MEDICAL MALPRACTICE AND TORT REFORM: EFFECTS ON THE DEATH RATE, A 2004 CROSS-SECTIONAL ANALYSIS

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MEDICAL MALPRACTICE AND TORT REFORM: EFFECTS ON THE DEATH RATE, A 2004 CROSS-SECTIONAL ANALYSIS

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MEDICAL MALPRACTICE AND TORT REFORM: EFFECTS ON THE DEATH RATE, A 2004 CROSS-SECTIONAL ANALYSIS

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James Bryan Gibson, son of Eddie and Meridee Gibson, was born in Birmingham, Alabama on September 6, 1985. He graduated magna cum laude from Auburn University in May 2008 with a degree Bachelor of Science in Business Administration in Economics and Finance. He then entered the Masters of Science in Economics program at Auburn University in August 2008.

THESIS ABSTRACT

MEDICAL MALPRACTICE AND TORT REFORM: EFFECTS ON THE DEATH RATE, A 2004 CROSS-SECTIONAL ANALYSIS

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This thesis scrutinizes the effects that tort reform, health expenditures per capita, and the median malpractice payment per state has on the age-adjusted death rate. The data is from 2004 and was collected for each state. Different models are used to find the determinants of the age adjusted death rate, health expenditures per capita, and the median malpractice payment per state. Then two stage least squares is used to compensate for simultaneity and improve the quality of the results. The analysis shows that tort reforms have a statistically significant impact on reducing the age adjusted death rate, while the median malpractice payment and health expenditures do not.

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

CHAPTER I

INTRODUCTION

Healthcare in the twenty-first century has evolved into a highly valued, highly debatable, and often highly controversial asset in the United States. The system by which medical care is delivered has also changed in many ways and has developed into our current complex network of healthcare providers, insurers, and individuals seeking care. The driving force behind the healthcare debate in the United States is the number of uninsured individuals who lack access to the system as it is currently constructed. To solve the problem one can look at a variety of proposals, but to find the fundamental trouble surrounding the dissemination of medical care in the United States, the proposal must go back to the costs associated with quality care. One issue that is focused upon when examining the rising costs of medical care is medical malpractice.

The debate over medical malpractice has been simmering in the political and medical communities for many years. Proposals and counter proposals have been made to try to address what is viewed by many as a hindrance to doctors and patients. To gain better perspective on the effect of malpractice on healthcare it is important to first introduce some basic data and statistics. In 2005, according to the A.M. Best Company, malpractice insurance premiums cost American doctors over $11 billion. The number of reported payments as a result of malpractice action in 2005 was over 17,000 as reported by the National Practitioner Data Bank. Yet despite these enormous costs, medical

malpractice lawsuits are often needed to compensate those who are injured or the family members of those killed by malpractice. The National Academy of Science has statistics that say errors in medication are among the most common malpractice events and affect at least 1.5 million people per year. Even more alarming, a Health Grades Study found that deaths resulting from malpractice numbered approximately 195,000 in 2002. The staggering statistics available concerning medical malpractice are hard to delineate into useful information. The simple question that needs to be answered is: do medical malpractice suits improve the population's health or do they hinder it?

CHAPTER II

HISTORY OF MEDICAL MALPRACTICE

Through the course of history, medicine has advanced and evolved in such a way that the expectations of care have grown exponentially. The credence given to doctors and nurses today far exceeds that in any point in history. Yet, despite the high level of healthcare that Americans expect and receive, there are still mistakes made. As long as a human element is involved in our healthcare system, errors will inevitably occur. David Hyman (2002) reaches the conclusion that today approximately 1% of individuals who are hospitalized become victims of malpractice. The history of medical malpractice dates back to the second century B.C. According to De Ville (1990), the Hammurabi code in Babylon specified various punishments for medical providers who injured or even caused the death of a patient. Although the code did not provide monetary compensation for the pain and suffering of victims, the penalties served as means to discourage mistakes by medical personnel.

The American judicial system is loosely based upon English common law. Thus, one can look across the Atlantic for the beginnings of present-day medical malpractice. James Mohr (2000) notes that the concept of malpractice, albeit in other professions, was well established in English legal theory by the early 18th century. Landes and Posner (1987) discuss that, "The writ of trespass *vi et armis* was at first the principal vehicle by which tort cases were brought before the royal courts. As early as the twelfth century

courts were awarding damages in battery cases commenced by this writ."[1] Mohr cites Sir William Blackstone for the first linkage of malpractice to medical professionals. In Blackstone's *Commentaries on the Laws of England* (1758), he references "mala praxis", a term that led to the modern terminology of malpractice. Despite the similarities between the English and American systems, Mohr (1993) said that most lawyers in the United States would not have the knowledge to draft, much less pursue, an action for medical malpractice until around 1840.

The first appellate decision for medical malpractice in the United States was in 1794. In the case of *Cross v. Guthrey*, a doctor in Connecticut, Cross, was sued for malpractice when he amputated one of Mrs. Guthrey's breasts and she died several hours later. Dr. Cross was ordered to pay restitution to Mr. Guthrey totaling forty pounds. Several other cases occurred in the early nineteenth century, but it was not until the 1840s, (De Ville 1990) that medical malpractice became a significant problem for the medical community. Due to the lack of regulation and insufficient training there was no uniform standard of care in this period. De Ville also notes that after this period of time, malpractice litigation became a "permanent feature of American medical life." The developmental stages of the law and its application to medical malpractice were slow to evolve, although there was robust growth in general tort law with the coming of the railroad in the nineteenth century as noted by Landes and Posner (1987). Olsen (1996) makes the point that it was during this period when medical malpractice lawsuits experienced significant growth and the medical professions began raising concerns about the explosion of lawsuits.

[1] P.2

As time and technology advanced, so did lawyers and their arguments. The development of the x-ray in the early 1900s was a pivotal tool for both doctors and lawyers. Doctors could now diagnose ailments much more easily and lawyers could sue for the lack of an x-ray or for an x-ray that was administered improperly. During this period the number of lawsuits continued to rise, but the modern day debate over malpractice did not emerge until the 1960s. Olsen (1996) writes that, "Malpractice insurance premiums rose dramatically during the 1960s and 1970s." The high price of malpractice insurance created a crisis of availability that seemed to reside toward the end of the 1970s as claims fell. This trend reversed itself in the 1980s as claims again rose and medical providers had trouble attaining affordable insurance. Sloan et. al (1991) points out that the problem in this time was affordability not availability. Through the 1990s, premiums generally decreased until beginning to rise again at the onset of the new century. A pattern of cyclical crises seems to be developing, perhaps indicating a response mechanism from the medical community which is then followed by attorneys seeking new grounds for legal action. These insurance crises highlight three major public concerns surrounding the insurance industry. Sloan et. al (1991) list the three issues as insurance availability and price, higher prices leading to reduced access to care, and the overall quality of the medical care. The medical community, particularly the individuals specializing in high risk areas such as obstetrics-gynecology and anesthesiology, has certainly become acutely more aware of the liabilities they faced in the twentieth century, and began to respond appropriately with remedies that will be discussed later.

CHAPTER III

TORT LAW

Medical malpractice falls under the umbrella of tort law, which provides recourse for civil wrongs that are not contracts. The word tort is derived from the Latin word tortus meaning twisted. Danzon (1985) describes tort law as, "That amorphous web of rules that governs injuries to person or property where crime or contract is not at issue."[2] The function of tort law is to provide compensation for pain and suffering and to serve as a means to correct behavior. Bell (1984) describes the two roles of the malpractice system as to provide a way for those injured to receive compensation and to create incentives for doctors to exercise care in their treatment. In spite of some of the crude medical practices employed in early American history, it took the law some time to fully scrutinize the role that torts would play in the legal system and how tort claims would be adjudicated.

The development of the tort system came surprisingly late in American legal history. Landes and Posner (1987) note that, "Tort law was part of the customary or unwritten law of England at the time of the Norman Conquest."[3] Notwithstanding the work of Blackstone and other early English legal minds, it took some time for the U.S. to build a standard tort system. White (2003) notes several important tort law milestones in

[2] P.1
[3] P. 2

the U.S. came in the late 19th century including the first tort casebook being published in 1874 and the separation of torts as a distinct subject in law schools in 1870. The standard for defining malpractice as a tort action in the United States was established in the case of *Pike v. Honsinger* in 1898. According to Hogan (2003), "The court ruled that all physicians should be expected to practice at the 'standard of care', and that the standard would be determined by having local physicians testify as to the standard in the locality."[4] Although this standard was hard to enforce given the lack of homogeneity in medicine, it became a landmark case that established a precedent for malpractice cases. Hogan also notes that this case marked the beginning of a slow transition from local, heterogeneous medical care to a national, homogeneous profession.

Many criticisms exist about the current tort system and the way certain cases are resolved. Patricia Danzon (1994) has a detailed list of concerns with torts that include rising claim costs, mismatch of claims and injuries, disproportionate or unsuitable compensation, and high overhead costs. She is not alone in her lengthy criticisms. Beider and Perry (2003) list several of their criticisms as follows: high transaction costs, arbitrary awards, "the class action mechanism", and the increasing costs of liability insurance. The objection to transaction costs is also raised by Fleming (1988), who writes that, "The most negative feature of the tort system is its staggering overhead cost."[5] An additional subtle problem raised with the tort system by Parchomovsky and Stein (2008) is that our current system may have hidden costs such as inhibiting innovation. That being said, there are certainly cases where malpractice has indeed occurred and where it has not. To easily distinguish between these, Leaman and Saxton

[4] P. 1
[5] P. 18

(1993) propose grouping suits into three categories: lack of understanding, emotional response, and malpractice. It is then the job of the courts to determine whether a case meets the standard of malpractice and the amount of damages to award.

Another complaint about malpractice suits are the extraordinary amount of awards often reported in the news media for certain, sensational cases. Olsen (1996) lists three variables that influence the average amount of benefit paid out by insurers: (1) the *frequency* is how often lawsuits occur; (2) the *probability* is the odds of losing the case: and (3) the *severity* is the average size of awards paid. One such case where the severity seemed to defy the odds occurred in Florida, where a jury awarded a man almost $127 million for a misdiagnosis of stroke symptoms. The blame for these large awards is often directed at the jury, who many believe lack the basic medical knowledge to effectively judge a case. Vidmar (1995) presents several claims that are often made about juries. He points out that juries award more based on the defendant's perceived ability to pay, and that they tend to "largess" when awarding damages for pain and suffering. Weiler (1991) also makes note of the "inability of a lay jury to understand the complex medical problems that doctors must deal with."[6] The runaway jury award is often cited as the chief problem facing the tort system but there are others.

This tendency of juries to award large damages has been named by some as the "lottery mentality." Dr. Donald Palmasino (2005) said in testimony before the U.S. House of Representatives Small Business Committee, "Transformed by high stakes financial incentives, it has become an increasingly irrational 'lottery' driven by open-ended non-economic damages." This mentality often leads to abuses by attorneys

[6] P.19-20

seeking to score the big case. It can also drive doctors to practice defensive medicine. Defensive medicine is commonly defined as doctors taking extra precautions and running additional tests to avoid liability, not necessarily insure the patient's health. An op-ed in USA Today on April 23, 2008, put the annual cost of defensive medicine at $210 billion, but it could not determine the health benefits derived from these expenditures. Although it is generally a negative term, Bhat (2001) notes that defensive medicine can either raise or lower the quality of the care. The test of defensive medicine lies in the cost-benefit analysis that would have to be performed to see if medical resources are being efficiently used. If the additional tests and procedures performed benefit the population's health at a price the population is willing to pay then it is logical to assume there are net benefits from defensive medicine. Yet, most view defensive medicine as a negative that results in cost overruns and unnecessary anguish for the patient. In fact, 93% of doctors surveyed in the *Journal of the American Medical Association* in 2005, confessed to practicing some form of defensive medicine. Thus, it is hard to categorize the effects of tort law on defensive medicine as necessarily good or bad.

CHAPTER IV

ECONOMICS OF MALPRACTICE

The economics of tort law, and thus malpractice, center on the costs of actions. When a person is injured and makes a claim to recoup damages, the damages are divided into two categories, economic and non-economic. Economic damages can include current and future lost income, medical bills, and other expenses that result from the injury. Non-economic damages, or pain and suffering, are harder to quantify. Speculation can be made that the greater the non-economic damages, the more positive the correlation will be with economic damages. Rubin (1993) examines the effect of economic and non-economic losses on utility functions. Utility in the economics sense is a relative measure of happiness from the consumption of different goods or services. Marginal utility is the additional happiness gained from the last unit of consumption. People do different things in order to gain utility and more utility makes individuals happier, thus they seek to accumulate as much utility as possible. However, at some level each additional unit of utility begins to have a smaller effect on happiness. This defines diminishing marginal utility, which is shown with a downward sloping curve. In the graphs of utility (Appendix A, Figure 1 and Figure 2) it is simple to see that as wealth increases the utility gained per unit increases at a decreasing rate and eventually flattens out. The marginal utility curve can also be seen to be downward sloping, which illustrates the concept of diminishing marginal utility. An economic loss moves along the

utility curve from point A to B to a lower level of utility, but alternatively leads to a higher marginal utility at point B (Appendix A, Figure 1). A non-economic loss will lower the utility curve from point A to B, but the marginal utility remains the same with A=B (Appendix A, Figure 2).

