are not born by either the buyer or seller in a market. Because they don't bear them, they won't consider these costs in their decisions of how much to trade under what conditions and terms to trade.

Each driver can affect the risk of accidents to others. The more other cars are on the road covers, the higher the potential for other drivers to risk an accident. This is referred to as the accident externality from driving. Externalities appear to be substantial in traffic density. The externality is that each driver's driving affects the accident risk of others. The more miles each person drives, the more cars are on the road and the more potential there is for accidents.

This study is an attempt to provide better estimates of the size (and sign) of the aggregate accident externality from driving. We analyzed the number of accidents as dependent variable.

This study expects that frequency of accidents tend to rise with a traffic density, as a result the cost of insurers will increase. This thesis is organized as follow:

In chapter 2 we present a review of the literature in automobile Accidents, externalities, traffic Congestion and calculate premiums based on mileage.

In chapter 3 we describe the relationship between the traffic density and insurance cost and elicit the formula of externality and define the proxy data which are used in this study and introduce our regression and methodology and briefly describe basic framework of panel data model.

The result of the pooled OLS, random-effects and fixed-effects estimation of the proposed model and tests the hypothesis represent in chapter 4.

The summary of this work and conclusions of the present work are given in Chapter 5.

1.2 Importance of the thesis subject:

The most of researches on pricing auto accident insurance ignored traffic volume of different places and different decisions of drivers will be made.

As a new driver takes to the road, does he/she increase the accident risk to others as well as assuming risk himself/herself? If so, then a 1 percent increase in aggregate driving increases aggregate accident costs by more than 1 percent.

It is possible that the probability of a multivehicle accident could begin to fall at high traffic densities because traffic will slow down.

An average person pays the average accident cost either by paying an insurance premium or by bearing accident risk. The accident externality from driving results because a driver increases traffic density and thereby increases accident risks and costs for other drivers and equivalently the costs that should be paid by insurance companies will be increased.

This study investigates a relationship between the frequency of accidents and traffic density and concludes that more accidents happen in high traffic

intersections, thus there are more accident risks and costs for other drivers and insurance companies.

1.3 Main hypothesis of the thesis:

Main hypothesis in this study will be as bellow

- High-traffic density intersections have large externality.
- Increases in traffic density increases accident frequency.

1.4 Methodology:

This research classifies intersections of Tehran into three regions of high density, low density, and moderate density according to their average traffic density based on information from Tehran Traffic Control Organization. Randomly 30 intersections, have been selected among those intersections that equipped with camera and use their monthly traffic data since 1389 to 1390, and the number of occurred accidents and the amount of costs in these intersections and related times have been considered.

This study estimates linear and quadratic models, to ordinary least squares (OLS) estimation with using panel data method. The EViews 7.1 software will be used to estimate the regression model. Meanwhile, the related test of

panel data (such as Random Effects, Fixed Effects and other statistics) will be conducted.

1.5 Data requirements:

- The number of occurred accident in 30 intersections of Tehran.
- The explanatory variable is traffic density of these intersections.