Another economic component of malpractice can be seen in the production possibilities frontier. This curve shows the total of any two goods that can be produced if all available resources are employed. In this illustration we will use healthcare and lump things such as insurance and preventative costs together into the category of other goods. If there are two goods, like healthcare and other goods, then there is an opportunity cost between the two. Opportunity cost for economists is defined as the value of the next best alternative use of that resource. If society wants more healthcare, it must give up some other goods, and vice versa. Thus, if more resources are being employed buying malpractice insurance and employing attorneys for legal defense (other goods), then fewer resources will be used for healthcare (Appendix A, Figure 3). The graph illustrates this point as healthcare is on the y-axis and other goods on the x-axis. If society starts at point B but experiences problems with medical malpractice and resources are shifted into insurance and other preventative measures then society moves to point A. This leads to less healthcare being produced for society, which is certainly detrimental to the population's overall health.

Economic efficiency is also pointed to by some as a way to measure the benefits or drawbacks of the tort system. Beider and Hagen (2004) point to economic efficiency as a measure of malpractice effectiveness. We can define economic efficiency as the action that provides the greatest net benefit to society. The tort system, by assigning

liability to medical practitioners, should in theory encourage the medical community to regulate itself, thus reducing malpractice incidents. This reduction of malpractice incidents would of course provide net benefit to society. Another element of efficiency is all dependent on the accuracy of damages awarded to those who are injured. Patricia Danzon (1983) writes that, "From the standpoint of economic efficiency, the medical malpractice system makes no sense if its sole function is compensation."[7] Another interesting study on the efficient use of medical resources was done by Kessler and McClellan (1996). They found that older patients with heart disease saw a drop of five to nine percent in medical costs in states that had implemented tort reform, yet there was no significant change in the death rates. Their study indicated that tort reforms could improve the efficiency in our medical markets. Based on the illustrations and theory presented, it is easy to see the economic impact that malpractice can have, yet it is difficult to ascertain the actual effect on overall health that malpractice has.

[7] P. 221

CHAPTER V

POTENTIAL SOLUTIONS

The first fact that needs to be ascertained is whether malpractice suits have a detrimental effect on health or if they improve the population's health. Two opposing viewpoints are offered by Dr. Donald Palmisano, former president of the American Medical Association, and Joanne Doroshow, director of the Center for Justice and Democracy. Palmisano (2005) said while testifying before the House of Representatives Small Business Committee that, "For the past several years, we have seen numerous symptoms that tell us our nation is facing a crisis because of a broken medical liability system." Doroshow as quoted by Jost (2003) countered with this statement: "The threat of liability is what works as a deterrent to improve patient safety."[8] The debate over tort reform is certainly an important debate to be had, as healthcare reforms continue to top the list of politicians and interest groups alike. David Hyman (2000) writes, "Depending on one's perspective, there is too much medical malpractice litigation or not enough; contingent fee arrangements create an obscene form of bounty hunting or are absolutely necessary to ensure justice; physicians should not be second guessed by those too dumb to avoid jury service or the jury system works just fine; and legislators who enact tort reform are protecting fat-cat doctors or have prudently restrained a tort system run amok."[9] As seen in Appendix A, Figure 4 from the New York Times, it appears that

[8] P. 134
[9] P. 258

malpractice premiums have been outpacing malpractice payments for many years which may explain the disparity that many see in our current system. The figures in the graph are adjusted for inflation and it can be seen that in 2003, malpractice insurance premiums cost the medical profession over ten billion dollars. Despite some disagreement among experts, most Americans believe there is a problem and there needs to be reform as evidenced by a Gallup Poll conducted September 24-27, 2007. The results of this poll showed 69% of respondents favored legislation to limit the amounts awarded in malpractice suits. There is evidence to support public opinion: the American Tort Reform Association notes that the growth of tort costs has exceeded GDP growth by 2 to 3% in the last 50 years, the average return on the dollar for tort cases is less than 50 cents, and from 2000 to 2003 tort costs have increased over 30%. Danzon (1994) also agrees with public opinion by essentially saying that the tort system is imperfect at best and it has high costs, particularly overhead costs. As there are conflicting opinions about the existence of a problem or lack thereof, we will let the empirical results provide the evidence although in hypothesizing the author will side with the majority of the public. Many solutions to the purported problem of medical malpractice have been offered up over the years by doctors, politicians, and policy experts. Now there are several proposals to be discussed and comments made on their possible effectiveness at reducing healthcare costs.

Alternatives to tort reform are advocated by others as means to limit malpractice liability, thus reducing the frequency of lawsuits. Robertson (1985) has several suggestions for medical personnel to prevent the likelihood of malpractice suits. His suggestions include things such as: improved doctor-patient communication, obtaining

consent, and ensuring proper documentation. Another way to prevent malpractice is proposed by Leaman and Saxton (1993), who propose an acronym SOAP in their approach called co-active practice. SOAP stands for "shared responsibility, open communication, approved documentation, and personalized care."[10] These two approaches are simple, low-cost ways to help doctors reduce their liability, but they can not be viewed as overall solutions. Keeping accurate records that thoroughly document all communication and discussion with the patients are obviously important to all healthcare professionals.

Still another option to reform the system is advocated by Sasha Polakow-Suransky (2007), who claims a more effective way to deal with malpractice would be to have a better effort to find and eliminate bad doctors from the profession. Although she does not provide specific details about how to classify physician performance or how to remove bad physicians the concept may have some merit. This would in theory help prevent some cases of malpractice from even occurring. The concept of more tightly regulating the medical community is echoed by Blair and Dewar (1988), who propose a longer residency requirement as well as a system of sanctions including fines, suspension, or probation. In their system, the medical community would be overseen by regulatory agencies that would have the power to license and discipline with measures including suspensions, probations, and fines. The proposed independent state agency would have over-arching authority and it would report to that state's governor. Although none of these proposals actually reforms the tort system as it is currently constituted, they do

[10] P. 102

offer some legitimate alternatives that would help reduce the frequency of lawsuits and ideally lead to a healthier population.

The no-fault alternative is another plan to change how our court system litigates malpractice. This plan, summarized by Law and Polan (1978), allows those who are injured to recover certain sums by showing that they were injured in a particular manner. For permitting their recovery of losses, the patients have to give up their right to sue in civil court. Law and Polan present two reasons in support of this alternative: (1) many patients who are injured never receive compensation, and (2) a percentage of malpractice payments do not reach the plaintiff, as they go to attorney and court fees. Problems with no-fault include the source of funds paid out, the arguments over whether an individual deserves compensation, the effect of deterrence, and the development of a set of guidelines to determine the amount paid out for particular degrees of injury. Law and Polan come to the conclusion that there is not enough evidence to support such a theoretical system and that it could be more expensive than the current tort system as more people would be entitled to compensation under a no-fault system. Since a feature of the current tort system, deterrence, would be lost in a no-fault system it would be important to increase scrutiny on medical professionals as well as direct some of the burden of no-fault premiums to them to encourage a continued standard of care that patients currently expect. Mello and Brennan (2002) also believe that the no-fault alternative will be more expensive than the system that is currently in place, primarily due to their belief that medical institutions will be forced to internalize costs that would otherwise be external in nature under the current system. A 2002 study was conducted by the Robert Wood Johnson Foundation entitled: “Can the No-fault Approach Contain

Malpractice Insurance Costs." The study focused on two states, Virginia and Florida, which were the first to enact a no-fault compensation system for birth complications. The study concluded that the system kept insurance premiums affordable for obstetricians, was less expensive than the current system, and lead to quick resolutions of claims. In spite of these findings, the researchers believed that due to the limited scope of the study there was no way to ascertain if the findings could be broadly prescribed to other medical treatments and specialties. Despite these issues, the no-fault approach would help to eliminate the transaction costs associated with tort law, but the question of its overall effectiveness remains.

A move to contractual liability is also an option. Shandell and Smith (1990) note that the current tort system has no contractual method to it as physician's opinions and even medical consent forms are not considered to be subject to contractual liability. If providers and patients entered into a contract that dealt with damages and legal recourse before care was provided, this could be beneficial to both parties. As Weiler (1991) notes, the only responsibility of the court system in this case is to enforce the contract. Rubin (1993) writes, "Where there is a prior relationship between injurers and victims, the parties should be allowed to specify by contract or warranty the types of damage for which injurers will be liable."[11] This reform is also trumpeted by Kersh and Sage (2006) who believe that the best way to adjudicate liability is to determine the "scope of liability by contract." They argue that this is the most economically efficient way to reform the tort system because it makes some patients better off, while making none worse off. This premise is based on the fact that many victims of malpractice never receive compensation

[11] P. 8

for their injuries under the current system. Hyman (2002) estimates that out of the 1% of hospitalized patients who suffer malpractice, only 2 % file a claim. Thus, the argument for contractual liability appears to be legitimate, with economic benefits to the population. This approach would substantially reduce the overhead costs associated with tort law, and thus lower insurance premiums.

Still another proposal is to cap contingency fees that attorneys often have plaintiffs agree to before taking a case. The fees, often set at 30% or higher, entitle the lawyer to a percentage of the settlement if the case is won. If the case is lost the lawyer receives no compensation. Alexander Tabarrok (2005) describes contingency fees in this way: "If America is, in the imagery of the tort reformers, lawsuit hell, then contingent-fee lawyers are its devils."[12] Sixteen states have already limited contingent fees in various ways. Suggestions for the caps include restricting contingent fees to 10% of the first $100,000 and 5% of the remaining settlement. Other proposals to reform contingency fees are outline by Hofmann (2001) and include: requirements of lawyers to inform clients that they have up to three days to reconsider, the fees are subject to negotiation, and some of the adverse outcomes of litigation. Beider and Hagen (2004) believe that putting a cap on contingent fees could improve the system's efficiency by limiting the number of "nuisance suits." Those in favor of contingent fees say that it is the only way poor citizens can bring a lawsuit to recoup damages they suffered. The opposition often argues that contingency fees encourage frivolous litigation, simply because attorneys believe they can win large settlements, the facts of the case notwithstanding. Limiting

[12] P. 42

contingent fees also restrict the ability of plaintiffs to reward those acting on their behalf, their attorney.

A reform in the way malpractice insurance is priced is another choice that makes sense, particularly from the perspective on insurers. In most all other forms of insurance an experience-rating is used to determine the premium amount charged the insured. For instance, automobile insurers look at the insured's past vehicle history and develops a premium for that driver based on the driving record and other factors that influence the likelihood of the insurer having to pay a claim. A similar system could be implemented for malpractice insurance. As Weiler (1991) writes the system could function something like the following: "The claims record of doctors is tracked over a five-year period, with a certain number of points awarded for each claim and additional points for each paid claim. Surcharges are placed on the future premiums of doctors with more than a minimum point level in this rolling five-year period."[13] An experience rating system applied to malpractice insurance could also deter bad doctors who have multiple claims filed against them. Fournier and McInnes (2001) describe the benefits of such a system as follows: "Adjusting insurance premiums through experience rating has two benefits: (1) cross-subsidization of high-risk subscribers by those subscribers of low risk is reduced and (2) high-risk subscribers are given incentives to find cost-effective ways to reduce risk."[14] Their study of claims history from Florida showed that such a system would be viable and would reduce the problem of low-risk doctors subsidizing high-risk specialties.

[13] P.77
[14] P. 255

Different reforms have passed state legislatures regarding tort reform, but there has been no uniform federal reform legislation to address the issue. A bill that was proposed in the House of Representatives in 2003, H.R. 5 or the HEALTH Act of 2003 (Help Efficient, Accessible, Low-Cost, Timely Health Care), is modeled after a law passed in California. California suffered from significant insurance premium increases in the 1970s, with some physicians seeing increases of over 400 percent according to Dr. John Whitelaw in a February 27, 2003, op-ed in the *Sacramento Bee*. The Medical Injury Compensation Reform Act, or MICRA, was passed in California in 1975, and limited non-economic damages to $250,000 while ensuring that compensation for all future economic damages was made. These main provisions in the law were included in H.R. 5, which although it passed the House, was never heard in the Senate. Beider and Hagen (2004) note that the Congressional Budget Office projected that this bill would lower insurance premiums by twenty-five to thirty percent. As different states restricted awards in malpractice it can seen that the amount of damages awarded per doctor varies widely across the United States (Appendix A, Figure 5). This figure shows the average malpractice claim payments on the state level from 1999-2001. States like California that have implemented tort reforms often have average malpractice claim payments per doctor under $2,878. Other states with higher average payments may even be labeled "judicial hellholes" by the American Tort Reform Association. In their 2004 annual report, some states that fall into this category include: Illinois, West Virginia, and Florida. This has often resulted in attorneys focusing their practices on certain states like these that did not limit non-economic damages and had higher average payouts.

CHAPTER VI

LITERATURE REVIEW

There is a wide-ranging array of literature and research in the area of tort reform. The model being proposed here will investigate theories drawn from several papers. Zeynep Or (2000) developed a model that explained the health of different countries based on several variables. Or measures the health of a country by using potential years of life lost per 100,000 people from age 0 to 70 and regresses it on variables commonly associated with good or bad health. He notes that, "Most empirical studies rely on mortality rates as a substitute partial indicator because they are objectively measured, relatively precise and readily available."[15] The variables chosen can be grouped into three categories: physical environment, life styles, and socio-economic factors. Or's model is specified as follows:

$$H_{it}=\alpha_i+M_{it}\beta+E_{it}\gamma+\varepsilon_{it}$$

The variables are vectors with M being a vector if medical variables, E a vector of non-medical factors, and *i* and *t* referring to country and time. The variables included in each vector are defined in the table.

[15] P. 55

Variable Description	
H	Potential years of life lost (per 100,000 persons age 0 to 69)
Texp	Total health expenditures per capita
Pubexp	Share of public expenditure in total health expenditure
GDP	Gross Domestic Product per capita (1990 price levels)
Status	Share of white-collar workers in total work force
Polut	Nox emissions per capita, kg
Alcohol	Consumption of alcoholic beverages, litres per head of population age 15 and over
Tobacco	Consumption expenditure on tabcoo per head of population age 15 and over
Fat	Butter consumption per head, kg
Sugar	Sugar consumption per head, kg

The data used is a pooled sample from twenty-one OECD, or Organization of Economic Cooperation and Development, countries from 1970-1992. Or discovered that for most countries, "the rise in the employment share of white-collar workers plays the greatest role in the reduction of premature mortality between 1970 and 1992." The next most important factor was per capita income, which would be a natural assumption; given that healthcare is a normal good. As income increases the population will tend to spend more on healthcare, thus leading healthier, longer lives. The results found for other variables generally match an educated hypothesis. Higher tobacco and alcohol consumption, higher levels of pollution, and higher consumption of fat and sugar leads to a population losing more life years. This paper is important to the model to be developed, because the sampling over a twenty-two year period proves that health results can be modeled and that useful conclusions can be drawn from the outcome. Obviously some considerations will need to be made to limit the model to the United States and a variable will need to be added to account for malpractice.

Mark Paul Guis (1998) proposed a model that showed that malpractice reforms did not have a statistically significant effect on insurance premiums. His model used a set of panel data for all 50 states from 1976 to 1990. The terms that are in dollar amounts are adjusted to values in 1983-84. The dependent variable was the amount of malpractice insurance premiums paid in each state. Some of the independent variables examined by Guis that may be of interest include: the presence of tort reform, patient compensation funds, arbitration, the rate on five-year treasury notes, and the number of attorneys per capita. Guis's model is as follows:

$$PREM=\alpha_0+\alpha_1 LEGAL+\alpha_2 LLOSS+\alpha_3 DIRECT+\alpha_4 LPREM+\alpha_5 AFDC+\alpha_6 LAWPER+\alpha_7 TBILL+\alpha_8 HHI3+ \alpha_9 DOCPER+\alpha_{10} URBAN+u$$

Variable	Description
PREM	Medical malpractice ins. Premiums for each state
LEGAL	Vector of tort reform variables
LLOSS	Adjusted loss ratio for medical malpractice insurers in a given state lagged 1 yr
DIRECT	Percentage of policies sold in state through direct writers
LPREM	Dependent variable lagged 1 yr
AFDC	Number of AFDC recipients per 100,000 (Aid to Families with Dependent Children)
LAWPER	Number of non-federal attorneys per capita
TBILL	5 year treasure note rate
HHI3	Hirschman-Herfindahl Index of medical malpractice ins. industry in a given state
DOCPER	Number of non-federal doctors per capita
URBAN	Percentage of population in a state that lives in urban areas

The variables that were significant with a negative sign included: DIRECT, LPREM, TBILL, and URBAN. Those that were significant with positive signs were AFDC, LAWPER, and DOCPER. The most intriguing result was that the presence of tort reform was not statistically significant when it came to lowering the costs of insurance

premiums. Guis notes that the reason this study comes to a different conclusion is other studies can be biased since they use OLS versus using a panel data estimation technique. This technique used by Guis certainly adds a new dimension to the examination of medical malpractice, and more importantly its effect on insurance premiums.

Born and Viscusi (2005) examine three different models that examine the losses from medical malpractice, the effect on insurance premiums, and a regression on the loss ratio, which is defined as the ratio of losses incurred to premium earned. The expectations for their study were that if reforms lowered malpractice losses then lower premiums would result. The regression of interest to help develop my model is the losses from medical malpractice. This model used by Born and Viscusi is:

$$\text{Log Losses Incurred}_{ijt}=\alpha+\delta_1\text{Log Losses Incurred}_{ijt-1}+\beta_1\text{Log Premiums}_{ijt}+\beta_2\text{Punitive Damages Reform}_{jt}+\beta_3\text{No Punitive Damages}_{jt}+\beta_4\text{Punitive Uninsurable}_{jt}+\beta_5\text{Noneconomic Damages Reform}_{jt}+\beta_6\text{Other Reform}_{jt}+\beta_7\text{1970s Reform}_{jt}+\beta_8\text{Patient Fund}_{jt}+\beta_9\text{Log National Premiums}+\beta_{10}\text{Log Number of States}_{it}+\beta_{11}\text{Log Real Income}_{jt}+\beta_{12}\text{Log Treasure Bill Rate}_{t}+\beta_{13}\text{Lloyds}_{i}+\beta_{14}\text{Mutual}_{i}+\beta_{15}\text{Reciprocal}_{i}+\beta_{16}\text{Prior Approval}_{j}+\varepsilon_{ijt}$$

Variable Description	
Log Losses Incurred	Amount of losses incurred by malpractice
Log Losses Incurred Lagged	Amount of losses lagged because firms ins. portfolio
Log Premiums	Amount of malpractice premiums paid
Punitive Damages Reform	Dummy variable for states with reform
No Punitive Damages	States where punitive damages are not recoverable
Punitive Uninsurable	States where punitive damages are not expressly insurable
Non-economic damages reform	Dummy variable for states that enacted limits
Other reform	Dummy variable for reforms other than non-economic damages
1970s Reform	Dummy variable if state participated in 1970s reform efforts
Patient Fund	Dummy variable if insurer operates in a state w/ a compensation fund
Log National Premiums	Total number of national premiums written by insurer
Log Number of States	Number of states in which insurer operates
Log Real Income	Real state aggregate income level
Log Treasury Bill Rate	Treasury bill rate
Lloyds	Remainder of ins. market after stock companies (comprise 90%)
Mutual	Remainder of ins. market after stock companies (comprise 90%)
Reciprocal	Remainder of ins. market after stock companies (comprise 90%)
Prior Approval	Dummy variable if state has a prior approval regulatory regime

The results from their regression shows that all of the tort reforms included have a statistically significant effect at the 5% level in lowering the amount of losses incurred. They also note that insurers in states with caps on non-economic damages had 17% lower losses. The variables of particular interest in development of my model are obviously the ones dealing with the different tort reforms.

Currie and MacLeod (2008) sought to examine if state-level tort reforms reduced defensive medicine in childbirth. They looked at whether specific tort reforms have any effect on procedures and what outcomes are noted for mothers and the babies. "Using data from national vital statistics natality files on millions of individual births from 1989 to 2001, we ask whether specific tort reforms affect the types of procedures that are performed and the health outcomes of mothers and their infants."[16] The model they tested is as follows:

$$OUTCOME_{it}=a+b_1TORT_{st}+b_2XVAR_{it}+b_3YEAR+b_4STATE*TIME+b_5COUNTY+e_{it}$$

Variable Description	
OUTCOME	Procedure or health outcome
TORT	Vector of indicators for tort reform
XVAR	Vector of personal characteristics
YEAR	Vector of year indicators
STATE*TIME	Vector of state specified linear time trends
COUNTY	Vector of indicators for all counties identified in the Vital Statistics data

The reforms that are used in the TORT vector are: caps on punitive damages, caps on non-economic damages, modifications of the joint-and-several liability rule, and reforms of the collateral source rule. The data used by Currie and MacLeod for OUTCOME is gathered from the Vital Statistics natality data, which is compiled from birth certificates. Their results show that defensive medicine in childbirth cases is not reduced when there is tort reform, in fact doctors may perform unnecessary procedures leading to complications.

Anca Cotet (2009) explores state-by-state variations in demand for medical care and how it is affected by tort reform, specifically non-economic damages caps. In

[16] P. 795

reviewing previous work Cotet concludes that caps do reduce the costs of medical services but do not lead to an increase in the population's health. The data used is state-level panel data from 1990-2005, which is a period during which there were not many changes in health regulation. The model of interest used by Cotet is the following:

$$\ln Y_{st}=\theta_{st}CAP_{st}+\lambda_{st}BORDERCAP_{st}+\beta_{st}X_{st}+\alpha_s+\gamma_{rt}+\omega_s t+\varepsilon_{st}$$

Variable Description	
Y	Proportion of people that receive a certain type of medical care
CAP	Dummy variable for cap on non-economic damages
BORDERCAP	Existence of non-economic damages cap in any bordering states
X	Vector of observable time varying state characteristics such as education, income, age, race, and health insurance status
α	State fixed effects
γ	Captures environmental health shocks or other things that could effect healthcare demand
ω	State specific trends

Cotet also used two other similar models to lag the results of the enactment of non-economic damages caps and to test the effectiveness based on the number of years the cap had been in place. The results indicate that non-economic damages caps are "negatively correlated with admissions to hospitals, and surgeries but it is statistically significant only in the case of surgeries."[17] Cotet concludes that although these caps reduce malpractice insurance premiums, they can reduce doctors' incentives to provide the best medical care. Although Cotet's findings do not indicate the effect of non-economic damages caps on the population's health we can see that the findings show a decrease in the utilization of medical services which would likely have a negative effect on health and should be duly considered in developing the model for this paper.

[17] P. 16

Esposto (2008) examined state-level tort reforms to see if there was an effect on medical technology diffusion. The author believes that if the diffusion of medical technology decreases then doctors are practicing defensive medicine. The data covered the years 1987 to 1993. The technologies Esposto focuses on are x-rays, ultrasounds, CT scanners, and MRI facilities. The model used by Esposto is including the dependent variable of technologies is:

$$\text{Log(units/millions)}_{st}=\alpha+\beta_1 Y1990+\beta_2 Y1993+\beta_3 INSURANCE_{st}+\beta_4 HMO_{st}+\beta_5 MetroPOP_{st}$$
$$+\beta_6 AGE_{st}+\beta_7 INCOME_{st}+\beta_8 PHYSICIANS_{st}+\beta_9 REFORM_{st}+$$
$$\beta_{10}(REFORM*PHYSICIANS)_{st}+\varepsilon_{st}$$

Variable Description	
Y1990	Dummy variable to control for diagnostic medical technology
Y1993	Dummy variable to control for diagnostic medical technology
INSURANCE	Percentage of population covered
HMO	Percentage of indivudals with insurance covered by an HMO
MetroPOP	Percentage of state residents who are living in metro statistical area
AGE	Percentage of population 65 and over
INCOME	Per capita personal income
PHYSICIANS	Number of physicians per 10,000 residents
REFORM	Dummy variable for tort reform
(REFORM*PHYSICIANS)	Interaction of dummy variable with physicians per 10,000 residents

The subscript of s indexes each state and t indexes time. Results found that INSURANCE and AGE were both positive and statistically significant, while INCOME and MetroPOP were negative but only MetroPOP was statistically significant. Different results are found within the different technologies being tested here, but of most interest

is the impact of the REFORM variable which was statistically significant at the1% level. This variable is positive for all technologies tested except CT scanners and MRI's. To circumvent this issue Esposto uses an interaction variable REFORM*PHYSICIANS to find the impact. It ends up being negative, which according to Esposto shows that there is defensive medicine practiced and it can have an affect on the diagnostics available. The conclusion of this article is that when there is less of a threat of litigation that physicians order fewer diagnostics, which can reduce costs albeit with a possible side-effect of missing certain diagnoses.

The literature review provides mixed results as to the effectiveness of tort reforms. Depending on the approach taken and the variables used it is obvious that there is no conclusive set of results that can be drawn from the literature review. The independent variables used represent a variety of things including health, insurance premiums, defensive medicine, and medical technology that can all be influenced by tort reforms and other variables. It is clear that various elements that affect our health can be modeled and we can determine what significantly affects our health and what does not.

CHAPTER VII

THE MODEL, HYPOTHESES, AND DATA

7.1. Model Specification

Following the existing literature with some new caveats, the model uses the following variables: the age adjusted death rate (AGEADJDR) for each state, education (EDUC), unemployment rate (UR), per capita income (INC), uninsured (NOINS), percentage of adults that are obese (OBESITY), median malpractice payment (MALPAY), per capita health expenditures (HEALTHEXP), emissions of sulfur dioxide (SO2), age adjusted percentage of cancer incidences (CANCER), percentage of adults who smoke (SMOKE), states that have tort reform (TORTREF), percentage of African-Americans (AFRAMER), percentage of females (FEMALE), percentage of population over age 65 (AGE65PLUS), percentage of population that are attorneys (ATTORNEY), number of malpractice claims filed (CLAIMS), percentage of healthcare institutions that do not report malpractice amounts (NOREPORT), number of malpractice payments (PAYMENTS), and the share of public health expenditures (SHAREPUB). The models are then constructed in the following manner.

Model 1: $AGEADJDR = \beta_{10} + \beta_{11}*\log(EDUC) + \beta_{12}*\log(NOINS) + \beta_{13}*\log(OBESITY) + \beta_{14}*INC + \beta_{15}*MALPAY + \beta_{16}*TORTREF + \beta_{17}*\log(CANCER) + \beta_{18}*SO2 + \beta_{19}*HEALTHEX + \beta_{110}*SHAREPUB + \beta_{111}*\log(SMOKE) + \beta_{112}*\log(AFRAMER) + u_1$

Model 2: $MALPAY=\beta_{20}+\alpha_{21}*AGEADHAT+\beta_{22}*\log(NOINS)+\beta_{23}*\log(EDUC)+\beta_{24}*TORTREF+\beta_{25}*SO2+\beta_{26}*\log(AGE65PLUS)+\beta_{27}*\log(ATTORNEY)+\beta_{28}*\log(AFRAMER)+\beta_{29}*\log(FEMALE)+\beta_{221}*CLAIMS+\beta_{222}*\log(NOREPORT)+\beta_{223}*PAYMENTS+u_2$

Model 3: $HEALTHEX=\beta_{30}+\gamma_{31}*AGEADHAT+\beta_{32}*INC+\beta_{33}*NOINS+\beta_{34}*EDUC+\beta_{35}*TORTREF+\beta_{36}*\log(SMOKE)+\beta_{37}*\log(ATTORNEY)+\beta_{38}*\log(AFRAMER)+\beta_{39}*\log(FEMALE)+\beta_{331}*\log(CANCER)+u_3$

Due to the risk of simultaneity I will use two stage least squares and substitute for the variable AGEADJDR in Model 2 with the explanatory variables from Model 1 (sans the variables already in Model 2) to form Model 2'. Then the procedure will be repeated with Model 3 to form Model 3'.

Model 2': $MALPAY=\beta_{21}+\beta_{22}*\log(NOINS)+\beta_{23}*\log(EDUC)+\beta_{24}*TORTREF+\beta_{25}*SO2+\beta_{26}*\log(AGE65PLUS)+\beta_{27}*\log(ATTORNEY)+\beta_{28}*\log(AFRAMER)+\beta_{29}*\log(FEMALE)+\beta_{221}*CLAIMS+\beta_{223}*\log(NOREPORT)+\beta_{224}*PAYMENTS+\beta_{225}*\log(OBESITY)+\beta_{226}*INC+\beta_{227}*\log(CANCER)+\beta_{228}*SHAREPUB+\beta_{229}*\log(SMOKE)+u_2$

Model 3': $HEALTHEX=\beta_{30}+\beta_{31}*TORTREF+\beta_{32}*SHAREPUB+\beta_{33}*\log(CANCER)+\beta_{34}*SO2+\beta_{35}*INC+\beta_{36}*\log(NOINS)+\beta_{37}*\log(EDUC)+\beta_{38}*\log(OBESITY)+\beta_{39}*TORTREF+\beta_{331}*\log(SMOKE)+\beta_{332}*\log(ATTORNEY)+\beta_{333}*\log(AFRAMER)+\beta_{334}*\log(FEMALE)+u_3$

The values predicted in the output for MALPAY are kept as MALPHAT and the predicted values for HEALTHEX are kept as HEALTHAT, which are then used in Model 1 to create the second stage of the two stage least squares model, Model 1'.

Model 1': $AGEADJDR = \beta_{10} + \beta_{11}*\log(EDUC) + \beta_{12}*\log(NOINS) + \beta_{13}*\log(OBESITY) + \beta_{14}*INC + \beta_{15}*MALPHAT + \beta_{16}*TORTREF + \beta_{17}*\log(CANCER) + \beta_{18}*SO2 + \beta_{19}*HEALTHHAT + \beta_{110}*SHAREPUB + \beta_{111}*\log(SMOKE) + \beta_{112}*\log(AFRAMER) + u_1$

Variable	**Description**
AGEADJDR	Age adjusted death rate
AGEADHAT	Predicted values for age adjusted death rate
NOINS	Percentage of population without health insurance
EDUC	Percentage of population with bachelor's degree
INC	Per capita income
MALPAY	Median malpractice payment
MALPHAT	Predicted values for median malpractice payments
TORTREF	Dummy for tort reform in state (1=reform, 0=none)
SO2	Sulfur dioxide emissions (in metric tons)
HEALTHEX	Total health expenditures per capita
HEALTHAT	Predicted values for health expenditures per capita
OBESITY	Percentage of population classified as obese
SHAREPUB	Share of health expenditures that is public
CANCER	Percentage of occurrences per state
SMOKE	Percentage of adults who smoke
ATTORNEY	Percentage of population (over 18) that are attorneys
AFRAMER	Percentage of population that is African-American
FEMALE	Percentage of population that is female
AGE65PLUS	Percentage of population over age 65
CLAIMS	Number of claims filed per state
NOREPORT	Percentage of healthcare facilities that do not report malpractice
PAYMENTS	Number of malpractice payments per state

7.2. Hypotheses

I am attempting to determine the significance of each of the variables and to find a link between simple demographic, economic, and medical characteristics and the age adjusted death rate for each state. The variables of most interest in Model 1 are MALPAY and TORTREF, while the focus on Model 2 is TORTREF and ATTORNEY. For Model 3 we focus on the same variables, while being open to the influence of other variables and how their interpretation may affect the findings and hypotheses. The hypotheses were formed by deferring to the literature and common expectations that the general public would have.

For Model 1, I expect that education (EDUC) will have a negative impact on the age adjusted death rate. The better educated the population is the more likely they will be informed of good health practices. Income level can be an important factor in obtaining quality healthcare and cutting-edge treatments. Thus, with a higher per capita income (INC) comes a lower death rate. I hypothesize that a lack of health insurance (NOINS) will boost the death rate. Individuals without health insurance will likely lack access to preventative care and other important health components. The number of sulfur dioxide emissions (SO2) will also increase the death rate. As sulfur dioxide has been known to cause respiratory problems, contribute to acid rain, and exacerbate current ailments it will certainly be detrimental to the population's health. The percentage of attorneys in each state (ATTORNEY) will also have the effect of increasing the death rate, due to a belief that more attorneys lead to more lawsuits, which leads to higher healthcare costs when premiums increase. The amount of health expenditures per capita (HEALTHEX) is

thought to have a quality effect on health and thus it will lower the age adjusted death rate. Similarly, the share of public health expenditures (SHAREPUB) is believed to have the same effect and decrease the death rate. The median malpractice payment (MALPAY) is thought to have a positive effect on the death rate. When doctors pay increased insurance premiums as a result of high malpractice payments they may pass along the costs to consumers, which could limit access to care and increase the death rate. States that have enacted tort reform (TORTREF) are thought to have a lower death rate than states that have not enacted non-economic damages caps. Based on previous results and the belief that tort reforms would lower malpractice insurance premiums are keys to this hypothesis. Presumably, lower insurance premiums for doctors would lead to lower costs for healthcare providers which could pass these savings on to consumers. Realizing these costs savings would allow more consumers to have easier access to care and thus we would hypothetically live longer lives, which would lower the death rate. As the number of obese in the population continues to grow it has become a significant health risk. Thus, the percentage of the population that is obese (OBESITY) is thought to increase the death rate. Cancer is the second leading cause of death in the U.S. and thus the number of cancer incidences (CANCER) is also thought to increase the age adjusted death rate. The percentage of adults who smoke (SMOKE) would be thought to have the same effect as CANCER particularly due to the known health risks associated with smoking. The percentage of the population that is African-American (AFRAMER) is alleged to increase the death rate because evidence shows shorter life-spans for African-Americans.

The hypotheses for Model 2 are developed more by intuition than by previous empirical work. The age-adjusted death rate for each state (AGEADJDR) is hypothesized to have a positive effect on median malpractice payments. If more individuals die per state then there is a higher risk of malpractice occurring, leading to a higher median payment. The percentage of uninsured per state (NOINS) is thought to decrease the median malpractice payment, as the more individuals that are uninsured the less likely they would be to seek treatment for ailments, leading to fewer incidences of malpractice. The percentage of the population with a bachelor's degree (EDUC) is believed to positively affect malpractice payments. The more educated the victim of malpractice, the more likely they are to know their legal rights and pursue an action to recoup any damages suffered as a result of malpractice. The dummy variable for tort reform (TORTREF) is hypothesized to have a negative impact on malpractice payments when the state has reforms in place. This is important to the model because it shows that states with reforms experience lower median payments, thus perhaps their healthcare costs would be lower as a result. The level of sulfur dioxide emissions (SO2) should have a positive effect on malpractice payments. In states with more pollution, there is likely to be more illness leading to higher chances for malpractice; in fact litigants may even target pollution in lawsuits along with doctors. The percentage of the population over age 65 (AGE65PLUS) is conjectured to also have a positive effect on the median malpractice payment. The older a population is, the more healthcare they will require, leading to increased probability of malpractice occurring. The percentage of a state's population over age 18 that is practicing attorneys (ATTORNEY) is thought to increase the median malpractice payment. Lawyers would tend to flock to states with looser tort

reforms and a greater chance of winning litigation, thus states with more attorneys would see higher payments. The percentage of the population that is African-American (AFRAMER) is deemed to increase the malpractice payment as well. Since African-Americans are often in poorer health than other race groups they would require more healthcare, leading to more possibilities for malpractice to occur. The percentage of each state's population that is female (FEMALE) is hypothesized to have a negative effect on the median malpractice payment because as a general rule females have longer life-spans and thus fewer health complications than males. The number of malpractice claims per state (CLAIMS) is thought to lower the median payment because as the more frivolous claims are filed that do not result in payment, it will have the effect of lowering the median payment. The percentage of hospitals in each state that do not report malpractice incidences to the National Practitioner Data Bank (NOREPORT) will have a negative effect on MALPAY. The more medical institutions that do not report will obviously lead to some malpractice cases not being reported and thus not being calculated in the median payment. The number of payments reported per state (PAYMENTS) will have a positive impact on the median malpractice payment. If a state has more payments then the odds are the median payment result will be higher.

Model 3 is perhaps the hardest to intuitively assign hypotheses for due to the complex nature of healthcare expenditures. The more healthcare expenditures per capita (HEALTHEX), the lower the age adjusted death rate (AGEADJDR) will be. The higher the per capita income (INC), the higher health expenditures will be as individuals with more disposable income will buy more healthcare. The higher the percentage of the population without health insurance (NOINS), the lower healthcare expenditures as these

individuals will avoid seeking care for all but the most serious ailments. The more educated the population is (EDUC), the lower healthcare expenditures will be due to the increased knowledge the population will take more preventative measures regarding their health as well as be more selective when pricing their healthcare options. Two obvious factors that will increase healthcare expenditures are SMOKE and CANCER. As more of the population participates in an activity detrimental to their health, such as smoking, there will be more healthcare resources required. Just as more in the population fall victim to serious illnesses such as cancer, healthcare expenditures will also increase. States that have tort reform (TORTREF) will have slightly higher per capita health expenditures because there will be less of a need to concentrate resources in malpractice insurance and other preventative measures and more focus on actual care for patients, thus states with reforms can spend more on the population. The percentage of attorneys in the population (ATTORNEY) will increase the amount of healthcare expenditures due to their effect on forcing providers to be thorough in their diagnostics and treatment programs. The higher the percentage of African-Americans in the population (AFRAMER), the lower healthcare expenditures will be because this racial group is often economically disadvantage and unable to properly spend on healthcare. Finally, the higher the percentage of females in the population (FEMALE) the higher healthcare expenditures will be. As women live longer they may face more health ailments and as women bear children they incur more medical costs than men.

7.3 DATA

The data for the variables tested was gathered from a wide range of sources and their descriptive statistics are listed in Table 13 in Appendix B. The age adjusted death

rate (AGEADJDR) for 2004 was gathered from the National Vital Statistics System, which falls under the CDC's National Center for Health Statistics. Age adjusted death rate is defined by the Colorado Department of Public Health as, "The death rate that would occur if the observed age-specific death rates were present in a population with an age distribution equal to a standard population." This measure is used to compensate for different health problems at varying ages in the population, thus enabling states to be compared regardless of their age distribution.

INC, or per capita income, was found from the Bureau of Economic Analysis. The BEA defines personal income as, "the sum of wage and salary disbursements, supplements to wages and salaries, proprietors' income with inventory valuation and capital consumption adjustments, rental income of persons with capital consumption adjustment, personal dividend income, personal interest income, and personal current transfer receipts, less contributions for government social insurance." Then to calculate per capita personal income the BEA divides personal income by the population of the area, which is reported by the Census Bureau.

The percentage of the population in each state that lacks health insurance is represented by NOINS. The Census Bureau's *Current Population Survey* for 2004 lists the percentage of each state's population without health insurance coverage. Coverage is considered any private insurance, employer-sponsored insurance, self-insurance, or public insurance program such as Medicare, Medicaid, or SCHIP. The lack of health insurance would be considered an inhibiting factor to those seeking care.

The educational attainment of the population of each state is measured as the percentage of the population that has achieved a bachelor's degree or higher. This

variable is represented by EDUC in the model. The data for education levels is found from the U.S. Census Bureau's *Current Population Survey* of 2004.

The median malpractice payment for each state, MALPAY, was gathered from the National Practitioner Data Bank. The percentage of hospitals that do not report malpractice (NOREPORT) as well as the number of claims filed per year (CLAIMS) is also found from this source. The NPDB issues annual reports detailing malpractice cases and award amounts. The median malpractice payment was found in the *2004 Annual Report*. The NPDB was enacted in order to centralize data that could not be done at the state level, particularly due to the increasing number of cases involving medical malpractice. The NPDB's goal is to "improve the quality of health care by encouraging State licensing boards, hospitals, and other health care entities, and professional societies to identify and discipline those who engage in unprofessional behavior; and to restrict the ability of incompetent physicians."

Obesity is an important measure of a population's health and has been a source of growing concern in the United States in recent years. OBESITY in my model is measured as the percentage of each state's population that has a Body Mass Index of 30 or greater. BMI is calculated from an individual's weight and height. The Center for Disease Control says that, "BMI provides a reliable indicator of body fatness for most people." The data was found from the CDC's Behavioral Risk Factor Surveillance System *Annual Survey 2004*.

Health expenditure per capita is represented as HEALTHEX. This variable includes all healthcare related expenditures incurred per capita in 2004. Thus, it encompasses Medicare, Medicaid, HMO's, and any other health care providers. The total

health expenditures per state are obtained from Centers for Medicare and Medicaid Services, Office of the Actuary of the National Health Statistics Group. These totals are then divided by each state's 2004 population estimates, which were found on the U.S. Census Bureau's *Annual Estimates of the Population for the United States and States*.

The share of public health expenditures (SHAREPUB) could be important to future trends as government takes a larger role in the healthcare system. For this model total public health expenditures would include all government healthcare funding and any other public source. The data for each state is gathered from Centers for Medicare and Medicaid Services, Office of the Actuary of the National Health Statistics Group. These totals are then divided by each state's total public health expenditures to find the share of public health expenditures.

In order to examine claims of a "lottery" effect on malpractice litigation, an important indicator is the number of attorneys per state. The number for each state was gathered from the American Bar Association report on *National Lawyer Population by State*. This total was then divided by the total population in the state over age 18 to find ATTORNEY.

Although it is difficult to obtain an accurate measure of how pollution affects an individual state's population I will attempt to ascertain a quality indicator of the levels of pollution in the air. SO2, which represents sulfur dioxide emissions, is used because it is a main byproduct of coal. Coal is the chief source of U.S. energy and according to the Department of Energy it producies over one half of our energy; so a measure of its byproducts would be a good indicator of pollution levels. The levels of sulfur dioxide are

measured in thousands of metric tons. The data is found from the Environmental Protection Agency's Air Emission Sources.

The Centers for Disease Control report that cancer is the second leading cause of death in the U.S. and thus we will assess the incidences of cancer in the population. The leading cause of death, heart disease, did not have any reports on the number of incidences. This gauge is not deaths from cancer but the number of cases per 100,000 in each state's population. The data is found from the Center for Disease Control's National Cancer Institute which published, *United States Cancer Statistics*: *1999-2004 Incidence and Mortality*. The variable used in the model is CANCER.

In order to determine whether tort reform (TORTREF) has had an impact of the health of the population a dummy variable will be used to measure states that have enacted a non-economic damages cap. States that have enacted the cap will be assigned a 1 and those that have not will be assigned a 0. The information regarding states that have passed a tort reform cap was gathered from the Congressional Budget Office's report on Tort Reform. If a damages cap was found to be unconstitutional then it was not included in the data.

Smoking causes many health problems and thus the number of adult smokers per state is important to the health of a population, though not as much as it once was. With increased focus on smoking prevention the number of smokers has been steadily declining. The adult smoking rate per state (SMOKE) was found from the CDC's Behavioral Risk Factor Surveillance System *Annual Survey 2004*.

The percentage of each state's population that is African-American (AFRAMER), over age 65 (AGE65PLUS), and female (FEMALE) is found from the Census Bureau's

Annual Estimates of the Population for the United States and States. The estimated total for each of these groups is found. Then, these totals are divided by each state's 2004 population estimates, which were also found on the U.S. Census Bureau's *Annual Estimates of the Population for the United States and States*.

CHAPTER VIII

EMPIRICAL RESULTS

The regressions of the first three models are looked at individually to see what affects the dependent variables in each. Then, the predicted values are kept for Models 2' and 3' and are then used in Model 1' to correct for any risk of simultaneity. The results for all models are discussed in detail in this section.

After running the OLS regression on Model 1, some interesting results were found which are presented here in Table 1.

Table 1 OLS Regression of Model 1

	Coeff.	Std.Err.	t-ratio	P-value
ONE	0.005828	0.002	2.90757	0.00612
INC**	-5.72E-08	2.74E-08	-2.0893	0.04361
NOINS**	0.006159	0.00256	2.40241	0.02142
HEALTHEX	6.75E-08	1.66E-07	0.40627	0.68688
EDUC	-0.00389	0.00263	-1.4812	0.14703
OBESITY***	0.008487	0.00432	1.96441	0.05703
MALPAY	9.66E-10	1.25E-09	0.77248	0.44474
TORTREF***	-0.00024	0.00014	-1.6994	0.09763
SHAREPUB***	-0.0032	0.00162	-1.9735	0.05594
CANCER	0.497268	0.30456	1.63272	0.11101
SMOKE	-0.00022	0.00221	-0.0998	0.92101
SO2	1.61E-08	3.41E-07	0.0471	0.96269
AFRAMER*	0.003527	0.00098	3.59665	0.00094

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

Negative signs on the variables indicate that the death rate will be lower if these variables are significant while the opposite is true for positive signs. All my hypotheses were

confirmed for the variables that were statistically significant at the 10% level and lower. At the 10% level TORTREF, SHAREPUB, and OBESITY were significant with a positive sign on OBESITY and a negative sign on TORTREF and SHAREPUB. At the 5% level we find that INC and NOINS are statistically significant with a negative sign on INC and a positive sign on NOINS. The only variable significant at the 1% level in this first regression was AFRAMER. Perhaps the most surprising result was the limited significance of per capita health expenditures on the age adjusted death rate (HEALTHEX *t-stat*=.40627). Other variables with low *t-stats* include EDUC, SMOKE, and SO2. Unfortunately, MALPAY was also insignificant with a *t-stat* of .7725. The R^2 was .81 and the adjusted R^2 was .75, which indicates a good fit for the model. The F-stat is reported at 13.26, which is statistically significant at thirty-seven degrees of freedom and an F-critical value of 2.1 at the 5% level. The correlation matrix (Appendix B, Table 14) is checked for any multicollinearity. There is some degree of correlation between AGEADJDR and OBESITY at .77 but this is expected. Also, EDUC and INC are correlated at .75 which is not an alarming result as I suspect that as education levels increase income levels increase. Griffiths, Hill, and Judge (1993) note that, "A commonly used rule of thumb is that a correlation coefficient between two explanatory variables greater than 0.8 or 0.9 indicates a strong linear association and a potentially harmful collinear relationship."[18] Thus, even those variables with some level of correlation in the model do not meet the standard to raise concerns about multicollinearity.

[18] P. 435

Since the data is cross sectional the main issue we need to test for is heteroskedasticity. Autocorrelation is not anticipated to be an issue with this model and our Durbin-Watson Statistic of 2.205 proves this. To correct for heteroskedasticity the regression was run with White Standard Errors. The Breusch-Pagan LM statistic was found to be 16.05, which when compared to the critical value of 55.76 at the 5% level allows us not to reject the null hypothesis of homoskedasticity. Thus, the White Standard Errors allow the model to be estimated using OLS. Of added importance are the results from this second regression.

Table 2 Regression of Model 1 with White Standard Errors

	Coeff.	Std.Err.	t-ratio	P-value
ONE	0.005828	0.0014	4.15506	0.00018
INC**	-5.72E-08	2.26E-08	-2.5352	0.0156
NOINS*	0.006159	0.00215	2.86383	0.00686
HEALTHEX	6.75E-08	1.41E-07	0.47879	0.63491
EDUC	-0.00389	0.0025	-1.5544	0.12859
OBESITY**	0.008487	0.00389	2.18392	0.03538
MALPAY	9.66E-10	1.00E-09	0.96442	0.3411
TORTREF**	-0.00024	0.00011	-2.2115	0.03326
SHAREPUB**	-0.0032	0.00142	-2.262	0.02966
CANCER**	0.497268	0.23765	2.09245	0.04332
SMOKE	-0.00022	0.00134	-0.1645	0.8702
SO2	1.61E-08	2.17E-07	0.07411	0.94133
AFRAMER*	0.003527	0.00073	4.80207	2.60E-05

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

At the 1% significance level AFRAMER remains significant, while NOINS is now significant at the 1% level. The 5% level of significance now includes TORTREF, CANCER, and SHAREPUB while at INC is still statistically significant at this level. MALPAY is still not significant at these levels with a *t-stat* of .964. The RESET test

was then run to check for specification error, where the null hypothesis was no specification error. The F-test value was found to be 1.66 which passes at the 5% level, where the F-critical value was 2.91 with 31 degrees of freedom in the denominator and 3 degrees in the numerator. This result allows no rejection of the null hypothesis, thus I can assert model 1 has no specification error.

Model 2 was run to find variables that affected the median malpractice payment, with the predicted results from model 1 substituted as AGEADHAT. The results from the OLS regression can be found in Table 3.

Table 3 OLS Regression of Model 2

	Coeff.	Std.Err.	t-ratio	P-value
ONE	3.57E+06	1.18E+06	3.02263	0.00453112
AGEADHAT*	8.63E+07	3.14E+07	2.75042	0.00915647
NOINS**	-692506	337397	-2.0525	0.0472452
EDUC*	947520	311613	3.04069	0.00431972
TORTREF	-7597.04	16979.8	-0.447415	0.657184
SO2**	68.7549	39.1459	1.75638	0.0872988
AGE65PLU*	2.39E+06	610623	3.91482	0.000374346
ATTORNEY*	2.70E+07	7.74E+06	3.48953	0.00126786
AFRAMER	29160.1	143847	0.202717	0.840467
FEMALE*	-9.04E+06	2.72E+06	-3.32309	0.00201402
CLAIMS**	-9.27673	5.00379	-1.85394	0.0717326
NOREPORT**	-196402	72600.9	-2.70522	0.0102586
PAYMENTS	122.273	91.9461	1.32983	0.191715

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

The hypotheses for this model proved to be correct for all significant variables, albeit there were several that were unexpectedly insignificant. The variables significant at the 5% level include: NOINS, SO2, CLAIMS, and NOREPORT. Finally, at the 1% level the significant variables were AGE65PLUS, EDUC, AGEADHAT, ATTORNEY, and

FEMALE. The particular finding of the significance of AGE65PLUS is plausible because as the population grows older more medical complications arise, which lead to misdiagnosis or any other form of malpractice, real or perceived. The variable representing the number of payments for each state, PAYMENTS, was also surprisingly insignificant with a *t-stat* of 1.33. The variable of TORTREF, which I felt would be significant on MALPAY, is not significant at any level with a *t-stat* of -.44. Thus, states with tort reform do not have a statistically significant reduction in malpractice payments. Other variables that are significant can be examined for ways to lower the median payment, if that is the goal of a state. One other variable that was insignificant was AFRAMER. So, from Model 2 it can be shown that although those without health insurance die at a much higher rate than the rest of the population, there is no relation between the increased death rate and malpractice payments.

The R^2 for this regression was .55, which was not as high as the R^2 in Model 1. The adjusted R^2 was .40, thus this model is not nearly as powerful as Model 1. The F-stat was found to be 3.77, which I can say that it is significant at any level where the F-critical value was 2.10 with 37 degrees of freedom. To check for multicollinearity we examine the correlation matrix (Appendix B, Table 15) and find that there is a serious issue between CLAIMS and PAYMENTS, but this is expected because the more claims that are made the more payments will likely be made so we will not consider this to be a serious problem. The RESET test was run again to check for specification error with this second model. The F-value was calculated to be .934 which passes at the 5% level where the F-critical was 2.88 with 3 numerator degrees of freedom and 34 denominator degrees

of freedom. To correct for any heteroskedasticity Model 2 was run with the White Standard Errors (Table 4).

Table 4 OLS Regression of Model 2 with White Standard Errors

	Coeff.	Std.Err.	t-ratio	P-value
ONE	3.57E+06	1.34E+06	2.66643	0.0113012
AGEADHAT**	8.63E+07	3.30E+07	2.61526	0.0128265
NOINS**	-692506	281119	-2.46339	0.0185367
EDUC*	947520	260009	3.64418	0.000818339
TORTREF	-7597.04	14373.5	-0.528546	0.600277
SO2**	68.7549	32.9555	2.0863	0.0439011
AGE65PLU*	2.39E+06	685477	3.48733	0.00127571
ATTORNEY*	2.70E+07	9.18E+06	2.93984	0.00563087
AFRAMER	29160.1	103550	0.281604	0.779816
FEMALE*	-9.04E+06	3.25E+06	-2.78147	0.00846411
CLAIMS**	-9.27673	4.51835	-2.05313	0.047181
NOREPORT*	-196402	64138.4	-3.06215	0.00408068
PAYMENTS	122.273	88.3754	1.38356	0.174785

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

Of significance from these results we note that at the 5% level NOINS, SO2, AGEADHAT, and CLAIMS are now statistically significant. At the 1% level of significance the variables of importance are ATTORNEY, EDUC, AGE56PLUS, FEMALE, and NOREPORT. Thus, it is important to note states that have a high percentage of hospitals that do not report malpractice cases, as it can lead to skewed data from states that may have more malpractice problems than the data would indicate. It is also important to note the effect that the percentage of attorneys in each state has, as a state has more attorneys it has a higher median malpractice payment. The Breusch-Pagan LM statistic was found to be 21.72, which when compared to the critical value of 26.22 at the 1% level allows us not to reject the null hypothesis of homoskedasticity. Again,

autocorrelation was not anticipated to be a problem and the Durbin-Watson Statistic of 2.02 confirms this.

Another model is used to determine the health expenditures per capita. The results from the OLS regression of Model 3 are seen below in Table 5.

Table 5 OLS Regression of Model 3

	Coeff.	Std.Err.	t-ratio	P-value
ONE	-13744.3	7379.75	-1.86244	0.070087
AGEADHAT	19638.4	289577	0.0678173	0.946278
INC**	0.0697249	0.0276965	2.51746	0.0160391
NOINS	-3978.99	2858.79	-1.39184	0.171857
EDUC**	-5784.8	2635.95	-2.19458	0.0342145
TORTREF	142.609	136.942	1.04139	0.304109
SMOKE	2053.53	1878.16	1.09337	0.280938
ATTORNEY	96119.2	60945.1	1.57714	0.12284
AFRAMER	-1659.7	1340.67	-1.23797	0.22313
FEMALE***	30568.5	15862.3	1.92711	0.0612734
CANCER***	565523	303405	1.86392	0.0698731

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

The results from this regression show that there are several significant variables that affect health expenditures per capita, particularly at the 5% level. These include INC and EDUC. The 10% level contains FEMALE and CANCER. At the 1% level there are no significant variables, thus this model is not particularly strong in explaining what affects health expenditures per capita. The R^2 for the regression is .70, with an adjusted R^2 of .62. Unfortunately, TORTREF is not as significant as anticipated although the signs predicted by the hypotheses are accurate. The F-stat for the model is 9.06, which is statistically significant with an F critical value of 2.4 at 39 degrees of freedom. Autocorrelation is checked with the Durbin-Watson Statistic of 2.085. The RESET test

was run to check for specification error and the model passes with a value of .449 compared to the critical value of 2.87 at the 5% level with 3 degrees of freedom in the numerator and 36 in the denominator.

Model 3 is also run with White Standard Errors to enable the use of OLS even in the presence of possibly heteroskedasticity. The results are in Table 6.

Table 6 OLS Regression of Model 3 with White Standard Errors

	Coeff.	Std.Err.	t-ratio	P-value
ONE	-13744.3	11035.8	-1.24543	0.220403
AGEADHAT	19638.4	258363	0.0760107	0.939799
INC*	0.0697249	0.0231386	3.01336	0.0045229
NOINS***	-3978.99	2054.36	-1.93686	0.0600317
EDUC**	-5784.8	2233.05	-2.59054	0.0134084
TORTREF	142.609	98.0746	1.45409	0.153922
SMOKE	2053.53	1671.06	1.22888	0.226479
CANCER**	565523	252190	2.24245	0.0306903
ATTORNEY	96119.2	67238.7	1.42952	0.160816
AFRAMER	-1659.7	1011.81	-1.64033	0.10898
FEMALE	30568.5	25118.6	1.21696	0.230932

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

This regression indicates that at the 1% level INC is very important to healthcare expenditures, which is logical considering healthcare is a normal good. At the 5% level EDUC and CANCER are significant, while at the 10% level NOINS is significant as well. AFRAMER is barely insignificant with a p-value of .109. The Breusch-Pagan LM Statistic is 33.08 which is then compared to the critical value 54.57 at the 5% level with 39 degrees of freedom allows us not to reject the null hypothesis of homoskedasticity. Finally, the correlation matrix is checked for any evidence of multicollinearity and there are no concerns found (Appendix B, Table 16).

Model 2' was then run for the first stage of the two stage least squares to find MALPHAT. The results from this OLS regression are found below in Table 7.

Table 7 OLS Regression of Model 2'

	Coeff.	Std.Err.	t-ratio	P-value
ONE	3.29E+06	1.79E+06	1.84027	0.0747373
INC	-1.95867	4.26264	-0.459498	0.648889
NOINS	-256735	356056	-0.721053	0.475955
EDUC	393370	401523	0.979694	0.334365
OBESITY	546974	611608	0.894322	0.377626
TORTREF	-20193.9	20681.1	-0.97644	0.335951
SHAREPUB	-212790	221456	-0.960871	0.343605
CANCER	1.71E+07	3.62E+07	0.470948	0.640776
SMOKE	-145360	264676	-0.549199	0.586567
SO2	65.5333	48.5532	1.34972	0.186292
AGE65PLU*	2.30E+06	830681	2.76569	0.00922979
ATTORNEY**	2.55E+07	1.17E+07	2.1758	0.036833
AFRAMER***	295104	167667	1.76006	0.0876656
FEMALE***	-7.07E+06	3.75E+06	-1.8879	0.0678592
CLAIMS	-9.43391	5.93024	-1.59081	0.121187
NOREPORT***	-180718	98352.4	-1.83745	0.0751624
PAYMENTS	119.821	107.162	1.11812	0.271589

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

The predicted values for MALPAY are kept as MALPHAT, to be used in the final stage of the two stage least squares model. Variables that were significant at the 10% level include NOREPORT, FEMALE, and AFRAMER. At the 5% level the only significant variable is ATTORNEY, while at the 1% level we see that AGE65PLUS is statistically important. This is a logical conclusion to reach as the older the population the more likely people will die and mistakes will be made, which will increase malpractice suits and awards. The R^2 for the regression was .50 with an adjusted R^2 of .25 so the model is not the best fit we would like. The F-stat for this model was 2.04, which evaluated

against the critical value of 1.88 at the 10% level with 32 degrees of freedom. Thus, the model is barely statistically significant.

The regression was also run with White Standard Errors to allow the equation to be estimated using OLS, even if heteroskedasticity exists. The results are in Table 8.

Table 8 OLS Regression of Model 2' with White Standard Errors

	Coeff.	Std.Err.	t-ratio	P-value
ONE	3.34E+06	2.06E+06	1.62119	0.114216
INC	-1.96061	3.52071	-0.556879	0.581258
NOINS	-201757	253604	-0.795562	0.431806
EDUC	445929	265821	1.67755	0.102605
OBESITY	573995	412804	1.39048	0.173419
TORTREF	-23213.9	19212.8	-1.20825	0.235286
SHAREPUB	-219888	251850	-0.873092	0.388738
CANCER	1.61E+07	2.54E+07	0.633632	0.530561
SO2***	69.2963	39.3946	1.75903	0.0875705
AGE65PLU*	2.29E+06	837058	2.73456	0.0098483
ATTORNEY***	2.54E+07	1.36E+07	1.868	0.0704011
AFRAMER	299667	197726	1.51557	0.138872
WOMEN***	-7.27E+06	4.16E+06	-1.74545	0.0899399
CLAIMS***	-9.47759	5.03151	-1.88365	0.0681889
NOREPORT**	-186666	91182.7	-2.04716	0.0484328
PAYMENTS	122.829	97.2287	1.2633	0.215077

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

The White Standard Errors show that at the 10% level, ATTORNEY and SO2 are now significant while at the 5% level NOREPORT is now significant. The rest of the results match the findings from the original OLS regression on Model 2. The R^2 was .49 with and adjusted R^2 of .27. The Breusch-Pagan LM Statistic was 34.66, which compared to the critical value of 48.6 at 34 degrees of freedom allows us to not reject the null hypothesis of homoskedasticity. Finally, the RESET test is run to check for specification

error. The F-value was calculated to be 1.32 which passes at the 5% level with 31 degrees of freedom where the critical value is 2.92.

In this joint system of equations we will also examine what affects the level of health expenditures per capita (HEALTHEX). To complete the first stage of the two stage least squares model we run Model 3' and keep the predicted values of HEALTHEX as HEALTHAT. The results from this OLS regression are below in Table 9.

Table 9 OLS Regression of Model 3'

	Coeff.	Std.Err.	t-ratio	P-value
ONE	-19618	8070.13	-2.43094	0.0200241
TORTREF	201.316	141.136	1.4264	0.162137
SHAREPUB	2379.83	1467.76	1.62141	0.113423
CANCER***	498714	255129	1.95475	0.0581996
SMOKE	1927.91	1890.81	1.01962	0.31453
SO2	-0.168612	0.312447	-0.539652	0.59267
INC*	0.0788593	0.0251525	3.13525	0.00335687
NOINS	-3078.88	2270.39	-1.3561	0.183286
EDUC***	-4602.19	2339.96	-1.96678	0.0567429
OBESITY	3519.22	3705.91	0.949624	0.348466
ATTORNEY	55691	62242.8	0.894739	0.37671
AFRAMER**	-2546.79	1010.94	-2.51924	0.0162104
FEMALE**	39565.6	16097.1	2.45793	0.0187796

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

The results show us that at the 10% level the variables that are significant include CANCER and EDUC only, yet at the 5% level we have several including AFRAMER and FEMALE. Finally, at the 1% level INC is statistically significant as the most influential measure on health expenditures, which is not surprising. The R^2 for this regression was .73, adjusted to .64. The F-stat is reported at 8.18 which is statistically significant at the 5% level with a critical value of 2.01 at 36 degrees of freedom. The

RESET test was run to check for specification error. The F-value was found to be .99 which passes at the 5% level with 33 degrees of freedom in the denominator and 3 in the numerator, where F-critical value is 2.92. The model was also run with White Standard Errors.

Table 10 OLS Regression of Model 3' with White Standard Errors

	Coeff.	Std.Err.	t-ratio	P-value
ONE	-19618	9573.06	-2.04929	0.0475734
TORTREF***	201.316	113.409	1.77514	0.0841027
SHAREPUB***	2379.83	1232.55	1.93082	0.0611948
CANCER**	498714	212237	2.34979	0.0242291
SMOKE	1927.91	1724.42	1.118	0.270772
SO2	-0.168612	0.159599	-1.05647	0.297601
INC*	0.0788593	0.0213455	3.69443	0.00070878
NOINS	-3078.88	1887.31	-1.63136	0.111298
EDUC**	-4602.19	2198.39	-2.09343	0.0432223
OBESITY	3519.22	3983.53	0.883443	0.382701
ATTORNEY	55691	55688.1	1.00005	0.323781
AFRAMER*	-2546.79	576.808	-4.41532	8.44E-05
FEMALE***	39565.6	21723.2	1.82135	0.0766464

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

The results show that at the 1% level TORTREF and SHAREPUB are significant. So, this shows that tort reforms are a significant part of healthcare expenditures. At the 5% level EDUC, CANCER, and FEMALE are significant. Then at the 1% level AFRAMER and INC are statistically important to the regression. The Breusch-Pagan LM Statistic is 30.97 which compared to the critical value of 51 with 36 degrees of freedom lets us not reject the null hypothesis of homoskedasticity.

To finalize the two stage least squares model and to see if the original results from Model 1 are improved we run the final OLS regression, or Model 1'. The final output is seen here in Table 11.

Table 11 OLS Regression of Model 1'

	Coeff.	Std.Err.	t-ratio	P-value
ONE	0.00610439	0.00208787	2.92373	0.00587202
INC***	-6.29E-08	3.44E-08	-1.82722	0.075742
NOINS**	0.00646731	0.0028132	2.29891	0.0272568
HEALTHAT	2.22E-07	3.76E-07	0.590533	0.558423
EDUC	-0.00368941	0.00273416	-1.34937	0.185416
OBESITY	0.00755362	0.00468902	1.61092	0.115697
MALPHAT	-9.02E-11	2.63E-09	-0.0342759	0.972841
TORTREF***	-0.000260096	0.000147758	-1.76028	0.086625
SHAREPUB***	-0.0037415	0.00194897	-1.91973	0.0626274
CANCER	0.40623	0.392279	1.03556	0.307126
SMOKE	-0.000748911	0.00246156	-0.304243	0.762647
SO2	3.51E-08	3.54E-07	0.0991063	0.921589
AFRAMER*	0.00382113	0.00113266	3.37359	0.00175189

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

The results show an R^2 of .81 adjusted to .75. This continues to show the good fit of this model and is not dissimilar from the original results on Model 1. Yet, the significance of variables is of concern as OBESITY is no longer significant in these results. The F-stat was 13.1, which is statistically significant at the 5% level where the critical value is 2.0 with 37 degrees of freedom. The Durbin-Watson statistic is reported at 2.2 so no issues with autocorrelation. The RESET test was run again to check for any specification error. The F value found was to be 1.61 which passes RESET at the 5% level where the critical value was 2.92 with 3 degrees of freedom in the numerator and 33 degrees in the denominator. This model was also run with White Standard Errors and the results are

here in Table 12. Again, TORTREF is significant at the 10% level though it is nearly significant at the 5% level. The Breusch-Pagan LM statistic was found to be 18.16, which compared to the critical value of 21.03 at the 5% level allows us to not reject the null hypothesis of homoskedasticity. Overall, the results did not significantly change when using 2SLS.

Table 12 OLS Regression of Model 1' with White Standard Errors

	Coeff.	Std.Err.	t-ratio	P-value
ONE	0.00610439	0.00125407	4.86767	2.12E-05
INC***	-6.29E-08	3.27E-08	-1.92202	0.0623291
NOINS**	0.00646731	0.00268269	2.41075	0.0210032
HEALTHAT	2.22E-07	3.25E-07	0.683909	0.498294
EDUC	-0.00368941	0.00282839	-1.30442	0.200145
OBESITY**	0.00755362	0.0035336	2.13766	0.0392177
MALPHAT	-9.02E-11	3.28E-09	-0.0275261	0.978188
TORTREF***	-0.000260096	0.000129044	-2.01555	0.0511533
SHAREPUB*	-0.0037415	0.00130203	-2.87359	0.00668646
CANCER	0.40623	0.306764	1.32424	0.193544
SMOKE	-0.000748911	0.00167931	-0.445964	0.658222
SO2	3.51E-08	2.22E-07	0.158188	0.875169
AFRAMER*	0.00382113	0.000707775	5.39879	4.09E-06

* Significant at the 1% level
** Significant at the 5% level
***Significant at the 10%level

To check the effects of tort reform additional regressions were run with an interaction term between TORTREF and MALPAY as well as NOINS and TORTREF. These regressions showed no statistically significant effect on the age adjusted death rate thus it is hard to quantify these effects. From the previous regressions I have shown that tort reform had a significant effect on the death rate, yet its interaction with important variables as MALPAY and NOINS shows no important results. Presumably, if tort reforms were in place the interaction with MALPAY would show that tort reforms

lowered malpractice payments, thus lowering the death rate. The interaction between tort reform and no insurance would logically show that if tort reforms had their intended effect of lowering malpractice costs then insurance would become cheaper leading to fewer uninsured citizens. The lack of significance among these interactions is of some concern but does not detract from the original results.

CHAPTER IV

CONCLUSION

Based on the careful analysis of the regression results some interesting conclusions can be drawn concerning medical malpractice, tort reform, and their effects on the population's health. States with tort reforms have a statistically significant lower age adjusted death rate than states without reforms. This is an important result in that some previous studies have not found tort reforms to be a statistically significant indicator of health or insurance premiums. This could be explained by the fact that those papers were earlier studies, while this paper is done with 2004 data. This later data examination could show that in some instances tort reforms that have been passed may take several years to affect the results, thus there is a possible lag effect that may need to be examined. It is also important to note that the only tort reform tested here was a non-economic damages cap, and it may be necessary to look at other reforms in later studies. Despite its effect on the death rate, tort reform had no significant effect on reducing the median malpractice payment. This is certainly an interesting result that can lead to contradictory conclusions about the effectiveness of tort reforms, and what can be accomplished if they are implemented. Another element to consider would be the effect of tort reform on the number of payments or even the payments per capita.

These results also show that there are some preventative measures that can be taken to improve the lives of every citizen. Particularly, those without health insurance

are at a much higher risk than those with insurance due to the preventative and preemptive measures that can be undertaken by those with insurance. The outcome show that states with a higher percentage of uninsured have a statistically significant increase in the age adjusted death rate. In Appendix A, Figure 6 shows many states that have alarming levels of uninsured individuals. Several states in the figure have rates that reach as high as twenty-five percent uninsured. Also, levels of obesity have a frightening effect on the death rate. States with a higher percentage of obese adults have a statistically significant increase in the age adjusted death rate. Thus, it may be helpful to examine proposals to limit the effects of these two issues. If there are more preventative measures taken such as obesity awareness programs, then malpractice may decrease as well as fewer individuals need emergency care or even routine care for ailments that can be prevented.

If the focus is on lowering the median malpractice payment per state then a different set of policies should be utilized. Although most would agree that lowering the death rate is a positive step, there remain conflicting opinions about the level of average malpractice payments. Some elements that influence the median payment can not be altered such as the aging of the population but others can be, such as requiring all healthcare institutions to report malpractice claims. Despite the fact that tort reform does not significantly affect payments it could affect the percentage of lawyers in each state, which does have the impact of significantly increasing the median malpractice payment.

Quality healthcare is a luxury that not all in the United States can currently afford. Despite its expense, it can prolong and improve the average citizen's life, if they have access to the care when they require it. Thus, if there are changes to the current system,

such as tort reform, that would make healthcare more accessible, then they should be implemented if possible. Due to the fact that malpractice insurance and other costs constitute a small percentage of overall healthcare expenditures, it is difficult to ascertain if tort reform will truly lower medical costs a significant degree without further investigation. Thus at this stage, perhaps the best proposal would be one that was a combination of those discussed above. Some level of damage capping or a move toward contracts as well as more training and better regulation of doctors and nurses may offer a solid, comprehensive approach to lowering the costs of malpractice. If these measures help lower costs of malpractice, the cost reduction will ideally trickle down to overall healthcare costs. Making healthcare more affordable makes individuals' insurance more affordable and perhaps the right reform will lead to the only uninsured being those who choose to go without insurance. Ultimately, the affordability of insurance and subsequent increase in healthcare access depends on the magnitude and effectiveness of any reforms undertaken.

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APPENDIX A

Figure 1 Utility Analysis
Loss moves from Point A to Point B

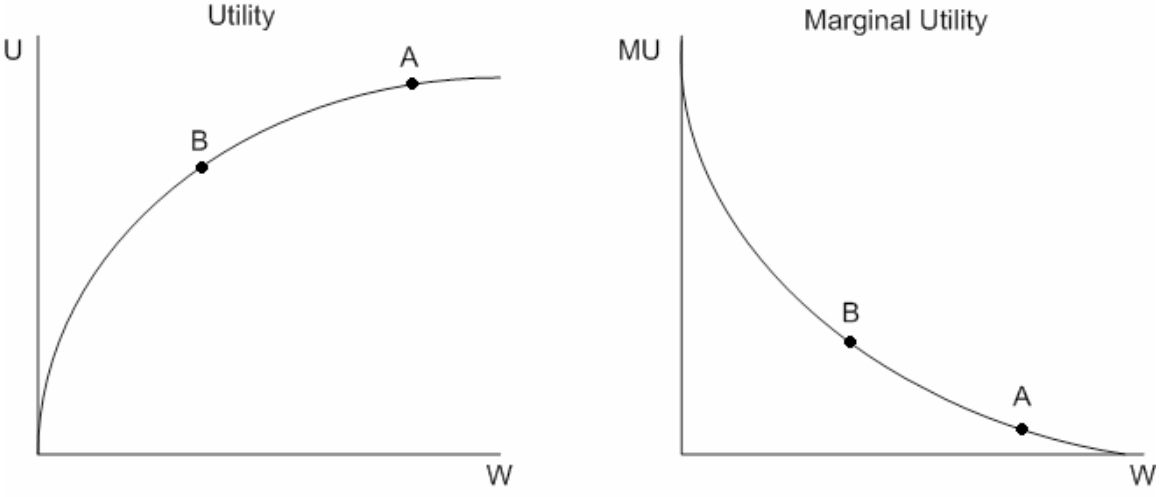


Figure 2 Utility Analysis
Loss moves from Point A to Point B

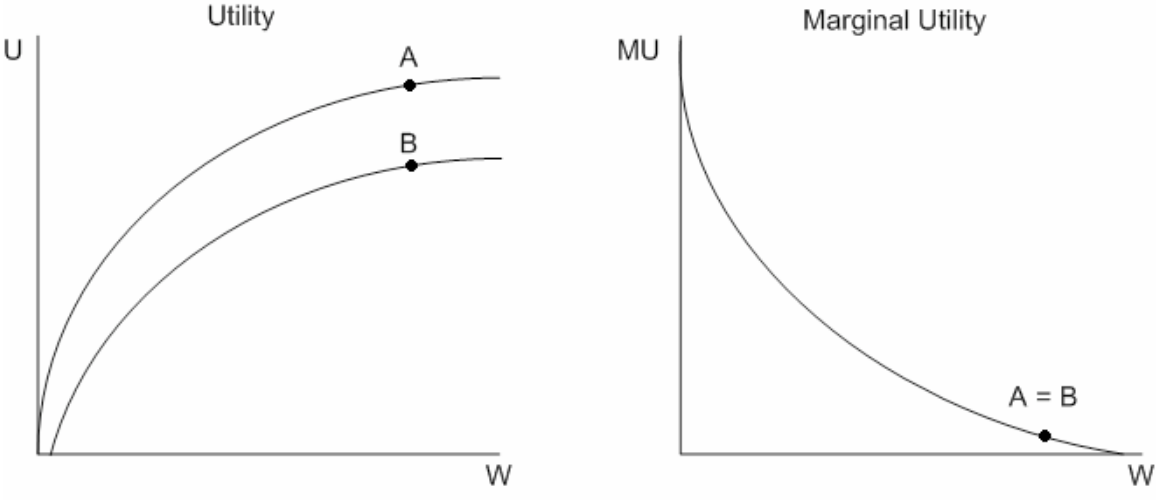


Figure 3 Production Possibility Frontier

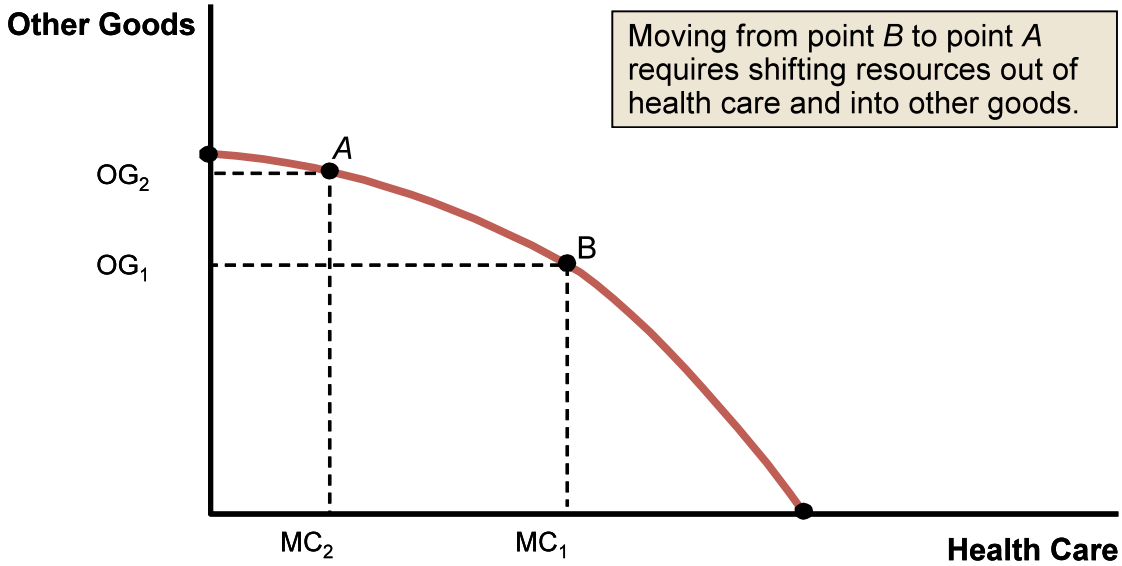
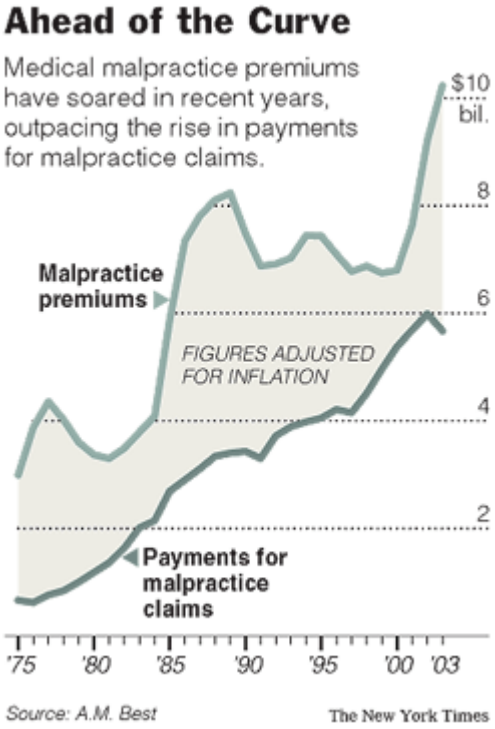


Figure 4[19] Malpractice Premiums



[19] 2005 New York Times article by Joseph Treaster and Joel Brinkley, "Behind Those Medical Malpractice Rates"; http://www.nytimes.com/2005/02/22/business/22insure.html.

Figure 5[20] Malpractice Payments Per Doctor

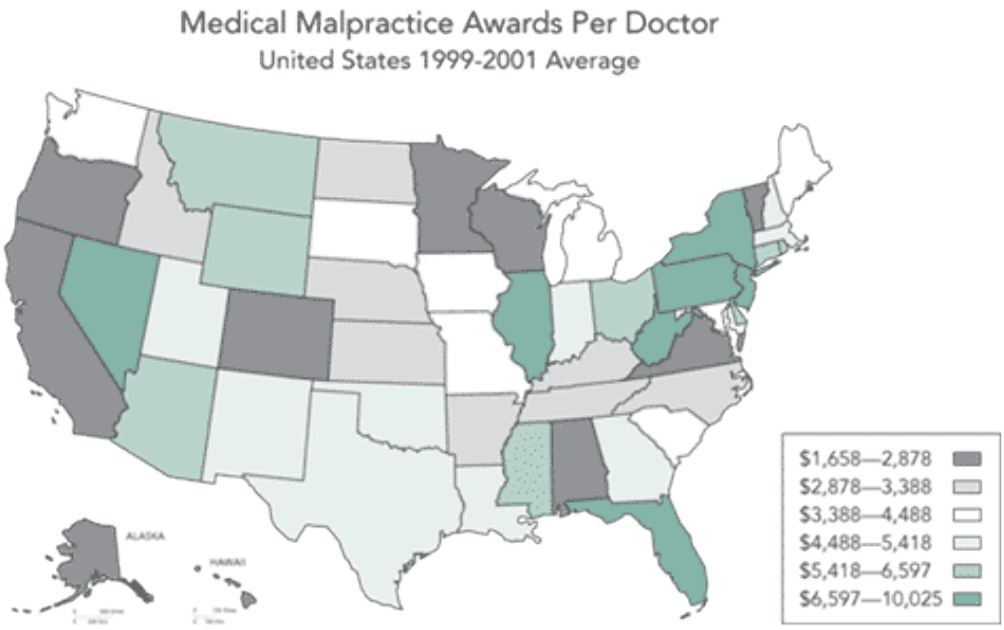
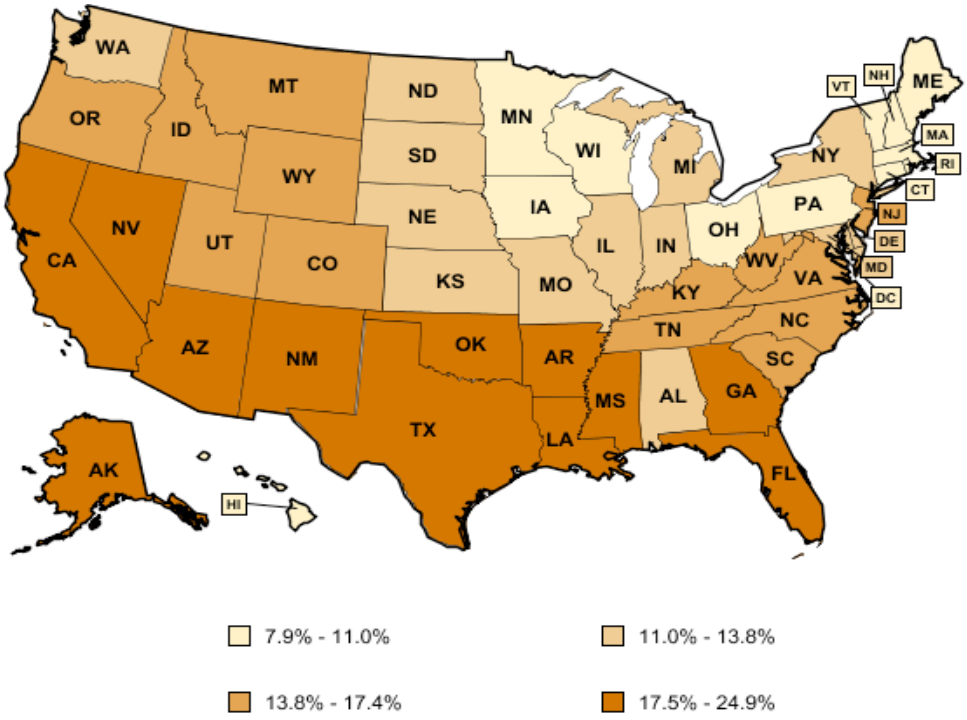


Figure 6 Percentage Uninsured by State



[20] Graph obtained from "Medical Malpractice Awards, Insurance, and Negligence: Which Are Related?"; Manhattan Institute, http://www.manhattan-institute.org/html/cjr_10.htm.

APPENDIX B

Table 13 Descriptive Statistics

	Mean	Std.Dev.	Skewness	Kurtosis	Minimum	Maximum
AGEADJDR	0.0080812	0.000886907	0.586252	2.52709	0.006231	0.009982
INC	31975.5	4565.75	0.756042	3.45064	24144	45762
NOINS	0.135589	0.034234	0.677852	3.1481	0.0823541	0.240329
HEALTHEX	5350.92	639.05	0.161728	2.51941	3972	6683
EDUC	0.26804	0.0475691	0.320376	2.69055	0.153	0.367
OBESITY	0.23091	0.0275888	0.00562934	2.74097	0.168	0.295
MALPAY	168658	61091.1	0.762613	4.18869	50000	375000
TORTREF	0.36	0.484873	0.577471	1.31347	0	1
SHAREPUB	0.226192	0.0456629	0.454498	3.13331	0.150505	0.353469
CANCER	0.00462132	0.000294213	0.145908	3.45786	0.003833	0.0054
SMOKE	0.21134	0.0377606	-0.991971	4.52987	0.094	0.275
SO2	190.48	235.685	1.6441	5.03788	1	970
AGE65PLU	0.125408	0.0174847	-0.796744	5.21107	0.0639072	0.168279
ATTORNEY	0.00411323	0.00151527	2.08128	8.0903	0.00231773	0.00982369
AFRAMER	0.103265	0.0969213	1.05668	3.16874	0.00374488	0.368241
WOMEN	0.50622	0.00687071	-0.687152	3.0433	0.487369	0.51776
CLAIMS	4640.28	6703.07	2.54785	9.31186	335	31280
NOREPORT	0.52156	0.131946	-0.0126535	2.03823	0.267	0.776
PAYMENTS	265.8	383.261	2.59945	9.8589	17	1951

Table 14 Correlation Matrix of Model 1

	AGEADJDR	INC	NOINS	HEALTHEX
AGEADJDR	1	-0.54	0.37	-0.18
INC	-0.5	1	-0.3	0.5
NOINS	0.37	-0.28	1	-0.51
HEALTHEX	-0.18	0.48	-0.51	1
EDUC	-0.6	0.75	-0.25	0.16
OBESITY	0.77	-0.52	0.16	-0.05
MALPAY	-0.08	0.45	-0.26	0.34
TORTREF	-0.05	-0.11	0.19	-0.07
	EDUC	OBESITY	MALPAY	TORTREF
AGEADJDR	-0.6	0.77	-0.08	-0.05
INC	0.8	-0.5	0.5	-0.1
NOINS	-0.25	0.16	-0.26	0.19
HEALTHEX	0.16	-0.05	0.34	-0.07
EDUC	1	-0.64	0.3	-0.13
OBESITY	-0.64	1	-0.13	0.05
MALPAY	0.3	-0.13	1	-0.17
TORTREF	-0.13	0.05	-0.17	1

	AGEADJDR	INC	NOINS	HEALTHEX
SHAREPUB	0.03	0.02	-0.02	0.24
CANCER	0.01	0.43	-0.39	0.65
SMOKE	0.01	-0.22	-0.34	0.26
SO2	0.43	-0.2	0.06	0
AFRAMER	0.63	-0.07	0.22	-0.04
	TORTREF	SHAREPUB	CANCER	SMOKE
SHAREPUB	-0.18	1	0.11	0.04
CANCER	-0.12	0.11	1	0.12
SMOKE	0.19	0.04	0.12	1
SO2	0.05	-0.1	0	-0.1
AFRAMER	-0.09	0.26	0.14	-0.13

	EDUC	OBESITY	MALPAY	SO2	AFRAMER
SHAREPUB	-0.12	0.09	-0.01	-0.08	0.26
CANCER	0.22	0.02	0.36	-0.01	0.14
SMOKE	-0.31	0.1	-0.11	-0.09	-0.13
SO2	-0.3	0.52	0.11	1	0.35
AFRAMER	-0.11	0.55	0.12	0.35	1

Table 15 Correlation Matrix of Model 2

	AGEADJDR	NOINS	EDUC	TORTREF
AGEADJDR	1.00	0.37	-0.60	-0.05
NOINS	0.37	1.00	-0.25	0.19
EDUC	-0.60	-0.25	1.00	-0.13
TORTREF	-0.05	0.19	-0.13	1.00
SO2	0.43	0.06	-0.32	0.05
AGE65PLU	-0.01	-0.32	-0.23	-0.06
ATTORNEY	-0.33	-0.13	0.57	-0.13
AFRAMER	0.63	0.22	-0.11	-0.09
	SO2	AGE65PLU	ATTORNEY	AFRAMER
AGEADJDR	0.43	-0.01	-0.33	0.63
NOINS	0.06	-0.32	-0.13	0.22
EDUC	-0.32	-0.23	0.57	-0.11
TORTREF	0.05	-0.06	-0.13	-0.09
SO2	1.00	0.10	-0.13	0.35
AGE65PLU	0.10	1.00	-0.06	-0.09
ATTORNEY	-0.13	-0.06	1.00	0.04
AFRAMER	0.35	-0.09	0.04	1.00

	AGEADJDR	NOINS	EDUC	TORTREF
FEMALE	0.41	-0.21	0.05	-0.38
CLAIMS	-0.13	0.23	0.18	-0.03
NOREPORT	0.20	0.11	-0.44	0.38
PAYMENTS	-0.10	0.27	0.16	-0.02
	SO2	AGE65PLU	FEMALE	CLAIMS
FEMALE	0.38	0.38	1.00	0.18
CLAIMS	0.28	0.01	0.18	1.00
NOREPORT	-0.04	0.05	-0.34	-0.32
PAYMENTS	0.30	0.06	0.23	0.97
	NOREPORT	PAYMENTS	ATTORNEY	AFRAMER
FEMALE	-0.34	0.23	0.27	0.61
CLAIMS	-0.32	0.97	0.49	0.17
NOREPORT	1.00	-0.28	-0.35	-0.06
PAYMENTS	-0.28	1.00	0.50	0.22

Table 16 Correlation Matrix of Model 3

	HEALTHEX	AGEADJDR	INC	NOINS
HEALTHEX	1.00	-0.18	0.48	-0.51
AGEADJDR	-0.18	1.00	-0.54	0.37
INC	0.48	-0.54	1.00	-0.28
NOINS	-0.51	0.37	-0.28	1.00
EDUC	0.16	-0.60	0.75	-0.25
CANCER	0.65	0.01	0.43	-0.39
SMOKE	0.26	0.01	-0.22	-0.34
TORTREF	-0.07	-0.05	-0.11	0.19
	EDUC	CANCER	SMOKE	TORTREF
HEALTHEX	0.16	0.65	0.26	-0.07
AGEADJDR	-0.60	0.01	0.01	-0.05
INC	0.75	0.43	-0.22	-0.11
NOINS	-0.25	-0.39	-0.34	0.19
EDUC	1.00	0.22	-0.31	-0.13
CANCER	0.22	1.00	0.12	-0.12
SMOKE	-0.31	0.12	1.00	0.19
TORTREF	-0.13	-0.12	0.19	1.00

	HEALTHEX	AGEADJDR	INC	NOINS
SHAREPUB	0.48	-0.33	0.69	-0.13
CANCER	-0.04	0.63	-0.07	0.22
SMOKE	0.35	0.41	0.03	-0.21
SO2	0.43	-0.20	0.06	0.00
AFRAMER	0.63	-0.07	0.22	-0.04
	EDUC	CANCER	ATTORNEY	AFRAMER
SHAREPUB	0.57	0.37	1.00	0.04
CANCER	-0.11	0.14	0.04	1.00
SMOKE	0.05	0.41	0.27	0.61
SO2	-0.30	0.52	0.11	0.05
AFRAMER	-0.11	0.55	0.12	-0.09

	FEMALE	SMOKE	TORTREF	ATTORNEY	AFRAMER
SHAREPUB	0.27	-0.17	-0.13	0.21	0.26
CANCER	0.61	-0.13	-0.09	0.34	0.14
SMOKE	1.00	-0.01	-0.38	1.00	-0.13
SO2	-0.10	0.00	-0.10	0.35	0.35
AFRAMER	0.26	0.14	-0.13	0.04	1.00